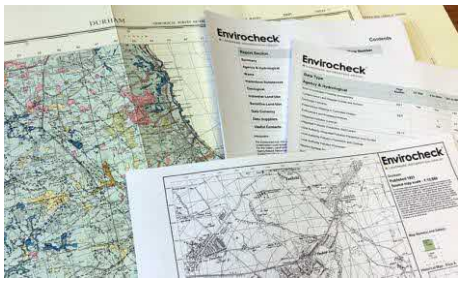



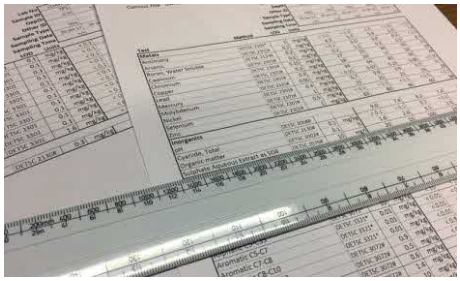

Phase 2: Site Investigation

Manor Farm, Cowthorpe

John Ellis Builders Ltd

S220450

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ISO 14001:2015 Environmental Management
ISO 45001 Occupational Health and Safety Management
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PHASE 2 SITE INVESTIGATION REPORT

MANOR FARM, COWTHORPE

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APPENDICES

Revision	Date	Prepared By	Signed
Final	July 2022	L Cassidy *Senior Environmental Engineer*	[redacted]
		Checked By	
		M Atkins *Senior Engineering Geologist*	[redacted]
		Approved By	
		R Woods *Principal Geotechnical Engineer*	[redacted]

1 EXECUTIVE SUMMARY

Site Address	Manor Farm, Oak Road, Cowthorpe, Wetherby, North Yorkshire, LS22 5EY.
Proposed Development	The site is outlined for a residential development.
Fieldwork	5no. small percussive boreholes (BH01 to BH05) drilled to a depth of 5.00mbgl. 3no. monitoring pipes in BH01, BH03 and BH04.
Ground Conditions	Made ground was encountered to depths of between 0.50mbgl in TP4 and 2.40mbgl in BH3. Firm becoming stiff clay was generally encountered down to a maximum depth of 5.00mbgl. Loose clayey gravelly sand encountered within BH04 (2.40-3.60mbgl). Groundwater was noted within BH04 at 2.80mbgl.
Contamination Testing Results	Four made ground samples tested. Elevated PAHs in BH01. Asbestos fibres in BH01 & BH04. Slightly alkaline to alkaline pH.
Contamination Analysis	Given the site's proposed residential land use, the levels of contamination recorded on site may 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 posing a moderate risk with respect to construction workers. PPE for workers. Damping down of site during dry windy conditions. Clean cover system required for all proposed areas of soft landscaping, to 0.60m based on guidance from YALPAG. 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.
Geotechnical Testing Results	Cohesive deposits low to high strength (28kPa-75kPa) based on in-situ hand vanes. Cohesive materials on site have a low volume change potential. Moisture contents between 14 and 25%. Sulphates between 10-140mg/l, pH slightly alkaline to alkaline.
Geotechnical Analysis & Foundation Recommendations	Bearing capacity of 100kN/m^2 at minimum depth of 0.75mbgl on 0.60m wide strips. Local deepening of foundations to 1.60mbgl due to depth of made ground. Settlements within 25mm. Normal earthworks plant for excavations.

2 INTRODUCTION

2.1 Authorisation

The site investigation described in this report was carried out by Solmek to the instructions of John Ellis Builders Ltd, on land located at Manor Farm, Oak Road, Cowthorpe, Wetherby.

Sources of information, including previous work undertaken at the site, are detailed below:

Solmek Phase 1 Desk Study (S220324) March 2022.

Reference should be made to the above report for details of the site's history and environmental setting.

2.2 Scope of Works

The site is expected to be developed with a conversion of the existing barns to form residential housing with associated parking and soft landscaping.

The following steps may be required in the investigation and remediation of potentially contaminated land:

Phase 1: Desk Study
Phase 2: Intrusive Investigation
Phase 3: Remediation Statement
Phase 4: Validation Reports

Phases 1 and 2 are generally required in the redevelopment of most sites. Phases 3 and 4 are subject to the findings of the initial stages.

A geotechnical and environmental (Phase 2) investigation including a ground gas risk assessment was requested. The fieldwork and testing was generally carried out according to;

BS 5930:2015+A1:2020 Code of Practice for Ground Investigations
BS 10175:2011+A1:2013 Investigation of Potentially Contaminated Sites – Code of Practice.
CIRIA C665:2007 Assessing Risks Posed by Hazardous Ground Gas to Buildings
BS 8485:2015+A1:2019 Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments
Rock and soil descriptions shall be in accordance with BS EN ISO 14689-1:2003, BS EN ISO 14688-1:2002 and BS EN ISO 14688-2:2004

This report forms part of a Stage 1 Risk Assessment (Generic Quantitative Risk Assessment) with respect to the Environment Agency's guidance document Environment Agency *Land Contamination Risk Management*, which replaced the now-withdrawn *Contaminated Land Report 11 – Model Procedures for the Management of Land Contamination (2004)*.

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 25th May 2022. The site is centred at Ordnance Survey Co-ordinates 442600, 452270 and covers approximately 0.11Ha.

The desk study area is located on a parcel of land south of Cowthorpe off Wetherby Lane.

The site is irregularly shaped and has a mostly flat and even topography. The site is currently used as a

farm, with several buildings present.

The main building on the site is a large barn-type building in the north of the site which appears to incorporate various potential asbestos containing materials within its structure (cladding & roofing). A long rectangular brick building runs along the boundary of the site in the southwest.

The remainder of the site consists of a hardstanding yard.

The site perimeter is secure, with gated access to the south west.

The River Nidd is present to the west of the site. The land use surrounding the site is agricultural in nature.

The village of Cowthorpe is located to the north of the site.

3.1 Fieldwork

The fieldwork was carried out on 25th May 2022. The extent of the investigation was:

5no small percussive boreholes (BH01 to BH05 inclusive) to a maximum depth of 5.00m below ground level (bgl).
- The boreholes were evenly spread around the site to achieve maximum site coverage.

Gas monitoring wells were installed in BH's 01, 03 & 04.
- The wells were spaced at <25m centres evenly around the site in accordance with CIRIA C665.

Insitu testing in the exploratory positions as Standard Penetration Tests (SPTs) and hand shear vanes.

Retrieval of samples for geotechnical and chemical testing.

The boreholes were backfilled with clean arisings and bentonite/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 Topsoil

Topsoil was encountered within BH03 & BH04 only, to depths of 0.40mbgl. Within BH04, the topsoil was noted as containing gravel of brick and concrete.

4.2 Made Ground

Made ground was variable across the site and was encountered within BH01, BH02 & BH05, comprising sandy slightly gravelly clay was encountered to depths of between 0.60 and 1.60mbgl.

4.3 Natural Deposits

Proven to underlie the made ground deposits across the site, natural ground generally comprised soft to firm sandy slightly gravelly low to medium strength clay, which was encountered to a maximum determination depth of 5.00mbgl in the boreholes. Within BH04, a band of loose clayey gravelly sand was encountered from 2.40-3.60mbgl.

4.4 Groundwater

Groundwater strikes, where encountered, are presented on the exploratory logs (Appendix B) and are summarised below in Table 1:

TABLE 1: SUMMARY OF GROUNDWATER STRIKES

Exploratory Position	Depth Encountered (mbgl)	Depth after 20 minutes (mbgl)	Strata
BH04	2.80	-	Sand

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. Therefore, water levels significantly higher than those found during this investigation may be encountered.

5 CONTAMINATION TESTING RESULTS

The proposed development of the site is to involve the conversion of the existing barns to form residential homes with associated gardens, parking and access roads. The chemical samples were generally retrieved in line with BS ISO 18400-105:2017 *Soil Quality. Sampling*. The chemical results are presented in Appendix C.

5.1 Site Characterisation

Within the Solmek Phase 1 Desk Study, a preliminary conceptual model was formed based on the information obtained. The initial risk was based on the site history which recorded farm building as present from the 1890s onwards.

An overall low to moderate risk was provided for various receptors:

Human Health – Low to Moderate
Controlled Water – Low to Moderate
Current Site Users (on-site workers/visitors) – Low to Moderate
Vegetation – Low to Moderate
Construction Materials – Low to Moderate

5.2 Contamination Testing and Rationale

To provide information upon the possibility of ground contamination two samples of made ground and two samples of topsoil were selected for shallow contamination testing. A Low to Moderate overall contamination risk was highlighted in the Phase 1 Desk Study due to previous land uses. This coupled with the end use being Residential with Home Grown Produce means that four samples are considered appropriate for testing. The samples selected are detailed below:

BH01 – 0.20-0.40m (Made ground – cohesive)
BH03 – 0.40-0.60m (Made ground – topsoil)
BH04 – 0.20-0.40m (Made ground – topsoil)
BH05 – 0.40-0.60m (Made ground – cohesive)

The samples selected are considered to provide coverage of the made ground 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:

4no Metals, semi-metals, non-metals, inorganic determinants
4no Asbestos identification screenings
- 2no Asbestos quantification analysis

4no Speciated Polyaromatic Hydrocarbons (PAHs)
1no Total Petroleum Hydrocarbon Criteria Working Group fractions (TPHCWG)

5.3 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 2 and 3.

TABLE 2: SUMMARY OF INORGANIC CONTAMINATION TESTING RESULTS

Determinand	Units	Number of Samples above Level of Detection	Minimum Recorded Level	Maximum Recorded Level	Residential with HGP Threshold Value	Number of Results Exceeding Threshold Value
Metals						
Cadmium	mg/kg	3	<0.1	0.28	11	0
Chromium	mg/kg	4	4.9	9.8	910	0
Copper	mg/kg	4	2.1	11	2400	0
Lead	mg/kg	4	4.5	63	200*	0
Mercury	mg/kg	0	<0.1	-	40	0
Nickel	mg/kg	4	3.9	9.5	180	0
Zinc	mg/kg	4	7.2	58	3700	0
Semi metals and non-metals						
Arsenic	mg/kg	4	1.2	5.1	37**	0
Boron	mg/kg	3	<0.4	1.4	290	0
Selenium	mg/kg	3	<0.2	0.55	250	0
Inorganic chemicals						
Cyanide (Total)	mg/kg	0	<0.5	0.5	1.49**	0
Sulphate (2:1 Water Soluble)	mg/l	4	14	56	2000^	0
Other						
pH	pH	-	8.0	9.0	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

5.4 Metals, Semi Metals and Non Metals

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

5.5 Inorganic Chemicals

Soluble sulphates (potentially aggressive to foundation concrete) were recorded between 14 and 56mg/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 were between 8.0 and 9.0, which is consistent with slightly alkaline to alkaline conditions.

5.6 Organic Chemicals

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

The average SOM recorded across the site was 5.26% therefore a SOM of 6% has been used to determine the S4UL thresholds. Table 3, below, summarises the results.

TABLE 3: SUMMARY OF ORGANIC CONTAMINATION TESTING RESULTS

Determinand	Units	Number of Samples above Level of Detection	Minimum Recorded Level	Maximum Recorded Level	Residential with HGP Threshold Value at 6% SOM	Number of Results Exceeding Threshold Value
TPH Aliphatic Fractions						
Aliphatic (C5-C6)	mg/kg	0	<1.0	-	160	0
Aliphatic (C6-C8)	mg/kg	0	<1.0	-	530	0
Aliphatic (C8-C10)	mg/kg	0	<1.0	-	150	0
Aliphatic (C10-C12)	mg/kg	0	<1.0	-	760	0
Aliphatic (C12-C16)	mg/kg	0	<1.0	-	4300	0
Aliphatic (C16-C21)	mg/kg	0	<1.0	-	110000	0
Aliphatic (C21-C35)	mg/kg	0	<1.0	-	110000	0
Aliphatic (C35-C44)	mg/kg	0	<1.0	-	110000	0
TPH Aromatic Fractions						
Aromatic (C5-C7)	mg/kg	0	<1.0	-	300	0
Aromatic (C7-C8)	mg/kg	0	<1.0	-	660	0
Aromatic (C8-C10)	mg/kg	0	<1.0	-	190	0
Aromatic (C10-C12)	mg/kg	0	<1.0	-	380	0
Aromatic (C12-C16)	mg/kg	0	<1.0	-	660	0
Aromatic (C16-C21)	mg/kg	0	<1.0	-	930	0
Aromatic (C21-C35)	mg/kg	0	<1.0	-	1700	0
Aromatic (C35-C44)	mg/kg	0	<1.0	-	1700	0
Speciated PAH						
Naphthalene	mg/kg	1	<0.1	0.27	13	0
Acenaphthylene	mg/kg	1	<0.1	0.26	920	0
Acenaphthene	mg/kg	1	<0.1	0.15	1100	0
Fluorene	mg/kg	1	<0.1	0.3	860	0
Phenanthrene	mg/kg	2	<0.1	0.89	440	0
Anthracene	mg/kg	2	<0.1	0.31	11000	0
Fluoranthene	mg/kg	3	<0.1	7.1	890	0
Pyrene	mg/kg	3	<0.1	5.5	2000	0
Benzo[a]anthracene	mg/kg	2	<0.1	3.1	13	0
Chrysene	mg/kg	2	<0.1	2.1	27	0
Benzo[b]fluoranthene	mg/kg	1	<0.1	2.6	3.7	0
Benzo[k]fluoranthene	mg/kg	1	<0.1	1.1	100	0
Benzo[a]pyrene	mg/kg	1	<0.1	3	3	0
Benzo[g,h,i]perylene	mg/kg	1	<0.1	5.6	41	0
Dibenz(a,h)Anthracene	mg/kg	1	<0.1	1.2	0.3	1
Indeno(1,2,3-c,d)Pyrene	mg/kg	1	<0.1	2.3	350	0
Total PAH	mg/kg	3	<2.0	30	50*	0
Total Phenol	mg/kg	0	<0.1	-	1100	0
* EA Threshold Values						

Concentrations of dibenz(ah)anthracene were elevated in BH01 only.

5.7 Asbestos

From the four samples subject to asbestos screening, asbestos fibres were recorded within the below two samples:

BH01 – 0.20-0.40m (Made ground – cohesive) recorded asbestos (chrysotile) quantified as 0.008%
BH04 – 0.20-0.40m (Made ground – topsoil) recorded asbestos (chrysotile) quantified as 0.027%

5.8 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 E for additional notes on contamination guidelines.

6 CONCEPTUAL MODEL AND CONTAMINATION ANALYSIS

The contamination conceptual model in Table 4 identifies the potential pollution linkages present on site based on source – pathway – receptor relationships.

TABLE 4: CONCEPTUAL MODEL

Source	Pathway	Receptor	Risk Rating	Comments
Asphyxiating or explosive ground gases Made ground (<1.60m) No coal mining No landfills within 500m	**Ground gas migration** Migration through permeable soils Inhalation	**Future site users** Adult & infant residents	Moderate /Low	Gas monitoring in progress, source risk rating subject to change.
		Users during development Construction workers	Low	
Areas of contamination hazardous to human health (Residential Thresholds) 4no samples tested No elevated inorganic determinants Elevated PAHs within 1no sample (BH01) Asbestos fibres within BH01 & BH04.	Inhalation Dust ingestion Dermal contact	**Future site users** Adult & infant residents	Moderate	Moderate risk to human health, to be mitigated by encapsulation of contaminated areas beneath proposed structure, hardstanding or a clean cover system.
		Users during development Construction workers	High	Mitigation measures required during construction. Consideration to be given to Health and Safety Executive: *Protection of Workers and the General Public During the Development of Contaminated Land.*
	Inhalation Dust ingestion	**Users of surrounding sites** Transient adult workers	Moderate /Low	Potential moderate risk during remediation/construction from dust generation. Consideration to be given to dust suppression, in line with BRE: *The Control of Dust and Emissions from Construction and Demolition, Best Practice Guidance.*
	Leaching of mobilised contaminants	**Drift geology** Secondary Aquifer – Undifferentiated	Low	The low permeability and relatively low sensitivity aquifer is not considered to be at risk.
		Solid geology Principal Aquifer	Low	Sensitive aquifer however it is located beneath thick, low permeability deposits and is not considered to be at risk.
	Drainage Lateral migration Accumulation of contaminated sediment	**Surface water features** River 17m northwest of the site	Low	The encountered contamination (low mobility PAHs and asbestos) is not considered to pose a risk to controlled waters.
Areas of phytotoxic contamination	Uptake via roots and leaf surfaces	**Vegetation** Possible gardens proposed	Low	Any garden areas would require imported topsoil and screened natural subsoil.
Areas of contamination above service fabric or BRE Special Digest 1 thresholds	Direct contact	**Construction Materials** Concrete	Low	Made ground and natural ground not considered to be aggressive to concrete.
		Construction Materials Service Fabric	Moderate	Copper piping to be avoided and prudent to lay any service within a clean bedding.

In general terms, future householders, construction workers, users of the surrounding sites and construction materials are **potentially most** at risk as pollution linkages may be present for each of these receptors. Controlled waters and vegetation are considered to be at **potentially less** of a risk.

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.

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.

The levels of contaminants across the site are generally low, with exceedances noted within two of the four samples, as summarised below:

> BH01 – 0.20-0.40m (Made ground – cohesive) recorded dibenzo(a,h)anthracene and asbestos (chrysotile) quantified as 0.008%
> BH04 – 0.20-0.40m (Made ground – topsoil) recorded asbestos (chrysotile) quantified as 0.027%

The new development is expected to comprise conversion of the existing agricultural building to form residential properties with associated gardens/access roads. Based on the **shallow** soil contamination testing, it is considered that the levels of contamination may pose a risk to future users of the site, as soft landscaping is proposed in the final development. This pollutant linkage however will be severed as long as all contaminated areas are covered either by buildings, hardstanding, or a clean cover system.

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.

Amosite and chrysotile asbestos fibres were detected in the samples from BH01 & BH04 (both at 0.20-0.40mbgl). These samples were sent for further analysis asbestos quantification testing by Gravimetry. The results of the screening and further testing are presented in Appendix C. This indicated that there was 0.008-0.027% by mass of asbestos within the sample.

Based on the guidance set forth in the Interdepartmental Committee for the Redevelopment of Contaminated Land (ICRCL), 1990, Guidance note 64/85 *Asbestos on Contaminated Sites* asbestos contaminated soil should be considered as a hazardous waste if the percentage by mass exceeds 0.1%. Should it have a mass of >0.001% it is considered as a risk to human health. Given that the samples showed 0.008-0.027% by mass it is possible that the soil may present a risk to human health.

As well as the asbestos, PAH was locally elevated It is considered that such levels of contamination may pose a risk to construction workers and users of surrounding sites. As good practice, full PPE must be employed in accordance with Health and Safety Executive*: Protection of Workers and the General Public During the Development of Contaminated Land* 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.

Further asbestos may be present elsewhere on the site that has not been sampled or tested during this investigation. It is therefore advised that having a qualified asbestos surveyor present during the initial site strip and any excavation works is given careful consideration. All works should be undertaken in accordance with the *Control of Asbestos Regulations* (2012) and CIRIA C733 *Asbestos in soil and made ground: a guide to understanding and managing risks*.

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 Monitoring of dust concentrations during construction should be given careful consideration to ensure occupational exposure levels are not exceeded. A moisture content of >15% is required to inhibit dust migration. Works should be undertaken in line with BRE: *The Control of Dust and Emissions from Construction and Demolition, Best Practice Guidance*.

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 four samples tested.

During the initial site strip, proposed soft landscaped areas should be excavated to 0.60mbgl or natural ground (whichever is the shallowest). Any deleterious materials encountered (i.e. ash, slag, brick rubble and concrete) should be removed and placed beneath areas of permanent hardcover. Topsoil and subsoil from around the site is deemed unsuitable for re-use given the elevated levels of asbestos and speciated PAH.

The cover system should include imported topsoil, to a depth of 300mm over either natural ground or clean imported subsoil at least 300mm in thickness. Given insufficient clean topsoil is available on site then it should be imported from a reputable source. Appropriate certification would be required to ensure that the onsite or imported materials are clean and free from deleterious materials in accordance with the Local Authority Guidelines *Verification Requirements for Cover Systems, Technical Guidance for developers, Landowners and Consultants* (Yorkshire and Lincolnshire Pollution Advisory Group Version 4.1 – June 2021). Details of the clean cover system must be presented in a Phase 3 Remediation Statement.

The diagram below gives an overview of the minimum thicknesses of clean cover system that should be placed by the site operatives in soft landscaped areas.

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 made ground (<1.60m) of topsoil over sandy slightly gravelly clay, which can be considered to have a low permeability. The drift deposits are designated as a Secondary Aquifer – Undifferentiated by the Environment Agency.

The published geology indicates the site is underlain by solid geology of Sherwood Sandstone, which is designated as a Principal Aquifer by the Environment Agency. Rockhead was not proven in the intrusive investigation.

The nearest surface water feature is 17m northwest of the site.

The encountered contamination was limited to low-mobility PAHs and asbestos, which are not considered to pose a risk to controlled water receptors.

Due to the generally low contamination found across the site, the low permeability clays 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.

6.5.1 Concrete Classification

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.

6.5.2 Water Supply Pipes Material Selection

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 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.

Level of slightly alkaline to alkaline pH (8.0 to 9.1) were recorded across the site at depths of between 0.20mbgl and 2.00mbgl within the made ground and natural samples.

The concentrations of the selected determinants should be compared to the pipe material selection table in Appendix E, and consultation with the appropriate utility supply company is required to identify the most suitable service fabric. However, the pH levels preclude the use of copper pipes.

6.6 Unexpected Contamination

If during the initial site strip or subsequent ongoing construction activities, any zones of odorous, brightly coloured or suspected contaminated ground are encountered, then the following procedure should be followed:

Stop work in the affected area
Contact Solmek and provide pictures of the affected area
Solmek can visit site to investigate the material and provide guidance
If required – Solmek can sample and test the material
Once test results are returned, this will determine whether or not remediation will be required

6.7 Waste Classification and WAC Testing

During the site strip and construction activities, material may be required to be removed from site. Any such material would require classification, in line with Environment Agency Technical Guidance *Waste Classification: Guidance on the classification and assessment of waste* (2015). This would classify the material as either Non-Hazardous or Hazardous Waste.

Once the material has been classified, determining the suitable landfill for disposal is governed by landfill directive Waste Acceptance Criteria (WAC) testing, with landfills categorized as Inert Waste, Stable Non-

Reactive Hazardous Waste and Hazardous Waste.

If waste classification and/or WAC testing are not undertaken, material taken off site may be subject to WAC testing by the appropriate waste disposal company. The decision on whether or not to accept waste, or whether further testing is required, is at the discretion of the waste disposal company.

For this project, Waste Classification has not been requested by the client. Waste classification, in line with the aforementioned EA guidance, would be needed to classify the material as Hazardous or Non-Hazardous Waste. WAC testing would then be required to determine the suitability of the material for the relevant landfill.

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.

For this report, gas monitoring is via measuring emissions from three standpipes (BH01, BH03 & BH04) that were installed during the sitework. The gas monitoring will consist of six visits over a period of three months. The gas monitoring results will be presented as an addendum to this report.

8 GEOTECHNICAL TESTING AND ANALYSIS

Samples taken from the boreholes underwent a series of geotechnical tests (BS 1377:1990) to aid foundation design and soil description. In addition, insitu Standard Penetration Tests (SPTs) and Hand Shear Vanes were undertaken at regular intervals during drilling. The geotechnical results are presented in Appendix D.

8.1 Strength and Density

8.1.1 *SPT N Values*

A Standard Penetration Test undertaken within granular deposits at 3.00mbgl within BH04 yielded an N value 9, indicative of loose deposits.

8.1.2 *Hand Shear Vanes*

Hand shear vane testing within the natural cohesive deposits returned results ranging from 28kPa to 75kPa, which are indicative of low to high strength conditions. At approximate foundation depth (1.20mbgl) the results ranged between 58kPa and 65kPa.

8.2 Moisture Contents

Three samples recovered from the boreholes have been subject to moisture content tests to determine the moisture profile at depths of between 0.80 and 2.00mbgl. Moisture levels were between 14% and 25%.

8.3 Atterberg Limit Determinations

Three Atterberg Limit Determination tests were carried out on samples of cohesive material to classify the fine grained soils. The results were compared to the Casagrande Chart published in BS 5930 and showed the samples to generally be clay of low to intermediate plasticity.

The Plasticity Indices ranged from 10 to 19 with equivalent moisture contents recorded above the corresponding plastic limits. The cohesive material can be assessed as having a **low** shrinkage potential in relation to NHBC Guidance Chapter 4.2.

8.4 Particle Size Distribution Testing

One sample was subject to Particle Size Distribution (PSD) testing in accordance with BS1377 Part 2 to aid

soil descriptions. The results have been used to prepare precise soil descriptions in accordance with BS5930:2015 Section 6 and are presented in Appendix D.

8.5 pH and Sulphate Results

Three natural samples from the boreholes were tested for acidity and soluble sulphate content to assess whether the material may be potentially aggressive to building fabric. The results of the testing for pH ranged from 8.0 to 9.1 indicating slightly alkaline to alkaline conditions. Soluble sulphates were recorded at levels ranging from 10mg/l to 140mg/l.

8.6 Foundations

8.6.1 *Conventional Foundations upon Cohesive Deposits*

Based on plasticity index results, all cohesive soils at the site should be regarded as being of low volume change potential. Foundations should therefore be placed at a minimum depth of 0.75m below original or finished ground level, whichever is the lower.

Based on a conservative undrained shear strength of 58kN/m² a safe bearing capacity of 100kN/m² has been determined for strip foundations 0.60m wide founding on the natural medium strength clay at depths of around 0.75mbgl. Providing the safe bearing capacity is not exceeded settlements have been calculated to be less than 25mm.

Locally, foundations will require deepening into competent natural stratum due to made ground depths (up to 1.60mbgl). All deepened sections should be adequately stepped, in accordance with NHBC Standards Chapter 4.4

Foundations near existing or proposed trees should be deepened and provided with appropriate heave precautions in accordance with NHBC Standards Chapter 4.2 current guidance.

It should be recognised that clay rich soils can deteriorate fairly rapidly on exposure, particularly in periods of wet weather and frost. It would be prudent to protect all exposed soils in foundation excavations with a concrete blinding layer, particularly if they are likely to remain open for extended period of time.

Prior to placing foundation 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.

8.7 Excavation

Based on the nature of the ground conditions encountered, excavations should be within the capacity of normal earthworks plant although breaking out of localised hardstanding and other obstructions should be anticipated. Stability of excavations will be poor in the made ground but 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*.

8.8 Groundwater

Groundwater was encountered within BH04 only at 2.80mbgl.

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. Therefore, water levels significantly higher than those found during this investigation may be encountered.

SOLMEK

APPENDIX A:
Figures and Drawings

SOLMEK
12-16 Yarm Road, Stockton on Tees, TS18 3NA
Tel: 01642 607083 Email: info@solmek.com

Figure Title

Site Location Plan

Project Number

S220450

Project Name

Manor Farm, Cowthorpe

Client

John Ellis Builders

Date

July 2022

DRG Number

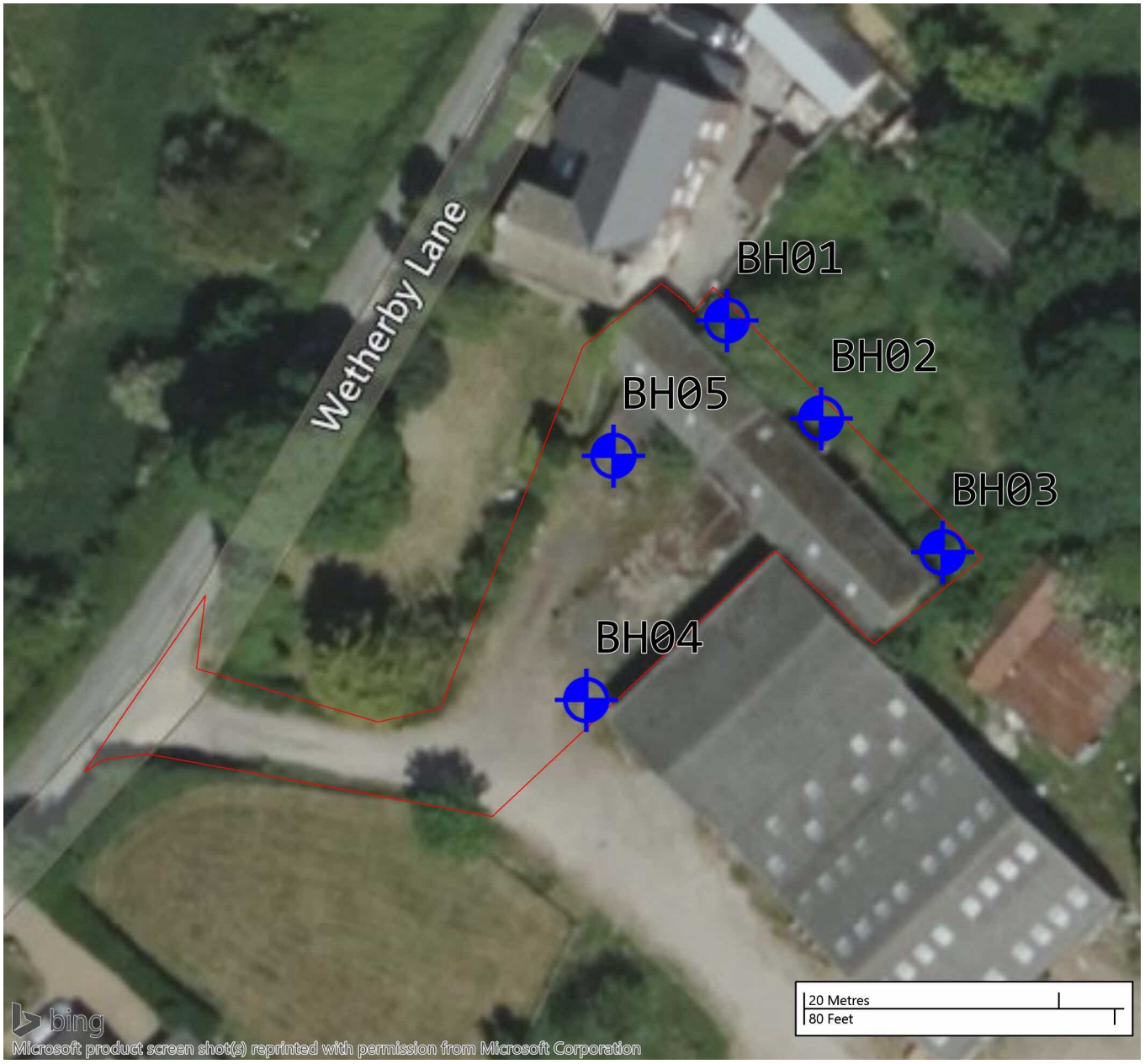
Figure 1

Scale

1:1500 @ A4 [DO NOT SCALE]

Legend Key

Project Bounds - Project Bounds



SOLMEK

12-16 Yarm Road, Stockton on Tees, TS18 3NA
Tel: 01642 607083 Email: info@solmek.com

Figure Title

Exploratory Hole Location Plan

Project Number

S220450

Project Name

Manor Farm, Cowthorpe

Client

John Ellis Builders

Date

July 2022

DRG Number

Figure 2

Scale

1:500 @ A4 [DO NOT SCALE]

Legend Key

- Locations By Type - Empty
- Locations By Type - BH
- Project Bounds - Project Bounds

APPENDIX B:
Borehole Logs

	Back‖ ll / Installaeon

	Back‖ ll / Installaeon

	Back‖ ll / Installaeon

	Back‖ ll / Installaeon

	Back‖ ll / Installaeon

APPENDIX C:
Contamination Laboratory Results

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Amended Report

Report No.:	22-20259-2		
Initial Date of Issue:	07-Jun-2022	**Date of Re-Issue:**	22-Jun-2022
Client	Solmek Ltd		
Client Address:	12 Yarm Road Stockton-on-Tees TS18 3NA		
Contact(s):	Lab Leo Cassidy Office		
Project	S220450 Manor Farm, Cowthorpe		
Quotation No.:		**Date Received:**	31-May-2022
Order No.:	SOL-6259	**Date Instructed:**	31-May-2022
No. of Samples:	4		
Turnaround (Wkdays):	18	**Results Due:**	27-Jun-2022
Date Approved:	22-Jun-2022		
Approved By:	[redacted]		
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: S220450 Manor Farm, Cowthorpe

Client: Solmek Ltd			**Chemtest Job No.:**		22-20259	22-20259	22-20259	22-20259
Quotation No.:			**Chemtest Sample ID.:**		1439034	1439035	1439036	1439037
			Sample Location:		BH01	BH03	BH04	BH05
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.2	0.4	0.2	0.4
			Bottom Depth (m):		0.4	0.6	0.4	0.6
			Date Sampled:		25-May-2022	25-May-2022	25-May-2022	25-May-2022
			Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type	U	2192		N/A	Cement	-	Cement	-
Asbestos Identification	U	2192		N/A	Chrysotile	No Asbestos Detected	Chrysotile	No Asbestos Detected
Asbestos by Gravimetry	U	2192	%	0.001	0.008		0.027	
Total Asbestos	U	2192	%	0.001	0.008		0.027	
Moisture	N	2030	%	0.020	15	19	13	8.4
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Roots	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Loam	Clay	Gravel	Gravel
pH	M	2010		4.0	8.0	8.0	8.3	9.0
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	1.4	0.73	0.64	< 0.40
Sulphate (2:1 Water Soluble) as SO4	M	2120	mg/l	10	56	14	28	26
Cyanide (Total)	M	2300	mg/kg	0.50	0.50	< 0.50	< 0.50	< 0.50
Arsenic	M	2455	mg/kg	0.5	2.7	2.9	5.1	1.2
Cadmium	M	2455	mg/kg	0.10	0.21	< 0.10	0.19	0.28
Chromium	M	2455	mg/kg	0.5	8.4	9.8	9.6	4.9
Copper	M	2455	mg/kg	0.50	9.8	9.0	11	2.1
Mercury	M	2455	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	M	2455	mg/kg	0.50	7.4	8.9	9.5	3.9
Lead	M	2455	mg/kg	0.50	63	17	40	4.5
Selenium	M	2455	mg/kg	0.25	< 0.25	0.55	0.41	0.25
Zinc	M	2455	mg/kg	0.50	58	33	51	7.2
Organic Matter	M	2625	%	0.40	4.6	0.74	1.7	14
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0		
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		< 5.0		
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		< 1.0		
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		< 1.0		
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0		< 1.0		
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0		< 1.0		
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0		< 1.0		
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		< 1.0		

Results - Soil

Project: S220450 Manor Farm, Cowthorpe

Client: Solmek Ltd		**Chemtest Job No.:**			22-20259	22-20259	22-20259	22-20259
Quotation No.:		**Chemtest Sample ID.:**			1439034	1439035	1439036	1439037
			Sample Location:		BH01	BH03	BH04	BH05
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.2	0.4	0.2	0.4
			Bottom Depth (m):		0.4	0.6	0.4	0.6
			Date Sampled:		25-May-2022	25-May-2022	25-May-2022	25-May-2022
			Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0		< 1.0		
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0		
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		< 5.0		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		< 10		
Naphthalene	M	2700	mg/kg	0.10	0.27	< 0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	0.26	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	0.15	< 0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	0.30	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	0.89	< 0.10	0.26	< 0.10
Anthracene	M	2700	mg/kg	0.10	0.31	< 0.10	0.19	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	3.2	< 0.10	0.61	7.1
Pyrene	M	2700	mg/kg	0.10	3.6	< 0.10	0.67	5.5
Benzo[a]anthracene	M	2700	mg/kg	0.10	3.1	< 0.10	0.51	< 0.10
Chrysene	M	2700	mg/kg	0.10	2.1	< 0.10	0.43	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	2.6	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	1.1	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	3.0	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	2.3	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	1.2	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	5.6	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	30	< 2.0	2.7	13
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10

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.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
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
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"
SOP	Standard operating procedure
LOD	Limit of detection

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 30 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:
Geotechnical Laboratory Results

Laboratory Report Front Sheet

Site name	Job number
John Ellis Builders Ltd	S220450

Solmek
12-16 Yarm Road,
Stockton on Tees,
TS18 3NA
01642 607083
lab@solmek.com

UKAS TESTING
7607

Client details:

Reference: S220450
Name: Solmek
Address: 12 Yarm Road,
Stockton-on-tees,
TS18 3NA

Telephone: 01642 607083
Email: lcassidy@solmek.com

FAO: Leo Cassidy

Date commenced:

Date reported: 08/06/2022

Observations and interpretations are outside of the UKAS Accreditiation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Samples will be held at the laboratory for a period of 4 weeks after the report date. After the above reporting date the samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Signature:	Approved Signitories:
[redacted]	☐ D.Anderson (Associate Director) ☑ J. Brischuk (Laboratory Manager) ☐

Summary of Classification Tests

Site name	Job number
John Ellis Builders Ltd	S220450

Solmek
12-16 Yarm Road,
Stockton on Tees
01642 607083
lab@solmek.com

UKAS TESTING
7607

Hole	Depth Top m	Depth Base m	Type	w %	Oven temp. oc	wa %	Pa %	Pr %	wL %	wP %	IP %	IL	Plasticity class	Preparation method
BH01	1.80	2.00	D	14	105	14	97	3	23-s	13	10	0.100	CL	Tested after >425µm removed by hand
BH03	0.80	1.00	D	17	105	18	95	5	35-s	18	17	0.000	CI	Tested after >425µm removed by hand
BH05	0.80	1.00	D	25	105	28	88	12	45-s	26	19	0.105	CI	Tested after >425µm removed by hand

All tests found in Solmek UKAS Schedule of Accreditation are tested to standard unless otherwise indicated

Key	Description		Category	BS Test Code
w	Moisture content			BS 1377:1990 Part 2 Clause 3.2
wa	Equivalent moisture content passing 425µm sieve			BS 1377:1990 Part 2 Clause 3.2
wL	Liquid limit	Single point	-s	BS 1377:1990 Part 2 Clause 4.4
		Four point	-f	BS 1377:1990 Part 2 Clause 4.3
wP	Plastic limit			BS 1377:1990 Part 2 Clause 5.2
Pa	Percentage passing 425um sieve			
Pr	Percentage retained 425um sieve			
IP	Plasticity index			BS 1377:1990 Part 2 Clause 5.4
IL	Liquidity index			BS 1377:1990 Part 2 Clause 5.4
	Suffix indicating test is "Not UKAS Accredited"		*	

Approved by	JBrischuk
Approval date	08/06/2022 12:46
Date report generated	
Report Number	

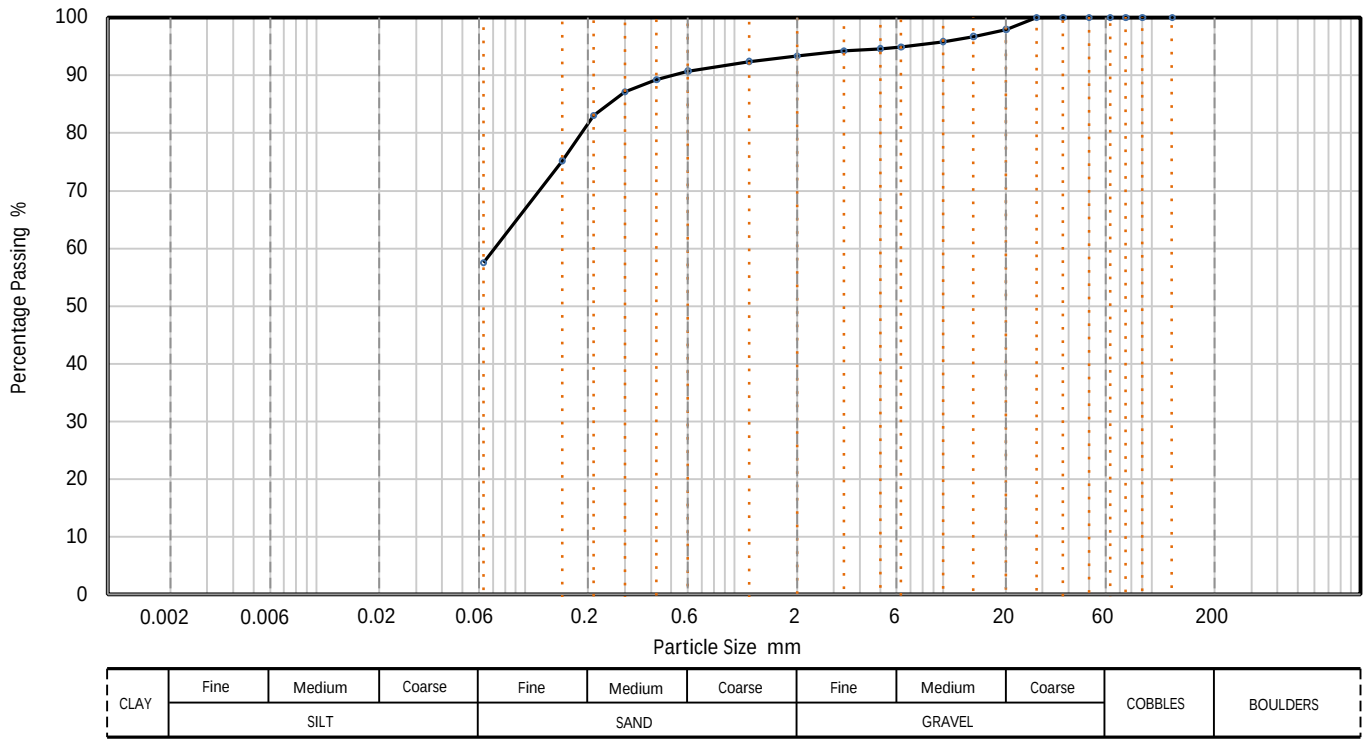
PARTICLE SIZE DISTRIBUTION

Site name	Job number
John Ellis Builders Ltd	S220450

Solmek
12-16 Yarm Road,
Stockton on Tees,
TS18 3NA
01642 607083
lab@solmek.com

UKAS TESTING 7607

Hole	BH05	Lab sample ID	SLMK20220530195
Depth (Top) m	0.80	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base) m	1	Soil Description	Slightly Gravelly, Very Sandy CLAY
Sample type	D		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	98		
14	97		
10	96		
6.3	95		
5	95		
3.35	94		
2	93		
1.18	92		
0.6	91		
0.425	89		
0.3	87		
0.212	83		
0.15	75		
0.063	58		

Dry Mass of sample, g	629

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	6.7
Sand	35.8
Fines <0.063mm	57.0

Grading Analysis		
D100	mm	
D60	mm	0.0712
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks
Preparation and testing in accordance with test method unless noted below

Sample tested was deviating in accordance with BS1377 test standard

Accreditation status
Hydrometer is the usual Sedimentation method carried out by Solmek and is part of the Solmek UKAS accreditation schedule.

Approved by	JBrischuk
Approval date	08/06/2022 12:50

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING
2183

Amended Report

Report No.:	22-20493-2		
Initial Date of Issue:	07-Jun-2022	**Date of Re-Issue:**	07-Jun-2022
Client	Solmek Ltd		
Client Address:	12 Yarm Road Stockton-on-Tees TS18 3NA		
Contact(s):	B Atkinson Joe Brischuk Lab Office Leo Cassidy		
Project	S220450 Manor Farm, Cowthorpe		
Quotation No.:		**Date Received:**	01-Jun-2022
Order No.:	LAB1490	**Date Instructed:**	01-Jun-2022
No. of Samples:	3		
Turnaround (Wkdays):	5	**Results Due:**	09-Jun-2022
Date Approved:	07-Jun-2022		
Approved By:	[redacted]		
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: S220450 Manor Farm, Cowthorpe

Client: Solmek Ltd			**Chemtest Job No.:**		22-20493	22-20493	22-20493
Quotation No.:			**Chemtest Sample ID.:**		1440336	1440337	1440338
			Sample Location:		BH01	BH03	BH05
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		1.80	0.80	0.80
			Bottom Depth (m):		2.00	1.00	1.00
			Date Sampled:		25-May-2022	25-May-2022	25-May-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Moisture	N	2030	%	0.020	22	16	15
pH	U	2010		4.0	9.1	8.6	8.0
Sulphate (2:1 Water Soluble) as SO4	U	2120	mg/l	10	140	10	23

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

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"
SOP	Standard operating procedure
LOD	Limit of detection

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 30 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 E:
Notes on Limitations & Contamination Guidance

SOLMEK NOTES ON CONTAMINATION GUIDANCE (REF: VERSION 1/2022)

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 Environment Agency's guidance document Environment Agency *Land Contamination Risk Management*, which replaced the now-withdrawn *Contaminated Land Report 11 – Model Procedures for the Management of Land Contamination (2004)*, 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.

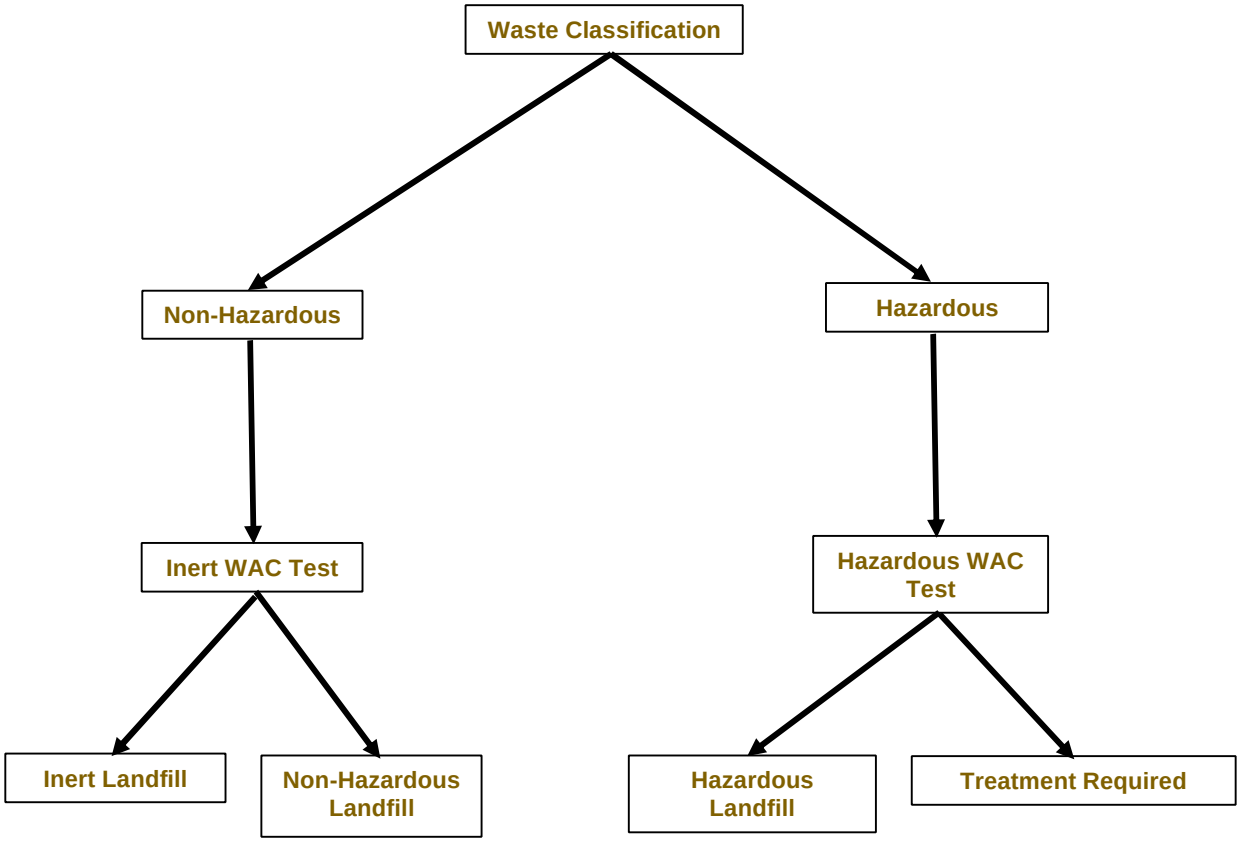
WASTE CLASSIFICATION AND WASTE ACCEPTANCE CRITERIA

During the site strip and construction activities, material may be required to be removed from site. Any such material would require classification, in line with Environment Agency Technical Guidance *Waste Classification: Guidance on the classification and assessment of waste (2015)*. This would classify the material as either Non-Hazardous or Hazardous Waste.

Once the material has been classified, determining the suitable landfill for disposal is governed by landfill directive Waste Acceptance Criteria (WAC) testing, with landfills categorized as Inert Waste, Stable Non-Reactive Hazardous Waste and Hazardous Waste. 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 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.

If waste classification and/or WAC testing are not undertaken, material taken off site may be subject to WAC testing by the appropriate waste disposal company. The decision on whether or not to accept waste, or whether further testing is required, is at the discretion of the waste disposal company.

The below flow chart provides further information on the waste classification process.



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: version1/2022)

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.