

**PHASE 2
GEOTECHNICAL AND GEO-ENVIRONMENTAL
SITE INVESTIGATION**

LOWER EASTFIELD FARM, THURGOLAND

FOR

MR AND MS MILLER

ISSUE 1



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10 March 2020

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Catherine Topliss

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1.0 EXECUTIVE SUMMARY

1. The approximately 0.4 hectare site is located south of Eastfield Lane. It comprises a residential farmhouse with several associated agricultural outbuildings. An above ground fuel tank is present in the central southern part of the site and a capped well is noted in the central part.
2. The site has been developed with the farmhouse and agricultural buildings since at least the mid-19th Century. Two collieries and an old sandstone quarry are recorded between 120 and 220 m from the site on historical maps but are not recorded on more recent mapping.
3. The site is shown to be underlain by sandstone of the Pennine Lower Coal Measures Formation. No superficial deposits are shown to cross the site. The Silkstone Four Foot Coal is shown to outcrop around 60 m to the south west, dipping beneath the site at shallow depth.
4. Beneath the surface covering of concrete or topsoil / reworked topsoil, made ground extends to between 0.2 m and 0.7 m in the central part of the site, deepening to around 1.1 m in the east. A localised area of deep made ground was encountered to 2.9 m in the east. Residual sandstone was encountered beneath the made ground with a seam of coal between 300 mm and 500 mm thick encountered from between 0.9 m in the west to around 2.9 m in the east. Mudstone was encountered below the coal.
5. No evidence of workings within the seam of coal was recorded. Therefore, the risk to ground stability from past underground coal mining is considered to be low and no remedial works are considered to be necessary.
6. Groundwater was not typically encountered. The exception to this was localised seepages encountered between 1.2 and 2 m associated with the coal seam.
7. It is expected that unreinforced strip or trench-fill footings can be used within the natural granular soils or underlying bedrock.
8. The well in the central part of the site should be investigated as part of the enabling works and backfilled / capped as appropriate.
9. It is expected that cast in-situ concrete floors can be used within the natural residual soils where there is less than 600 mm of made ground below the slab.

10. Radon precautions are not required. No sources of ground gas / mine gas were encountered during the investigation. No gas precautions are therefore considered necessary.
11. Soakaway tests were undertaken in two positions with favourable results. Soakaway drainage is therefore considered viable for the proposed development.
12. Elevated concentrations of lead have been recorded in the reworked topsoil. Elevated polycyclic aromatic hydrocarbons (PAHs) and asbestos containing materials have been recorded within the made ground. At this stage the natural topsoil is considered suitable for re-use at surface within gardens whereas the reworked topsoil is not. Where made ground or reworked topsoil remains beneath gardens and areas of soft landscaping a minimum 600 mm thick capping layer will be necessary. **Further test results are awaited.**
13. Where natural soils remain beneath gardens and soft landscaping a minimum 300 mm thickness of topsoil / sub-soil is recommended to provide an adequate growing medium for plants.
14. DS-4 AC-4 sulphate precautions are required for below ground concrete in contact with made ground. DS-2 AC-2 should be assumed for concrete in contact with natural ground only. If concrete is in contact with coal then DS-4 AC-5 precautions are required.
15. The results of the chemical testing will need to be forwarded to the water company so that appropriate water supply pipes can be selected.
16. The conclusions made in this report in relation to contamination are subject to agreement by the approving bodies, such as the Local Authority and your warranty provider.

2.0 INTRODUCTION

2.1 Terms of Reference

This report presents the findings of an intrusive (phase 2) geotechnical and geo-environmental site investigation carried out by Eastwood & Partners (Consulting Engineers) Limited on the instructions of Group Ginger and on behalf of Mr and Ms Miller. Any other parties using the information in this report do so at their own risk and any duty of care is excluded.

2.2 Context

A Phase 1 Preliminary Appraisal Report (ref. C8520) was produced for the site by Sirius in September 2019. This report is therefore supplementary to, and should be read in conjunction with, the above report. We are not aware of any other investigation having been undertaken on the site in the past.

2.3 Aims and Objectives

The aims and objectives of this additional investigation were as follows:

- Obtain additional information and incorporate with previous data enabling refinement and subsequent further testing of the conceptual model;
- Detail the ground conditions and their geotechnical properties enabling outline foundation proposals to be made for the proposed residential development;
- Carry out a tiered risk assessment to establish the likely risks to future receptors, involving the use of generic assessment criteria and, where unacceptable risks are identified, site specific assessment criteria within a detailed quantitative risk assessment;
- Identify feasible remediation options if unacceptable risks are highlighted; and
- Develop an appropriate remediation strategy where remediation is required.

2.4 Scope of Investigation

The findings were used to test the conceptual model and produce a final risk assessment. The intrusive works comprised trial pits and rotary open-hole drilling to enable:

- Examination of the shallow ground conditions;

- In situ description of soils, enabling any localised lateral and vertical changes in soil conditions to be logged;
- Assessment of any contamination identified using visual and olfactory methods;
- Collection of soil samples for chemical testing; and
- Determine the depth, thickness and condition of any coal seams below the site that are present within 30 m of the surface.

2.5 Limitations of Investigation

This report is based on the assumption that the site will be developed with residential properties, each with private gardens and areas of hardstanding. The dwellings will be of conventional construction and will be three storeys or less in height. It is assumed that existing ground levels will not alter significantly. If this is not the case, then the advice given in this report may not be appropriate.

Where assessments of site areas affected in particular ways are given, these are approximate. All information, comments and opinions given in this report are based on the ground conditions encountered during the site work, on the results of laboratory testing carried out as part of the investigation and information gained from a geological and historical desk study. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata and water conditions between or below investigation points. It should be noted that groundwater levels vary due to seasonal or other effects, and may at times differ from those measured during the investigation.

This report considers the ground and groundwater and does not cover any buildings or their fabric or the constituents of any existing hardstanding materials. Generally, testing has only been carried out for contaminants identified as potentially present with no assessment made of biological contamination. Risks to ecological receptors, such as bats, have not been considered.

3.0 SITE OVERVIEW AND SUMMARY OF PHASE 1

This section of the report provides an overview of the site based upon information gathered during the site walkover and based upon the Envirocheck and Coal Authority reports included within the Phase 1 report completed by a third party (Sirius).

3.1 Description

The approximately 0.4 hectare site is located south of Eastfield Lane and comprises a residential farmhouse building with several barns and outbuildings, some of which are to be retained in whole or in part as part of the planned redevelopment works to form three residential properties with associated outbuildings and barns. Some of which are to be retained for agricultural use. A new septic tank and surface water balancing pond are proposed in the field to the east.

The site typically slopes from around 180 m AOD in the north west to around 175 m AOD at the southern boundary. A raised above ground fuel tank, estimated to be around 1500 litre in capacity, is located in the central southern part and a well is present in the central part. The well is covered by a large capping stone.

Cement based roofing and rainwater goods were noted to some of the agricultural buildings in the eastern half of the site. Some cement based rainwater products were also noted on the ground surrounding the agricultural buildings in the south. Small stockpiles of rubble and building materials were recorded behind the agricultural shed in the north east. The piles were noted to contain fragments and larger pieces of corrugated cement based roofing product. Such products are commonly found to contain asbestos.

The surrounding area comprises predominantly agricultural land with associated hedgerows and drystone walling.

3.2 History

Historical mapping shows the site to have comprised a farmhouse with associated agricultural buildings and surrounding farm land since at least 1855. At this time two collieries (120 m north west and 220 m south), an old sandstone quarry (200 m north) and a series of coke kilns (360 m south) are recorded in the surrounding area. These features disappeared from mapping over time, with the only new addition being two small ponds noted in around the start of the 20th Century 40 m and 115 m west of the site, respectively.

3.3 Geology and Mining

The site is recorded to be underlain by sandstone of the Pennine Lower Coal Measures Formation. No superficial deposits or faults are shown to cross the site at surface.

The Silkstone Four Foot Coal is shown to outcrop around 60 m south west of the site, dipping to the north east beneath the site between around 5° and 10°. The seam is reported to range between 0 m and 1.6 m in thickness and is expected beneath the site between around 5 m and 12 m below ground level (bgl). Any workings within this seam, if encountered, may present an unacceptable risk to the surface stability of the proposed development. Any workings within influencing distance of the development would require consolidation through drilling and grouting. No mine entries are recorded within 20 m of the site. However, the presence of unrecorded mine entries, shallow crop workings or bell pits cannot be discounted.

There are seven British Geological Survey recorded mineral sites within 500 m of the site. All of which relate to deep coal mining with the exception of one entry located around 215 m to the north relating to historical opencast extraction of sandstone. The presence of unrecorded quarries cannot be discounted.

3.4 Hydrology and Hydrogeology

The nearest surface water feature is Bagger Wood Dike 150 m south of the site.

The site is at low risk from flooding from rivers or sea (Flood Zone 1).

The solid strata are classified as a Secondary A Aquifer.

The site is not located within a Groundwater Source Protection Zone. There are no licensed groundwater abstractions within 250 m of the site. A discharge consent relating to sewage discharge to land / soakaway is recorded 240 m to the west.

3.5 Ground Gas

Radon protection measures are not required.

There are no landfills recorded within 250 m of the site.

Potential workings within the underlying Coal Measures Strata presents a potential source of mine gas to the proposed development.

4.0 OUTLINE CONCEPTUAL MODEL

The site is being considered for development with low-rise residential properties with private gardens, access road and areas of hardstanding.

4.1 Potential Sources of Contamination

The site has been previously occupied by a farmhouse with associated agricultural buildings since at least the mid-19th Century.

Made ground / reworked topsoil is expected to be present below the site. Such materials may contain elevated concentrations of heavy metals/metalloids, polycyclic aromatic hydrocarbons (PAHs), pesticides / herbicides, and sulphates. Asbestos fibres may also be present.

The above ground tank is considered to be a potential source of petroleum hydrocarbons.

Possible workings within the shallow coal beneath the site may act a source of mine gas.

4.2 Potential Contaminant Linkages

The following table details the possible sources and associated contaminants of concern, pathways and receptors, highlighted by review of the Phase 1 investigation as potentially present:

Source	Pathway	Receptor
Heavy metals/metalloids, PAHs, pesticides, herbicides and asbestos within made ground and shallow natural soils	Ingestion, inhalation, direct contact	Site residents and visitors Construction workers
	Root Uptake	Plants
	Migration through ground	Controlled waters (Secondary A Aquifer / Bagger Wood Dyke)
Hydrocarbons associated with leaks or spillage from above ground tank	Ingestion, inhalation, direct contact	Site residents and visitors Construction workers
	Root Uptake	Plants
	Migration through ground	Controlled waters (Secondary A Aquifer / Bagger Wood Dyke)
Sulphates in made or natural ground Low pH	Direct contact	Below ground concrete
Mine gas from potential shallow workings beneath the site	Migration through ground	Site residents and visitors Construction Workers Buildings

5.0 GROUND INVESTIGATION

5.1 Site Works

We visited site on 18 February 2020 and excavated nine trial pits (TP1 to TP9) to depths of between 1.5 and 3.4 m bgl. Two shallow hand dug trial pits (HDP01 and HDP02) were excavated to depths of 0.15 and 0.4 m bgl.

Six rotary boreholes (R01 to R06) were advanced across the site to depths of up to 30 m bgl to assess the deeper geology, in particular the presence, depth and condition of the Silkstone Four Foot Coal.

Copies of the exploratory hole logs are presented in Appendix 2, and their locations are plotted on the Exploratory Hole Location Plan, Drawing number 44856/001A in Appendix 1.

5.2 Laboratory Testing

Four samples of made ground, three samples of topsoil and five samples of natural ground were dispatched for chemical testing. A sample of suspected asbestos containing material recovered from TP8 was also submitted for asbestos identification. Soil samples were taken in 500 g plastic tubs, 250 ml and 60 ml amber glass jars and analysed at Chemtest Laboratories, using MCERTs accredited methodologies where available. Laboratory testing results are presented in Appendix 4 and discussed further in Section 8.

A sample of mudstone was also dispatched for geotechnical testing at Professional Soils Laboratory. The geotechnical test results are presented in Appendix 3 and discussed in Section 7.

6.0 GROUND CONDITIONS

Rotary open-hole borehole logs are based on chippings returned to surface by flush returns. Therefore, the ground conditions for shallow soils are based off findings from trial pits only unless specified.

6.1 Surface Covering

Two trial pits (TP1 and TP2) excavated in the central courtyard and TP8 in the east encountered a surface covering of concrete between 40 mm and 100 mm thick. Seven locations (TP3 to TP5, TP7, TP9, HDP01 and HDP02) recorded between 100 mm and 300 mm of topsoil, typically comprising slightly sandy gravelly clay with a granular component of angular sandstone. The topsoil encountered within TP5, HDP01 and HDP02 is noted to be reworked. The natural topsoil within TP3 and TP9 was found to be underlain by a sub-soil typically comprising soft slightly sandy gravelly clay with low cobble content to depths of between 0.4 and 0.6 m bgl. The granular component comprises angular sandstone.

6.2 Made Ground

A variable thickness of made ground, typically comprising sandy gravelly clay or clayey sand with medium cobble content, was recorded to depths of between 0.2 and 2.9 m bgl. The granular component included fragments of brick, concrete and sandstone with occasional inclusions of plastic, macadam, metal and roofing tiles. A fragment of suspected asbestos containing roofing material was recovered from TP8 at 0.3 m bgl.

The thickness of made ground typically ranged between 0.2 and 0.7 m in the main body of the site, increasing in thickness to around 1.1 m in the east where levels appear to have been built up behind the eastern drystone wall. Made ground was typically absent beyond the eastern wall and beyond the buildings in the west. The exception to this was within TP3 where made ground was encountered in the eastern part of the trial pit extending to 2.9 m bgl. Coal was encountered at the base of the made ground but appears to be intact at a thickness of 300 mm. Therefore, it is considered that the feature may have targeted the overlying sandstone for building material. A trial pit (TP9) excavated around 8 m to the east found no evidence of the feature.

HDP01 excavated to the south of the farmhouse was terminated at 0.15 m on large sandstone paving slabs.

6.3 Natural Ground

Residual sandstone, typically recovered as angular tabular cobbles with some sandy clayey gravel, was encountered beneath the made ground in the majority of exploratory holes.

A seam of coal, between 300 mm and 500 mm thick was encountered beneath the sandstone within four trial pits (TP1, TP2, TP3 and TP7) and all rotary boreholes from depths from around 0.9 m in the west and to around 2.9 m bgl in the east. No other seams of coal were recorded within 30 m of the surface.

Where encountered within trial pits, the coal is typically underlain by extremely weak destructured mudstone typically recovered as clayey gravel to at least 3.3 m bgl.

6.4 Groundwater

Groundwater was not typically encountered. The exception to this was within TP1, TP2 and TP6 where slight seepages were encountered between 1.2 and 2 m bgl. The seepages within TP1 and TP2 are attributed to the fractures within the coal seam providing a preferential pathway to groundwater that may be limited in its downward migration by the underlying mudstone. TP6 didn't record any coal. However, the nearby borehole (R06) encountered coal from 2.1 m bgl, just below the termination depth of the trial pit where groundwater was recorded.

7.0 GEOTECHNICAL APPRAISAL

7.1 General

Our investigations indicate that in the majority of the site, beneath the surface covering of concrete or topsoil / reworked topsoil, made ground extends to between 0.2 m and 0.7 m in the central part of the site, deepening to around 1.1 m in the east. A localised area of deep made ground was encountered to 2.9 m in the east. The feature considered to be consistent with a small quarry for building stone, lies outside the area of the proposed development proper but does lie in the vicinity of the proposed new cess pit and balancing pond.

The shallow natural soils typically comprise residual sandstone recovered as coarse granular soils. However, a sample of the deeper destructured mudstone was dispatched for geotechnical testing. A modified plasticity index 10% has been calculated for the mudstone, falling on the boundary between non shrinkable and low volume change potential soils. Considering the above, along with visual assessment, the mudstone is considered to be non-shrinkable. Given the above, the residual granular soils and underlying mudstone bedrock should be regarded as 'non-shrinkable' in accordance with NHBC Chapter 4.2 guidance.

Given the variable nature of the made ground, these strata are not considered suitable bearing stratum. A safe bearing capacity of at least 150 kN/m² is considered appropriate for natural residual soils and underlying destructured mudstone bedrock.

7.2 Coal Mining Assessment

Coal was encountered within four trial pits and all rotary boreholes from around 0.9 m in the western part of the site to around 2.9 m bgl in the east. All coal was recorded intact between 300 and 500 mm thick. No other seams of coal were recorded within 30 m of the surface.

Given the above, the seam is considered to be representative of the Silkstone Four Foot Coal. No evidence of workings within the coal have been encountered. The exception to this is the presumed sandstone quarry in the east of the site. However, at this location the excavation extends to the coal but does not appear to have disturbed it.

The risk to ground stability from past underground mining is considered to be low and therefore no remedial works are considered to be necessary.

7.3 Foundations

It is expected that unreinforced strip or trench-fill footings can be used within the natural residual granular soils or underlying destructured bedrock across the site. The residual granular soils and underlying mudstone bedrock are considered to be non-shrinkable. Therefore, a minimum founding depth of 600 mm below current or finished ground level, whichever is the lower, will be required. All foundations must be taken down to bear on undisturbed, non-desiccated natural ground of adequate bearing capacity. It may be possible to shallow the minimum foundation depth where existing foundations are to be retained / reused.

Due to the shallow depth of the bedrock, there may be both residual sandstone and mudstone in the same foundation at formation level. In this case, to prevent differential settlement, it would be prudent to deepen the foundations onto the same ground type i.e. on to the mudstone. If coal is encountered in foundation trenches, this should be blinded using a lean mix of concrete.

Although the presence of unrecorded quarries or mine entries is considered to be low. It would be prudent to inspect foundation excavations for any evidence of such features.

7.4 Ground Floors

Where natural granular residual soils are encountered at shallow depth a cast in-situ concrete floor slab is considered appropriate for the development as long as there is less than 600 mm of made ground below the slab.

Where over 600 mm of made ground is recorded, a precast concrete floor with an underlying minimum 150 mm ventilated void or reinforced suspended in-situ slab is recommended.

7.5 Superstructure Precautions

Additional superstructure precautions are not considered to be required at this stage, due to ground conditions encountered.

7.6 Excavation Problems and Obstructions

Trial pits typically terminated on shallow bedrock. The shallowest was recorded within TP8 at 1.6 m bgl. This may hinder deeper excavations.

The stability of any trenches is likely to be variable due to the presence of re-worked ground. Support will be required in accordance with current Health & Safety Regulations wherever access is required to trenches deeper than 1.2 m or less where there is risk of collapse.

Service plans show water supply pipes along with above ground electricity and communications cables crossing onto the site. A stop valve for water supply is also located to the west of the farm buildings which does not conform to the routing as shown on statutory plans.

7.7 Problems due to Past Development

The structures on site are intended to be retained, in the most part, with the replacement of the barn in the east with a smaller agricultural building and localised extension / alterations to the farmhouse and out-buildings.

Foundations and services associated with these buildings are expected to be present which will need to be removed where they conflict with new foundations or structures. Foundations were exposed within HDP02 where they were formed directly on the residual sandstone at 0.3 m bgl.

An old cess pit remains to the south of the farmhouse and a well is recorded in the central part of the site. The depth and condition of the well should be investigated as part of the enabling works. The well should be backfilled and capped appropriately.

7.8 Surface Water Drainage

Infiltration tests were undertaken within two trial pits, referred to as TP4 and TP5. The results and calculation of infiltration rates are provided in Appendix 3, and are summarised in the table below.

Pits	Change in water depth (mm)	Time taken to drain (mins)	BRE365 Soil Infiltration Rate (m/s)
TP4	500	2.5	1.9×10^{-3}
	600	2.5	3.0×10^{-3}
	600	3.5	1.9×10^{-3}
TP5	450	7	7.0×10^{-4}
	500	9	4.9×10^{-4}
	500	9	9.7×10^{-4}

Water was placed into the test pits from a mobile tanker. In all cases, the water drained rapidly, with the tests being completed in between 2.5 to 9 minutes. BRE365 soil infiltration rates of between 4.9×10^{-4} and 3×10^{-3} m/sec were recorded.

Given the above, soakaway drainage within the natural granular soils is considered to be viable for the draining of surface water from the proposed development. Favourable rates are not expected for the underlying mudstone.

8.0 REFINEMENT OF OUTLINE CONCEPTUAL MODEL

8.1 Source Characterisation

An outline conceptual model, detailing the possible sources and associated contaminants of concern, potential pathways and receptors identified in the Phase 1 report, is detailed in Section 4.

This section of the report documents the works undertaken to obtain information to test and refine this model enabling a risk assessment to be produced and, where significant risks are expected, remediation recommendations.

8.2 Investigation of Potential Contamination Sources

The investigation works undertaken to cover each of the sources of potential contamination outlined in Section 4 are detailed in the table below.

Source	Potential Contaminants	Exploratory hole used to investigate source
Made ground and shallow natural soils	Elevated levels of metals/metalloids, sulphates, PAHs, pesticides, herbicides and asbestos	All trial pits (HDP01, HDP02 and TP1 to TP9)
Above ground tank	TPHs	TP6 was excavated in close proximity to the tank
Possible shallow coal workings beneath the site	Ground gas	R01 to R06 were drilled across the site to determine the depth, thickness and condition of coal seams within the upper 30 m.

8.3 Ground Gas

No radon precautions are required at the site.

A localised area of deep made ground (>2.5 m), suspected to represent a small sandstone quarry, was encountered within the eastern part of the site. Given the likely age of the made ground, that no significant volumes of putrescible materials were encountered, and that the feature does not lie in close vicinity to any proposed inhabited enclosed spaces, the feature is not considered to represent a significant gas risk to the site.

8.4 Unexpected Contamination

Visual evidence of possible contamination was identified within the natural strata encountered in TP2. Here, at 1.1 m, a slight black staining was noted to the soils. No odour was recorded and it is suspected the staining may relate to the coal encountered below at 1.3 m coupled with shallow perched groundwater fluctuating within the coal and lower parts of the residual sandstone.

Notwithstanding the above, a sample taken at this depth was submitted for a standard suite of chemical analysis and was also scheduled for fractionated total petroleum hydrocarbons (TPH CWG).

Although no evidence of contamination was noted within TP6, due to its location next to an old above ground tank, a shallow sample was sent for TPH analysis.

No olfactory evidence of contamination was noted at any location.

A fragment of suspected asbestos containing material was identified in TP8 and sent for asbestos identification. Similar materials, expected to comprise cement bound asbestos were found at various locations across the site at surface. This included corrugated roofing products near TP5 and cement based rainwater goods to the rear (south) of the southern barn.

8.5 Chemical Testing

Three samples of topsoil / reworked topsoil, three samples of made ground and five samples of natural ground were dispatched for chemical testing. Each of the samples was analysed for the suite of contaminants listed below:

Contaminant Type	Actual Contaminants
Metals/Metalloids	Arsenic, cadmium, chromium (VI and total), lead, mercury, nickel, selenium, copper and zinc
pH	pH
PAHs	Speciated PAH
Sulphates*	water soluble sulphate, total (acid soluble sulphate) and sulphur

*Made and natural ground only

In addition to the above:

- One sample of topsoil was tested for organochloride and organophosphorus pesticides;
- A sample of made ground and a sample of natural soil were tested for TPH CWG; and
- A sample of suspected asbestos containing material was submitted for bulk asbestos identification.

8.6 Assessment Criteria

Residential properties with private gardens are proposed for the site. The assessment criteria relating to a residential with home-grown produce end use have been used initially and are presented in Appendix 4.

8.7 Chemical Test Results

Some preliminary risk assessment is undertaken in this section of the report where determinants can be readily discounted.

8.7.1 Topsoil

Given the organic nature of the topsoil a soil organic matter (SOM) of 6% has been assumed.

Asbestos testing is outstanding for both the reworked and natural topsoil. Once received, the results and updated analysis will be issued as an updated version of this report.

Reworked Topsoil

The sample of reworked topsoil tested from HDP02 recorded lead at a concentration of 580 mg/kg, in excess of the human health and phytotoxic screening values of 200 mg/kg and 300 mg/kg, respectively. It is expected, given the proximity of the trial pit to the existing farmhouse, that this result may have been influenced by a rouge piece of lead flashing or similar. Therefore, the material has been sub-sampled at the laboratory a further three times to determine if the result is representative of the sample. The results are currently outstanding and will be issued in due course as an updated version of this report

No other determinants in excess of the human health or phytotoxic screening values were recorded.

Natural Topsoil

The two samples of natural topsoil did not return any elevated concentrations of metals/metalloids, PAHs, or pesticides in relation to the human health or phytotoxic screening values.

8.7.2 Made Ground

Elevated PAH determinants were recorded within two samples of the made ground and are presented in the table below.

Determinant	Residential with Homegrown Produce Assessment Value (mg/kg) 1% SOM	Sample ID		
		TP3 0.8 m	TP5 0.9 m	TP6 0.2 m
Phenanthrene	95	4.9	47	240

Fluoranthene	280	0.64	68	330
Benzo(a)anthracene	7.2	0.45	30	83
Chrysene	15	0.72	27	73
Benzo(b)fluoranthene	2.6	0.21	35	93
Benzo(a)pyrene	2.2	0.27	32	82
Indeno(1,2,3-c,d)pyrene	27	<0.1	18	52
Dibenz(a,h)anthracene	0.24	<0.1	3.7	10

Detectable concentrations of TPHs (aromatic C16-21 and C21-35) were recorded in the sample of made ground recovered from TP6 in the vicinity of the above ground tank. However, these fall significantly below the human health assessment criteria.

The fragments of suspected asbestos containing material recovered from TP8 at 0.3 m was confirmed to contain cement bound fibres of chrysotile. No loose fibres or any other asbestos containing materials were recorded within any of the soil samples tested.

No other elevated determinands were recorded in excess of human health or phytotoxic assessment values.

8.7.3 Natural Ground

No elevated metal/metalloids were recorded within the five samples of natural ground tested. However, three samples returned elevated concentrations of PAHs. These are presented below.

Determinant	Residential with Homegrown Produce Assessment Value (mg/kg) 1% SOM	Sample ID				
		TP1 0.5 m	TP2 1 m	TP3 3 m	TP5 1.3 m	TP8 1.2 m
Naphthalene		<0.1	<0.1	4.4	0.44	<0.1
Benzo(a)anthracene	7.2	<0.1	0.22	0.29	11	2.8
Benzo(b)fluoranthene	2.6	<0.1	0.21	<0.1	12	2.8
Benzo(a)pyrene	2.2	<0.1	0.18	<0.1	10	2.4
Dibenz(a,h)anthracene	0.24	<0.1	<0.1	<0.1	1.2	0.12

No other determinands were recorded in excess of the human health or phytotoxic assessment values.

8.7.4 Sulphates

In accordance with BRE Special Digest 1 (2005), the site has been taken as a brownfield location in relation to the Aggressive Chemical Environment. Groundwater is expected to be mobile through the near surface soils.

The samples of made ground recorded water soluble sulphate results from <10 mg/l to 21 mg/l. This would equate to a Design Sulphate Class of DS-1, of which the upper limit is 500 mg/l. However, the total potential sulphate results for the made ground were between 0.17% and 1.44%, which equates to a Design Sulphate Class of DS-4, of which the lower limit is 1.3%. The pH varies between 7.5 and 8.6.

The four samples of natural residual soils recorded water soluble sulphate results ranging between <10 mg/l and 120 mg/l. The total potential sulphate results range between 0.045% and 0.25%, which equates to a Design Sulphate Class of DS-2, of which the lower limit is 0.24%. The pH varies between 7.4 and 8.6.

A sample of coal recorded a water soluble sulphate concentration of 5.9%, a total sulphate concentration of 1.65% and pH of 5.9.

8.8 Significant Pollutant Linkages

The significant pollutant linkages identified are documented in the following table:

Source	Pathway	Receptor
Possible asbestos fibres or asbestos containing materials within the natural or reworked topsoil (awaiting test results)	Ingestion, inhalation, direct contact	Site residents and visitors Construction workers Water supply pipes
Elevated lead in reworked topsoil (awaiting test results)	Migration through ground	Controlled waters (Secondary A aquifer)
Elevated PAHs and asbestos containing material in made ground Elevated PAHs within the shallow natural soils		
Sulphates in made ground and sulphates and low pH in coal	Direct contact	Below ground concrete

9.0 RISK ASSESSMENT

9.1 Human Health – Future Residents and Visitors

Topsoil

All samples of topsoil have been screened for asbestos. The test results for this are still outstanding and will be included, along with updated analysis and conclusions, within an updated version of this report.

Reworked Topsoil

The sample of reworked topsoil tested from HDP02 recorded lead at a concentration of 580 mg/kg, in excess of the human health and phytotoxic screening values of 200 mg/kg and 300 mg/kg, respectively. It is expected, given the proximity of the trial pit to the existing farmhouse, that this result may have been influenced by a rouge piece of lead flashing or similar. Therefore, the material has been sub-sampled at the laboratory a further three times to determine if the result is representative of the sample material. The results of this additional testing are outstanding and will be issued as part of an updated report in due course.

No other determinands in excess of the human health or phytotoxic screening values were recorded.

At this stage, given the proximity of the reworked topsoil to the farm buildings and the concentration of lead recorded thus far, the soils should not be considered suitable for re-use within gardens at this stage. This may be refined once all testing results have been received.

Natural Topsoil

The two samples of natural topsoil did not return any elevated concentrations of metals/metalloids, PAHs, or pesticides in relation to the human health or phytotoxic screening values. Given the above, it is expected that the natural topsoil will be suitable for re-use within gardens. However, this will need to be confirmed upon receipt of the asbestos screen.

Made Ground

Elevated PAH compounds were recorded within two of the three samples of made ground tested. The PAHs recoded within TP6 at 0.2 m bgl are noted to be significantly elevated, with some determinands exceeding the assessment criteria by around 40 times. These concentrations are considered likely to relate to historical spillage / leakage of the nearby above ground fuel tank. Detectable concentrations of TPHs were recorded within the same sample however, these did not

exceed the human health assessment criteria. Notwithstanding the above, PAH concentrations recorded within TP5 at 0.7 m also exceed the relevant assessment criteria.

A fragment of asbestos containing material was encountered at 0.3 m bgl within TP8. Given the presence of asbestos products at surface in varying states or repair the presence of further asbestos containing materials or fibres within the made ground cannot be discounted.

Given the above, this material is considered to pose a risk to human health for the proposed development. The made ground is not considered chemically or texturally suitable to be left in-situ beneath gardens or areas of soft landscaping. A 600 mm thick capping system, including 100 mm of clean, inert topsoil is recommended in all gardens where made ground remains.

Natural Ground – Residual Sandstone

Two samples of natural residual sandstone recorded elevated PAH determinands.

The average for each of the four elevated PAH determinands has been taken across the four samples of the natural residual strata and are presented below;

Determinant	Residential with Homegrown Produce Assessment Value (mg/kg) 1% SOM	Sample ID				Mean
		TP1 0.5 m	TP2 1 m	TP5 1.3 m	TP8 1.2 m	
Benzo(a)anthracene	7.2	<0.1	0.22	11	2.8	3.53
Benzo(b)fluoranthene	2.6	<0.1	0.21	12	2.8	3.78
Benzo(a)pyrene	2.2	<0.1	0.18	10	2.4	3.17
Dibenz(a,h)anthracene	0.24	<0.1	<0.1	1.2	0.12	0.38

The relationship between the PAH determinands have been assessed using double ratio plots for which the PAHs recorded within the samples of natural ground recovered from TP5 and TP8 are indicated to be coal derived.

Given that the mean concentrations only marginally exceed their respective assessment criteria, and taking into account that the source of the exceedances is expected to result from occasional coal fragments within the natural strata, the concentrations of PAHs recorded are not considered to pose a significant risk to human health for the proposed development.

The residual natural soils are considered chemically suitable to remain beneath gardens and areas of soft landscaping. However, given the granular nature of the soils, a growing medium of at least 300 mm thick, with at least 100 mm of clean topsoil, is recommended to provide a suitable growing medium for plants.

Coal

Given the high carbon content of coal. A SOM of at least 6% can be assumed. On that basis the concentration of naphthalene recorded at 4.4% falls below the human health acceptance criteria of 13%. Therefore, the naphthalene recorded within the sample of coal is not considered to pose a significant risk to human health.

Notwithstanding the above, shallow coal may present a potential combustion risk to the proposed development. Therefore, should shallow coal be found to underlie gardens, a 1 m capping layer would be required. Alternatively, the coal could be excavated and removed. Potential heat sources, such as electricity cables, should not be laid in contact with coal.

9.2 Human Health – Construction Workers

Groundworkers employed during the construction phase of the development are most at risk of harm due to them having direct contact with the affected soils. However, the contact is generally of short duration, and all competent ground workers will be aware of the potential risks associated with soils of this nature. Therefore, the overall risk to the health of construction workers is considered to be low.

All ground workers employed on the site should be made aware that elevated concentrations of heavy metals, PAHs and asbestos containing materials are present, and normal site procedures such as the wearing of gloves when handling soils, and the washing of hands prior to eating should be implemented. Damping down of asbestos containing soils may be required in dry weather.

Any unusual, brightly coloured, ashy or odorous material or material suspected of containing asbestos encountered during construction should be brought to the attention of the site staff and investigated.

9.3 Plants

An elevated concentration of lead was recorded within the reworked topsoil in respect to phytotoxicity. No phytotoxic concentrations of contaminants were recorded. At this stage the

reworked topsoil is not considered suitable for re-use within gardens. **However, this may be revised following receipt of all outstanding chemical test results.**

At this stage, given the localised nature of the exceedance and that no phytotoxic effects were observed to the existing vegetation, the soils on site are not considered to pose a phytotoxic risk to plants. It is also considered that the proposed capping layer will provide a suitable growing medium. This may need to be increased in areas of proposed tree planting.

9.4 Controlled Waters

The elevated concentrations of heavy metals and PAHs present locally within the reworked topsoil, made ground, and shallow natural soils do not appear to be leaching or migrating significantly deep into the natural ground in any significant concentration. The only exception to this is the elevated PAHs recorded within the natural residual soils. However, these are considered to be a result of coal fragments within the natural soils.

There are no Groundwater Source Protection Zones in the vicinity of the site, the bedrock underlying the site is classified as a Secondary A Aquifer and Bagger Wood Dike is present 150 m, down gradient, to the south.

Based on this, the elevated concentrations of metals recorded in the re-worked topsoil and PAHs recorded within the made ground and shallow natural soils are considered to pose a low risk to controlled waters.

Notwithstanding the above, should any free product be found during construction works, it should be remediated.

9.5 Construction Materials

The chemical test results indicate that DS-4 and AC-4 sulphate precautions are required for below ground concrete which will be in contact with the made ground.

A design sulphate class of DS-2 and ACEC class of AC-2 should be assumed for concrete in contact with natural ground only (i.e. where all made ground has been removed). If concrete is in contact with the natural coal DS-4 and AC-5 sulphate precautions are required.

It is not considered that protective measures will be required for new drinking water supply pipes laid within the natural ground, however, protection should be anticipated for pipes laid within made ground. The test results will need to be submitted to the water supplier for review.

9.6 Disposal of Material

If material needs to be removed, it should to be taken to a suitably licensed landfill or waste treatment facility. The costs of disposal and landfill tax can be substantial. The disposal of material should therefore be seen as a last resort with options such as treatment and reuse either on-site or off-site considered where possible.

The category of landfill which can accept the waste (inert, non-hazardous or hazardous) would need to be determined and will also have a significant effect on the costs. Additional testing may be required by the landfill operator and the acceptance of material is generally at their discretion.

9.7 Ground Gas

Radon precautions are not required.

No significant sources of ground gas have been identified during the investigation and therefore the risk to the proposed development is considered to be low. No gas precautions are therefore considered to be required.

Appendix 1

Exploratory Hole Location Plan, drawing reference 44856/001A

Appendix 2

Trial Pit Logs (HDP01, HDP02 and TP1 to TP9)

Rotary Borehole Logs (R01 to R06)

Photographs of Site and Trial Pits

Project Name Lower Eastfield Farm		Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland			Dimensions: 0.50m Depth: 0.15m	Scale 1:25
Client: Mr and Ms Miller				Logged GCB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.00	ES		0.15			Grass over brown slightly sandy gravelly CLAY with roots and rootlets. Gravel is fine to coarse of angular tabular sandstone. (Reworked TOPSOIL)
Trialpit Complete at 0.150m						
1						
2						
3						
4						

Remarks: Terminated on Sandstone paving slab. Groundwater not encountered. Backfilled with arisings upon completion.

Stability: Sides stable during excavation.

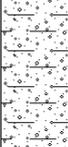
Project Name Lower Eastfield Farm		Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland			Dimensions: 0.50m Depth: 0.40m	Scale 1:25
Client: Mr and Ms Miller				Logged GCB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.00 - 0.10	ES					Grass over brown slightly sandy gravelly CLAY with roots and rootlets. Gravel is fine to coarse of angular tabular sandstone. (Reworked TOPSOIL)
			0.30			Yellowish brown slightly clayey GRAVEL of fine to coarse angular tabular sandstone with occasional coal fragments.
			0.40			Trialpit Complete at 0.400m

Remarks: Terminated on Sandstone bedrock. Groundwater not encountered. Backfilled with arisings upon completion.

Stability: Sides stable during excavation.

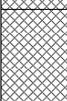
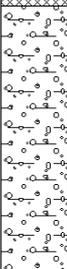
Project Name Lower Eastfield Farm	Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland	Dimensions: 0.80m Depth: 3.30m		Scale 1:25
Client: Mr and Ms Miller		2.80m	Logged JH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.00 - 0.10	ES		0.04			MADE GROUND: Grey concrete.
			0.20			MADE GROUND: Firm brown slightly sandy silty CLAY with high cobble content. Cobbles are angular to sub-rounded of flint, mudstone and brick.
0.50 - 0.70	ES					Yellowish brown slightly clayey sandy GRAVEL with high cobble content. Gravel and cobbles are fine to coarse of angular tabular sandstone.
			0.90			Extremely weak black destructured COAL, recovered as fine to coarse angular cubic gravel.
			1.40			Extremely weak brownish grey MUDSTONE recovered as clayey fine to coarse angular tabular gravel.
			3.30			Trialpit Complete at 3.300m

Remarks: Trial pit complete at 3.30 m. Groundwater seepage encountered from 1.20 m. Backfilled with arisings upon completion.

Stability: Sides stable during excavation with some minor spalling in the upper part.

Project Name Lower Eastfield Farm	Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland	Dimensions: 2.70m Depth: 3.00m		Scale 1:25
Client: Mr and Ms Miller		0.90m 	Logged JH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10 - 0.30	ES		0.04			MADE GROUND: Grey concrete. MADE GROUND: Brown clayey SAND with high content of cobble-sized fragments of brick.
1.00 - 1.10	ES		0.40			At 0.40 m <i>redundant clay pipe.</i> Yellowish brown angular tabular COBBLES of sandstone with some sandy clayey gravel. Gravel is fine to coarse of angular tabular sandstone.
			1.30			At 1.10 m <i>slight black staining. No odour.</i> Extremely weak black COAL recovered as fine to medium angular gravel.
2.60 - 3.00	ES		1.80			Extremely weak grey mottled orange brown MUDSTONE recovered as fine to coarse angular gravel.
			3.00			Trialpit Complete at 3.000m

Remarks: Trial pit complete at 3.00 m. Slight groundwater seepage encountered between 1.00 m and 1.80 m. Backfilled with arisings upon completion.

Stability: Sides stable during excavation.

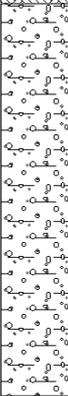
Project Name Lower Eastfield Farm	Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland	Dimensions: 4.50m		Scale 1:25
Client: Mr and Ms Miller	Depth: 3.30m	0.90m 	Logged JH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20 - 0.40	ES		0.10			Grass over brown sandy CLAY with rootlets. (TOPSOIL)
			0.40			Soft yellowish brown slightly sandy gravelly CLAY with medium cobble content. Gravel and cobbles are fine to coarse of angular, tabular sandstone. (SUBSOIL).
0.80 - 1.00	ES					Yellowish brown angular tabular COBBLES of sandstone with some sandy clayey gravel. Gravel is fine to coarse of angular tabular sandstone.
0.90 - 1.10	ES					<i>MADE GROUND: Dark grey silty gravelly SAND with gravel of siltstone and mudstone in eastern end of excavation.</i>
						<i>MADE GROUND: Orangish brown slightly sandy CLAY with high cobble content of sub angular, tabular sandstone in eastern end of excavation.</i>
3.00 - 3.20	ES		2.90			Extremely weak black COAL recovered as fine to medium angular tabular gravel.
			3.20			Extremely weak MUDSTONE recovered as clayey angular gravel and cobbles.
			3.30			Trialpit Complete at 3.300m

Remarks: Trial pit terminated at 3.30 m due to collapse of made ground. Groundwater not encountered. Backfilled with arisings upon completion.

Stability: Sides stable during excavation.

Project Name Lower Eastfield Farm		Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland			Dimensions: 2.20m	Scale 1:25
Client: Mr and Ms Miller			Depth: 1.50m	Logged JH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
1.00	ES		0.20			Grass over brown sandy clayey SILT with rootlets and low cobble content. Cobbles are angular of sandstone. (TOPSOIL)
			1.50			Yellowish brown angular tabular COBBLES of sandstone with some sandy clayey gravel. Gravel is fine to coarse of angular tabular sandstone.
Trialpit Complete at 1.500m						

Remarks: Trial pit complete at 1.50 m and soakaway test undertaken (see SA Test Sheet TP4). Groundwater not encountered. Backfilled with arisings upon completion.

Stability: Sides remained stable during excavation.

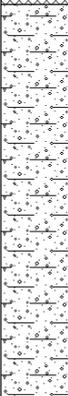
Project Name Lower Eastfield Farm	Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland	Dimensions: 3.40m		Scale 1:25
Client: Mr and Ms Miller	Depth: 2.20m	0.70m 	Logged JH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20 - 0.40	ES		0.10			Grass over brown slightly gravelly clayey SAND with rootlets and low cobble content. Gravel and cobbles are fine to coarse of angular sandstone. (Reworked TOPSOIL)
0.70 - 0.90	ES		0.50			MADE GROUND: Soft dark grey gravelly CLAY with high cobble content. Gravel and cobbles are angular of concrete, brick and slate tile with occasional inclusions of rebar and macadam.
1.30 - 1.50	ES		1.10			Yellowish brown clayey GRAVEL with low cobble content. Gravel and cobbles are of angular tabular sandstone.
			1.70			Yellowish brown angular tabular COBBLES of sandstone with some sandy clayey gravel. Gravel is fine to coarse of angular tabular sandstone.
			2.20			Trialpit Complete at 2.200m

Remarks: Trial pit complete at 2.20 m and soakaway test undertaken (see SA Test Sheet TP5). Groundwater not encountered. Backfilled with arisings upon completion.

Stability: Sides stable during excavation.

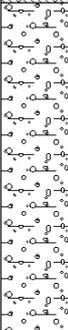
Project Name Lower Eastfield Farm		Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland			Dimensions: 2.00m	Scale 1:25
Client: Mr and Ms Miller			Depth: 2.00m	Logged JH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20 - 0.30	ES		0.70			MADE GROUND: Grass over brown slightly sandy gravelly CLAY with rootlets and low cobble content. Gravel and cobbles are angular of sandstone, brick, slate and concrete with occasional inclusions of plastic, glass and macadam.
1.70 - 1.90	ES					Yellowish brown slightly clayey sandy GRAVEL with high cobble content. Gravel and cobbles are of angular tabular sandstone.
						Trialpit Complete at 2.000m

Remarks: Trial pit terminated at 2.00 m due to refusal in bedrock. Slight groundwater seepage encountered at 2.00 m. Backfilled with arisings upon completion.

Stability: Sides stable during excavation.

Project Name Lower Eastfield Farm		Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland			Dimensions: 2.70m	Scale 1:25
Client: Mr and Ms Miller			Depth: 3.40m	Logged JH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10 - 0.30	ES		0.30			Grass over brown slightly sandy CLAY with rootlets. (TOPSOIL)
			1.40			Yellowish brown angular tabular COBBLES of sandstone with some sandy clayey gravel. Gravel is fine to coarse of angular tabular sandstone.
			1.80			Extremely weak black COAL recovered as fine to coarse cubic gravel.
			2.70 - 2.90			Extremely weak destructured MUDSTONE recovered as clayey angular gravel. <i>From 2.20 m recovered as slightly clayey gravel with medium cobble content.</i>
	ES		3.40			Trialpit Complete at 3.400m

Remarks: Trial pit complete at 3.40 m. Groundwater not encountered. Backfilled with arisings upon completion.

Stability: Sides stable during excavation.

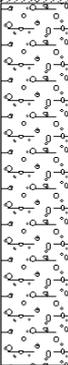
Project Name Lower Eastfield Farm		Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland			Dimensions: 3.00m	Scale 1:25
Client: Mr and Ms Miller			Depth: 1.60m	Logged JH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10 - 0.30	ES		0.10			MADE GROUND: Dark grey CONCRETE.
0.30	ES					MADE GROUND: Soft to firm mottled red brown and grey slightly sandy CLAY with high cobble content. Gravel and cobbles are angular of brick, sandstone and concrete with occasional inclusions of plastic, metal and coal fragments.
1.20 - 1.40	ES		1.00			Yellowish brown angular tabular COBBLES of sandstone with some sandy clayey gravel. Gravel is fine to coarse of angular tabular sandstone.
			1.60			Trialpit Complete at 1.600m

Remarks: Trial pit complete at 1.60 m due to refusal on bedrock. Groundwater not encountered. Backfilled with arisings upon completion.

Stability: Sides stable during excavation.

Project Name Lower Eastfield Farm		Project No. 44856	Co-ords: - Level:	Date 18/02/2020
Location: Thurgoland			Dimensions: 1.70m	Scale 1:25
Client: Mr and Ms Miller			Depth: 1.80m	Logged JH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10 - 0.20	ES					Grass over brown slightly sandy CLAY with rootlets. (TOPSOIL)
			0.30			Orangeish brown sandy CLAY with low cobble content. Cobbles are angular of sandstone. (SUBSOIL)
			0.60			Yellowish brown angular tabular COBBLES of sandstone with some sandy clayey gravel. Gravel is fine to coarse of angular tabular sandstone.
			1.80			Trialpit Complete at 1.800m

Remarks: Trial pit complete at 1.80 m due to refusal on bedrock. Groundwater not encountered. Backfilled with arisings upon completion.

Stability: Sides stable during excavation.



OPENHOLE DRILL LOG

Job No. 1000
 Contract Name: Thurgoland
 Working Day: 1

Date: 18/2/20
 Client: Eastwoods
 Sheet: 1 of 2

Hole No.	From	To	Flush (W/A/M)	Casing T/S (m)	Strata Description	Rig Type:																									
R01	GL	2.00	0	—	Overburden	Kleeman																									
	2.00	2.4			Sandstone																										
	2.4	2.8			Coal																										
	2.8	4.5			Mudstone / Sandstone Bands																										
	4.5	15.2			Mudstone																										
	* 15.2	15.7			Dark mudstone																										
	15.7	30.0		Mudstone.																											
<p>Installation Borehole, Drilled to 3.00 metres 2 metres Slotted Pipe with end cap, 1 metre of Plain Pipe with gas Valve. Gravel Pack 3.00m - 1.00m. Bentonite Plug 1.00m - GL, Steel lockable Cover flush to ground level.</p>						Crew Details: D. Graybe S. Davvington Remarks:																									
						<table border="1"> <thead> <tr> <th colspan="5">Gas Monitoring</th> </tr> <tr> <th>%</th> <th>O₂</th> <th>CO₂</th> <th>CH₄</th> <th>CO</th> </tr> </thead> <tbody> <tr> <td>Start</td> <td>20.8</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Mid</td> <td>20.8</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>End</td> <td>20.8</td> <td>0</td> <td>0</td> <td>0</td> </tr> </tbody> </table>	Gas Monitoring					%	O ₂	CO ₂	CH ₄	CO	Start	20.8	0	0	0	Mid	20.8	0	0	0	End	20.8	0	0	0
Gas Monitoring																															
%	O ₂	CO ₂	CH ₄	CO																											
Start	20.8	0	0	0																											
Mid	20.8	0	0	0																											
End	20.8	0	0	0																											
R02	GL	1.3		—	Overburden	Showers																									
	1.3	1.8			Sandstone																										
	1.8	2.1			Coal																										
	2.1	5.3			Sandstone																										
	5.3	13.8			Mudstone																										
	13.8	14.2			Dark Mudstone																										
	14.2	15.2		Mudstone.																											
R03	GL	1.00		—	Overburden	Boreholes Total																									
	1.00	1.3			Sandstone																										
	1.3	1.7			Coal																										
	1.7	4.00			Sandstone																										
	4.00	14.00			Mudstone																										
	14.00	14.5			Dark Mudstone																										
	14.5	15.5		Mudstone.																											
R04	GL	0.5		—	Overburden	Casing Total																									
	0.5	1.1			Sandstone																										
	1.1	1.5			Coal																										
	1.5	3.6			Sandstone																										
	3.6	13.7			Mudstone																										
	* 13.7	14.2			Dark Mudstone																										
	14.2	15.2		Mudstone.																											
<p>Installation Borehole, Drilled to 3.00 metres. 2 metres of Slotted Pipe with end cap, 1 metre of Plain with gas Valve, Gravel Pack 3.00m - 1.00m Bentonite Plug 1.00m - GL, Steel lockable Cover flush to ground level.</p>						Today Previous To Date Drilled Total Today Previous To Date Casing Total Today Previous To Date																									



OPENHOLE DRILL LOG

Job No. 4000
 Contract Name: Thurgoland
 Working Day: 1

Date: 18/2/20
 Client: Eastwoods
 Sheet: 2 of 2

Hole No.	From	To	Flush (W/A/M)	Casing T/S (m)	Strata Description	Rig Type:
R05	GL	0.1		-	Overburden	Kleeman
	0.1	1.6			Sandstone	
	1.6	2.00			Coal	
	2.00	4.00			Sandstone	
	4.00	11.3			Mudstone	
	11.3	11.7			Dark Mudstone	
	11.7	15.00			Mudstone	
R06	GL	0.4			Overburden	D. Gayle J. Harrington
	0.4	2.1			Sandstone	
	2.1	2.4			Coal	
	2.4	4.3			Sandstone	
	4.3	10.5			Mudstone	
*	10.5	11.00			Dark Mudstone	Remarks: Back Alled Boreholes with drill Arisings and Bentonite Plug.
	11.00	30.00			Mudstone	
<p>Installation Borehole Drilled to 30 metres - 2 metres Slotted Pipe with end cap, 1 metre of Plain Pipe with gas Valve. Gravel Pack 3.0m - 1.0m, Bentonite Plug 1.0m - GL, Steel Lockable Cover.</p>						
						Gas Monitoring
						% O ₂ CO ₂ CH ₄ CO
						Start
						Mid
						End
						Weather Conditions:
						Boreholes Total
						Today 6
						Previous
						To Date
						Drilled Total
						Today 120.9
						Previous
						To Date
						Casing Total
						Today 6
						Previous
						To Date



TP1

Prepared	JH	Checked	GCB	Date	18.02.2020	Photograph No	1 and 2
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E+P
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LOWER EASTFIELD FARM, THURGOLAND

MR AND MS MILLER

SITE PHOTOGRAPHS



TP2

Prepared	JH	Checked	GCB	Date	18.02.2020	Photograph No	3 and 4
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LOWER EASTFIELD FARM, THURGOLAND

MR AND MS MILLER

SITE PHOTOGRAPHS



TP3

Prepared	JH	Checked	GCB	Date	18.02.2020	Photograph No	5 and 6
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LOWER EASTFIELD FARM, THURGOLAND

MR AND MS MILLER

SITE PHOTOGRAPHS



TP6

Prepared	JH	Checked	GCB	Date	18.02.2020	Photograph No	7 and 8
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MR AND MS MILLER

SITE PHOTOGRAPHS



TP7

Prepared	JH	Checked	GCB	Date	18.02.2020	Photograph No	9 and 10
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LOWER EASTFIELD FARM, THURGOLAND

MR AND MS MILLER

SITE PHOTOGRAPHS



TP8

Prepared	JH	Checked	GCB	Date	18.02.2020	Photograph No	11 and 12
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SITE PHOTOGRAPHS



TP9

Prepared	JH	Checked	GCB	Date	18.02.2020	Photograph No	13 and 14
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LOWER EASTFIELD FARM, THURGOLAND

MR AND MS MILLER

SITE PHOTOGRAPHS



View south of main site entrance



View west towards farm house and surrounding agricultural buildings

Prepared	JH	Checked	GCB	Date	18.02.2020	Photograph No	15 and 16
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LOWER EASTFIELD FARM, THURGOLAND

MR AND MS MILLER

SITE PHOTOGRAPHS



View east from vicinity of TP6

Prepared	JH	Checked	GCB	Date	18.02.2020	Photograph No	17 and 18
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LOWER EASTFIELD FARM, THURGOLAND

MR AND MS MILLER

SITE PHOTOGRAPHS

Appendix 4

Chemical Test Results (Chemtest 20-05677-1)
Table of Assessment Values – Residential with Homegrown Produce



Final Report

Report No.: 20-05677-1

Initial Date of Issue: 28-Feb-2020

Client: Eastwood & Partners

Client Address: St. Andrews House
23 Kingfield Road
Sheffield
South Yorkshire
S11 9AS

Contact(s): Geo

Project: 44856 Lower Eastfield Farm

Quotation No.: **Date Received:** 21-Feb-2020

Order No.: **Date Instructed:** 24-Feb-2020

No. of Samples: 13

Turnaround (Wkdays): 5 **Results Due:** 28-Feb-2020

Date Approved: 28-Feb-2020

Approved By:


Details: Glynn Harvey, Laboratory Manager

Bulk Identification Certificate

Client: Eastwood & Partners
Site Address:
Date Sampled: 18-Feb-2020
Date Received: 21-Feb-2020

Your Ref.:
Project: 44856 Lower Eastfield Farm
Job Number: 20-05677
No Samples:
Date Reported: 28-Feb-2020

Sample No.	Sample ID	Sample Ref.	Description	Top (m)	Bottom (m)	SOP	Accred.	Laboratory	Material	Result
974143			TP8	0.3	0.3	2185	U	COVENTRY	Cement	Chrysotile

The in-house procedure SOP2185 is in accordance with the requirements of Appendix 2 of the Analyst Guide (HSG 248).

The results relate only to items tested as supplied by the client.

Comments and interpretations are beyond the scope of UKAS accreditation.

Samples associated with asbestos in building surveys are retained for six months (HSG 264 refers)

Results - Soil

Client: Eastwood & Partners	Chemtest Job No.:											
Quotation No.:	Chemtest Sample ID.:											
Sample Location:	TP1	TP2	TP2	TP3	TP3	TP3	TP5	TP5	TP6			
Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		
Top Depth (m):	0.5	1	0.1	0.2	0.8	3	0.7	1.3	0.2			
Bottom Depth (m):	0.7	1.1	0.3	0.4	1	3.2	0.9	1.5	0.3			
Date Sampled:	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020		
Asbestos Lab:			COVENTRY		COVENTRY		COVENTRY	COVENTRY	COVENTRY			
Determinand	Accred.	SOP	Units	LOD								
ACM Type	U	2192		N/A			-	-	-	-		
Asbestos Identification	U	2192	%	0.001			No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected		
ACM Detection Stage	U	2192		N/A			-	-	-	-		
Moisture	N	2030	%	0.020	8.9	13	15	15	14	22	17	14
Soil Colour	N	2040		N/A	Black,	Brown,	Black,	Black,	Brown,	Brown,	Brown,	Brown,
Other Material	N	2040		N/A	Stones,	Roots,	Stones,	Stones,	Stones,	Stones,	Stones,	Stones,
Soil Texture	N	2040		N/A	Clay,	Clay,	Clay,	Gravel,	Clay,	Clay,	Clay,	Clay,
pH	M	2010		4.0	8.6	7.8	7.9	7.5	5.9	7.5	7.4	8.6
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	0.12		< 0.010	< 0.010	0.021	0.013	0.11
Total Sulphur	M	2175	%	0.010	0.016	0.084		0.48	0.55	0.057	0.026	0.19
Sulphate (Acid Soluble)	M	2430	%	0.010	< 0.010	0.026		0.44	0.11	0.066	< 0.010	0.049
Arsenic	M	2450	mg/kg	1.0	7.3	8.3	13	37	10	12	6.5	18
Cadmium	M	2450	mg/kg	0.10	< 0.10	< 0.10	0.29	0.16	0.10	0.23	0.11	0.56
Chromium	M	2450	mg/kg	1.0	8.4	9.6	39	54	7.6	24	13	43
Copper	U	2450	mg/kg	0.50	9.8	8.2	19	25	16	19	10	32
Mercury	M	2450	mg/kg	0.10	< 0.10	< 0.10	0.16	0.30	0.14	0.84	< 0.10	0.19
Nickel	M	2450	mg/kg	0.50	15	15	19	21	29	16	12	29
Lead	M	2450	mg/kg	0.50	26	20	56	41	15	75	24	91
Selenium	M	2450	mg/kg	0.20	0.30	0.41	0.60	1.2	0.72	0.63	0.40	0.70
Zinc	U	2450	mg/kg	0.50	46	46	160	69	37	73	59	190
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		< 1.0						< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		< 1.0						< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0		< 1.0						< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0		< 1.0						< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0		< 1.0						< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0		< 1.0						< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0		< 1.0						< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0						< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		< 5.0						< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		< 1.0						< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		< 1.0						< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0		< 1.0						< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0		< 1.0						< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0		< 1.0						< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		< 1.0						76
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0		< 1.0						830

Results - Soil

Client: Eastwood & Partners	Chemtest Job No.:												
Quotation No.:	Chemtest Sample ID.:												
	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677	
	974133	974134	974135	974136	974137	974138	974139	974140	974141				
	Sample Location:		TP1	TP2	TP2	TP3	TP3	TP3	TP5	TP5	TP6		
	Sample Type:		SOIL										
	Top Depth (m):		0.5	1	0.1	0.2	0.8	3	0.7	1.3	0.2		
	Bottom Depth (m):		0.7	1.1	0.3	0.4	1	3.2	0.9	1.5	0.3		
	Date Sampled:		18-Feb-2020										
	Asbestos Lab:				COVENTRY		COVENTRY		COVENTRY	COVENTRY			
Determinand	Accred.	SOP	Units	LOD									
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0						< 1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		< 5.0						910	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		< 10						910	
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10		0.11	< 0.10	4.4	1.1	0.44	0.99
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	0.14		< 0.10	0.30	0.23	0.59	0.25	1.5
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	6.5	3.4	19
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10	0.18	< 0.10	5.5	2.7	14
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	0.23		0.37	4.9	7.7	47	24	240
Anthracene	M	2800	mg/kg	0.10	< 0.10	0.16		0.12	< 0.10	< 0.10	16	7.9	48
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	0.99		1.2	0.64	0.72	68	29	330
Pyrene	M	2800	mg/kg	0.10	< 0.10	0.73		0.99	0.64	0.63	55	22	260
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	0.22		0.61	0.45	0.29	30	11	83
Chrysene	M	2800	mg/kg	0.10	< 0.10	0.22		0.52	0.72	0.66	27	11	73
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	0.21		0.59	0.21	< 0.10	35	12	93
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	0.14		0.19	< 0.10	< 0.10	13	4.5	35
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	0.18		0.51	0.27	< 0.10	32	10	82
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	0.11		0.32	< 0.10	< 0.10	18	6.2	52
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	3.7	1.2	10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	0.11		0.41	< 0.10	< 0.10	16	5.1	46
Total Of 16 PAH's	N	2800	mg/kg	2.0	< 2.0	3.4		5.9	8.3	15	370	150	1400
Demeton-O	N	2820	mg/kg	0.20				< 0.20					
Phorate	N	2820	mg/kg	0.20				< 0.20					
Demeton-S	N	2820	mg/kg	0.20				< 0.20					
Disulfoton	N	2820	mg/kg	0.20				< 0.20					
Fenthion	N	2820	mg/kg	0.20				< 0.20					
Trichloronate	N	2820	mg/kg	0.20				< 0.20					
Prothiofos	N	2820	mg/kg	0.20				< 0.20					
Fensulphothion	N	2820	mg/kg	0.20				< 0.20					
Sulprofos	N	2820	mg/kg	0.20				< 0.20					
Azinphos-Methyl	N	2820	mg/kg	0.20				< 0.20					
Coumaphos	N	2820	mg/kg	0.20				< 0.20					
Alpha-HCH	N	2840	mg/kg	0.20				< 0.20					
Gamma-HCH (Lindane)	N	2840	mg/kg	0.20				< 0.20					
Beta-HCH	N	2840	mg/kg	0.20				< 0.20					
Delta-HCH	N	2840	mg/kg	0.20				< 0.20					
Heptachlor	N	2840	mg/kg	0.20				< 0.20					
Aldrin	N	2840	mg/kg	0.20				< 0.20					
Heptachlor Epoxide	N	2840	mg/kg	0.20				< 0.20					

Results - Soil

Client: Eastwood & Partners		Chemtest Job No.:								
Quotation No.:	Chemtest Sample ID.:	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677	20-05677
	Sample Location:	TP1	TP2	TP2	TP3	TP3	TP3	TP5	TP5	TP6
	Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):	0.5	1	0.1	0.2	0.8	3	0.7	1.3	0.2
	Bottom Depth (m):	0.7	1.1	0.3	0.4	1	3.2	0.9	1.5	0.3
	Date Sampled:	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020	18-Feb-2020
	Asbestos Lab:			COVENTRY		COVENTRY		COVENTRY	COVENTRY	
Determinand	Accred.	SOP	Units	LOD						
Gamma-Chlordane	N	2840	mg/kg	0.20			< 0.20			
Alpha-Chlordane	N	2840	mg/kg	0.20			< 0.20			
Endosulfan I	N	2840	mg/kg	0.20			< 0.20			
4,4-DDE	N	2840	mg/kg	0.20			< 0.20			
Dieldrin	N	2840	mg/kg	0.20			< 0.20			
Endrin	N	2840	mg/kg	0.20			< 0.20			
4,4-DDD	N	2840	mg/kg	0.20			< 0.20			
Endosulfan II	N	2840	mg/kg	0.20			< 0.20			
Endrin Aldehyde	N	2840	mg/kg	0.20			< 0.20			
4,4-DDT	N	2840	mg/kg	0.20			< 0.20			
Endosulfan Sulphate	N	2840	mg/kg	0.20			< 0.20			
Methoxychlor	N	2840	mg/kg	0.20			< 0.20			
Endrin Ketone	N	2840	mg/kg	0.20			< 0.20			

Project: 44856 Lower Eastfield Farm

Client: Eastwood & Partners	Chemtest Job No.:				20-05677	20-05677	20-05677
Quotation No.:	Chemtest Sample ID.:				974142	974144	974145
	Sample Location:				TP7	TP8	HDPO2
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.1	1.2	0.2
	Bottom Depth (m):				0.3	1.4	0.2
	Date Sampled:				18-Feb-2020	18-Feb-2020	18-Feb-2020
	Asbestos Lab:						
Determinand	Accred.	SOP	Units	LOD			
ACM Type	U	2192		N/A			
Asbestos Identification	U	2192	%	0.001			
ACM Detection Stage	U	2192		N/A			
Moisture	N	2030	%	0.020	15	8.6	21
Soil Colour	N	2040		N/A	Brown,	Brown,	Brown,
Other Material	N	2040		N/A	Stones,	Stones,	Stones,
Soil Texture	N	2040		N/A	Clay,	Clay,	Sand,
pH	M	2010		4.0	6.0	7.7	7.4
Sulphate (2:1 Water Soluble) as SO ₄	M	2120	g/l	0.010		< 0.010	
Total Sulphur	M	2175	%	0.010		0.015	
Sulphate (Acid Soluble)	M	2430	%	0.010		< 0.010	
Arsenic	M	2450	mg/kg	1.0	13	6.5	25
Cadmium	M	2450	mg/kg	0.10	0.25	< 0.10	0.71
Chromium	M	2450	mg/kg	1.0	16	11	36
Copper	U	2450	mg/kg	0.50	20	10	70
Mercury	M	2450	mg/kg	0.10	0.13	< 0.10	0.51
Nickel	M	2450	mg/kg	0.50	19	21	25
Lead	M	2450	mg/kg	0.50	67	23	580
Selenium	M	2450	mg/kg	0.20	0.65	0.27	0.97
Zinc	U	2450	mg/kg	0.50	95	64	270
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0			
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0			
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0			
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0			
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0			
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0			
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0			
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0			
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0			
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0			
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0			
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0			
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0			
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0			
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0			
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0			

Project: 44856 Lower Eastfield Farm

Client: Eastwood & Partners	Chemtest Job No.:				20-05677	20-05677	20-05677
Quotation No.:	Chemtest Sample ID.:				974142	974144	974145
	Sample Location:				TP7	TP8	HDPO2
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.1	1.2	0.2
	Bottom Depth (m):				0.3	1.4	0.2
	Date Sampled:				18-Feb-2020	18-Feb-2020	18-Feb-2020
	Asbestos Lab:						
Determinand	Accred.	SOP	Units	LOD			
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0			
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0			
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0			
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.19
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	0.10
Acenaphthene	M	2800	mg/kg	0.10	0.46	0.81	< 0.10
Fluorene	M	2800	mg/kg	0.10	0.45	0.69	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	4.6	7.9	0.62
Anthracene	M	2800	mg/kg	0.10	1.2	1.9	0.15
Fluoranthene	M	2800	mg/kg	0.10	5.6	8.5	1.3
Pyrene	M	2800	mg/kg	0.10	4.4	6.7	1.1
Benzo[a]anthracene	M	2800	mg/kg	0.10	2.1	2.8	0.68
Chrysene	M	2800	mg/kg	0.10	1.7	2.0	0.70
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	2.5	2.8	1.1
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.91	1.1	0.37
Benzo[a]pyrene	M	2800	mg/kg	0.10	2.0	2.4	0.42
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	1.5	1.4	0.69
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.29	0.12	0.12
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	1.2	1.3	0.57
Total Of 16 PAH's	N	2800	mg/kg	2.0	29	40	8.1
Demeton-O	N	2820	mg/kg	0.20			
Phorate	N	2820	mg/kg	0.20			
Demeton-S	N	2820	mg/kg	0.20			
Disulfoton	N	2820	mg/kg	0.20			
Fenthion	N	2820	mg/kg	0.20			
Trichloronate	N	2820	mg/kg	0.20			
Prothiofos	N	2820	mg/kg	0.20			
Fensulphothion	N	2820	mg/kg	0.20			
Sulprofos	N	2820	mg/kg	0.20			
Azinphos-Methyl	N	2820	mg/kg	0.20			
Coumaphos	N	2820	mg/kg	0.20			
Alpha-HCH	N	2840	mg/kg	0.20			
Gamma-HCH (Lindane)	N	2840	mg/kg	0.20			
Beta-HCH	N	2840	mg/kg	0.20			
Delta-HCH	N	2840	mg/kg	0.20			
Heptachlor	N	2840	mg/kg	0.20			
Aldrin	N	2840	mg/kg	0.20			
Heptachlor Epoxide	N	2840	mg/kg	0.20			

Project: 44856 Lower Eastfield Farm

Client: Eastwood & Partners		Chemtest Job No.:			20-05677	20-05677	20-05677
Quotation No.:		Chemtest Sample ID.:			974142	974144	974145
		Sample Location:			TP7	TP8	HDP02
		Sample Type:			SOIL	SOIL	SOIL
		Top Depth (m):			0.1	1.2	0.2
		Bottom Depth (m):			0.3	1.4	0.2
		Date Sampled:			18-Feb-2020	18-Feb-2020	18-Feb-2020
		Asbestos Lab:					
Determinand	Accred.	SOP	Units	LOD			
Gamma-Chlordane	N	2840	mg/kg	0.20			
Alpha-Chlordane	N	2840	mg/kg	0.20			
Endosulfan I	N	2840	mg/kg	0.20			
4,4-DDE	N	2840	mg/kg	0.20			
Dieldrin	N	2840	mg/kg	0.20			
Endrin	N	2840	mg/kg	0.20			
4,4-DDD	N	2840	mg/kg	0.20			
Endosulfan II	N	2840	mg/kg	0.20			
Endrin Aldehyde	N	2840	mg/kg	0.20			
4,4-DDT	N	2840	mg/kg	0.20			
Endosulfan Sulphate	N	2840	mg/kg	0.20			
Methoxychlor	N	2840	mg/kg	0.20			
Endrin Ketone	N	2840	mg/kg	0.20			

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2185	Asbestos	Asbestos	Polarised light microscopy
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2680	TPH A/A Split	Aliphatics: >C5-C6, >C6-C8,>C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35, >C35- C44Aromatics: >C5-C7, >C7-C8, >C8- C10, >C10-C12, >C12-C16, >C16- C21, >C21- C35, >C35- C44	Dichloromethane extraction / GCxGC FID detection
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[gh]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2820	Organophosphorus (O-P) Pesticides in Soils by GC-MS	Organophosphorus pesticide representative suite including Parathion, Malathion etc, plus client specific determinands	Dichloromethane extraction / GC-MS
2840	Organochlorine (O-Cl) Pesticides in Soils by GC-MS	Organochlorine pesticide representative suite including DDT and its metabolites, 'drins' and HCH etc, plus client specific determinands	Dichloromethane extraction / GC-MS

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

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

All Asbestos testing is performed at the indicated laboratory

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

Sample Deviation Codes

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

Sample Retention and Disposal

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

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

Charges may apply to extended sample storage

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

customerservices@chemtest.com

Inorganic Compounds	Human Health - Residential with Homegrown Produce (mg/kg)
Arsenic	37
Cadmium	11
Chromium (III)	910
Chromium (VI)	6
Lead	200
Mercury	1.2
Nickel	180
Selenium	250
Copper	2400
Zinc	3700

Organic Compounds	Human Health - Residential with Homegrown Produce (mg/kg)		
	1% SOM	2.5% SOM	6% SOM
Naphthalene	2.3	5.6	13
Acenaphthene	210	510	1100
Acenaphthylene	170	420	920
Fluorene	170	400	860
Phenanthrene	95	220	440
Anthracene	2400	5400	11000
Fluoranthene	280	560	890
Pyrene	620	1200	2000
Benzo(a)anthracene	7.2	11	13
Chrysene	15	22	27
Benzo(b)fluoranthene	2.6	3.3	3.7
Benzo(k)fluoranthene	77	93	100
Benzo(a)pyrene	2.2	2.7	3.0
Dibenz(a,h)anthracene	0.24	0.28	0.3
Indeno(1,2,3-cd)pyrene	27	36	41
Benzo(g,h,i)perylene	320	340	350
Benzene	0.087	0.17	0.37
Toluene	130	290	660
Ethylbenzene	47	110	260
o-Xylene	60	140	330
m-Xylene	59	140	320
p-Xylene	56	130	310

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Prepared	JA	Checked	CAT	Date	12.03.20	Job No	44856
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 Eastwood & Partners <small>CONSULTING ENGINEERS</small> St Andrew's House 23 Kingfield Road Sheffield S11 9AS Tel: (0114) 255 4554 Fax: (0114) 255 4330	LOWER EASTFIELD FARM, THURGOLAND MR AND MS MILLER ASSESSMENT CRITERIA – RESIDENTIAL WITH HOMEGROWN PRODUCE
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Contaminant	Phytotoxicity			
	pH 5.0 to 5.5	pH 5.5 to 6.0	pH 6.0 to 6.5	pH >7.0
Arsenic	50			
Cadmium	3			
Chromium	400			
Lead	300			
Mercury	1			
Nickel	50	60	75	110
Copper	80	100	135	200
Zinc	200	200	200	300

The assessment concentration for lead is the Category 4 Screening Level produced by Contaminated Land: Applications in Real Environments (CL:AIRE) and outlined in Appendix H of their report SP1010. The others have been taken from Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R., and Nathanail, J., 2015, 'The LQM/CIEH S4ULs for Human Health Risk Assessment', Land Quality Press, Nottingham. The metals/metalloids are based on a sandy loam soil and 6% soil organic matter. The assessment values are not intended to be applied to individual sample results where materials are similar, as the levels of contaminants will have a natural variability across the site. Instead, the modified mean value should be compared with the assessment concentration.

The assessment values for phytotoxicity are the levels at which plant growth is thought to be affected. They are taken from the maximum permissible and advisable concentrations in soil after application of soil sludge given in the 'The Code of Good Agricultural Practice for the Protection of Soil', MAFF, 1998.

The assessment of sulphate, water soluble sulphate, elemental sulphur and sulphide is to determine the aggressive nature of the ground with respect to concrete and consequently the results are compared with BRE Special Digest 1:2005 'Concrete in Aggressive Ground'.

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Prepared	JA	Checked	CAT	Date	12.03.20	Job No	44856
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TPH Fraction	Intended Land Use Residential (mg/kg)		
	1% SOM	2.5% SOM	6% SOM
Aliphatic EC 5-6	42	78	160
Aliphatic EC >6-8	100	230	530
Aliphatic EC >8-10	27	65	150
Aliphatic EC >10-12	130 (48) ^{vap}	330 (118) ^{vap}	760 (283) ^{vap}
Aliphatic EC >12-16	1100 (24) ^{sol}	2400 (59) ^{sol}	4,300 (142) ^{sol}
Aliphatic EC >16-35	65,000 (8.48) ^{f, sol}	92,000 (21) ^{f, sol}	110,000 ^f
Aliphatic EC >35-44	65,000 (8.48) ^{f, sol}	92,000 (21) ^{f, sol}	110,000 ^f
Aromatic EC 5-7	70	140	300
Aromatic EC >7-8	130	290	660
Aromatic EC >8-10	34	83	190
Aromatic EC >10-12	74	180	380
Aromatic EC >12-16	140	330	660
Aromatic EC >16-21	260 ^f	540 ^f	930 ^f
Aromatic EC >21-35	1,100 ^f	1,500 ^f	1,700 ^f
Aromatic EC >35-44	1,100 ^f	1,500 ^f	1,700 ^f

^f oral, dermal, and inhalation exposure compared with oral HCV

^{sol} S4UL presented exceeds the solubility saturation limit, which is presented in brackets

^{vap} S4UL presented exceed the vapour saturation limit, which is presented in brackets

The assessment criteria for each of the petroleum hydrocarbon fractions have been taken from Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R., and Nathanail, J., 2015, 'The LQM/CIEH S4ULs for Human Health Risk Assessment', Land Quality Press, Nottingham. These are also all based on a sandy loam soil.

Within the Environment Agency Science Report P5-080/TR3, Askari, K. & Pollard, S., 2005 'The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils' it is stated that the assessment values should not be considered individually; instead the potential additive effects should be calculated. This is achieved by calculating an individual Hazard Quotient (HQ) for each fraction. The HQ is the proportion of the assessment concentration represented by the recorded concentration. The HQs are then added together to form a Hazard Index (HI) and where this exceeds unity a potential significant risk to human health may exist.

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