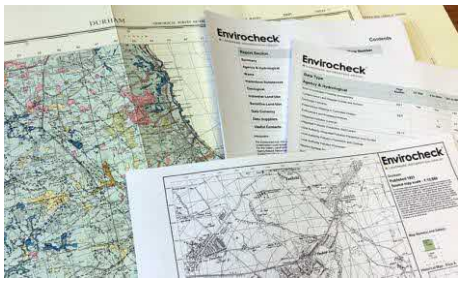
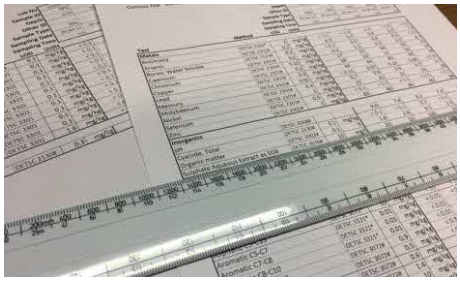
SOLMEK







Phase 2: Site Investigation

Rowley Farm, Cornsay Colliery, County Durham

Mark & Nicola Frost

S2001011

Solmek Ltd

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PHASE 2 SITE INVESTIGATION REPORT

ROWLEY FARM, CORNSAY COLLIERY, COUNTY DURHAM

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APPENDICES

Revision	Date	Prepared By	Signed
Final	January 2021	T Deo Geotechnical Engineer	[redacted]
		Checked By	
		R Woods *Principal Geotechnical Engineer*	[redacted]
		Approved By	
		R Woods *Principal Geotechnical Engineer*	[redacted]

1 EXECUTIVE SUMMARY

Site Address	Rowley Farm, Cornsay Colliery, Durham, DH7 9EB.
Proposed Development	The site is outlined for a residential development.
Fieldwork	2no open hole rotary boreholes (RBH1 and RBH2) to a maximum depth of 30.00m below ground level (bgl). Gas monitoring wells were installed in BH's 1 & 2.
Ground Conditions	Made ground was relatively uniform across the site and was encountered to a minimum depth of 0.30mbgl (RBH2) and a maximum depth of 0.40mbgl (RBH1). Natural ground generally comprised brown and grey slightly sandy clay which was encountered to a maximum depth of 3.40mbgl. Proven to underlie the sandy clay a brown slightly sandy slightly gravelly clay, gravel parts sub-angular to subrounded of sandstone and limestone was encountered to a maximum depth of 27.00mbgl. Rock-head was proven at depth 26.60mbgl (RBH1) and 27.00mbgl (RBH2) generally compromising of mudstone and sandstone.
Contamination Testing Results	One made ground sample and one natural ground sample tested for shallow contamination. No samples indicated raised levels of contamination above the residential S4UL threshold values, based on the two samples tested. No asbestos fibres detected from the samples tested. Slightly alkaline pH.
Contamination Analysis	Given the site's proposed residential land use, the levels of contamination recorded on site do not pose a risk to the current and future users of the site. If any zones of odorous, brightly coloured or suspected contaminated ground or groundwater are encountered then work should cease in that area until the material has been investigated. The results of the investigation will therefore determine whether or not remediation will be required. Made ground classed as uncontaminated with respect to construction workers. PPE for workers. Damping down of site during dry windy conditions. Based on the contamination test results the topsoil and natural clay is considered suitable for re-use in the garden areas. A suitable growing medium of 200mm topsoil over natural clay should be provided. Controlled waters unlikely to be at risk. With respect to utilities pH was elevated as a minimum all services should be laid in clean trenches. Sub surface concrete should be designed to DS-1 ACEC (Class AC-1s). This assumes static groundwater conditions.
Coal Mining Assessment	During the rotary open hole drilling no loss of flush was recorded and no coal seams were encountered. The shallowest sub-cropping coal seam is the Bottom Busty with a section thickness of 0.94m, as no coal seams were encountered during drilling the Bottom Busty Seam is >30.00mbgl. In this situation the Bottom Busty seam is at a sufficient depth to give a ratio well in excess of 10x the seam thickness (assuming the boulder clay proven is 0.5h).
Geotechnical Appraisal	Based on the chemical testing sub-surface concrete should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-1s.

2 INTRODUCTION

2.1 Authorisation

The site investigation described in this report was carried out by Solmek on behalf of the client Mark & Nicola Frost, on land located at Rowley Farm, Cornsay Colliery, Durham, DH7 9EB.

2.2 Scope of Works

The site is expected to be developed with new residential housing with associated soft landscaping.

A geotechnical and environmental investigation including a ground gas risk assessment was requested. The fieldwork and testing were generally carried out according to the recommendations of BS5930: 2015 "Code of Practice for Ground Investigations" and were applicable BS EN 1997-2:2007 with soil descriptions to BS EN 14688-1:2013 where applicable. The information provided in this report is based on the investigation fieldwork and is subject to the comments and approval of the various regulatory authorities.

There may be other conditions prevailing on the site which have not been disclosed by this investigation and which have not been taken into account by this report. Solmek reserve the right to alter conclusions and recommendations should further information be available or provided. Any schematic representation or opinion of the possible configuration of ground conditions between exploratory holes is conjectural and given for guidance only and confirmation of intermediate ground conditions should be considered if deemed necessary.

3 SITE DESCRIPTION AND FIELDWORK

A site inspection, as recommended in BS 5930 and BS 10175, was undertaken on Wednesday 25th November 2020. The site is centred at Ordnance Survey Co-ordinates 417549, 542658.

The site is an irregularly shaped parcel of land of level topography. The site is currently utilised as Rowley Farm which can be accessed via a country lane from the west. The site predominantly consists of a compacted gravel hardstanding with numerous industrial units associated with the farm. A residential building is located in the most eastern part of the site. The site is surrounded by vacant grass fields.

The surrounding areas of the site is predominantly rural in nature.

3.1 Fieldwork

The fieldwork was carried out on Wednesday 25th November 2020. The extent of the investigation was:

2no open hole rotary boreholes (RBH1 and RBH2) to a maximum depth of 30.00m below ground level (bgl).
Gas monitoring wells were installed in BH's 1 & 2.

The boreholes were backfilled with gas well installations upon completion.

Descriptions of the strata encountered in the boreholes together with details of sampling and groundwater are presented in Appendix B of this report. A plan showing the location of the boreholes can be found in Appendix A (Figure 2).

4 GROUND CONDITIONS

A summary of the ground conditions encountered is given below.

4.1 Made Ground

Made ground was relatively uniform across the site and was encountered to a minimum depth of 0.30mbgl (RBH2) and a maximum depth of 0.40mbgl (RBH1). The made within RBH1 consisted of dark greyish brown slightly sandy slightly gravelly clayey topsoil, gravel part comprising ceramic, brick and limestone to a

maximum depth of 0.40mbgl. Within RBH2 the made ground consists of fine to coarse gravel, the gravel including concrete to a maximum depth of 0.30mbgl.

4.2 Natural Deposits

Proven to underlie the made ground deposits across the site, natural ground generally comprised brown and grey slightly sandy clay which was encountered to a maximum depth of 3.40mbgl. Proven to underlie the sandy clay a brown slightly sandy slightly gravelly clay, gravel parts sub-angular to subrounded of sandstone and limestone was encountered to a maximum depth of 27.00mbgl

4.3 Solid Geology

In the deep open-hole boreholes, rock-head was proven at depth 26.60mbgl (RBH1) and 27.00mbgl (RBH2) generally compromising of mudstone and sandstone. No coal bands were encountered in the boreholes.

4.4 Groundwater

No groundwater was encountered in any of the boreholes (RBH1 & RBH2).

It should be noted the rapid rate of advancement of the exploratory holes may mask minor seepages and it should be borne in mind that water levels fluctuate with a number of influences including season, rainfall, dewatering and pumping activities.

5 CONTAMINATION TESTING RESULTS

The proposed development of the site is to involve the construction of a residential building with areas of soft landscaping. The chemical results are presented in Appendix C.

5.1 Contamination Testing and Rationale

To provide information upon the possibility of ground contamination one sample of made ground and one sample of natural clay were selected for shallow contamination testing.

RBH1 – 0.10mbgl (Made ground – topsoil)
RBH2 – 0.50mbgl (Natural clay)

The samples selected are considered to provide coverage of both the made ground and shallow natural strata from across the site that would be most likely to be exposed during future site works. The samples were tested for the following contaminant suites:

2no Metals, semi-metals, non-metals, inorganic determinants
2no Asbestos identification screenings
2no Speciated Polyaromatic Hydrocarbons (PAHs)
2no Organic Matter Content

5.2 Test Results

Based on the proposed development at the site, the test results have been compared to a series of Land Quality Management (LQM) Suitable for Use Levels (S4UL) based on a residential with home grown produce land use. These are the most up to date thresholds published in December 2014.

The value for lead has been compared with the Category 4 Screening Level (March 2014) developed by Contaminated Land: Applications In Real Environments (CL:AIRE).

The test results are presented in Appendix C, and a summary is provided below in Tables 1 and 2.

TABLE 1: SUMMARY OF INORGANIC CONTAMINATION TESTING RESULTS

Determinant	Units	Number of Samples above Level of Detection	Minimum Level	Maximum Level	Residential with HGP Value	Number of Results Exceeding Threshold Value
Metals						
Cadmium	mg/kg	1	<0.1	0.16	11	0
Chromium	mg/kg	2	11	13	910	0
Copper	mg/kg	2	9.5	16	2400	0
Lead	mg/kg	2	19	49	200*	0
Mercury	mg/kg	0	<0.1	-	40	0
Nickel	mg/kg	2	6.9	9.1	180	0
Zinc	mg/kg	2	30	47	3700	0
Semi metals and non-metals						
Arsenic	mg/kg	2	3.9	5.7	37**	0
Boron	mg/kg	1	<0.4	0.49	290	0
Selenium	mg/kg	2	0.34	0.4	250	0
Inorganic chemicals						
Cyanide (Total)	mg/kg	0	<1	-	1.49**	0
Sulphate (2:1 Water Soluble)	mg/l	0	<10	-	2000^	0
Other						
pH	pH	-	8.0	8.1	5.5^	0

* Category 4 Screening Levels, March 2014
** CLEA Software Version 1.06 (pH7 and 1%SOM)
^ EA Threshold Values
HGP Home Grown Produce

5.3 Metals, Semi Metals and Non-Metals

No samples indicated raised levels of contamination above the residential S4UL threshold values, based on the two samples tested.

5.4 Inorganic Chemicals

Soluble sulphates (potentially aggressive to foundation concrete) were recorded between <10mg/l. None of the samples were elevated above levels affecting human health or the BRE Special Digest 1 500mg/l limit for the sulphate classification of concrete.

The results of the pH testing was 8.0 and 8.1, which is consistent with slightly alkaline conditions.

5.5 Organic Chemicals

The organic thresholds vary depending on the levels of soil organic matter (SOM).

The average SOM recorded across the site was 5.7% therefore a SOM of 6% has been used to determine the S4UL thresholds. Table 2, below, summarises the results.

TABLE 2: SUMMARY OF ORGANIC CONTAMINATION TESTING RESULTS

Determinant	Units	Number of Samples above Level of Detection	Minimum Level	Maximum Level	Residential with HGP Value at 6% SOM	Number of Results Exceeding Threshold Value
Speciated PAH						
Naphthalene	mg/kg	0	<0.1	-	13	0
Acenaphthylene	mg/kg	0	<0.1	-	920	0
Acenaphthene	mg/kg	0	<0.1	-	1100	0
Fluorene	mg/kg	0	<0.1	-	860	0
Phenanthrene	mg/kg	0	<0.1	-	440	0
Anthracene	mg/kg	0	<0.1	-	11000	0
Fluoranthene	mg/kg	0	<0.1	-	890	0
Pyrene	mg/kg	0	<0.1	-	2000	0
Benzo[a]anthracene	mg/kg	0	<0.1	-	13	0
Chrysene	mg/kg	0	<0.1	-	27	0
Benzo[b]fluoranthene	mg/kg	0	<0.1	-	3.7	0
Benzo[k]fluoranthene	mg/kg	0	<0.1	-	100	0
Benzo[a]pyrene	mg/kg	0	<0.1	-	3	0
Benzo[g,h,i]perylene	mg/kg	0	<0.1	-	41	0
Dibenz(a,h)Anthracene	mg/kg	0	<0.1	-	0.3	0
Indeno(1,2,3-c,d)Pyrene	mg/kg	0	<0.1	-	350	0
Total PAH	mg/kg	0	<2	-	50*	0
Total Phenol	mg/kg	0	<0.3	-	1100	0
* EA Threshold Values						

No samples indicated raised levels of contamination above the residential S4UL threshold values, based on the two samples tested.

5.6 Asbestos

From the two samples subject to asbestos screening, asbestos fibres were not recorded in any of the samples.

5.7 Environmental Protection Act 1990: Part 2A Revised Statutory Guidance (April 2012)

This revised document explains how the Local Authority should decide if land, based on a legal interpretation, is contaminated. The document replaces the previous guidance given in Annex 3 of DEFRA Circular 01/2006, issued in accordance with section 78YA of the 1990 Environmental Protection Act.

The main objectives of the Part 2A regime are to *"identify and remove unacceptable risks to human health and the environment" and* to *"seek to ensure that contaminated land is made suitable for its current use".* Part 2A uses a risk based approach to defining contaminated land whereby the "risk" is interpreted as *"the likelihood that harm, or pollution of water, will occur as a result of contaminants in, on or under the land"* and by *"the scale and seriousness of such harm or pollution if it did occur".*

For a relevant risk to exist a contaminant, pathway and receptor linkage must be present before the land can be considered to be contaminated. The document explains that *"for a risk to exist there must be contaminants present in, on or under the land in a form and quantity that poses a hazard, and one or more pathways by which they might significantly harm people, the environment, or property; or significantly pollute controlled waters."*

A conceptual model is used to develop and communicate the risks associated with a particular site.

To determine if land is contaminated the local authority use various categories from 1 to 4. Categories 1 and 2 include *"land which is capable of being determined as contaminated land on grounds of significant possibility of significant harm to human health."* Categories 3 and 4 *"encompass land which is not capable of being determined on such grounds".*

See Appendix D for additional notes on contamination guidelines.

6 CONTAMINATION ANALYSIS

Mitigation measures to reduce the risks identified for each receptor are discussed in the following sections.

6.1 Users of the Site Once Development is Complete

The users of the site, particularly construction workers, are likely to be exposed to contaminants present in the soils beneath the site during redevelopment work. **Potential** exposure pathways include dermal absorption after contact with contaminated ground, inhalation of soil or dust, inhalation of volatised compounds, and inadvertent soil ingestion. Moreover, a risk to ground/surface water receptors exists through leaching of contaminants.

To establish if the levels of contaminants present on site may pose a risk to the health of the future users of the site the results of the contamination testing have been compared to a series of LQM/CIEH S4UL based on residential with home grown produce end use.

Based on the shallow soil contamination testing undertaken to date, it is considered that the levels of contamination are unlikely to pose a risk to future users of the site.

During the initial site strip if any zones of odorous, brightly coloured or suspected contaminated ground are encountered then work should cease in that area until the material has been tested. The results of the tests will determine whether or not remediation will be required.

The current legislation on waste involves the categorization of materials into inert waste, non reactive hazardous wastes and hazardous wastes. The determination of the category depends on DEFRA landfill directive waste acceptance criteria (WAC) testing. Material taken off site may be subject to WAC by the appropriate waste disposal company.

6.2 Construction Workers and Users of Surrounding Sites

Short term human exposure to contaminants present in soils can occur via several pathways during the construction and ground works phase of the development. These include dermal absorption after contact with contaminated ground, inhalation of soil or dust (including windblown dust), inhalation of volatised compounds, inadvertent soil ingestion and contact with contaminated groundwater.

It is considered that the encountered levels of contamination are unlikely to pose a risk to construction workers and users of surrounding sites. As good practice, full PPE must be employed in accordance with HSE guidance and safeguards should be taken to limit dust during ground works, and access to the public should be restricted. Construction workers should use gloves as a precaution when handling any fill materials. Provision of suitable hygiene facilities are needed for site workers.

Although asbestos was not detected from the soil samples subjected to testing within this investigation, the possibility still exists that asbestos containing materials may still be present on site and currently lie undetected. It is therefore advised that a 'watching brief' is undertaken during the initial site strip and any excavation works and advice sought if asbestos is found or suspected.

During dry weather, any excavations may require clean water to be sprinkled at shallow depth to prevent excess dust escaping to off-site receptors. Monitoring of dust concentrations during construction should be given careful consideration to ensure occupational exposure levels are not exceeded.

6.3 Vegetation

Plants can be affected by soil contamination in a number of ways resulting in growth inhibition, nutrient deficiencies and yellowing of leaves. Contaminants are taken up by plants through the roots and through foliage. Contaminants identified as being highly phytotoxic include boron, cadmium, copper, nickel, and zinc.

To establish if the levels of contaminants present on site may pose a risk to vegetation the results of the contamination testing have been compared to a series of threshold values published in "*Code of Good Agricultural Practice for the Protection of Soil"*. No concentrations of the phytotoxic determinants are shown as elevated from the three samples tested.

Based on the contamination test results the topsoil and natural clay is considered suitable for re-use in the

garden areas. A suitable growing medium of 200mm topsoil over natural clay should be provided.

6.4 Ground and Surface Water

The principal pathway by which soil contamination may reach the water environment is through a slow seepage or leaching to groundwater or surface water. The potential for contaminants to migrate along such pathways is dependent on the chemical and physical characteristics of the contaminants and the local hydrogeology.

From the site investigation undertaken, ground conditions broadly comprise thin topsoil over glacial till Formation superficial deposits.

The published geology indicates the site is underlain by solid geology of Pennine Lower Coal Measures Formation.

The nearest surface water feature is Rowley Burn 45m to the south-west of the site.

No groundwater was encountered during the site investigation. Due to the generally low contamination found across the site, the aquifer designations beneath the site, and the distance to surface waters, the development is considered to represent a low risk to groundwater or surface water receptors.

6.5 Construction Materials

Materials at risk from potential soil contamination include inorganic matrices such as cement and concrete and also organic material, e.g. plastics and rubbers. Acid ground conditions and elevated levels of sulphates can accelerate the corrosion of building materials. Plastics and rubbers are generally used for piping and service ducts and are potentially attacked by a range of chemicals, most of which are organic, particularly petroleum-based substances. Drinking water supplies can be tainted by substances that can penetrate piping and water companies enforce stringent threshold values.

BRE Special Digest One: *"Concrete in Aggressive Ground"*: 2005 3rd Edition has been used to assess the risks posed to underground concrete and to establish the design measures required to mitigate the risks. The results of the pH and water-soluble sulphate tests (when converted to total potential sulphate) fall into Class DS-1 ACEC (Class AC-1s) requirements for concrete protection. This assumes static groundwater conditions.

The levels of potential contaminants should be compared to thresholds supplied in the UK Water Industry Research (UKWIR) publication "Guidance for the selection of Water Supply Pipes to be used in Brownfield Sites" (January 2011). A Brownfield Site is defined in the document as "Land or premises that have previously been used or developed that may be vacant or derelict". It should be noted that Brownfields sites may not be contaminated. The guidance does not apply to Greenfield Sites however water companies may have their own assessment criteria which should be checked by the developer.

The concentrations of the selected determinants should be compared to the pipe material selection table in Appendix D and Consultation with the appropriate water supply company is required to identify the most suitable service fabric. However due to the elevated pH levels >8 copper piping should be avoided.

7 GROUND GAS ASSESSMENT

The proposed development includes the construction of residential housing.

Ground gases such as carbon dioxide (CO_2), methane (CH_4), carbon monoxide (CO) and volatile organic compounds (VOCs) can be classed as a form of contamination where there is a potential risk to human health.

Ground gas monitoring (six return visits) is currently in progress and this will be reported as an addendum to this report once complete. This report will also recommend suitable gas protection measures suitable to the levels observed during monitoring.

8 GEOTECHNICAL ANALYSIS

8.1 Preliminary Mining Assessment

The ten times seam thickness rule states that where competent rock exceeds ten times the extracted seam thickness then no major crown holing should occur at the surface (Structural Foundations Manual; M. F. Atkinson, *Spon Press* 2003). If the competent rock cover is less than six times the extracted seam thickness, then recommendations suggest the workings must be grouted using a mixture of pulverised fuel ash (PFA) and cement placed into the area under pressure.

For a transition zone of 6-10 times the seam thickness, it may be acceptable to consider the use of raft foundations subject to approval from the regulatory authorities. However, the use of 6 to 10 times the seam thickness is not appropriate for steeply dipping seams and where strong flowing water is encountered.

During the rotary open hole drilling no loss of flush was recorded and no coal seams were encountered. Boulder clay was prove to 27m and can be assumed to represent 1m of solid cover per 2m of proven clay (i.e. 0.5h). Based on the borehole logs to 30m it can be assumed that 20.5h is present.

After the inspection of NZ14SE Geological Map the shallowest sub-cropping coal seam is the Bottom Busty with a section thickness of 0.94m (H), as no coal seams were encountered during drilling the Bottom Busty Seam is >30.00mbgl. In this situation the Bottom Busty seam is at a sufficient depth to give a ratio well in excess of 10x the seam thickness (20.5h / 0.94 gives a ratio of 19.27 which is deemed safe).

8.2 Geotechnical Appraisal

Based on the chemical testing sub-surface concrete should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-1s.

Prior to placing concrete, obvious soft or loose spots should be removed and replaced with suitably recompacted hardcore or lean mix concrete. In addition, all excavations should be inspected to ensure that they fully penetrate areas of disturbed ground.

Further advice should be sought from Solmek if unexpected ground conditions are encountered during redevelopment.

8.3 Excavation

Based on the nature of the ground conditions encountered, excavations should be within the capacity of normal earthworks plant although breaking out of possible obstructions should be anticipated. Stability of excavations will be poor in the made ground, but stability should improve in the natural clay. Excavation sides should be designed, constructed and supported in accordance with the recommendations given in CIRIA Report No. 97: “Trenching Practice”.

8.4 Groundwater

No groundwater was encountered in any of the boreholes (RBH1 & RBH2).

It should be noted the rapid rate of advancement of the exploratory holes may mask minor seepages and it should be borne in mind that water levels fluctuate with a number of influences including season, rainfall, dewatering and pumping activities.

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Appendix A
Drawings

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Title
Site Location Map

Project
Rowley Farm, Cornsay Colliery, County Durham

Client
Mark & Nicole Frost

Date
January 2021

Fig No.
Figure 1

Scale
On map

Key

[redacted]

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Title
Approximate Borehole Location Plan

Project
Rowley Farm, Cornsay Colliery, County Durham

Client
Mark & Nicole Frost

Date
January 2021

Fig No.
Figure 2

Scale
On map

Key

Rotary Open Hole Borehole

(G) Gas Pipe Installed

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SOLMEK

Appendix B
Borehole Logs

	Back‖ ll / Installaeon

	Back‖ ll / Installaeon

	Back‖ ll / Installaeon

	Back‖ ll / Installaeon

	Back‖ ll / Installaeon

	Back‖ ll / Installaeon

Appendix C
Contamination Laboratory Results

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Email: info@chemtest.com

Final Report

Report No.:	20-34752-1		
Initial Date of Issue:	22-Dec-2020		
Client	Solmek Ltd		
Client Address:	12 Yarm Road Stockton-on-Tees TS18 3NA		
Contact(s):	Leo Cassidy Office		
Project	S201101 Rowley Farm, Durham		
Quotation No.:		**Date Received:**	17-Dec-2020
Order No.:	SOL-4568	**Date Instructed:**	17-Dec-2020
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	23-Dec-2020
Date Approved:	22-Dec-2020		
Approved By:	[redacted]		
Details:	Glynn Harvey, Technical Manager		

Results - Soil

Project: S201101 Rowley Farm, Durham

Client: Solmek Ltd		**Chemtest Job No.:**			20-34752	20-34752
Quotation No.:		**Chemtest Sample ID.:**			1115543	1115544
		Sample Location:			HP1	HP2
		Sample Type:			SOIL	SOIL
		Top Depth (m):			0.10	0.50
		Bottom Depth (m):			0.50	0.70
		Date Sampled:			25-Nov-2020	25-Nov-2020
		Asbestos Lab:			COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	22	21
Soil Colour	N	2040		N/A	Brown	Brown
Other Material	N	2040		N/A	None	None
Soil Texture	N	2040		N/A	Sand	Clay
pH	M	2010		4.0	8.1	8.0
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	0.49	< 0.40
Sulphate (2:1 Water Soluble) as SO4	M	2120	mg/l	10	< 10	< 10
Cyanide (Total)	M	2300	mg/kg	0.50	[B] < 0.50	[B] < 0.50
Arsenic	M	2450	mg/kg	1.0	5.7	3.9
Cadmium	M	2450	mg/kg	0.10	0.16	< 0.10
Chromium	M	2450	mg/kg	1.0	13	11
Copper	M	2450	mg/kg	0.50	16	9.5
Mercury	M	2450	mg/kg	0.10	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50	9.1	6.9
Lead	M	2450	mg/kg	0.50	49	19
Selenium	M	2450	mg/kg	0.20	0.40	0.34
Zinc	M	2450	mg/kg	0.50	47	30
Organic Matter	M	2625	%	0.40	8.6	2.8
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10

Results - Soil

Project: S201101 Rowley Farm, Durham

Client: Solmek Ltd			**Chemtest Job No.:**		20-34752	20-34752
Quotation No.:			**Chemtest Sample ID.:**		1115543	1115544
			Sample Location:		HP1	HP2
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.10	0.50
			Bottom Depth (m):		0.50	0.70
			Date Sampled:		25-Nov-2020	25-Nov-2020
			Asbestos Lab:		COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	< 2.0
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1115543			HP1	25-Nov-2020	B	Amber Glass 250ml
1115543			HP1	25-Nov-2020	B	Plastic Bag
1115544			HP2	25-Nov-2020	B	Amber Glass 250ml
1115544			HP2	25-Nov-2020	B	Plastic Bag

Test Methods

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
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
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.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

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

All Asbestos testing is performed at the indicated laboratory

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

Sample Deviation Codes

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

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

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

Charges may apply to extended sample storage

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

customerservices@chemtest.com

Appendix D
Notes on Limitations
&
Contamination
Guidelines

SOLMEK NOTES ON CONTAMINATION GUIDANCE (REF: VERSION 1/2021)

UK BACKGROUND

Environmental Protection Act 1990: Part 2A Revised Statutory Guidance (April 2012)

This revised document explains how the Local Authority should decide if land, based on a legal interpretation, is contaminated. The document replaces the previous guidance given in Annex 3 of DEFRA Circular 01/2006, issued in accordance with section 78YA of the 1990 Environmental Protection Act.

The main objectives of the Part 2A regime are to *"identify and remove unacceptable risks to human health and the environment" and* to *"seek to ensure that contaminated land is made suitable for its current use".*

Part 2A uses a risk based approach to defining contaminated land whereby the "risk" is interpreted as *"the likelihood that harm, or pollution of water, will occur as a result of contaminants in, on or under the land"* and by *"the scale and seriousness of such harm or pollution if it did occur".*

For a relevant risk to exist a contaminant, pathway and receptor linkage must be present before the land can be considered to be contaminated. The document explains that *"for a risk to exist there must be contaminants present in, on or under the land in a form and quantity that poses a hazard, and one or more pathways by which they might significantly harm people, the environment, or property; or significantly pollute controlled waters."*

A conceptual model is used to develop and communicate the risks associated with a particular site.

To determine if land is contaminated the local authority use various categories from 1 to 4. Categories 1 and 2 include *"land which is capable of being determined as contaminated land on grounds of significant possibility of significant harm to human health."*

Categories 3 and 4 *"encompass land which is not capable of being determined on such grounds".*

PRELIMINARY CONCEPTUAL MODEL

Preliminary Conceptual Models are undertaken in accordance with CIRIA C552. The Preliminary Conceptual Model assesses the consequence and the likelihood of a risk being realised to provide a risk classification, using the tables detailed below.

CONSEQUENCE OF RISK BEING REALISED (Based on C552 CIRIA, 2001)

Classification	Definition	Example
Severe	Short-term (acute) risk to human health, the environment, an element of the development or other aspect with is likely to result in *significant harm*, damage or both.	High concentrations of cyanide on the surface of an informal recreational area. Major spills of contaminants from site into controlled water. High concentrations of explosive gas in the subsurface environment that have a clear unobstructed pathway into buildings.
Moderate	Chronic damage to human health, a plausible chance that an event will occur, although the timeline is not immediate to be in the short-term.	Appreciable concentration of contamination that over the longer-term will cause significant harm i.e. high lead concentration in topsoil. Shallow mine workings that are potentially unstable but may remain in a satisfactory or stable conditions for a number of years.
Mild	Low level pollution of non-sensitive water, a feasible hazardous scenario although the timeline of such occurring can probably be considered in 10's of years.	The effect of high sulphate concentrations on structural concrete. Pollution of non-classified groundwater.
Minor	Harm, although not necessarily significant to human health, or with respect to other aspects of the development, which are considered implausible in terms of occurrence, or will have little consequential impact.	The presence of contaminants at such low concentrations that protective equipment is required during site works. Any damage to structures is minimal and will not be structural in characteristics.

PROBABILITY OF RISK BEING REALISED (C552 CIRIA, 2001)

Classification	Definition
High Likelihood	There is a viable pollutant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence that the receptor has been harmed or polluted.
Likely	There is a viable pollutant linkage and all elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a viable pollutant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a viable pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

RISK CLASSIFICATION MATRIX (C552 CIRIA, 2001)

Risk = Probability x Consequence		Consequence			
		Severe	Moderate	Mild	Minor
Probability	High likelihood	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

HUMAN RECEPTORS

Human exposure to contaminants present in soils can occur via several pathways. Direct exposure pathways include dermal absorption after contact with contaminated ground, inhalation of soil or dust, inhalation of volatised compounds, and inadvertent soil ingestion (or deliberate soil ingestion in the case of some children). Other indirect pathways include human ingestion of plants grown in contaminated soil or contaminated ground or surface water. Contaminants associated with wind blown dust can affect humans on surrounding sites.

VEGETATION

Plants can be affected by soil contamination in a number of ways resulting in growth inhibition, nutrient deficiencies and yellowing of leaves. Contaminants are taken up by plants through the roots and through foliage. Contaminants identified as being highly phytotoxic include boron, cadmium, copper, lead, nickel, and zinc.

To establish if the levels of contaminants present on a site may pose a risk to vegetation the results of the contamination testing are compared to a series of threshold values published in 'Code of Good Agricultural Practice for the Protection of Soil'.

GROUNDWATER AND SURFACE WATER RECEPTORS

The principal pathway by which soil contamination may reach the water environment is through a slow seepage or leaching to groundwater or surface water. The potential for contaminants to migrate along such pathways is dependent on the chemical and physical characteristics of the contaminants and the local hydrogeology. Surface watercourses may also accumulate contamination as contaminated sediments are deposited within the water body.

Where the site investigated overlies major/principal aquifers (and in some cases minor/secondary aquifers depending on certain conditions), groundwater Source Protection Zones and areas in close proximity to groundwater abstractions, contamination test results have been compared with the Water Supply (Water Quality) Regulations 1989 and The Water Supply (Water Quality) Regulations 2000.

Should a surface water receptor, such as a fresh water environment (river, canal, stream, lake etc), or marine environment be considered sensitive in relation to a site, then test results are compared with DEFRA & SEPA Environmental Quality Standards (2004). Many of the Environmental Quality Standards are hardness ($CaCO_3$) depended. Where no hardness values are available, Solmek assume conservative values (of between 0 and 50mg/l).

In the absence of vulnerable ground and surface water environments, Solmek may compare any test results with the Environment Agency Leachate Quality Threshold Values.

DETAILED QUANTITATIVE RISK ASSESSMENT (DQRA)

In line with CLR 11- Model Procedures, a DQRA for groundwater/human health may be required following a Phase 2 investigation and before the preparation of a Phase 3 Remediation Strategy. For human health DQRA, a site specific assessment criteria is undertaken using CLEA Software Version 1.06. For groundwater DQRA, the Environment Agency Remedial Targets Worksheet Version 3.1 is used.

WASTE ACCEPTANCE CRITERIA

The WAC testing relates to materials that are to be exported from a site/development to landfill, and do not directly relate to human health specifically. The WAC test categorises materials as either inert waste, non-reactive hazardous waste, and hazardous waste.

The testing results are generally presented as certificates which can be used by site owners/contractors etc, which should be presented to the accepting waste facility or waste contractor.

CONSTRUCTION MATERIALS

Materials at risk from possible soil contaminants include inorganic matrices such as cement and concrete and also organic material such as plastics and rubbers. Acid ground conditions and high levels of sulphates can accelerate the corrosion of building materials. Where pH and soluble sulphate analysis has been undertaken, Solmek compare the test results with the guidelines presented within BRE Special Digest 1, 2005 (3rd Edition) 'Concrete in Aggressive Ground'. Plastics and rubbers are generally used for piping and service ducts and are potentially attacked by a range of chemicals, most of which are organic, particularly petroleum based substances. Drinking water supplies can be tainted by substances that can penetrate piping and water companies enforce stringent threshold values.

The levels of potential contaminants should be compared to thresholds supplied in the UK Water Industry Research (UKWIR) publication "Guidance for the selection of Water Supply Pipes to be used in Brownfield Sites" (January 2011). A Brownfield Site is defined in the document as "Land or premises that have not previously been used or developed that may be vacant or derelict". It should be noted that Brownfield sites may not be contaminated. The guidance does not apply to Greenfield Sites however water companies may have their own assessment criteria which should be checked by the developer. The table below outlines the pipe material selection threshold concentrations.

	Pipe Material (Threshold concentrations in mg/kg)					
Parameter group	**PE**	**PVC**	**Barrier pipe (PE-AL-PE)**	**Wrapped Steel**	**Wrapped Ductile Iron**	**Copper**
Extended VOC suite by purge and trap or head space and GC-MS with TIC	0.5	0.125	Pass	Pass	Pass	Pass
+ BTEX + MTBE	0.1	0.03	Pass	Pass	Pass	Pass
SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C5-C10)	2	1.4	Pass	Pass	Pass	Pass
+ Phenols	2	0.4	Pass	Pass	Pass	Pass
+ Cresols and chlorinated phenols	2	0.04	Pass	Pass	Pass	Pass
Mineral oil C11-C20	10	Pass	Pass	Pass	Pass	Pass
Mineral oil C21-C40	500	Pass	Pass	Pass	Pass	Pass
Corrosive (Conductivity, Redox and pH)	Pass	Pass	Pass	Corrosive if pH <7 and conductivity >400µS/cm	Corrosive if pH <5, Eh not neutral and conductivity >400µS/cm	Corrosive if pH <5 or >8 and Eh positive
Specific suite identified as relevant following site investigation						
Ethers	0.5	1	Pass	Pass	Pass	Pass
Nitrobenzene	0.5	0.4	Pass	Pass	Pass	Pass
Ketones	0.5	0.02	Pass	Pass	Pass	Pass
Aldehydes	0.5	0.02	Pass	Pass	Pass	Pass
Amines	Fail	Pass	Pass	Pass	Pass	Pass

REQUIREMENTS OF PARTIES WITHIN THE DEVELOPMENT PROCESS

Interested parties involved in the development process may use the data in different ways and there may be varying views and interpretation of the factual data. Local Authority staff may have a view on contamination and human health and the wider environment. The Environment Agency are concerned principally with the protection of Controlled waters. Building insurers, funders and purchasers may be primarily concerned with issues of potential commercial blight. Purchasers are also not always fully informed, and perceptions on issues associated with risk can affect the decision to purchase. Developers and construction organisations will focus on financial aspects of dealing with the contamination in the context of the development and construction programme.

RISKS & LIABILITIES FROM CONTAMINATION

In simple terms, risks associated with contamination may be considered in terms of 1) statutory risks and 2) development related risks. If contamination is severe or forms a potential hazard based on its potential to affect groundwater, surface water or human health, a statutory risk may be present, and as such, if the risk is not reduced, criminal proceedings may be instigated by a government body or local authority.

If the contamination is less severe or not considered to be mobile, it may be considered a commercial liability which could, in theory remain untreated, but which may at a later date affect the value of the property, or, with changing legislation, become a statutory risk. Commercial liabilities could give rise to civil proceedings by third parties if there are grounds for action.

♣Solmek conditions of offer, notes on limitations & basis for contract (ref: version1/2021)

These conditions accompany our tender and supercede any previous conditions issued. Solmek will prepare a report solely for the use of the Client (the party invoiced) and its agent(s). No reliance should be placed on the contents of this report, in whole or in part by 3rd parties. The report, its content and format and associated data are copyright, and the property of Solmek. Photocopying of part or all of the contents, transfer or reproduction of any kind is forbidden without written permission from Solmek. A charge may be levied against such approval, the same to be made at the discretion of Solmek.

Solmek cannot be held liable and do not warrant, or otherwise guarantee the validity of information provided by third parties and subsequently used in our reports. Solmek are not responsible for the action negligent of otherwise of subcontractors or third parties.

Site investigation is a process of sampling. The scope and size of an investigation may be considered proportional to levels of confidence regarding the ground and groundwater conditions. The exploratory holes undertaken investigate only a small volume of the ground in relation to the overall size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions as encountered within each of the exploratory holes. There may be different ground conditions elsewhere on the site which have not been identified by this investigation and which therefore have not been taken into account in this report. Reports are generally subject to the comments of the local authority and Environment Agency. The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that mobile contamination, ground gas levels and groundwater levels may vary owing to seasonal, tidal and/or weather related effects. Solmek cannot be held liable for any unrecorded or unforeseen obstructions between exploratory boreholes and trial pits. This includes instances where previous structures on the site (buried man made structures) or the presence of boulder clay (cobbles and/or boulder obstructions) have been anticipated. All types of piling operations should make allowance for obstructions within the construction budget to accommodate this. Unrecorded ancient mining may occur anywhere where seams that have been worked and influence the rock and soil above. Dissolution cavities can occur where gypsum or chalk is present. Rotary drilling is the recommended technique to prove the integrity of the rock.

Where the scope of the investigation is limited via access to information, time constraints, equipment limitations, testing, interpretation or by the client or his agents budgetary constraints, elements not set out in the proposal and excluded from the report are deemed to be omitted from the scope of the investigation.

Desk studies are generally prepared in accordance with RICS guidelines. Environmental site investigations are generally undertaken as 'exploratory investigations' in accordance with the definitions provided in paragraph 5.4 of BS 10175:2011 in order to confirm the conceptual assumptions. You are advised to familiarize yourself with the typical scope of such an investigation. No pumping of water will be undertaken unless a licence or facilities/equipment have been arranged by others.

Where the type, number or/and depth of exploratory hole is specified by others, Solmek cannot and will not be responsible for any subsequent shortfall or inadequacy in data, and any consequent shortfall in interpretation of environmental and geotechnical aspects which may be required at a later date in order to facilitate the design of permanent or temporary works.

All information acquired by Solmek in the course of investigation is the property of Solmek, and, only also becomes the joint property of the Client only on the complete settlement of all invoices relating to the project. Solmek reserve the right to use the information in commercial tendering and marketing, unless the Client expressly wishes otherwise in writing. The quoted rates do not include VAT, and payment terms are 30 days from dispatch of invoice from our offices. Quotes are subject to a site visit.

We have allowed for 1 mobilisation and normal working hours unless otherwise stated. The scope of the investigation may be reviewed following the desk study and/or fieldwork. The presence or otherwise of Japanese Knotweed or other invasive plants can be difficult to identify especially during winter months. If Japanese Knotweed or other invasive species are suspect, it should be confirmed by an ecologist. We have not allowed for acquiring services information, and cannot be responsible for damage to underground services or pipes not shown to us or not clearly shown on plans. Costs incurred will be passed on to you, and in commissioning Solmek you understand and accept that you/your agent have a contractual relationship with Solmek & you accept this. Our rates assume unobstructed, reasonably level and firm access to the exploratory positions and adequate clear working areas and headroom. We have priced on the basis that you or your client have the necessary permissions, wayleaves and approvals to access land. All boreholes and pits are backfilled with arisings except where gas monitoring pipes are installed with stopcock covers. Solmek are not responsible for any uneven surfaces as a result of siteworks and rutting and backfilled excavations may require re-levelling and/or making good by others after fieldwork is complete, and Solmek has not allowed for this. No price has been provided or requested for a return visit to remove pipework and covers. Hourly rates apply to consultancy only and do not include expenses unless otherwise shown. If warranties are required, legal costs incurred will be passed on to you assuming Solmek agree to complete such warranties, modified or otherwise and you understand and agree to pay all costs.

We reserve the right to pursue full payment of the invoice prior to release of any information including reports. We advise you/your client that we may elect to pursue our statutory rights under late payment legislation, and will apply 8% to the base rate for unreasonably late payments. Solmek are exempt from the CIS Scheme. Solmek offer to undertake work only in strict accordance with conditions covered by our current insurances, which are available for inspection. Solmek are not responsible for acts, negligent or otherwise of subcontractors and as a matter of policy cannot indemnify any other parties. Professional indemnity Insurance is limited to ten times the invoice net total except where stated otherwise by Solmek. Solmek give notice that consequential loss as a direct or indirect result of Solmek's activities or omission of the same are excluded.