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Main Investigation Report

at
Rowfold Lodge, Coneyhurst Road, Billingshurst, West Sussex RH14 9DD

for
Andrew Rutherford

Reference: 21591/MIR Rev1.0
October 2024

Control Document

Project
Rowfold Lodge, Coneyhurst Road, Billingshurst, West Sussex RH14 9DD

Document Type
Main Investigation Report

Document Reference
21591/MIR Rev 1.0

Document Status
Final

Date
October 2024

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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Commission

This document comprises the Main Investigation Report (MIR) and incorporates the results, discussion, and conclusions to this intrusive works. General site data is recorded below:

Commission Record	
Client	Andrew Rutherford
Site Name	Rowfold Lodge, Coneyhurst Road, Billingshurst, West Sussex RH14 9DD
Grid Reference	TQ 098 254
Soils Limited Quotation Ref	Q29160_Rev2, dated 23rd August 2024
Clients Purchase Order	Q29160_rev2, dated 27th August 2024

Documents associated with this development that must be referred to are given below.

Record Of Associated Documents			
Reference	**Type**	**Date**	**Creator**
LS7634	Desk Study	May 2024	Land Science

Limitations and Disclaimers

The report was prepared solely for the brief described in our quotation and Section 1.1 of this report. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of our engagement.

We have exercised all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contract of Business and taking into account the resources devoted to us by agreement with the Client.

This report is a snapshot of the site and conditions taken only at the time of our investigation works and described in our reporting. The ground is a product of continuing natural and artificial processes, and has variation by depth and location that cannot be determined absolutely. While a ground investigation will aim to understand and mitigate, risk cannot be eliminated.

Current regulations and good practice were used in the preparation of this report. Consideration of any subsequent changes to regulations or practice that may have occurred following issue of this report is the responsibility of the user.

If the term “competent person” is used in this report or any Soils Limited document, it means an engineering geologist or civil engineer with a minimum of three years post graduate experience in the understanding and application of the appropriate codes of practice.

Unless the site investigation works have been designed and specified in accordance with EC7, this report is not a Ground Investigation Report as defined by Eurocode 7.

Any reference to ground level relates to the site level at the time of the investigation, unless otherwise stated. Ground elevations and coordinates are only provided when this forms part of our engagement.

A survey of the possible presence or absence of invasive species including Japanese Knotweed is outside the scope of this investigation.

Unless specifically granted, in writing, by Soils Limited, no parties other than the named client hold reliance or license over this report. The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited. Use of this report by others is wholly at their own risk.

License for and reliance on this report is only valid once we have been paid in full for this engagement. In the event of non-payment, we reserve the right to notify parties other than the client of failure to pay and our cancellation of license and reliance.

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Section 1 Introduction

1.1 Objective of Investigation

The Client commissioned Soils Limited to undertake an intrusive ground investigation and to prepare a Main Investigation Report to supply the Client and their designers with information regarding ground conditions, to assist in preparing a foundation scheme for development that was appropriate to the settings present on the site.

The investigation was to be undertaken to provide comment on appropriate foundation options for the proposed development. The investigation was to be made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the exploratory holes.

Soil samples were to be taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any contamination identified as dictated by the Conceptual Site Model (CSM) in the Preliminary Investigation Report undertaken for the site by Land Science (Ref: LS7634, dated May 2024) and/or the Revised Conceptual Site Model presented in Appendix E.1.

1.2 Site Description

The site comprised of a former, small redundant agricultural building sitting approximately 50m to the south of Rowfold Lodge which was another residential building in the area.

Immediately to the north of the proposed site there was a redundant shed and stables, which once formed part of Rowfold Lodge, and which are both used for storage. There was also a mixed gravel surfaced area to the north at the eastern end of the access where vehicles can park.

20m south of site, there was a new residential development that had been separated using wire mesh fencing, hedgerows and a drainage ditch. The site's topography was sloping at <2˚ in a southerly direction.

There were shrubs and bushes around the site with a few mature trees around the perimeter.

The site location plan is given in Figure 1. An aerial photograph of the site and its close environs has been included in Figure 2.

1.3 Proposed Development

The proposed development was understood to comprise the conversion of the redundant former agricultural building to a small single storey, one-bedroom, residential dwelling with space for private gardens. The proposed development was covered under planning

application number DC/24/0304.

The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Development plans provided by the Client are presented in Appendix B.

1.4 Anticipated Geology

The 1:50,000 BGS map showed the site to be located directly upon the Weald Clay Formation bedrock with no overlying superficial deposits.

1.4.1 Weald Clay Formation

The Weald Clay Formation consists of shales and mudstones with occasionally thin beds of siltstones, sandstone, shelly limestone and clay ironstone. When fresh the beds are normally dark grey weathering to mottled yellow and brown near the surface or at outcrop. Bands of red clay occur within the bed, usually in association with the sandstone.

Section 2 Site Works

2.1 Proposed Project Works

The proposed intrusive investigation was designed to provide information on the ground conditions and to aid the design of foundations for the proposed residential development. The intended investigation, as outlined within the Soils Limited quotation (Q29160_Rev2, 23rd August 2024), was to comprise the following items:

- Service clearance via EMF/GPR
- 4No (up to) 3m deep external windowless sampler boreholes
- 1No (up to) 3m internal windowless sampler boreholes (if deemed safe at time of SI)
- Dynamic probing for in-situ geotechnical strength data
- Sampling of perched water if encountered
- Geotechnical laboratory testing
- Contamination soils testing

2.1.1 Actual Project Works

The actual project works were undertaken 6th September 2024 and 26th September 2024, with subsequent sample logging, laboratory testing, monitoring, and reporting. The actual works comprised:

- Service clearance via EMF/GPR
- 3No 4m external windowless sampler boreholes
- 1No 4m internal windowless sampler boreholes
- 4x Dynamic probing for in-situ geotechnical strength data
- 5No 1m deep hand dug trial pits
- Geotechnical laboratory testing
- Contamination soils testing

An additional five hand dug trial pits were included in the actual project works as the Client requested that the investigation area was to be expanded, incorporating the surrounding greenfield area. As such, these trial pits allowed for additional contamination testing of the proposed soft landscaped areas.

All exploratory hole locations have been presented in Figure 3.

Following completion of site works, soil cores were logged, and sub-sampled so that samples could be sent to the laboratory for both contamination and geotechnical testing.

2.2 Ground Conditions

On 6th September 2024, four windowless sampler boreholes (WS1 – WS4) were drilled, using a Premier Compact 110 series windowless sampler rig, to a depth of 4.00m below ground level (bgl) at locations selected by Soils Limited using a development plan provided by the Client.

Four super heavy dynamic probes, (DP1 – DP4) were driven prior and adjacent to their corresponding windowless sampler borehole to depths ranging between 5.00m and 6.00m bgl.

On the 26th September 2024, five hand dug trial pits (HDTP1 - HDTP5) were dug to depths of 1.00m at locations selected by Soils Limited.

The maximum depths of exploratory holes have been included in Table 2.1.

All exploratory holes were scanned with a Cable Avoidance Tool (C.A.T.) and GENNY prior to excavation to ensure the health and safety of the operatives.

Table 2.1 Final Depth of Exploratory Holes

Exploratory Hole	Depth (m bgl)	Exploratory Hole	Depth (m bgl)
WS1	4.00	DP1	6.00
WS2	4.00	DP2	6.00
WS3	4.00	DP3	6.00
WS4	4.00	DP4	6.00
HDTP1	1.00	HDTP4	1.00
HDTP2	1.00	HDTP5	1.00
HDTP3	1.00		

Note(s): The depths given in this table are taken from the ground level on-site at the time of investigation.

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the exploratory hole logs and quoted in this report were measured from ground level.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots or has been identified as part of the in-situ weathering profile, it has been described as Topsoil both on the logs and within this report. Where man has clearly either placed the soil, or the composition altered, with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the log and within this report.

For more complete information about the soils encountered within the general area of the site reference must be made to the detailed records given within Appendix C, but for the purposes of discussion, the succession of conditions encountered in the exploratory holes in descending order can be summarised as:

Made Ground/Topsoil (MG/TS)
Weald Clay Formation (WC)

The ground conditions encountered in the exploratory holes are summarised in Table 2.2.

Table 2.2 Ground Conditions

Strata	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
	Top	Bottom		
MG/TS	G.L	0.20-0.50	0.35	Pinkish brown clayey very sandy GRAVEL. Gravel is angular to subangular fine to coarse of limestone, concrete and flint. Occasional rootlets.
WC	0.20-0.50	4.00[1] 6.00[3]	Not Proven[2]	Stiff light brown mottled light grey and yellowish-brown sandy CLAY with closely spaced thick laminations to very thin beds of extremely weak mudstone.

Note(s): [1] Final depth of exploratory hole. [2] Base of strata not encountered. The depths given in this table are taken from the ground level on-site at the time of investigation. [3]Inferred from DPs

2.3 Ground Conditions Encountered in Exploratory Holes

The ground conditions encountered in exploratory holes have been described below in descending order. The engineering logs are presented in Appendix C.1.

2.3.1 Made Ground and Topsoil

Soils described as Made Ground were encountered in eight out of the nine exploratory holes from ground level.

The Made Ground typically comprised of pinkish brown clayey very sandy GRAVEL. Gravel is angular to subangular fine to coarse of limestone, concrete and flint

The established depth of Made Ground found at each exploratory hole location have been included in Table 2.3.

Table 2.3 Established Depth of Made Ground

Exploratory Hole	Depth (m bgl)
WS1	0.35
WS2	0.30
WS3	0.50
WS4	0.20
HDTP1	0.35
HDTP2	0.30
HDTP3	0.30
HDTP4	0.30

2.3.2 Weald Clay Formation

The Weald Clay Formation was encountered directly underlying the Made Ground and recorded to the full depth of the investigation at 4.00m bgl. It was also inferred to a depth of 6.00m in the dynamic probe holes.

The Weald Clay Formation typically consists of stiff dark bluish grey mottled yellow and dark red CLAY

The established depth of Weald Clay Formation found at each exploratory hole location have been included in Table 2.4.

Table 2.4 Established Depth of Weald Clay Formation

Exploratory Hole	Depth (m bgl)
WS/DP1	4.00[1]/6.00[1]
WS2DP2	4.00[1]/6.00[1]
WS3DP3	4.00[1]/6.00[1]
WS4DP4	4.00[1]/6.00[1]

Note(s): [1] Final depth of exploratory hole.

2.4 Roots

Roots were encountered in all four exploratory holes at depths ranging between 0.75m and 2.70m bgl. The established depth of root penetration found at the exploratory hole locations has been included in Table 2.5 and 2.6.

Table 2.5 Established Depth of Root Penetration

Exploratory Hole	Depth (m bgl)
WS1	0.00
WS2	0.60
WS3	0.00
WS4	0.75
HDTP1	1.00[1]
HDTP2	1.00[1]
HDTP3	1.00[1]
HDTP4	1.00[1]

Notes: Base of Hole[1]

Table 2.6 Established Depth of Desiccated Roots

Exploratory Hole	Depth (m bgl)
WS1	1.30
WS2	2.70
WS3	0.95
WS4	0.00

Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs. The desiccated roots were found even in areas where there were no existing trees from the last 10 years and therefore the roots the soil is unlikely to still be desiccated.

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low. A direct observation such as from within a trial pit is necessary to gain a better indication of the maximum root depth.

2.5 Groundwater

Groundwater was not encountered in any of the exploratory holes.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in August (2024), when groundwater levels should be falling from their annual maximum (highest) which typically occurs around March to the annual minimum (lowest) which typically occurs around September.

Section 3 Geotechnical In-Situ and Laboratory Testing

3.1 Dynamic Probe Tests

The results were converted to equivalent SPT "N60" values based on dynamic energy using commercial computer software (Geostru). The results were then interpreted based on the classifications outlined in Appendix D.1,Table D.1.1.

Table 3.1 Hammer Efficiency

Rig Reference	Energy Ratio Er (%)
PREM 1	84.92

Table 3.2 Inferred SPT Interpretation

Strata	Depth Range (m bgl)	Inferred N60 Range	Soil Classification
WC	0.30-6.00	4-81	Low to extremely high

Note(s): SPT "N60" values presented have been corrected in accordance with BS EN 22476 Part 3

A full interpretation of the DPSH tests, are outlined in Appendix D.2.

3.2 Atterberg Limit Tests

Atterberg Limit tests were performed on five samples from the Weald Clay Formation. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

Table 3.3 Atterberg Limit Results Classification

Strata	Depth (m bgl)	Classification	
		NHBC	BRE 240
WC	0.95-2.20	Med-high	Med-high

A full interpretation of the Atterberg Limit tests, are outlined in Table D.2.2, Appendix D.2 and the laboratory report in Appendix D.3.

3.3 Sulphate and pH Tests

Water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

Table 3.4 Sulphate and pH Test Results

Strata	Depth (m bgl)	Sulphate Concentration (mg/l)	pH
WC	1.40	50	6.2
	2.40	70	6.5
	0.90	36	6.7

The significance of the sulphate and pH Test results are discussed in Section 5.2 and the laboratory report in Appendix D.3.

Section 4 Engineering Appraisal

4.1 Established Ground Conditions

An engineering appraisal of the soil types encountered during the site investigation and likely to be encountered during the redevelopment of this site is presented. Soil descriptions are based on analysis of disturbed samples taken from the exploratory holes.

4.1.1 Made Ground and Topsoil

Soils described as Made Ground were encountered in all four of the windowless sampler boreholes (WS1-WS4) reaching depths of 0.20-0.50m bgl. Made ground was encountered in four out of five of the hand dug trial pits reaching depths of up to 0.35m.

Foundations must not be placed on non-engineered fill unless such use can be justified on the basis of a thorough ground investigation and detailed design. Foundations must be taken through any Topsoil and/or Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

4.1.2 Weald Clay Formation

Soils described as Weald Clay Formation were encountered underlying the Made Ground from 0.20m to 0.50m bgl and persisted to the full investigatory depth of 4.00m bgl and inferred to 6.00m in the dynamic probes.

4.1.3 Guidance on Shrinkable Soils

The ground conditions were established as Made Ground with a typical thickness of 0.30m, overlying the bedrock of the Weald Clay Formation.

The volume change potential for each stratum was established and presented in Table 4.1.

Table 4.1 Established Volume Change Potential by Strata

Strata	Volume Change Potential		Established Lower Boundary (m bgl)
	BRE	NHBC	
WC	High	High	4.00[1]

Notes: [1]end of exploratory hole

4.1.4 Groundwater

Groundwater was not encountered in any of the exploratory holes during the investigation.

Section 5 Foundation Scheme

5.1 Foundation Recommendations

Foundations **must not** be constructed within any Made Ground due to the likely variability and potential for large load induced settlements both total and differential.

Live roots were encountered in seven out of the nine exploratory holes at depths ranging between 0.60m to 1.00m bgl. Desiccated roots were encountered in three out of the four windowless samples and none of the hand dug trial pits at depths ranging from 0.95m to 2.70m bgl. If the roots are encountered during the construction phase foundations **must not be placed within any live root penetrated** or desiccated **cohesive soils or those with a volume change potential**. Should the foundation excavations reveal such materials, the excavations **must** be extended to greater depth to bypass these unsuitable soils. Excavations must be checked by a suitable person prior to concrete being poured.

Considering the type of development, a shallow foundation solution was considered the most suitable.

5.1.1 Shallow Foundations into the Weald Clay Formation

Based on a 5.00 by 0.75m strip foundation, using commercial software Table 5.1 shows the calculated bearing values and anticipated settlement characteristics. The maximum encountered depth of Made Ground was 0.50m bgl, however, as there were roots encountered, the bearing capacities were calculated below this depth.

Table 5.1 Allowable Bearing Capacities in the Weald Clay

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
1.00	5.00 x 0.75	110	25
1.50		150	25
2.00		200	25

Foundations must be deepened locally where live roots are present. All foundation formations must be examined, recorded, and signed off by a competent person.

The use of reinforced trench fill foundations reduces the potential for differential settlement affecting the foundations.

For the allowable bearing value given above, settlements should not exceed the presented values, if excavation bases are carefully bottomed out and blinded or concreted as soon after excavation as possible and kept dry.

Foundations must not be constructed over former structures and other hard spots. The foundations design must be suitable for the conditions present at the site.

The anticipated settlement includes both elastic settlement and long-term drained settlement (in the case of cohesive soils).

Anticipated settlements may be taken as proportional to the bearing capacity adopted (for the same configuration of foundation), therefore if the bearing value is halved the anticipated settlement will halve.

It has been assumed that the foundations to any existing structures have been grubbed out. Where foundations have been grubbed out the new foundation must be taken through any backfill material into suitable natural ground as outlined in this report.

5.2 Subsurface Concrete

The sulphate and pH tests carried out in accordance with BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground', established the site concrete classifications for each stratum as presented in Table 5.2.

Table 5.2 Concrete Classification

Stratum	Design Sulphate Class	ACEC Class
WC	DS-1	AC-1s

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1 2005, *'Concrete in Aggressive Ground'* considering any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

5.3 Excavations

Shallow excavations in the Made Ground/Topsoil are likely to be marginally stable in the short term at best.

Deeper excavations taken into the Weald Clay Formation are likely to be unstable and require support. Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions must therefore be taken to ensure that such earth faces are adequately supported or battered back to a safe angle of repose.

Excavations beneath the groundwater table are likely to be unstable and dewatering of foundation trenches may be necessary.

Section 6 Determination of Chemical Analysis

6.1 Site Characterisation and Revised Conceptual Site Model

The Preliminary Investigation Report undertaken by Land Science (report ref: LS7634) dated May 2024 identified up to a moderate risk of ground contamination from previous usage of the site and offsite sources.

This investigation recorded Made Ground to depths of up to 0.50m with limited anthropogenic material noted.

There were no significant visual or olfactory indicators of contamination noted.

Soils of the Weald Clay Formation were encountered underlying the Made Ground and groundwater was not encountered during the investigation. The conceptual site model was updated to take account of the above findings, where required, and is presented in Appendix E.1.

6.2 Soil Sampling

Exploratory hole locations were established to provide an overview of ground conditions across the site in relation to the proposed construction, together with enabling the collection of samples to enable chemical characterisation of the underlying strata.

Representative samples for potential environmental testing were obtained from the exploratory holes at depths of between 0.20m and 0.60m to allow appropriate representation of the materials encountered, with additional samples to be obtained, if necessary, where there was visual or olfactory evidence of contamination.

Unless otherwise stated, analytical testing was based initially on a screening suite of commonly identified inorganic and organic contaminants, considering the prevailing site conditions and the findings of the conceptual site model.

6.3 Determination of Chemical Analysis

The driver for determination of the analysis suite was the information obtained from the Preliminary Investigation Report and this intrusive investigation.

The chemical analyses were carried out on seven samples in the Made Ground and two samples in the Weald Clay Formation. The nature of the analyses is detailed in Table 6.1.

Table 6.1 Chemical Analyses Suites - Soil

No. of Tests		Determinants
MG	WC	
7	2	Metal suites: Arsenic, Boron (Water Soluble), Cadmium, Chromium (total & hexavalent), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc
7	2	Organic Matter

No. of Tests		Determinants
MG	WC	
7	2	pH
7	2	Polycyclic aromatic hydrocarbons (PAH) – (EPA 16)
7	2	Phenols – total monohydric
7	2	Extractable petroleum hydrocarbons (EPH) – Texas banding
7	2	Total petroleum hydrocarbons (TPH) – CWG banding
2		Organochlorides and chlorobenzene (HCH) (HCB)
7	2	Asbestos screening

The soil testing was carried out in compliance with the MCERTS performance standard, and the results are shown in Appendix E.2, test reports 24-10774.1 and 24-11625.1

Section 7 Qualitative Risk Assessment

7.1 Assessment Criteria

The assessment criteria used to determine risks to human health are derived and explained within Appendix E.3.

7.2 Representative Contamination Criteria - Soil

The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Based on the proposed development, the results of the chemical analysis have been compared against generic assessment criteria (GAC) for a '***Residential with home grown produce***' end use, as presented in SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014 (C4SL), derived for the protection of human health. Where this document has not published screening values for determinants, GACs derived for the same end use have been adopted from the following published guidance; DEFRA Soil Guideline Values (SGV) and LQM/CIEH/Suitable 4 Use Level (S4UL).

To assess the potential toxicity of organic determinants (Petroleum Hydrocarbons and Polyaromatic Hydrocarbons) to the human health, soils samples were analysed for Soil Organic Matter (SOM). The selected samples analysed recorded, SOM values of between 0.6% and 5%. For each soil sample tested, the resultant SOM allowed for the correct comparison to be made with the appropriate guideline value for each organic determinant analysed.

7.2.1 Risk Assessment – Made Ground

HDTP2 had exceedance of

Benzo(b)fluoranthene,

Benzo(a)pyrene and

Di-benzo(a,h)anthracene

and therefore, considered a 'hotspot' for contamination. The relevant assessment criteria based on the human health risk assessment for 'residential with home grown produce. The full laboratory report is presented in Appendix E.2.

7.3 Asbestos

The test certificate for each sample submitted for contamination analysis during this investigation includes the results of an Asbestos Screen.

In each case 'Not detected' was reported.

This finding does not obviate the risk of asbestos being present on the site and the Client must seek advice from qualified and competent asbestos specialist during and prior to undertaking works to ensure compliance with appropriate legislation and guidance.

7.3.1 Radon

The site **was not** within an area where protection or risk assessment against the ingress of radon was required. Radon protective measures **will not be required** within the proposed new development.

7.4 Risk to Controlled Waters

The site was located on unproductive strata and is not within a groundwater source protection zone.

The groundwater flow was established to be in a southerly direction based on the overlying topography

The nearest surface watercourse feature was located approximately 1m to the east of the site and comprised a drainage ditch.

Based on the underlying geology, the vulnerability of site was very low and therefore the residual risk to groundwater receptor is negligible.

The soil contamination in HDTP2 will be remediated so will not cause further contamination.

7.5 Ground Gas

Ground Gas was considered a very low to low risk in the CSM ref (LS7634) due to the Made Ground on site. However, as the Made Ground was less than 1m in thickness and contained no putrescible matter throughout the site, ground gas monitoring was not needed.

7.6 Generic Quantitative Risk Assessment

Quantitative risk assessments are undertaken for soil. The CSM has been updated to take account of the assessments below and presented in Appendix E.1. The full laboratory chemical report is presented in Appendix E.2.

7.6.1 Soils

HDTP2 had exceedances in 3 PAHs to depths of at least 0.20m.

The Tier 1 Quantitative risk assessment therefore established that there was a **moderate/low risk to the human health receptors** of construction workers or future end-users.

7.7 Recommendations

Soil chemical analysis recorded HDTP2 with substance levels over their representative guideline values following the Human Health Risk Assessment for the development of a residential property with home grown plant uptake.

Therefore, a remediation strategy is needed and HDTP2 may be treated as a hotspot as the PAH could be a risk.

The remedial objective for the site is to ensure site clean-up removes any unacceptable risk to the identified receptors of Human Health, Building Structures and Services and Groundwater receptor.

In essence the remedial objective must sever any source-pathway-receptor pollutant linkages that have been established. Once this has been achieved, by whatever means, there can theoretically be no risk.

7.8 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

7.9 Excavated Material

Excavated material as waste must be defined or classified prior to any disposal, transport, recycling or re-use at or by an appropriately licensed or exempt carrier and/or off-site disposal facility. The requirements inherent in both Duty of Care and Health and Safety must also be complied with. In order to determine what is to happen, what is suitable, appropriate and most effective in the disposal of wastes, especially those subject to CDM waste management plan requirements, several factors must be considered, and competent advice must always be sought.

7.10 HazWasteOnline

Further consideration of results using HazWasteOnlineTM can be undertaken on request to give an indication of potentially hazardous properties in the materials analysed.

7.11 Re-use of Excavated Material On-site

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008 and is accepted as an alternative regime to the EPR.

7.12 Imported Material

Any soil, which is to be imported onto the site, must undergo chemical analysis to permit classification prior to its importation and placement in order to ascertain its status with

specific regard to contamination, i.e. to prove that it is suitable for the purpose for which it is intended.

7.13 Discovery Strategy

There may be areas of contamination not identified during the course of the investigation. Such occurrences may also be discovered during the demolition and construction phases for the redevelopment of the site.

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Figure 1 – Site Location Map

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Job Number 21591	**Project** Rowfold Lodge, Coneyhurst Road, Billingshurst, West Sussex, RH14 9DD
Client Andrew Rutherford	**Date** October 2024

Figure 2 – Aerial Photograph

Project
Rowfold Lodge, Coneyhurst Road, Billingshurst, West Sussex, RH14 9DD

Client
Andrew Rutherford

Date
September 2024

Job Number
21591

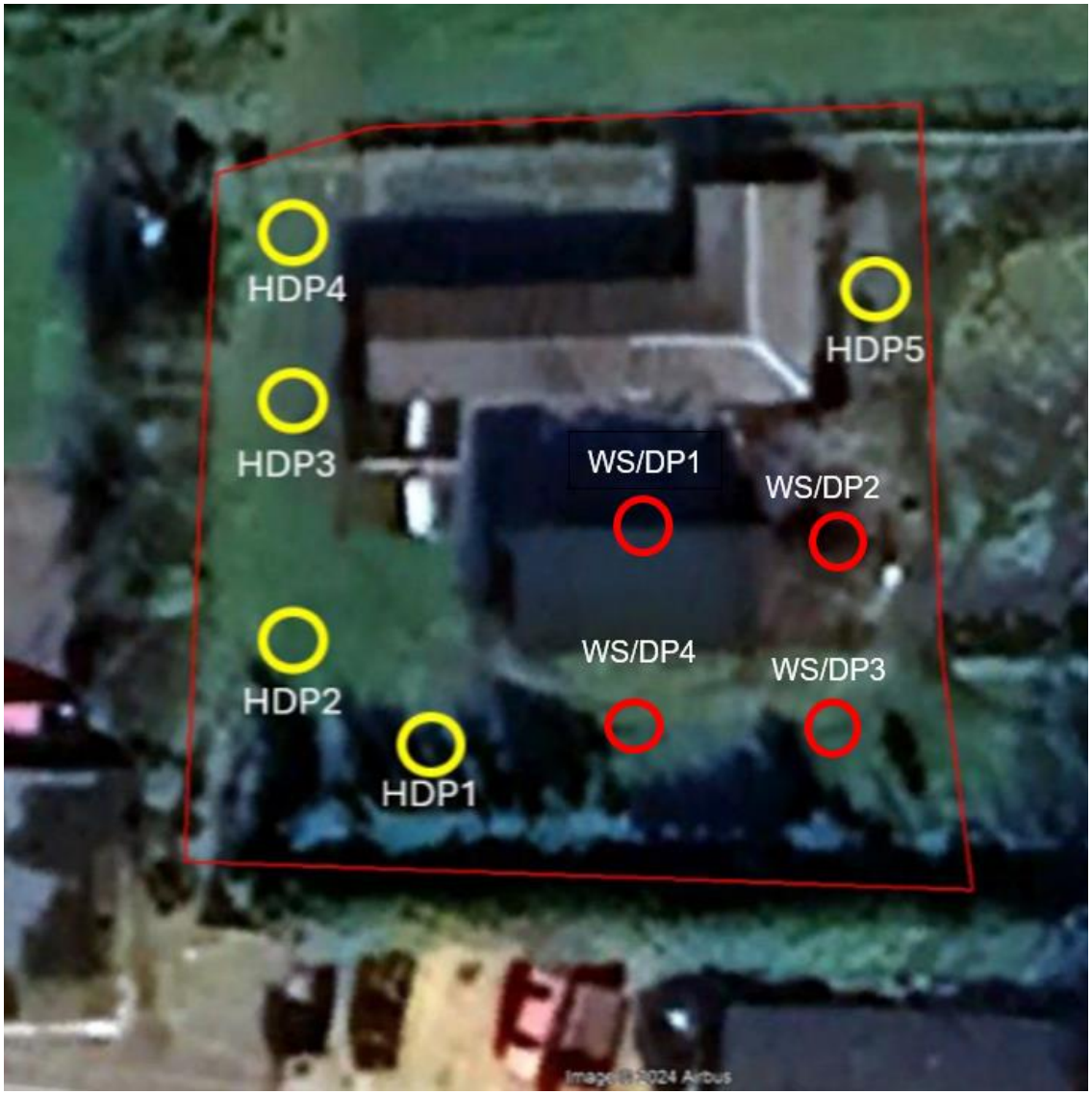

Figure 3 – Exploratory Hole Plan

Project
Rowfold Lodge, Coneyhurst Road, Billingshurst, West Sussex, RH14 9DD

Client
Andrew Rutherford

Date
September 2024

Job Number
21591

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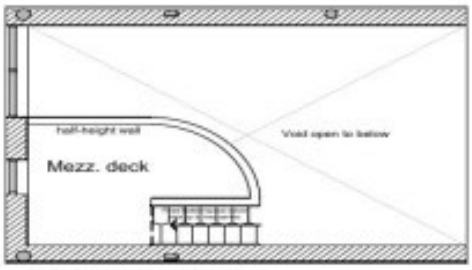
Appendix A Standards and Resources

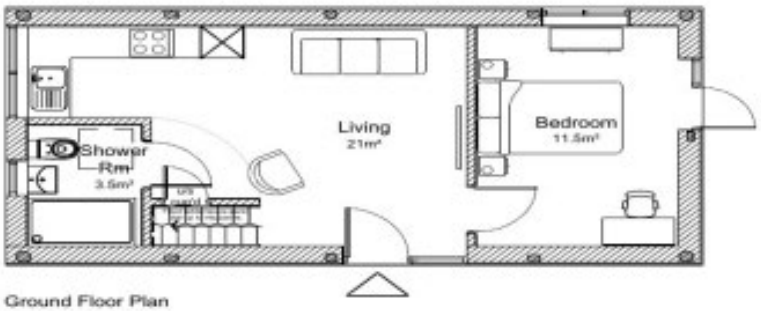
The site works, soil descriptions and geotechnical testing was undertaken in accordance with the following standards were applicable:

- BS 5930:2015 and BS EN ISO 22476-2 2005+A1:2011
- BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design
- BS EN ISO 14688-1:2018 - Geotechnical investigation and testing - Identification and description
- BS EN ISO 14688-2:2018 - Geotechnical investigation and testing - Principles for a classification
- BS 10175:2011+A2:2017 - Investigation of potentially contaminated sites
- LCRM 2021 Environment Agency
- BS 8004:2015 – Code of practice for foundations
- BS 1377:1990 Parts 1 to 8
- BRE Digest 241 “Low-rise buildings on shrinkable clay soils: Part 2
- BRE Special Digest 1, 2005, ‘Concrete in Aggressive Ground’
- Stroud, M. A. 1974, “The Standard Penetration Test – its application and interpretation”, Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.
- N.E. Simons, B.K. Menzies, “A Short Course in Foundation Engineering”
- NHBC Standards Chapter 4.2, January 2024.
- SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014
- CIRIA C733, Asbestos in soil and made ground: a guide to understanding and managing risks and CAR2012 regulations.
- Google Earth
- British Geological Survey Website & iGeology App

Appendix B Information Provided by the Client



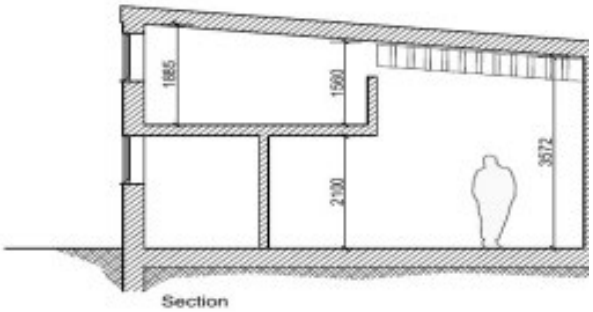
Mezzanine Storage area
(5.3m²)
(all head room above 1.8m)



Ground Floor Plan
(37.2m²)

Total GIA 42.5m²
1bed 1 person

75% of ceilings 2.3m or above



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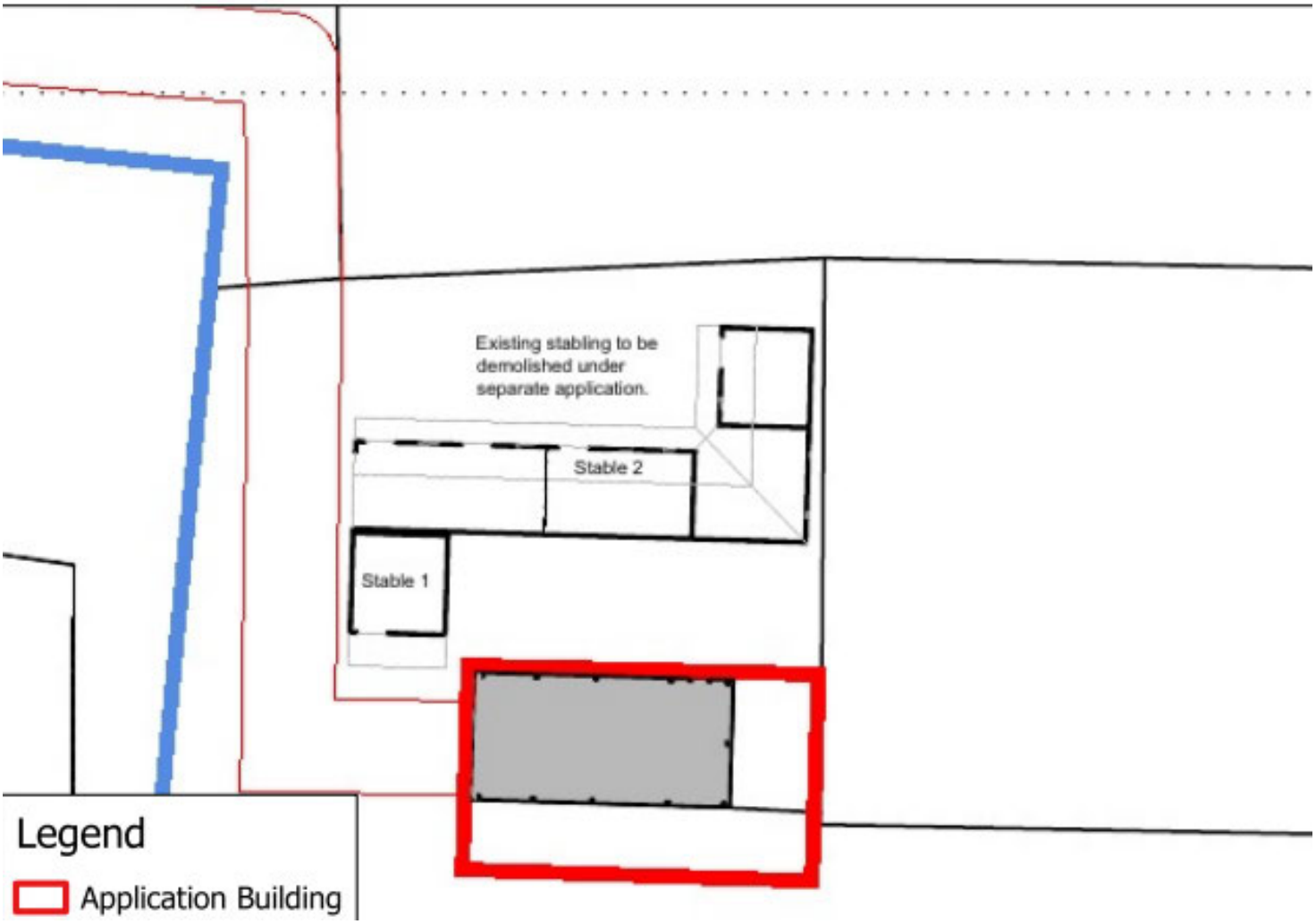

Appendix C Field Work

Appendix C.1 Engineers Logs

soils LIMITED

Contract Name:		Client:			Hole ID:
Rowfold Lodge		Mr A Rutherford			**WS1**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
21591	06/09/24	JD	KM	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
			PREM 1	31/10/2024	1:50

Weather: | Termination: Depth Achieved | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.15	ES			0.10		CONCRETE		
0.40	ES			0.35		Pinkish grey very sandy GRAVEL. Gravel is sub-angular fine to coarse of concrete, basalt and granite. MADE GROUND		
0.50	D			(0.40)		Firm greyish brown mottled reddish brown and yellowish brown silty CLAY. Frequent desiccated roots and rootlets.		
0.85	ES			0.75		Firm becoming stiff orangish brown mottled light grey and rarely red slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to medium of mudstone and fine grained sandstone. Rare desiccated rootlets to 1.30m bgl.		
0.95	D					*Orangish brown slightly clayey very sandy GRAVEL. Gravel is sub-angular, fine of extremely weak mudstone.*		
1.40	D			(1.25)		*Orangish brown slightly clayey very sandy GRAVEL. Gravel is sub-angular, fine of extremely weak mudstone.*		
1.55	D							
1.90	D			2.00		Very stiff reddish brown mottled light grey and yellowish brown slightly sandy CLAY with closely spaced thick laminations to very thin beds of mudstone.		
2.40	D					*Lignite present*		
2.60	D			(1.50)				
3.20	D			3.50		Stiff dark bluish grey mottled yellow and dark red CLAY.		
3.80	D			(0.50)				
				4.00		End of Borehole at 4.00m		

1 2 3 4 5 6 7 8 9 10

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)

Remarks:
Desiccated rootlets to 1.30m bgl

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:			Hole ID:
Rowfold Lodge		Mr A Rutherford			**WS2**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
21591	06/09/24	JD	KM	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
			PREM 1	31/10/2024	1:50

Weather: | Termination: Depth Achieved | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.05	ES			0.20		Grey slightly silty slightly gravelly SAND. Gravel is sub-rounded, fine of flint. Frequent angular medium gravel sized rubber fragments. Frequent rootlets. MADE GROUND		
0.25	ES			0.30		Light brownish grey fine and medium SAND. MADE GROUND		
0.30	D			0.45		Recovered as greenish brown slightly clayey very sandy GRAVEL. Gravel is sub-angular to sub-rounded fine to coarse of glauconitic sandstone.		
0.60	ES			(0.70)		Firm to stiff greenish grey mottled yellow and bluish grey slightly gravelly CLAY. Gravel is sub-angular, fine of mudstone. Weak organic odour. Rare rootlets to 0.60m bgl.		
0.80	D			1.15				
1.25	D			(1.15)		Firm becoming stiff orangish brown mottled light grey and rarely red slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to medium of mudstone and fine grained sandstone. Rare desiccated rootlets.		
1.90	D			2.30				
2.40	D			(0.90)		Very stiff reddish brown mottled light grey and yellowish brown slightly sandy CLAY with closely spaced thick laminations to very thin beds of. Rare desiccated rootlets to 2.70m bgl.		
3.00	D			3.20				
3.50	D			(0.80)		Stiff dark bluish grey mottled yellow and dark red CLAY.		
3.90	D			4.00		End of Borehole at 4.00m		

1 2 3 4 5 6 7 8 9 10

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)

Remarks:
Desiccated rootlets to 2.70m bgl

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:			Hole ID:
Rowfold Lodge		Mr A Rutherford			**WS3**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
21591	06/09/24	JD	KM	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
			PREM 1	31/10/2024	1:50

Weather: | Termination: Depth Achieved | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.15	ES			0.05		Dark brown silty gravelly fine to medium SAND. Gravel is sub-rounded fine of flint. Frequent rootlets. MADE GROUND		
0.35	D			0.28		Light brown gravelly fine to medium SAND. Gravel is sub-rounded fine of flint. Rare black odourless staining. Occasional rootlets. MADE GROUND		
0.60	ES D ES			0.50		FIBROUS MEMBRANE		
0.90	D			(0.45)		Stiff brown slilghtly sandy gravelly silty CLAY. Gravel is sub-angular fine to coarse of flint and clay tile. Rare black odourless staining. MADE GROUND		
1.20	D			0.95		Stiff yellowish brown mottled orangish brown and light brown sandy CLAY with closely spaced fine sand partings. Rare desiccated rootlets.		
1.80	D			(1.50)		Firm becoming stiff orangish brown mottled light grey and rarely red slightly sandy slightly gravelly CLAY. Gravel is sub-angular fine to medium of mudstone.		
2.20	D			2.45		Very stiff greyish brown mottled light grey and reddish brown slightly sandy CLAY with closely spaced thick laminations to very thin beds of mudstone.		
2.80	D			(1.35)				
3.40	D			3.80		Stiff dark bluish grey mottled yellow and dark red CLAY.		
3.90	D			4.00		End of Borehole at 4.00m		

1 2 3 4 5 6 7 8 9 10

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)

Remarks:
Desiccated rootlets to 0,95m bgl

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:			Hole ID:
Rowfold Lodge		Mr A Rutherford			**WS4**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
21591	06/09/24	JD	KM	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
			PREM 1	31/10/2024	1:50

Weather: | Termination: Depth Achieved | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.15	ES			0.05		Dark brown silty gravelly fine to medium SAND. Gravel is sub-rounded fine of flint. Frequent rootlets.		
0.30	D			0.20		MADE GROUND		
	ES			(0.30)		Pinkish brown clayey very sandy GRAVEL. Gravel is angular to sub-angular fine to coarse of limestone, concrete and flint. Occasional rootlets. MADE GROUND		
0.60	D			0.50		Stiff brownish grey mottled orangish brown sandy CLAY. Occasional rootlets.		
	ES					Firm to stiff orangish brown mottled light grey and reddish brown slightly gravelly sandy CLAY with closely spaced fine sand partings. Gravel is sub-angular fine to medium of mudstone. Rare rootlets to 0.75m bgl.		
1.00	D			(0.90)				
				1.40		Stiff light brown mottled light grey and yellowish brown sandy CLAY with closely spaced thick laminations to very thin beds of mudstone.		
1.80	D			(1.00)				
2.20	D			2.40		Very stiff dark bluish grey mottled yellow and dark brown slightly sandy CLAY with closely spaced thick laminations to very thin beds of mudstone.		
2.80	D					*Lignite present*		
				(1.05)				
3.20	D			3.45		Stiff dark bluish grey mottled yellow and dark red CLAY.		
				(0.55)				
3.80	D			4.00		End of Borehole at 4.00m		

1 2 3 4 5 6 7 8 9 10

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)

Remarks:
rootlets to 0.75m bgl

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No.
HDTP1
Sheet 1 of 1

Project Name: Rowfold Lodge	Project No.: 21591	Method: Hand Dug	Hole Type TP
Location: Coneyhurst Road, Billinghurst, West Sussex, RH14 9DD		Plant:	
		Support:	Scale 1:25
Client: Mr A Rutherford	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2024	Level:	Co-ords:	Logged By KM

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
	0.20	ES		0.35			Grey slightly clayey sandy angular to sub rounded, fine to coarse brick, concrete, tarmacadam and limestone GRAVEL. MADE GROUND
	0.60	ES		1.00			Orangish brown sandy CLAY. Occasional rootlets
							End of Pit at 1.000m

1
2
3
4
5

General Remarks:
Hand Dug Trial Pit

Groundwater Remarks: No groundwater encountered.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No.
HDTP2
Sheet 1 of 1

Project Name: Rowfold Lodge	Project No.: 21591	Method: Hand Dug	Hole Type TP
Location: Coneyhurst Road, Billinghurst, West Sussex, RH14 9DD		Plant:	
		Support:	Scale 1:25
Client: Mr A Rutherford	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2024	Level:	Co-ords:	Logged By KM

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
	0.20	ES		0.30			Dark brown slightly gravelly sandy CLAY and SILT. Gravel is sub angular to sub rounded fine to medium brick flint and occasional tarmacadam. Occasional rootlets. MADE GROUND
	0.70	ES		1.00			Yellowish brown very sandy CLAY. Occasional rootlets
							End of Pit at 1.000m

1
2
3
4
5

General Remarks:
Hand Dug Trial Pit

Groundwater Remarks: No groundwater encountered.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited
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Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No.
HDTP3
Sheet 1 of 1

Project Name: Rowfold Lodge	Project No.: 21591	Method: Hand Dug	Hole Type TP
Location: Coneyhurst Road, Billinghurst, West Sussex, RH14 9DD		Plant:	
		Support:	Scale 1:25
Client: Mr A Rutherford	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2024	Level:	Co-ords:	Logged By KM

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
	0.20	ES		0.30			Dark brown slightly gravelly sandy CLAY and SILT. Gravel is sub angular to sub rounded fine to medium brick flint and occasional tarmacadam. Occasional rootlets. MADE GROUND
	0.60	ES		1.00			Light brown slightly gravelly sandy SILT .Gravel is sub angular to sub rounded fine to coarse flint. Occasional rootlets
							End of Pit at 1.000m

1
2
3
4
5

General Remarks:
Hand Dug Trial Pit

Groundwater Remarks: No groundwater encountered.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No.
HDTP4
Sheet 1 of 1

Project Name: Rowfold Lodge	Project No.: 21591	Method: Hand Dug	Hole Type TP
Location: Coneyhurst Road, Billinghurst, West Sussex, RH14 9DD		Plant:	
		Support:	Scale 1:25
Client: Mr A Rutherford	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2024	Level:	Co-ords:	Logged By KM

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
	0.20	ES		0.30			Dark brown slightly gravelly sandy CLAY and SILT. Gravel is sub angular to sub rounded fine to medium brick flint and occasional tarmacadam. Occasional rootlets. MADE GROUND
	0.60	ES		1.00			Light brown slightly gravelly sandy SILT .Gravel is sub angular to sub rounded fine to coarse flint. Occasional rootlets
							End of Pit at 1.000m

General Remarks:
Hand Dug Trial Pit

Groundwater Remarks: No groundwater encountered.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No.
HDTP5
Sheet 1 of 1

Project Name: Rowfold Lodge	Project No.: 21591	Method: Hand Dug	Hole Type TP
Location: Coneyhurst Road, Billinghurst, West Sussex, RH14 9DD		Plant:	
		Support:	Scale 1:25
Client: Mr A Rutherford	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2024	Level:	Co-ords:	Logged By KM

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
				0.10			Grey SAND
	0.20	ES					Orangish yellow slightly clayey gravelly SAND. Gravel is sub angular to sub rounded fine to coarse sandstone
				0.40			Greenish grey sandy CLAY.
	0.60	ES					
				1.00			End of Pit at 1.000m

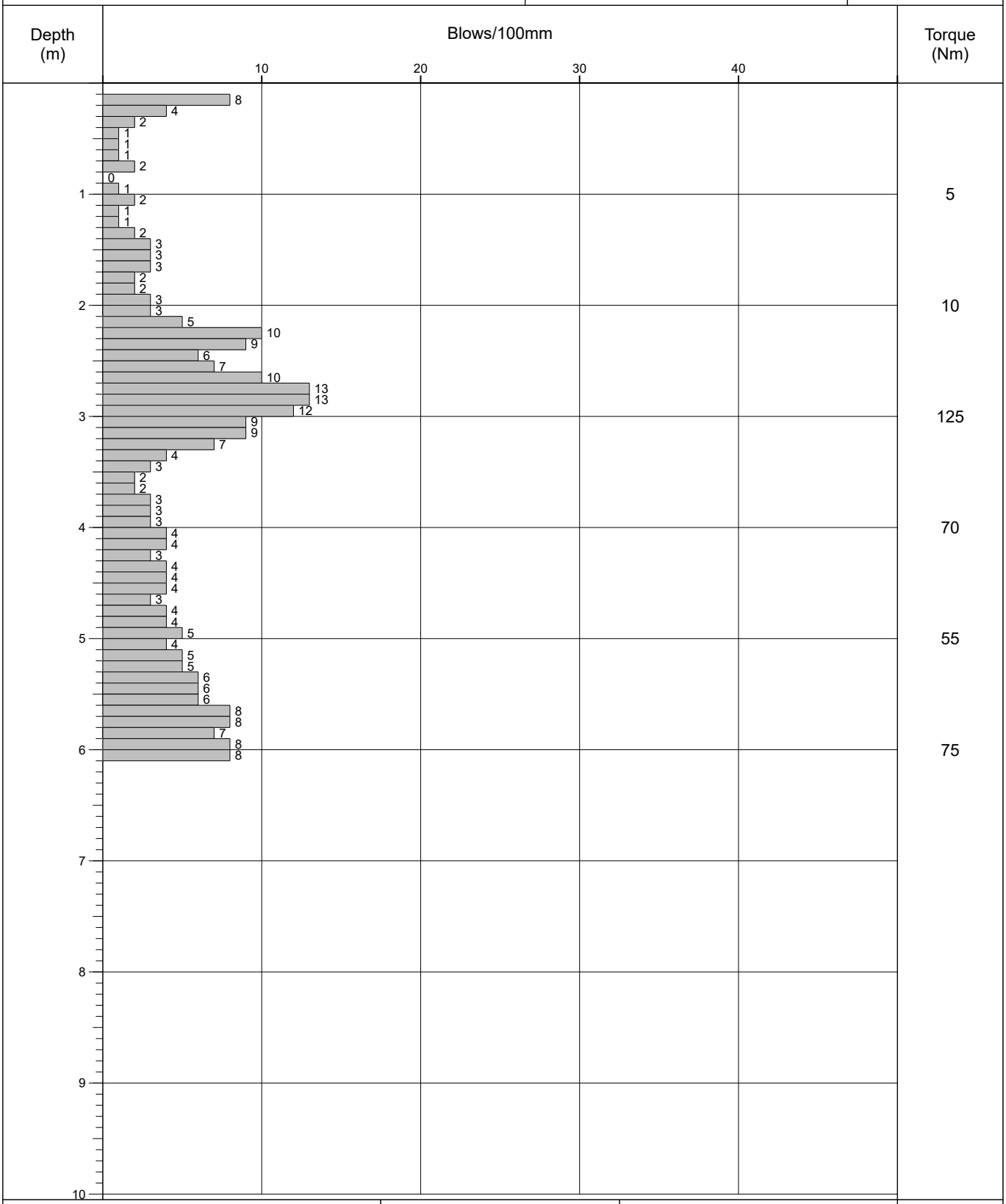
General Remarks:
Hand Dug Trial Pit

Groundwater Remarks: No groundwater encountered.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP1** Sheet 1 of 1

Project Name:	Rowfold Lodge	Project No. 21591	Co-ords:	Hole Type DP
Location:	Coneyhurst Road, Billinghurst, West Sussex, RH14 9DD		Level: m AOD	Scale 1:50
Client:	Mr A Rutherford		Dates: 06/09/2024	Logged By

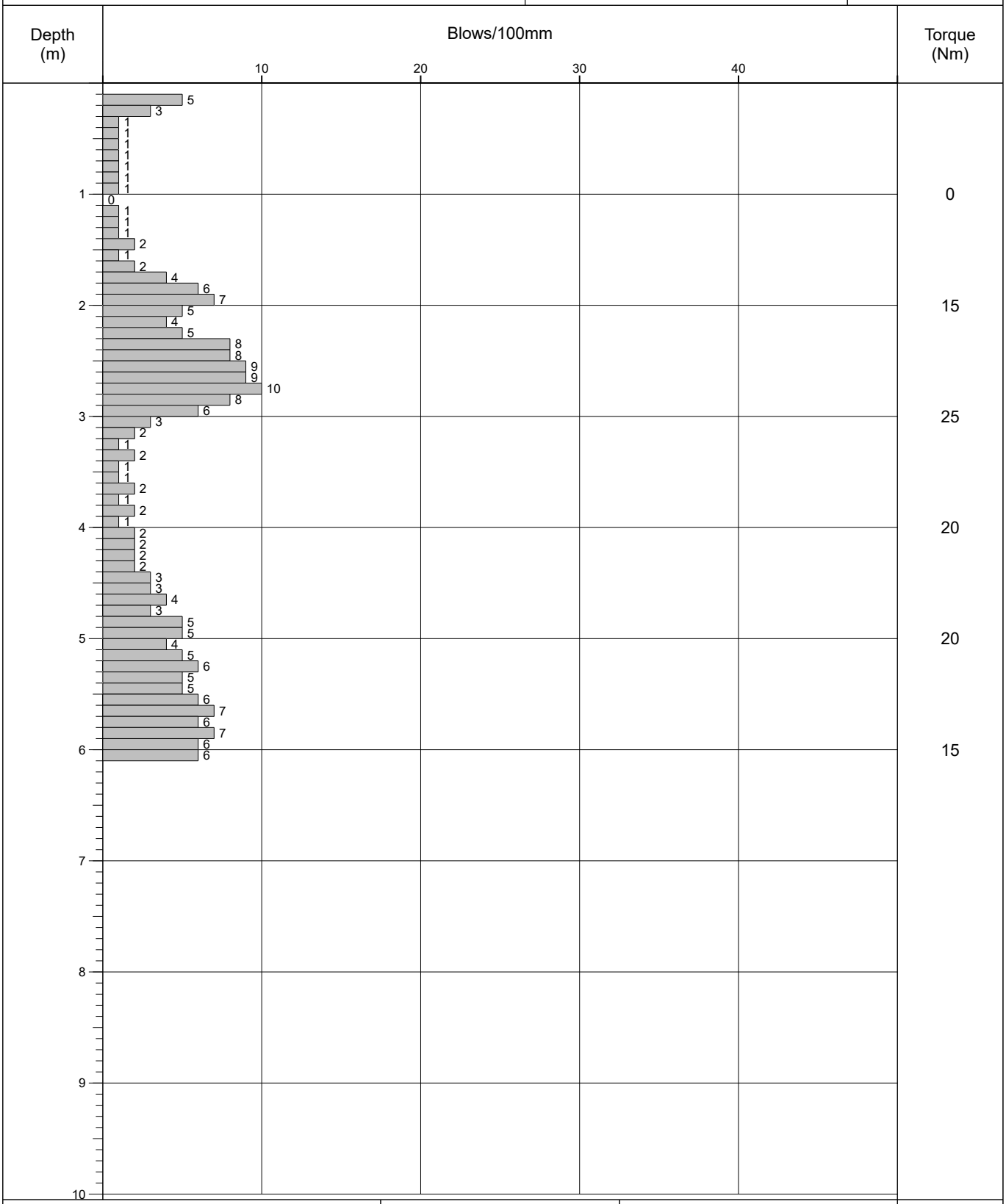


Remarks		Fall Height	750mm	Cone Base Diameter	mm
		Hammer Weight	kg	Final Depth	6m
		Probe Type	DPSH-B	Energy Ratio (Er)	84.92%

AGS REGISTERED USER 2020

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP2** Sheet 1 of 1

Project Name:	Rowfold Lodge	Project No. 21591	Co-ords:	Hole Type DP
Location:	Coneyhurst Road, Billinghurst, West Sussex, RH14 9DD		Level: m AOD	Scale 1:50
Client:	Mr A Rutherford		Dates: 06/09/2024	Logged By

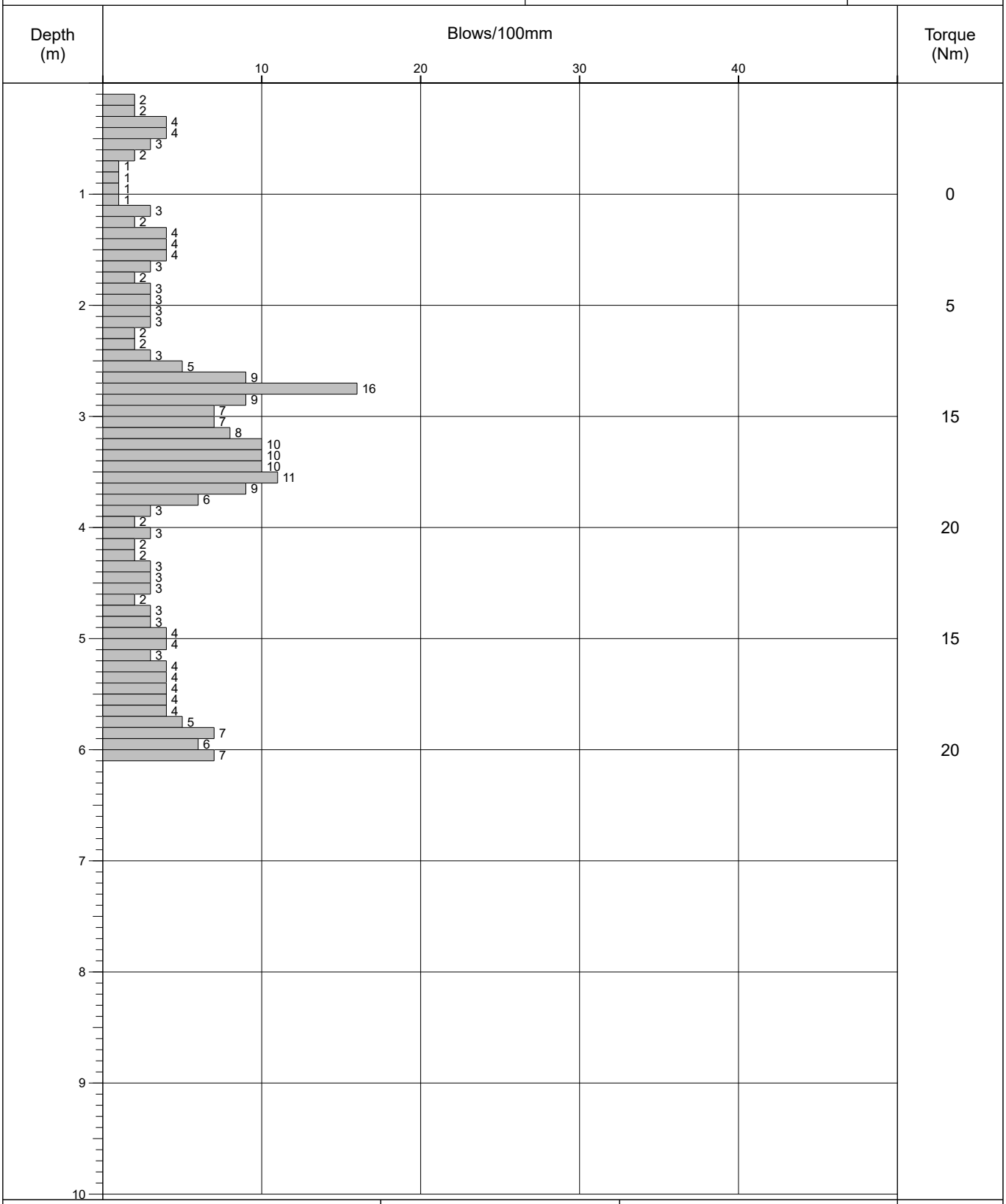


Remarks	Fall Height	750mm	Cone Base Diameter	mm
	Hammer Weight	kg	Final Depth	6m
	Probe Type	DPSH-B	Energy Ratio (Er)	84.92%

AGS REGISTERED USER 2020

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP3** Sheet 1 of 1

Project Name:	Rowfold Lodge	Project No. 21591	Co-ords:	Hole Type DP
Location:	Coneyhurst Road, Billinghurst, West Sussex, RH14 9DD		Level: m AOD	Scale 1:50
Client:	Mr A Rutherford		Dates: 06/09/2024	Logged By

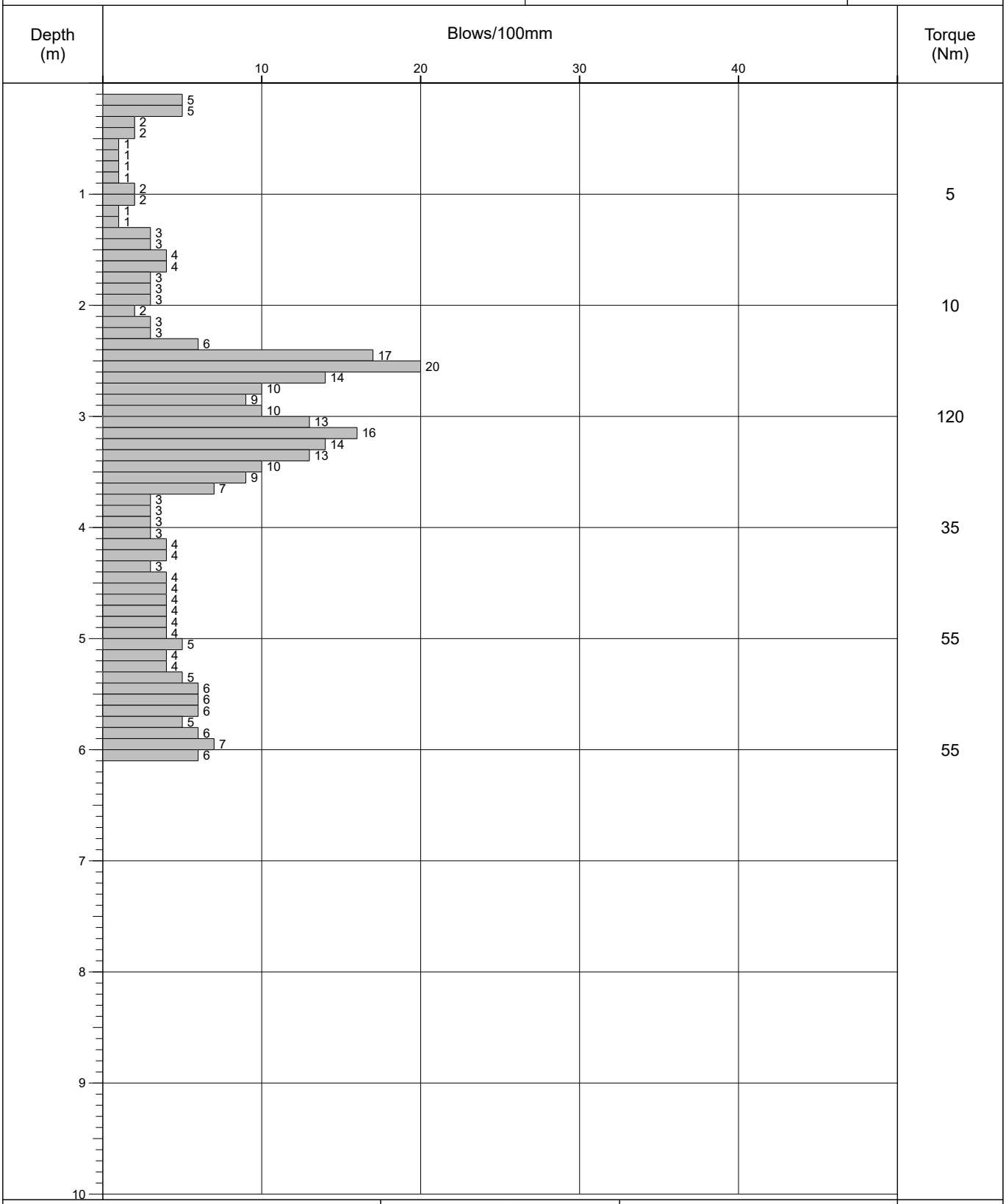


Remarks				
	Fall Height	750mm	Cone Base Diameter	mm
	Hammer Weight	kg	Final Depth	6m
	Probe Type	DPSH-B	Energy Ratio (Er)	84.92%

AGS REGISTERED USER 2020

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP4** Sheet 1 of 1

Project Name:	Rowfold Lodge	Project No. 21591	Co-ords:	Hole Type DP
Location:	Coneyhurst Road, Billinghurst, West Sussex, RH14 9DD		Level: m AOD	Scale 1:50
Client:	Mr A Rutherford		Dates: 06/09/2024	Logged By



Remarks	Fall Height	750mm	Cone Base Diameter	mm
	Hammer Weight	kg	Final Depth	6m
	Probe Type	DPSH-B	Energy Ratio (Er)	84.92%

AGS REGISTERED USER 2020

Appendix D Geotechnical In-Situ and Laboratory Testing

Appendix D.1 Classification

Classification based on SPT "N" values:

The inferred undrained strength of the cohesive soils was based on the SPT "N" blow counts, derived from the relationship suggested by Stroud (1974) and classified using Table D.1.1. (Ref: Stroud, M. A. 1974, "The Standard Penetration Test – its application and interpretation", Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.).

Table D.1.1 SPT "N" Blow Count Cohesive Classification

Classification	Undrained Cohesive Strength C_u (kPa)
Extremely low	<10
Very low	10 – 20
Low	20 – 40
Medium	40 – 75
High	75 – 150
Very high	150 – 300
Extremely high	> 300

Note(s): (Ref: BS EN ISO 14688-2:2004+A1:2013 Clause 5.3.)

Appendix D.2 Interpretation

Table D.2.1 Interpretation of SPT Tests

BH	Strata	SPT N60 Blow Counts	Inferred Cohesive Strength
WS1/DP1	WC 0.30-1.30 CLAY	4-8	Low (Cu = 20-40kPa)
	WC 1.40-2.00 CLAY	8-12	Low to Medium (Cu = 40-60kPa)
	WC 2.10-3.20 CLAY	20-53	High to Very High (Cu = 100-265kPa)
	WC 3.30-4.80 CLAY[1]	8-16	Low to high (Cu =(40-80kPa)
	WC 4.90-6.00 CLAY[1]	16-32	High to Very High (Cu = 80-160kPa)
WS2/DP2	WC 0.30-1.60 CLAY	0-8	Extremely Low to Low (Cu = 0-40kPa)
	WC 1.70-2.90 CLAY	16-40	High to Very High (Cu = (80-200kPa)
	WC 3.00-4.70 CLAY	4-16	Low to High (Cu = 20-80kPa)
	WC 4.80-6.00 CLAY	16-28	High (Cu = 80-140kPa)
WS3/DP3	WC 1.10-2.40 CLAY	8-16	Low to high (Cu = 40-80kPa)
	WC 2.50-3.70 CLAY	20-65	High to Extremely High (Cu = 100-325kPa)
	WC 2.80-5.60 CLAY	8-16	Low to high (Cu = 40-80kPa)
	WC 5.70-6.00[1] CLAY	20-28	High (Cu = 100-140kPa)
WS4/DP4	WC 0.50-1.40 CLAY	4-12	Low to Medium (Cu = 20-60kPa)
	WC 1.50-2.30 CLAY	16-24	High (Cu = 80-120kPa)

BH	Strata	SPT N60 Blow Counts	Inferred Cohesive Strength
	WC 2.40-3.60 CLAY	28-81	High to Extremely High (Cu = 140-405kPa)
	WC 3.70-5.30 CLAY	12-20	Medium to High (Cu = 60-100kPa)
	WC 5.40-6.00 CLAY	20-28	High (Cu = 100-140kPa)
Notes: anything beyond the WS depth has been inferred from the dynamic probes			

Table D.2.2 Interpretation of Atterberg Limit Tests

Stratum	M/C (%)	PI (%)	>425µm (%)	Mod PI (%)	Class	VCP	
						BRE	NHBC
WC	20-23	26-47	100	26-47	CI - CH	Med-high	Med-high

Note(s): BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results). VCP=Volume Change Potential
NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2
Soils Classification based on British Soil Classification System
The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Clauses 3.2, 4.3 and 5

Appendix D.3 Geotechnical Lab

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DETS Report No: 24-10775

Site Reference:	Rowford Lodge
Project / Job Ref:	21591
Order No:	21591/km
Sample Receipt Date:	13/09/2024
Sample Scheduled Date:	13/09/2024
Report Issue Number:	1
Reporting Date:	24/09/2024

Authorised by:

[redacted]

Steve Knight
Customer Support 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: 24-10775	**~Date Sampled**	06/09/24	06/09/24	06/09/24		
Soils Ltd	**~Time Sampled**	None Supplied	None Supplied	None Supplied		
~Site Reference: Rowford Lodge	**~TP / BH No**	WS1	WS2	WS3		
~Project / Job Ref: 21591	**~Additional Refs**	None Supplied	None Supplied	None Supplied		
~Order No: 21591/km	**~Depth (m)**	1.40	2.40	0.90		
Reporting Date: 24/09/2024	**DETS Sample No**	738069	738070	738071		

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	6.2	6.5	6.7		
Total Sulphate as SO_4	mg/kg	< 200	MCERTS	553	507	< 200		
Total Sulphate as SO_4	%	< 0.02	MCERTS	0.06	0.05	< 0.02		
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	50	70	36		
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.05	0.07	0.04		
Total Sulphur	%	< 0.02	NONE	< 0.02	0.04	< 0.02		
Ammonium as NH_4	mg/kg	< 0.5	MCERTS	0.5	3.1	< 0.5		
Ammonium as NH_4	mg/l	< 0.05	MCERTS	0.05	0.31	< 0.05		
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	14	26	8		
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	7	12.8	4.2		
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS	< 3	< 3	5		
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	MCERTS	< 1.5	< 1.5	2.3		
W/S Magnesium	mg/l	< 0.1	NONE	3.3	0.2	1.3		

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)
~Sample details provided by customer and can affect the validity of results

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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 24-10775	
Soils Ltd	
~Site Reference: Rowford Lodge	
~Project / Job Ref: 21591	
~Order No: 21591/km	
Reporting Date: 24/09/2024	

DETS Sample No	~TP / BH No	~Additional Refs	~Depth (m)	Moisture Content (%)	Sample Matrix Description
738069	WS1	None Supplied	1.40	15	Light brown sandy clay
738070	WS2	None Supplied	2.40	11.2	Light brown sandy clay
738071	WS3	None Supplied	0.90	14.2	Light brown sandy clay

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S
~Sample details provided by customer and can affect the validity of results

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Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 24-10775
Soils Ltd
~Site Reference: Rowford Lodge
~Project / Job Ref: 21591
~Order No: 21591/km
Reporting Date: 24/09/2024

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

D Dried
AR As Received

~Sample details provided by customer and can affect the validity of results

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List of HWOL Acronyms and Operators
DETS Report No: 24-10775
Soils Ltd
~Site Reference: Rowford Lodge
~Project / Job Ref: 21591
~Order No: 21591/km
Reporting Date: 24/09/2024

Acronym	**Description**
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total
~	Sample details provided by customer and can affect the validity of results

Det - Acronym

Laboratory Report

UKAS TESTING 2788

GSTL
GEOTECHNICAL SITE & TESTING LABORATORIES
A PHENNA GROUP COMPANY

Contract Number: 74786

Client Ref: **21591**
Client PO: **21591**

Client: **Soils Limited**

Contract Title: **21591**
For the attention of: **Kasha Mackay**

Date Received: **18-09-2024**
Date Completed: **27-09-2024**
Report Date: **27-09-2024**

This report has been checked and approved by:

[redacted]

Brendan Evans
Office Administrator

Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	5
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	5
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

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Approved Signatories:
Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)
Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)
Wayne Honey (HR & HSE Manager)

GEO Site & Testing Services Ltd
Unit 3-4 Heol Aur, Dafen Ind Est, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784 040 Fax: 01554 784 040 info@gstl.co.uk https://gstl.co.uk

GSTL
GEOTECHNICAL SITE & TESTING LABORATORIES

NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX
(BS 1377:1990 - Part 2 : 4.4 & 5.3)

Contract Number	74786
Project Name	21591
Date Tested	26/09/2024

DESCRIPTIONS

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
WS1		D	0.95	-		Brown silty CLAY
WS2		D	1.90	-		Brown silty CLAY
WS3		D	1.20	-		Brown silty CLAY
WS4		D	1.00	-		Brown silty CLAY
WS4		D	2.20	-		Brown silty CLAY
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		

Operator
Clayton Jenkins

GSTL
GEOTECHNICAL SITE & TESTING LABORATORIES

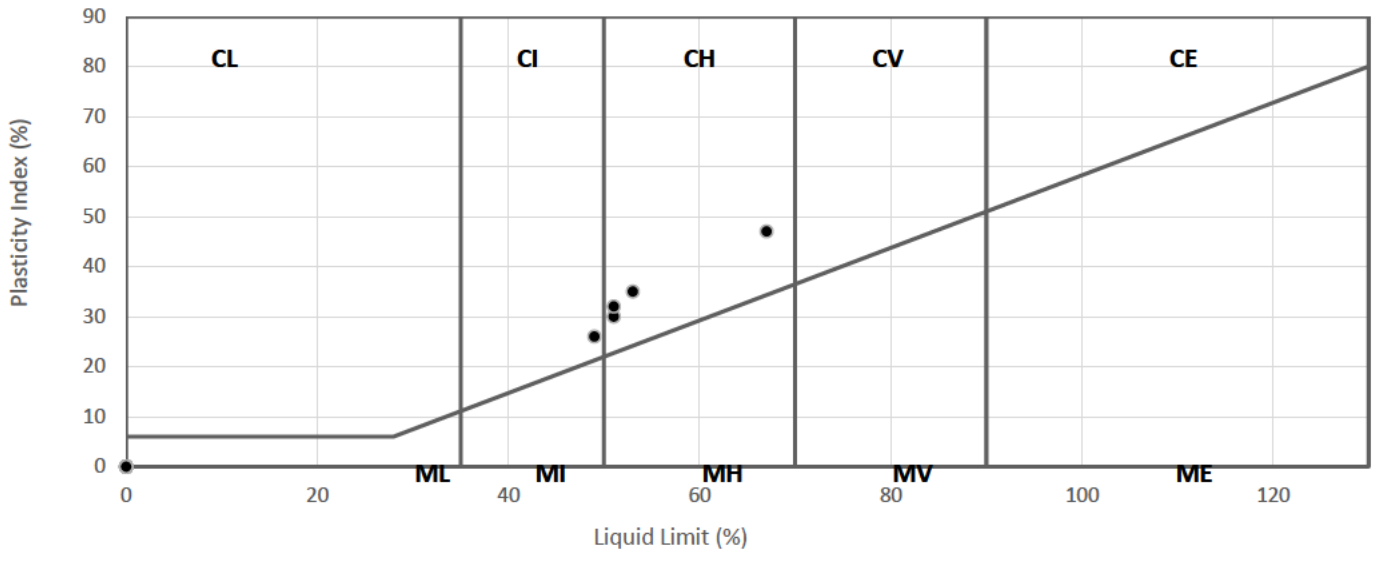
NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX
(BS 1377:1990 - Part 2 : 4.4 & 5.3)

Contract Number	74786
Project Name	21591
Date Tested	26/09/2024

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
WS1		D	0.95	-		21	49	23	26	100	CI Intermediate Plasticity
WS2		D	1.90	-		20	53	18	35	100	CH High Plasticity
WS3		D	1.20	-		22	51	21	30	100	CH High Plasticity
WS4		D	1.00	-		22	51	19	32	100	CH High Plasticity
WS4		D	2.20	-		23	67	20	47	100	CH High Plasticity

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:2015+A1:2020



Operator
Clayton Jenkins

UKAS TESTING
2788

Appendix E Chemical Laboratory Analyses

Appendix E.1 Conceptual Site Model

Table E.1.1 CSM Revised Pre-Chemical Analyses from Land Science

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Desk Study and Main Investigation Report Information			Comments	Further Works
				Severity	Probability	Risk		
Made Ground Agricultural Land	Metals, Semi-metals and non-metals, PAHs, Asbestos	Inhalation of dust	Site Workers/Site Maintenance	Medium	Low	Moderate/Low	There were no geological hazards in the area with a hazard rating above moderate. The Weald Clay Formation was classified as unproductive strata which has negligible significance for water supply or river base flow. There were no source protection zones in the area.	Chemical analysis of selected samples and human health risk assessment.
			End Users	Mild	Unlikely	Very Low		
			Off-site Users	Mild	Low	Low		
	PAHs, TPHs	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	Mild	Low	Low		
			End Users	Mild	Unlikely	Very Low		
			Off-site Users	Minor	Low	Very Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Medium	Low	Moderate/Low		
			End Users	Medium	Unlikely	Low		
			Off-Site Users	Medium	Unlikely	Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Migration via surface runoff	Surface Water	Minor	Unlikely	Very Low		
		Migration in solution via groundwater	Surface Water	Minor	Unlikely	Very Low		
			Shallow Aquifer	Minor	Unlikely	Very Low		
			Deep Aquifer	Minor	Unlikely	Very Low		
		Direct contact with construction material	Buried structures	Minor	Likely	Low		
			Buried Services	Mild	Unlikely	Very Low		
	PAHs, TPHs	Migration of gases via permeable soils	Site Workers/Site Maintenance	Mild	Low	Low		
			End Users	Minor	Unlikely	Very Low		
			Off-site Users	Minor	Low	Very Low		
			Building and confined spaces	Minor	Low	Very Low		

Table E.1.2 CSM Revised Post-Chemical Analyses

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Desk Study and Main Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
Made Ground	PAHs	Inhalation of dust	Site Workers/Site Maintenance	Mild	Likely	Moderate/Low	The investigation indicated that there was exceedance in three EPA-16 PAHs contamination in HDTP2.	A remediation strategy to be carried out on HDTP2
			End Users	Mild	Likely	Moderate/Low		
			Off-site Users	Mild	Likely	Moderate/Low		
	PAHs	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Mild	Likely	Moderate/Low		
			End Users	Mild	Likely	Moderate/Low		
	PAHs	Migration via surface runoff	Surface Water	Mild	Likely	Moderate/Low		
		Direct contact with construction material	Buried structures	Mild	Likely	Moderate/Low		
			Buried Services	Mild	Likely	Moderate/Low		
	PAHs,	Migration of gases via permeable soils	Site Workers/Site Maintenance	Mild	Likely	Moderate/Low		
			End Users	Mild	Likely	Moderate/Low		
			Off-site Users	Mild	Likely	Moderate/Low		
			Building and confined spaces	Mild	Likely	Moderate/Low		

Appendix E.2 Chemical Laboratory Results

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DETS Report No: 24-10774

Site Reference:	Rowford Lodge
Project / Job Ref:	21591
Order No:	21591/km
Sample Receipt Date:	13/09/2024
Sample Scheduled Date:	13/09/2024
Report Issue Number:	1
Reporting Date:	19/09/2024

Authorised by:

[redacted]

Steve Knight
Customer Support Manager

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

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Tel : 01622 850410

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Soil Analysis Certificate						
DETS Report No: 24-10774	**~Date Sampled**	06/09/24	06/09/24	06/09/24	06/09/24	
Soils Ltd	**~Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	
~Site Reference: Rowford Lodge	**~TP / BH No**	WS1	WS2	WS3	WS4	
~Project / Job Ref: 21591	**~Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	
~Order No: 21591/km	**~Depth (m)**	0.15	0.25	0.15	0.30	
Reporting Date: 19/09/2024	**DETS Sample No**	738065	738066	738067	738068	

Determinand	Unit	RL	Accreditation	(n)				
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	11.7	8.3	8.0	7.8	
Organic Matter (SOM)	%	< 0.1	MCERTS	5	0.7	1	2.5	
Arsenic (As)	mg/kg	< 2	MCERTS	12	< 2	7	11	
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	1.8	< 0.2	< 0.2	< 0.2	
Chromium (Cr)	mg/kg	< 2	MCERTS	19	2	6	14	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	149	< 4	5	13	
Lead (Pb)	mg/kg	< 3	MCERTS	105	< 3	6	21	
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	13	< 3	3	5	
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Vanadium (V)	mg/kg	< 1	MCERTS	15	3	16	29	
Zinc (Zn)	mg/kg	< 3	MCERTS	492	115	22	38	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)
~Sample details provided by customer and can affect the validity of results
(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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Tel : 01622 850410

Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 24-10774	**~Date Sampled**	06/09/24	06/09/24	06/09/24	06/09/24	
Soils Ltd	**~Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	
~Site Reference: Rowford Lodge	**~TP / BH No**	WS1	WS2	WS3	WS4	
~Project / Job Ref: 21591	**~Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	
~Order No: 21591/km	**~Depth (m)**	0.15	0.25	0.15	0.30	
Reporting Date: 19/09/2024	**DETS Sample No**	738065	738066	738067	738068	

Determinand	Unit	RL	Accreditation	(n)				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.15	
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.12	
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	

~Sample details provided by customer and can affect the validity of results
(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 - EPH Texas Banded						
DETS Report No: 24-10774	**~Date Sampled**	06/09/24	06/09/24	06/09/24	06/09/24	
Soils Ltd	**~Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	
~Site Reference: Rowford Lodge	**~TP / BH No**	WS1	WS2	WS3	WS4	
~Project / Job Ref: 21591	**~Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	
~Order No: 21591/km	**~Depth (m)**	0.15	0.25	0.15	0.30	
Reporting Date: 19/09/2024	**DETS Sample No**	738065	738066	738067	738068	

Determinand	Unit	RL	Accreditation	(n)				
EPH Texas (C6 - C8) : HS_1D_MS_Total	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
EPH Texas (>C8 - C10) : EH_1D_Total	mg/kg	< 1	**MCERTS**	< 1	< 1	< 1	< 1	
EPH Texas (>C10 - C12) : EH_1D_Total	mg/kg	< 1	**MCERTS**	< 1	< 1	< 1	< 1	
EPH Texas (>C12 - C16) : EH_1D_Total	mg/kg	< 1	**MCERTS**	< 1	< 1	< 1	< 1	
EPH Texas (>C16 - C21) : EH_1D_Total	mg/kg	< 1	**MCERTS**	< 1	< 1	< 1	< 1	
EPH Texas (>C21 - C40) : EH_1D_Total	mg/kg	< 6	**MCERTS**	< 6	< 6	< 6	< 6	
EPH Texas (C6 - C40) : HS_1D_MS+EH_1D_Total	mg/kg	< 6	NONE	< 6	< 6	< 6	< 6	

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Soil Analysis Certificate - Organochlorine Pesticides						
DETS Report No: 24-10774	**~Date Sampled**	06/09/24	06/09/24			
Soils Ltd	**~Time Sampled**	None Supplied	None Supplied			
~Site Reference: Rowford Lodge	**~TP / BH No**	WS3	WS4			
~Project / Job Ref: 21591	**~Additional Refs**	None Supplied	None Supplied			
~Order No: 21591/km	**~Depth (m)**	0.15	0.30			
Reporting Date: 19/09/2024	**DETS Sample No**	738067	738068			

Determinand	**Unit**	**RL**	**Accreditation**					
Aldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
alpha-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
beta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
cis-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
delta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Dieldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Endosulfan A	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Endosulfan B	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Endrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
gamma-HCH (Lindane)	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Heptachlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Heptachlor epoxide	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Hexachlorobenzene (HCB)	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Isodrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Methoxychlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
o,p' - DDD	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
o,p' - DDE	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
o,p' - DDT	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
p,p' - DDD	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
p,p' - DDE	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
p,p' - DDT	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
trans-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Trifluralin	mg/kg	< 0.02	NONE	< 0.02	< 0.02			

~Sample details provided by customer and can affect the validity of results

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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 24-10774	
Soils Ltd	
~Site Reference: Rowford Lodge	
~Project / Job Ref: 21591	
~Order No: 21591/km	
Reporting Date: 19/09/2024	

DETS Sample No	~TP / BH No	~Additional Refs	~Depth (m)	Moisture Content (%)	Sample Matrix Description
738065	WS1	None Supplied	0.15	3.6	Light brown sandy gravel with stones and concrete
738066	WS2	None Supplied	0.25	13.5	Light grey sand
738067	WS3	None Supplied	0.15	8.3	Brown sandy clay with stones
738068	WS4	None Supplied	0.30	11	Brown sandy clay

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S
~Sample details provided by customer and can affect the validity of results

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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-10774
Soils Ltd
~Site Reference: Rowford Lodge
~Project / Job Ref: 21591
~Order No: 21591/km
Reporting Date: 19/09/2024

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

D Dried
AR As Received

~Sample details provided by customer and can affect the validity of results

Normec DETS Limited
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List of HWOL Acronyms and Operators
DETS Report No: 24-10774
Soils Ltd
~Site Reference: Rowford Lodge
~Project / Job Ref: 21591
~Order No: 21591/km
Reporting Date: 19/09/2024

Acronym	**Description**
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total
~	Sample details provided by customer and can affect the validity of results

EPH Texas (C10 - C12) - EH_1D_Total
EPH Texas (C12 - C16) - EH_1D_Total
EPH Texas (C16 - C21) - EH_1D_Total
EPH Texas (C21 - C40) - EH_1D_Total
EPH Texas (C6 - C40) - HS_1D_MS+EH_1D_Total
EPH Texas (C6 - C8) - HS_1D_MS _Total
EPH Texas (C8 - C10) - EH_1D_Total

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4480

DETS Report No: 24-11625

Site Reference:	Rowfold Lodge, Billingshurst
Project / Job Ref:	21591
Order No:	21591/km
Sample Receipt Date:	01/10/2024
Sample Scheduled Date:	01/10/2024
Report Issue Number:	1
Reporting Date:	08/10/2024

Authorised by:

[redacted]

Steve Knight
Customer Support 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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4480

Soil Analysis Certificate						
DETS Report No: 24-11625	**~Date Sampled**	26/09/24	26/09/24	26/09/24	26/09/24	26/09/24
Soils Ltd	**~Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Rowfold Lodge, Billingshurst	**~TP / BH No**	HDTP1	HDTP2	HDTP3	HDTP4	HDTP5
~Project / Job Ref: 21591	**~Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: 21591/km	**~Depth (m)**	0.20	0.20	0.60	0.20	0.20
Reporting Date: 08/10/2024	**DETS Sample No**	741178	741179	741180	741181	741182

Determinand	**Unit**	**RL**	**Accreditation**	(n)				
Asbestos Screen (S)	N/a	N/a	**ISO17025**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	**MCERTS**	8.1	7.6	7.7	7.7	8.4
Organic Matter (SOM)	%	< 0.1	**MCERTS**	2.9	4.2	2.4	4.6	0.6
Arsenic (As)	mg/kg	< 2	**MCERTS**	17	31	12	14	6
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	**MCERTS**	1.2	0.6	< 0.2	0.4	< 0.2
Chromium (Cr)	mg/kg	< 2	**MCERTS**	11	14	12	16	7
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	**MCERTS**	16	24	16	25	5
Lead (Pb)	mg/kg	< 3	**MCERTS**	65	129	31	51	5
Mercury (Hg)	mg/kg	< 1	**MCERTS**	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	**MCERTS**	9	9	6	10	10
Selenium (Se)	mg/kg	< 2	**MCERTS**	< 2	< 2	< 2	< 2	< 2
Vanadium (V)	mg/kg	< 1	**MCERTS**	13	27	23	33	13
Zinc (Zn)	mg/kg	< 3	**MCERTS**	152	100	44	85	79
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)
~Sample details provided by customer and can affect the validity of results
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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 24-11625	**~Date Sampled**	26/09/24	26/09/24	26/09/24	26/09/24	26/09/24
Soils Ltd	**~Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Rowfold Lodge, Billingshurst	**~TP / BH No**	HDTP1	HDTP2	HDTP3	HDTP4	HDTP5
~Project / Job Ref: 21591	**~Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: 21591/km	**~Depth (m)**	0.20	0.20	0.60	0.20	0.20
Reporting Date: 08/10/2024	**DETS Sample No**	741178	741179	741180	741181	741182

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	0.24	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	0.37	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	1.01	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	10.40	1.08	1.78	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	2.13	0.25	0.36	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	14.70	2.90	5.46	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	12.30	2.55	5	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	6.44	1.39	2.54	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	5.52	1.67	2.49	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.12	6.40	2.14	2.91	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	2.03	0.51	0.80	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.14	6.26	2.14	3.02	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	2.82	1.30	1.35	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.79	0.22	0.23	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	2.25	1.18	1.18	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	73.7	17.3	27.1	< 1.6

~Sample details provided by customer and can affect the validity of results
(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 - EPH Texas Banded						
DETS Report No: 24-11625	**~Date Sampled**	26/09/24	26/09/24	26/09/24	26/09/24	26/09/24
Soils Ltd	**~Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Rowfold Lodge, Billingshurst	**~TP / BH No**	HDTP1	HDTP2	HDTP3	HDTP4	HDTP5
~Project / Job Ref: 21591	**~Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: 21591/km	**~Depth (m)**	0.20	0.20	0.60	0.20	0.20
Reporting Date: 08/10/2024	**DETS Sample No**	741178	741179	741180	741181	741182

Determinand	**Unit**	**RL**	**Accreditation**	(n)				
EPH Texas (C6 - C8) : HS_1D_MS_Total	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
EPH Texas (>C8 - C10) : EH_1D_Total	mg/kg	< 1	**MCERTS**	< 1	3	3	2	< 1
EPH Texas (>C10 - C12) : EH_1D_Total	mg/kg	< 1	**MCERTS**	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C12 - C16) : EH_1D_Total	mg/kg	< 1	**MCERTS**	< 1	11	1	2	< 1
EPH Texas (>C16 - C21) : EH_1D_Total	mg/kg	< 1	**MCERTS**	< 1	87	12	20	< 1
EPH Texas (>C21 - C40) : EH_1D_Total	mg/kg	< 6	**MCERTS**	< 6	134	36	48	< 6
EPH Texas (C6 - C40) : HS_1D_MS+EH_1D_Total	mg/kg	< 6	NONE	< 6	234	52	72	< 6

~Sample details provided by customer and can affect the validity of results
(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 - Sample Descriptions	
DETS Report No: 24-11625	
Soils Ltd	
~Site Reference: Rowfold Lodge, Billingshurst	
~Project / Job Ref: 21591	
~Order No: 21591/km	
Reporting Date: 08/10/2024	

DETS Sample No	~TP / BH No	~Additional Refs	~Depth (m)	Moisture Content (%)	Sample Matrix Description
741178	HDTP1	None Supplied	0.20	8	Brown sandy gravel with stones and concrete
741179	HDTP2	None Supplied	0.20	13.8	Brown sandy clay with vegetation
741180	HDTP3	None Supplied	0.60	9.4	Brown sandy clay with stones
741181	HDTP4	None Supplied	0.20	13.5	Brown sandy clay with vegetation
741182	HDTP5	None Supplied	0.20	12.2	Brown sandy clay with stones and concrete

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S
~Sample details provided by customer and can affect the validity of results

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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-11625

Soils Ltd

~Site Reference: Rowfold Lodge, Billingshurst

~Project / Job Ref: 21591

~Order No: 21591/km

Reporting Date: 08/10/2024

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

D Dried
AR As Received
~Sample details provided by customer and can affect the validity of results

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List of HWOL Acronyms and Operators
DETS Report No: 24-11625
Soils Ltd
~Site Reference: Rowfold Lodge, Billingshurst
~Project / Job Ref: 21591
~Order No: 21591/km
Reporting Date: 08/10/2024

Acronym	**Description**
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total
~	Sample details provided by customer and can affect the validity of results

EPH Texas (C10 - C12) - EH_1D_Total
EPH Texas (C12 - C16) - EH_1D_Total
EPH Texas (C16 - C21) - EH_1D_Total
EPH Texas (C21 - C40) - EH_1D_Total
EPH Texas (C6 - C40) - HS_1D_MS+EH_1D_Total
EPH Texas (C6 - C8) - HS_1D_MS_Total
EPH Texas (C8 - C10) - EH_1D_Total

Appendix E.3 General Assessment Criteria

HUMAN HEALTH RISK ASSESSMENT

Introduction

The statutory definition of contaminated land was initially defined in the Environmental Protection Act 1990, ref. 1.1, which was introduced by the Environment Act 1995, ref. 1.2, and retained in the Environment Act 2021, ref 1.3, as;

'Land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

> (a) significant harm is being caused or there is a significant possibility of such harm being caused; or
> (b) pollution of controlled waters is being, or is likely to be, caused.'

The UK guidance on the assessment of contaminated land has developed as a direct result of the introduction of these Acts. The technical guidance supporting the original legislation was summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs). These have since been replaced or superseded by Land Contamination Risk Management (LCRM) 2021, ref 1.4 produced and administrated by the Environment Agency online through the .GOV.uk website https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm .

However, the basic definitions, methodology and guidance remain essentially the same utilizing the UK Contaminated Land Exposure Assessment Models (CLEA) as within the original CLR and planning guidance it replaces or supersedes.

In establishing whether a site fulfils the statutory definition of 'contaminated land' it remains necessary to identify, whether a pollutant linkage exists in respect of the land in question and whether the pollutant linkage:

- is resulting in significant harm being caused to the identified receptor in the pollutant linkage,
- presents a significant possibility of significant harm being caused to that receptor,
- is resulting in the pollution of the controlled waters which constitute the receptor, or
- is likely to result in such pollution.

A 'pollutant linkage' may therefore be defined as the confirmation of a link between a contaminant 'source' and a vulnerable at risk 'receptor' by means of a 'pathway' and that the risk is potentially significant. If there is no complete linkage, risk defaults to low to negligible and can never be potentially significant.

Assessment Methodology

A four-stage assessment process is followed for identifying potential pollutant linkages on a site. These stages are summarised in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable in the context of existing and future proposals.

Stages 1 and 2 develop an initial *'conceptual model'* based upon information collated from desk-based available and existing site information and a walkover of the site as recommended in BS10175 and LCRM. The formation of any conceptual model is an iterative process and as such it should be updated and refined throughout each phase of the project to reflect any additional information obtained and unknowns being resolved and identify the potential contaminants of concern at the site, i.e. those with the potential to cause significant harm to identified receptors.

The extent of the desk studies and enquiries to be conducted should be in general accordance with BS10175 and other UK guidance to produce an initial conceptual model highlighting the known potential risks, remaining unknowns and contaminants of concern. The information from these enquiries is presented in a desk study or preliminary report with recommendations, if necessary, for further work based upon the conceptual model findings and any identified or unresolved unknowns.

If potential pollutant linkages or potentially significant unknowns are identified within the initial conceptual model, further site investigation and report will be recommended and usually required under planning. Such investigation should be based on and driven by the findings of the initial conceptual model and planned in general accordance with BS10175, LCRM and other current UK guidance where relevant. The number of exploratory holes and samples collected for analysis should be consistent with the size, extent and nature of the site, the identified contaminants of concern and the level of initial risk identified in the initial conceptual model. This will enable a contamination risk assessment to be conducted in accordance with current UK requirements, at which point the conceptual model can be updated and any relevant pollutant linkages can be further quantified and any remaining unknowns resolved. As previously this is an iterative process that may highlight or require additional investigation to resolve to the satisfaction of the regulator.

A two-stage investigation process may therefore be more appropriate where time constraints are less of an issue with the first intrusive investigation being conducted as an initial or screening assessment to confirm or validate the presence of potential sources on site identified in the initial conceptual model and to investigate if additional unknown sources not previously identified are present. This helps to define the scope, extent and requirements of a second more refined and targeted investigation to delineate wherever possible the extent of the identified contamination, contaminants of concern and/or remaining unknowns.

All site works should be undertaken in general accordance with the British Standards BS 10175, ref. 5, for environmental only investigations and BS 5930:2015, ref. 1.6, in the case of combined Geoenvironmental and/or Geotechnical investigations.

The results of analysis are compared initially against generic guidance values which are dependent on the proposed end-use of the development and which must ultimately be based on traceable, scientifically valid and justified exposure and chemical data using the UKCLEA methodology.

The end-use and therefore potential exposure pathways may be defined as one of the following under current UK guidance;

- Residential with homegrown produce i.e. typical low rise and low-density housing with gardens where vegetables and fruits may be grown for home consumption.
- Residential without homegrown produce i.e. low-density housing where no gardens are present where vegetables and fruits could be grown for home consumption.
- Allotments – i.e. areas where vegetables and fruits are grown for home consumption but are not specifically associated with a residential property.
- Public open space residential – i.e. grassed areas adjacent and/or directly related to high density housing and other common or communal open areas on which underlying soils could be exposed but on which vegetables and fruits are not grown for consumption.
- Public open space – i.e. areas such as parks, playing fields and other recreational areas to which public access is possible but otherwise to which there is no direct residential linkage.
- Commercial – i.e. industrial premises where there is limited exposure to soil and residents are not present on site.

Standard Land-use Scenarios

The standard land-use scenarios used to develop exposure models are further detailed in the following sections:

Residential with homegrown produce

Generic scenario assumes a house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

- Critical receptor is assumed to be a young female child (zero to six years old)
- Exposure pathways include direct soil and indoor dust ingestion, consumption of home-grown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.

A sub-set of the Residential land-use is **Residential without Homegrown produce**. The generic scenario assumes low density housing with communal landscaped gardens where the consumption of homegrown vegetables will not occur and the pathways of direct ingestion and produce inputs are suitably moderated.

Allotments

Areas of open space commonly made available to local users but remote from residential properties, but on which tenants may grow fruit and vegetables for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make only occasional accompanied visits.

Although some allotment holders may choose to keep animals on allotments, potential exposure to animal products is not currently considered within the CLEA model.

- Critical receptor is a young female child (zero to six years old)
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours but at reduced exposure levels reflecting non-residential status.

Commercial

This generic scenario assumes a typical commercial or light industrial property at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is over working lifetime
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours but exposure reduced to reflect non-residential nature and general lack of open spaces.

Public Open Space within Residential Area

This generic scenario refers to any grassed area up to 0.05 ha that is associated with residential properties but is not for their exclusive use and on which no fruit or vegetables are grown for home consumption.

- Grassed area of up to 0.05 ha and a considerable proportion of this (up to 50%) may be bare soil which can be interacted with directly
- Predominantly used by children for play and/or access
- Sufficiently close proximity to home for tracking back of soil to occur, thus indoor exposure pathways apply

- older children chosen as the critical receptor on basis that they will use site most frequently (age class 4-9 years)
- ingestion rate assumed to be 75 mg.day^{-1}

Public Open Space Park

This generic scenario refers to any public park or grassed space that is more than 0.5ha in area:

- Public park (>0.5 ha), predominantly grassed and may also contain children's play equipment and border areas of soil containing flowers or shrubs (75% assumed cover)
- Female child age classes 1-6
- Soil ingestion rate of 50 mg.day^{-1}
- Occupancy period outdoors = 2 hours.day^{-1}
- Exposure frequency of 170 days.year-1 for age classes 2-18 and 85
- days.year^{-1} for age class 1
- Outdoor exposure pathways only (no tracking back of soils).

Human Health Generic Quantitative Risk Assessment (GQRA) involves the comparison of contaminant concentrations measured in soil at the site with Generic Assessment Criteria (GAC) generated using the CLEA model based on the exposure and land use scenario assumptions noted above.

GAC's are deliberately conservative values adopted to ensure that they are applicable to the majority of possible contaminated sites and below which there is considered a low to negligible risk to identified human health receptors, i.e. there can be no harm. These values may be published Contaminated Land Exposure Assessment Model (CLEA) derived GAC's derived by a competent third party or the Environment Agency / DEFRA. It is imperative to the risk assessor to understand the uncertainties and limitations associated with these GAC's to ensure that they are used appropriately.

Where the adoption of a GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses or the contaminant is susceptible to wide variation depending on factors such as form and bioavailability, then a Detailed Quantitative Risk Assessment (DQRA) may be undertaken to develop site specific or remediation values for relevant soil contaminants based on site and contaminant specific conditions.

In 2014, the publication of Category 4 Screening Levels (C4SL), refs 1.8 and 1.9, as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3) ref 1.7 used in the generation of SGVs. C4SL were published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern. Where a C4SL has been published, Soils Limited has adopted them as GAC for these six substances.

For all other substances the soils will be compared to Suitable For Use Levels (S4ULs) published by LQM, ref. 1.10, which were developed for around 85 substances and are

intended to enable a screening assessment of the risks posed by soil quality on development sites. The updated LQM/CIEH GAC publication was developed to accommodate recent developments in the understanding of chemical, toxicological and routine exposure to soil-based contaminants.

Where no S4UL or C4SL is available, assessment criteria may be generated using the Contaminated Land Exposure Assessment (CLEA) Software Version 1.07, ref. 1.11, Toxicological and physico-chemical/fate and transport data used to generate the criteria has been derived from a hierarchy of data sources as follows:

1. Environment Agency or Department of Environment Food and Rural Affairs (DEFRA) documents;
2. Other documents produced by UK Government or state organisations;
3. European institution documents;
4. International organisation documents;
5. Foreign government institutions.

In the case of the majority of contaminants considered, the toxicological data has been drawn originally from the relevant CLR 9 TOX report, or updated toxicological data published by the Environment Agency (2009), where available. Where no TOX report is available reference has been made to appropriately determined health criteria values, derived from the above-noted hierarchy, as this is considered to represent appropriate peer reviewed data sources. Similarly, fate and transport data should also be determined by reference to appropriate sources and the CLEA model assumptions.

Chemical laboratory test results are processed as follows. A statistical analysis of the results is conducted, as detailed in CIEH and CL:AIRE ‘Guidance on Comparing Soil Contamination Data with a Critical Concentration’, ref. 1.12. Individual concentrations are then compared to the selected guideline values to identify and isolate concentrations of contaminants that are in excess of the selected screening low or no risk criteria.

Where the risk estimation identifies significant concentrations of one or more contaminants, further risk evaluation needs to be undertaken often as a site specific DQRA in line with current guidance to determine and confirm if the identified exceedances are significant in the context of the proposed development or activity.

References

1.1 The Environmental Protection Act, Part IIA, Section 78, DoE 1990.

1.2 Environment Act 1995, Section 57, DoE 1995.

1.3 Environment Act 2021 OEP 2021.

1.4 Land Contamination Risk Management Gov.UK (EA) 2021

1.5 BS 10175: 2011+A2:2017 '*Investigation of potentially contaminated sites. Code of practice*', British Standards Institute, 2017

1.6 BS 5930: 2015+A1:2020 '*Code of practice for ground investigations*', British Standards Institute, 2015

1.7 Science Report SC050021/SR3 '*Updated technical background to the CLEA model*', Environment Agency, 2008

1.8 DEFRA SP1010: Development of Category 4 Screening Levels for the Assessment of Land Affected by Contamination, published March 2014.

1.9 Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.

1.10 The LQM/S4ULs for Human Health Risk Assessment, Nathanail P, McCaffery C, Gillett A, Ogden R, and Nathanail J, Land Quality Press, Nottingham, published 2015.

1.11 CLEA '*Software Version 1.071*' (downloaded from the CL:AIRE website , https://www.claire.co.uk/home/news/44-risk-assessment/178-soil-guideline-values)

1.12 CIEH '*Guidance on Comparing Soil Contamination Data with a Critical Concentration*', Chartered Institute of Environmental Health (CIEH) and Contaminated Land: Applications in Real Environments (CL:AIRE), May 2008.

Land Use				Residential With or Without Plant Uptake							Allotments			Commercial			Public Open Space (POS)								
				With home-grown produce				Without home-grown produce									Residential			Park					
				SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	Name	Authority	Date
Type	Contaminants	Species	Year																					
	Antimony		2010						550						7500								EIC/AGS/ CL:AIRE	EIC/AGS/ CL:AIRE	2010
	Arsenic		2014			37			40		49			640			79			168			C4SL	DEFRA	2014
			2015			37			40		40			640			79			170			S4UL	LQM/CIEH	2015
	Barium		2010						1300						22000								EIC/AGS/ CL:AIRE	EIC/AGS/ CL:AIRE	2010
	Beryllium		2015			1.7			1.7		35			12			2.2			63			S4UL	LQM/CIEH	2015
	Boron		2015			290			11000		45			240000			21000			46000			S4UL	LQM/CIEH	2015
	Cadmium		2015			11			85		1.9			190			120			532			S4UL	LQM/CIEH	2015
			2014			26			149		4.9			410			220			880			C4SL	DEFRA	2014
	Chromium	*III*	2015			910			910		18000			8600			1500			33000			S4UL	LQM/CIEH	2015
		VI	2014			21			21		170			49			23			250			C4SL	DEFRA	2014
		VI	2015			6			6		1.8			33			7.7			220			S4UL	LQM/CIEH	2015
	Copper		2015			2400			7100		520			68000			12000			44000			S4UL	LQM/CIEH	2015
	Lead					210			310		84			6000			760			1400			C4SL	DEFRA	2014
Metals	Mercury	Elemental	2012			1.0			1.0		26			26									SGV	DEFRA	2012
			2015			1.2			1.2		21			*58*			16			*30*			S4UL	LQM/CIEH	2015
		Inorganic	2012			170			170		80			36000									SGV	DEFRA	2012
			2015			40			56		19			1100			120			240			S4UL	LQM/CIEH	2015
		Methyl	2012			11			11		8			410									SGV	DEFRA	2012
			2015			11			15		6			320			40			68			S4UL	LQM/CIEH	2015
	Molybdenum		2010						670						17000								EIC/AGS/ CL:AIRE	EIC/AGS/ CL:AIRE	2010
	Nickel		2012			130			130		230			1800									SGV	DEFRA	2012
			2015			130			180		53			980			230			800			S4UL	LQM/CIEH	2015
	Selenium		2012			350			350		120			13000									SGV	DEFRA	2012
			2015			250			430		88			12000			1100			1800			S4UL	LQM/CIEH	2015
	Vanadium		2015			410			1200		91			9000			2000			5000			S4UL	LQM/CIEH	2015
	Zinc		2015			3700			40000		620			730000			81000			170000			S4UL	LQM/CIEH	2015
	Benzene		2012			0.33			0.33		0.07			95									SGV	DEFRA	2012
			2014			0.87			3.3		0.18			98			140			230			C4SL	DEFRA	2014
			2015	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110		S4UL	LQM/CIEH	2015
	Toluene		2012			610			610		120			4400									SGV	DEFRA	2012
			2015	130	290	660	*880*	1900	3900	22	51	120	*65000*	*110000*	*180000*	56000	56000	56000	*87000*	*95000*	*100000*		S4UL	LQM/CIEH	2015
	Ethylbenzene		2012			350			350		90			2800									SGV	DEFRA	2012
			2015	47	110	260	83	190	440	16	39	91	*4700*	*13000*	*27000*	24000	24000	25000	*17000*	*22000*	*27000*		S4UL	LQM/CIEH	2015
BTEX & MTBE	Xylenes	o-xylene	2012			250			250		160			2600									SGV	DEFRA	2012
			2015	60	140	330	88	210	480	28	67	160	*6600*	*15000*	*33000*	41000	42000	43000	*17000*	*24000*	*33000*		S4UL	LQM/CIEH	2015
		m-xylene	2012			240			240		180			3500									SGV	DEFRA	2012
			2015	59	140	320	82	190	450	31	74	170	*6200*	*14000*	*31000*	41000	42000	43000	*17000*	*24000*	*32000*		S4UL	LQM/CIEH	2015
		p-xylene	2012			230			230		160			3200									SGV	DEFRA	2012
			2015	56	130	310	79	180	310	29	69	160	*5900*	*14000*	*30000*	41000	42000	43000	*17000*	*23000*	*31000*		S4UL	LQM/CIEH	2015
Petroleum Hydrocarbons Fractions	Aliphatic >C5 - C6		2015	42	78	160	42	78	160	730	1700	3900	*3200*	*5900*	*12000*	*570000*	590000	600000	*95000*	*130000*	*180000*		S4UL	LQM/CIEH	2015
	Aliphatic >C6 - C8		2015	100	230	530	100	230	530	2300	5600	13000	*7800*	*17000*	*40000*	600000	610000	620000	*150000*	*220000*	*320000*		S4UL	LQM/CIEH	2015
	Aliphatic >C8 - C10		2015	27	65	150	27	65	150	320	770	1700	*2000*	*4800*	*11000*	13000	13000	13000	*14000*	*18000*	*21000*		S4UL	LQM/CIEH	2015
	Aliphatic >C10 - C12		2015	*130*	*330*	*760*	*130*	*330*	*770*	2200	4400	7300	*9700*	*23000*	*47000*	13000	13000	13000	*21000*	*23000*	*24000*		S4UL	LQM/CIEH	2015
	Aliphatic >C12 - C16		2015	*1100*	*2400*	*4300*	*1100*	*2400*	*4400*	11000	13000	13000	*59000*	*82000*	*90000*	13000	13000	13000	*25000*	*25000*	*26000*		S4UL	LQM/CIEH	2015
	Aliphatic >C16 - C35		2015	*65000*	*92000*	*110000*	*65000*	*92000*	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000		S4UL	LQM/CIEH	2015
	Aliphatic >C35 - C44		2015	*65000*	*92000*	*140000*	*65000*	*92000*	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000		S4UL	LQM/CIEH	2015
	Aromatic >C5 - C7		2015	70	140	300	370	690	1400	13	27	57	*26000*	*46000*	*86000*	56000	56000	56000	*76000*	*84000*	*92000*		S4UL	LQM/CIEH	2015
	Aromatic >C7 - C8		2015	130	290	660	860	1800	3900	22	51	120	*56000*	*110000*	*180000*	56000	56000	56000	*87000*	*95000*	*100000*		S4UL	LQM/CIEH	2015
	Aromatic >C8 - C10		2015	34	83	190	47	110	270	8.6	21	51	*3500*	*8100*	*17000*	5000	5000	5000	*7200*	*8500*	*9300*		S4UL	LQM/CIEH	2015

Land Use			Residential With or Without Plant Uptake									Allotments			Commercial			Public Open Space (POS)								
				With home-grown produce			Without home-grown produce											Residential			Park					
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	Name	Authority	Date
Type	Contaminants Species	Year																							
	Aromatic >C10 - C12	2015	74	180	380	250	590	1200	13	31	74	*16000*	*28000*	*34000*	5000	5000	5000	*9200*	*9700*	*10000*	S4UL	LQM/CIEH	2015
	Aromatic >C12 - C16	2015	140	330	660	1800	2300	2500	23	57	130	*36000*	*37000*	*38000*	5100	5100	5000	10000	10000	10000	S4UL	LQM/CIEH	2015
	Aromatic >C16 - C21	2015	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	S4UL	LQM/CIEH	2015
	Aromatic >C21 - C35	2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aromatic >C34 - C44	2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aliphatic + Aromatic >C44 - C70		1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
Polycyclic Aromatic Hydrocarbons (PAH' s) (mg/kg)	Acenaphthene	2015	210	510	1100	*3000*	*4700*	*6000*	34	85	200	*84000*	*97000*	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Acenaphthylene	2015	170	420	920	*2900*	*4600*	*6000*	28	69	160	*83000*	*97000*	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Anthracene	2015	2400	5400	11000	*31000*	*35000*	*37000*	380	950	2200	520000	54000	540000	74000	74000	74000	150000	150000	150000	S4UL	LQM/CIEH	2015
	Benzo(a)anthracene	2015	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	S4UL	LQM/CIEH	2015
	Benzo(a)pyrene	2014			5			5.3			5.7			76			10			21	C4SL	DEFRA	2014
		2015	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	S4UL	LQM/CIEH	2015
	Benzo(b)fluoranthene	2015	2.6	3.3	3.7	3.9	4.0	4.0	0.99	2.1	3.9	44	44	45	7.1	7.2	7.2	13	15	16	S4UL	LQM/CIEH	2015
	Benzo(ghi)perylene	2015	320	340	350	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	S4UL	LQM/CIEH	2015
	Benzo(k)fluoranthene	2015	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	S4UL	LQM/CIEH	2015
	Chrysene	2015	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	S4UL	LQM/CIEH	2015
	Dibenz(a,h)anthracene	2015	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	S4UL	LQM/CIEH	2015
	Fluoranthene	2015	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	S4UL	LQM/CIEH	2015
	Fluorene	2015	170	400	860	*2800*	*3800*	*4500*	27	67	160	63000	68000	71000	9900	9900	9900	20000	20000	20000	S4UL	LQM/CIEH	2015
	Indeno(1,2,3-cd)pyrene	2015	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	S4UL	LQM/CIEH	2015
	Naphthalene	2015	2.3	5.6	13	2.3	5.6	13	4.1	10	24	*190*	*460*	*1100*	4900	4900	4900	*1200*	*1900*	*3000*	S4UL	LQM/CIEH	2015
	Phenanthrene	2015	95	220	440	*1300*	*1500*	*1500*	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	S4UL	LQM/CIEH	2015
	Pyrene	2015	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	S4UL	LQM/CIEH	2015
	Coal Tar(Bap as surrogate matter)	2015	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	S4UL	LQM/CIEH	2015
Chloroalkanes & alkenes	1,2 Dichloroethane	2015	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	S4UL	LQM/CIEH	2015
	1,1,1 Trichloroethane	2015	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	*140000*	*57000*	*76000*	*100000*	S4UL	LQM/CIEH	2015
	1,1,2,2 Tetrachloroethane	2015	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	S4UL	LQM/CIEH	2015
	1,1,1,2 Tetrachloroethane	2015	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	110	250	560	1400	1400	1400	1500	1800	2100	S4UL	LQM/CIEH	2015
	Tetrachloroethene	2015	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	*810*	*1100*	1500	S4UL	LQM/CIEH	2015
		2021	0.31	0.7	1.6	0.32	0.71	1.6	2	4.8	11	24	55	130	3200	3300	3400	1400	1900	2500	C4SL	CLAIRE	2021
	Tetrachloromethane (Carbon Tetrachloride)	2015	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	S4UL	LQM/CIEH	2015
	Trichloroethene (TCE)	2015	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	S4UL	LQM/CIEH	2015
		2021	0.0093	0.02	0.043	0.0097	0.02	0.045	0.032	0.072	0.16	0.73	1.5	3.4	76	78	79	41	54	69	C4SL	CLAIRE	2021
	Trichloromethane	2015	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	S4UL	LQM/CIEH	2015
	Vinyl Chloride (Cloroethene)	2015	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	S4UL	LQM/CIEH	2015
		2021	0.0064	0.01	0.017	0.015	0.019	0.029	0.0017	0.0031	0.0058	1.1	1.4	2.2	7.8	7.8	7.8	18	19	19	C4SL	CLAIRE	2021
Explosives	2,4,6 Trinitrotoluene	2015	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	S4UL	LQM/CIEH	2015
	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)	2015	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000	51000	53000	S4UL	LQM/CIEH	2015
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)	2015	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	*23000*	*23000*	*24000*	S4UL	LQM/CIEH	2015
Pesticides	Aldrin	2015	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	S4UL	LQM/CIEH	2015
	Dieldrin	2015	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	S4UL	LQM/CIEH	2015
	Atrazine	2015	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	S4UL	LQM/CIEH	2015
	Dichlorvos	2015	0.032	0.066	0.14	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	S4UL	LQM/CIEH	2015
	Alpha - Endosulfan	2015	7.4	18	41	*160*	*280*	*410*	1.2	2.9	6.8	*5600*	*7400*	*8400*	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Beta - Endosulfan	2015	7	17	39	*190*	*320*	*440*	1.1	2.7	6.4	*6300*	*7800*	*8700*	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Alpha -Hexachlorocyclohexanes	2015	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	S4UL	LQM/CIEH	2015
	Beta -Hexachlorocyclohexanes	2015	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	S4UL	LQM/CIEH	2015
	Gamma -Hexachlorocyclohexanes	2015	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	S4UL	LQM/CIEH	2015
Chlorobenzenes	Chlorobenzene	2015	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	*1300*	*2000*	*2900*	S4UL	LQM/CIEH	2015
	1,2-Dichlorobenzene	2015	23	55	130	24	57	130	94	230	540	*2000*	*4800*	*11000*	90000	95000	98000	*24000*	*36000*	*51000*	S4UL	LQM/CIEH	2015

Land Use				Residential With or Without Plant Uptake							Allotments			Commercial			Public Open Space (POS)								
				With home-grown produce				Without home-grown produce									Residential			Park					
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	Name	Authority	Date
Type	Contaminants	Species	Year																					
	1,3-Dichlorobenzene		2015	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	S4UL	LQM/CIEH	2015
	1,4-Dichlorobenzene		2015	61	150	350	61	150	350	15	37	88	*4400*	*10000*	*25000*	17000	17000	1700	*36000*	*36000*	*36000*	S4UL	LQM/CIEH	2015
	1,2,3,-Trichlorobenzene		2015	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	*770*	*1100*	*1600*	S4UL	LQM/CIEH	2015
	1,2,4,-Trichlorobenzene		2015	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	*1700*	*2600*	*4000*	S4UL	LQM/CIEH	2015
	1,3,5,-Trichlorobenzene		2015	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	*380*	*580*	*860*	S4UL	LQM/CIEH	2015
	1,2,3,4,-Tetrachlorobenzene		2015	15	36	78	24	56	120	4.4	11	26	1700	3080	4400	830	830	830	*1500*	*1600*	*1600*	S4UL	LQM/CIEH	2015
	1,2,3,5,- Tetrachlobenzene		2015	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	*49*	*120*	*240*	78	79	79	*110*	*120*	*130*	S4UL	LQM/CIEH	2015
	1,2,4, 5,- Tetrachlobenzene		2015	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	*42*	*72*	*96*	13	13	13	25	26	26	S4UL	LQM/CIEH	2015
	Pentachlrobenzene		2015	5.8	12	22	19	30	38	1.2	3.1	7	*640*	*770*	*830*	100	100	100	190	190	190	S4UL	LQM/CIEH	2015
	Hexachlorobenzene		2015	*1.8*	*3.3*	4.9	*4.1*	*5.7*	*6.7*	0.47	1.1	2.5	*110*	120	120	16	16	16	30	30	30	S4UL	LQM/CIEH	2015
Phenols & Chlorophenols																								
	Phenols		2012			420			420			280			3200							SGV	DEFRA	2012
			2015	120	200	380	440	690	1200	23	42	83	*440*	*690*	*1300*	*440*	*690*	*1300*	*440*	*690*	*1300*	S4UL	LQM/CIEH	2015
	Chlorophenols (4 Congeners)		2015	0.87	2	4.5	94	150	210	0.13	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	S4UL	LQM/CIEH	2015
	Pentachlorophenols		2015	0.22	0.52	1.2	27	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	S4UL	LQM/CIEH	2015
Others																								
	Carbon Disulphide		2015	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	S4UL	LQM/CIEH	2015
	Hexachloro-1,3-Butadiene		2015	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	S4UL	LQM/CIEH	2015
	Sum of PCDDs, PCDFs and dioxin-like PCB's.		2012			8			8			8			240							SGV	DEFRA	2012

NOTE

Priority	Guideline (mg kg $^{-1}$)
1	Site Specific Assessment Criteria (SSAC) (Soils Limited)
2	2014: Category 4 Screening Level (C4SL) (Contaminated Land: Application in Real Environment (CL:ARE), 2014 and 2021)
3	2012: Soil Guideline Value (SGV) (Environment Agency, 2009)
4	2015: Suitable 4 Use Level (S4UL) (Nathanail *et al*, 2015)

For Generic Risk Assessment, the values in Bold should have priority unless site specific, Client or regulatory requirements dictate otherwise – which must be justified

Table reviewed January 2022

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