

Draft Phase 2: Site Investigation

**Site A, Leconfield Industrial Estate, Cleator Moor
Copeland Borough Council**

S220141

Solmek Ltd

12 Yarm Road
Stockton-on-Tees
TS18 3NA
Tel: 01642 607083



www.solmek.com

info@solmek.com

DRAFT PHASE 2 SITE INVESTIGATION REPORT

SITE A, LECONFIELD INDUSTRIAL ESTATE, CLEATOR MOOR

TABLE OF CONTENTS

1	EXECUTIVE SUMMARY	2
2	INTRODUCTION	3
3	SITE DESCRIPTION AND FIELDWORK	3
4	GROUND CONDITIONS	4
5	CONTAMINATION TESTING RESULTS	6
6	CONCEPTUAL MODEL AND CONTAMINATION ANALYSIS.....	8
7	GROUND GAS ASSESSMENT	11
8	GEOTECHNICAL TESTING AND ANALYSIS.....	11
TABLE 1: COAL SEAM SUMMARY		5
TABLE 2: SUMMARY OF GROUNDWATER STRIKES		6
TABLE 3: CONCEPTUAL MODEL		9
TABLE 4: SUMMARY OF CBR TESTING RESULTS.....		12
TABLE 5: PRELIMINARY GROUND MODEL		14

APPENDICES

Appendix A:	Drawings
Appendix B:	Borehole & Trial Pit Logs
Appendix C:	Contamination Laboratory Results
Appendix D:	Geotechnical Laboratory Results
Appendix E:	Notes on Limitations & Contamination Guidelines

Revision	Date	Prepared By	Signed
Draft	March 2022	L Cassidy <i>Senior Environmental Engineer</i>	
		Checked By	
		A Lowry <i>Senior Geotechnical Engineer</i>	
		Approved By	
		R Woods <i>Principal Geotechnical Engineer</i>	

1 EXECUTIVE SUMMARY

Site Address	Leconfield Industrial Estate, Cleator Moor
Proposed Development	The site is outlined for development of a storage yard in the west and a new building in the east..
Fieldwork	• 9no rotary open-hole/cored boreholes (BH01 to RBH09 inclusive to a maximum depth of 40.00mbgl with 2no monitoring pipes in BHs 07 & 08. • 2no days slit trenching, 1 day in the area of each shaft (301515-006 & 301515-008) including anomaly A2. • 16no machine excavated trial pits (TP01 to TP16) were dug to a maximum depth of 1.10mbgl.
Ground Conditions	• Made ground was encountered to depths of between 1.30mbgl and 10.20mbgl. • Firm to stiff consistency sandy gravelly medium to high strength encountered (0.90-5.00m thick). • Locally underlain by dense sands and gravels (1.60-10.90m thick). • Rockhead between 7.30 & 18.00mbgl, generally comprising sandstones and mudstones with thin intact coal bands. • Groundwater was noted locally between 0.40 and 17.10m.
Contamination Testing Results	• 13no made ground samples tested. • Results will be added as an addendum to this report.
Contamination Analysis	• Interim Conceptual Model provided based on encountered ground conditions and historic WYG works. • Updated Conceptual Model to be issued once outstanding contamination testing results are received.
Geotechnical Testing Results	• Cohesive deposits medium to high strength based on SPT N values. • Granular deposits locally loose generally medium dense to very dense based on SPT N values. • CBRs within made ground ranged from 3-15%. • Remaining geotechnical results to be provided within an updated report.
Mining Assessment	• Similarly to the historic WYG report (12no boreholes), no voids/workings were recorded within the rotary drilling (additional 9no boreholes). • No evidence of the shafts based on historical geophysics and slit trenching. • Recommended to construct storage yard with structural precautions to mitigate against risks from the off-site shafts.
Geotechnical Analysis & Foundation Recommendations	• Storage yard to be constructed 450mm thick (recommended reinforced) atop compacted granular fill atop the competent fused slag. • For the proposed building, piled foundations are recommended – this report should be made available to a competent piling contractor. • 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 Billingham George & Partners, on behalf of Copeland Borough Council, on land located at Leconfield Industrial Estate, Cleator Moor.

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

- *AECOM Geotechnical & Structural Design Report (60520781) December 2016.*
- *WYG Phase 1 Desk Study (A114312) January 2020.*
- *WYG Phase 2 Site Investigation (A114312-1) November 2020.*

Reference should be made to the above report for details of the site's history and environmental setting, the ground conditions encountered, and the results of historical contamination analysis.

2.2 Scope of Works

The site is expected to be developed with a new BOC storage yard in the west, and a new BOC hub building in the northeast. The areas of the site proposed for development are shown as Figure 3 (Appendix A).

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
- CIRIA C758D Abandoned Mine Workings Manual

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 by WYG in 2020 and the site

was reappraised by Solmek prior to the site works on February 2022. The site is centred at Ordnance Survey Co-ordinates 301380, 515510 and covers approximately 15.46Ha.

The site is generally flat, occupied by light industrial and commercial developments with numerous relic slabs present following previous demolition works.

There are numerous areas of open land and vegetation noted across and around the site with localised evidence of burning/flytipping noted.

The surrounding areas of the site are mixed with residential and commercial land-uses present.

3.1 Fieldwork

The fieldwork commenced on 16th February 2022. The extent of the investigation was:

- Topographic setting out of shafts 301515-006 & 301515-008 as well as historic anomaly A2 associated with 301515-006.
- Topographic survey of all borehole locations.
- 9no rotary open-hole/cored boreholes (BH01 to RBH09 inclusive to a maximum depth of 40.00mbgl.
 - All nine boreholes were drilled to investigate the presence of shallow historic mine workings.
 - Within BHs 04, 07 & 09, rotary coring was undertaken initially to retrieve rock-core to provide geological information for pile design.
 - BH01 & BH02 were drilled to target the area of the proposed BOC yard.
 - BHs 07-09 were drilled to target the area of the proposed BOC hub building.
 - BHs 03-06 were drilled provide site investigation information in areas of the site considered for future development.
- Gas monitoring wells were installed in BH's 07 & 08.
 - The wells were spaced at <25m centres evenly around the area of the proposed BOC hub building, in accordance with CIRIA C665.
- 2no days slit trenching, 1 day in the area of each shaft (301515-006 & 301515-008) including anomaly A2.
 - The trenches were excavated in an X centred over the coordinates of the shafts.
- 16no machine excavated trial pits (TP01 to TP16) were dug to a maximum depth of 1.10mbgl.
 - TPs 01 to 05 were located to target the area of the proposed BOC yard.
 - TPs 13 to 16 were located to target the area of the proposed BOC hub building.
 - TPs 06-12 were excavated to provide site investigation information in areas of the site considered for future development.
- In-situ soakaway testing carried out in TP01 and TP03.
- Insitu testing in the exploratory positions as California Bearing Ratio (CBR) and Standard Penetration Tests (SPTs).
- Retrieval of samples for geotechnical and chemical testing.

The trial pits and boreholes were respectively backfilled with clean arisings and bentonite/installations upon completion. Selected plates of the trial pits are presented in Appendix A.

Descriptions of the strata encountered in the boreholes and trial pits together with details of sampling and groundwater are presented in Appendix B of this report. A plan showing the location of the boreholes and trial pits 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 only penetrated within the boreholes, proven to a minimum depth of 1.30mbgl (BH06) and a maximum depth of 10.20mbgl (BH03). The made ground consisted of a variable surface covering generally of topsoil but locally comprising concrete or tarmac.

This was then generally underlain by slag, initially in a granular form locally mixed with other granular materials (ash, brick, sandstone, clinker). This was in turn underlain by a fused slag which the excavator was unable to excavate through. Standard Penetration Tests within the slag each yielded N values of 50+ (refusal).

4.2 Obstructions

Localised surface concrete was encountered, within TP09 (0.15m thick), BH05 (0.50m). Across the site slag was encountered, posing a significant obstruction.

4.3 Natural Deposits

Proven to underlie the made ground deposits within the boreholes only, natural ground generally comprised firm to stiff consistency sandy gravelly medium to high strength clay, ranging in thickness from 0.90m to 5.00m.

Locally (BH04, BH05, BH06, BH08), the cohesive deposits were underlain (overlain in BH09) by medium to very dense sands and gravels (1.60-10.90m thick).

Locally, natural deposits were not encountered (BH01, with the made ground directly overlying rockhead).

4.4 Solid Geology

Rockhead, generally comprising sandstone or mudstone, was encountered within the rotary boreholes, between 7.30 (BH03) and 18.00mbgl (BH05).

The rotary boreholes continued to between 30 and 40.00mbgl, generally encountering interbedded sandstones and mudstones. Locally, the rock was inferred to be highly fractured resulting in loss of flush.

No voids or workings were encountered, however intact coal seams were noted locally.

Table 9 below summarises the coal seams that were encountered within seven of the nine rotary boreholes.

TABLE 1: COAL SEAM SUMMARY

Location	Strata	Top of Strata (mbgl)	Bottom of Strata (mbgl)	Flush Returns
BH01	Coal – Intact	10.20	11.70	100%
BH02	Coal – Intact	16.40	17.80	100%
BH03	Coal – Intact	10.40	10.50	100%
	Coal – Intact	17.10	17.90	100%
	Coal – Intact	19.40	20.00	100%
BH04	Coal – Intact	24.70	26.50	100%
BH05	Coal – Intact	23.00	23.70	100%
	Coal – Intact	36.20	36.50	100%
BH06	Coal – Intact	12.90	13.40	100%
	Coal – Intact	23.30	23.70	100%
BH09	Coal – Intact	22.10	22.40	100%

4.5 Groundwater

Groundwater strikes, where encountered, are presented on the exploratory logs (Appendix B) and are summarised below in Table 2:

TABLE 2: SUMMARY OF GROUNDWATER STRIKES

Exploratory Position	Depth Encountered (mbgl)	Depth after 20 minutes (mbgl)	Strata
BH01	10.20	-	Coal
BH02	9.60	-	Made Ground
BH03	5.90	-	Clay
BH04	9.10	-	Sandy Gravel
	16.40	-	Sandstone
BH05	5.90	-	Clay
	17.10	-	Gravel
BH06	4.70	-	Clay
BH07	10.20	-	Clay
BH08	17.10	-	Sandstone
BH09	15.20	-	Sandstone
TP06	0.40	-	Made Ground

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. Also, the water levels and minor seepages may have been masked by the use of water flush. 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 construction of a new yard in the west and a new building in the east, within an existing industrial estate. 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 & Historic Testing

Within the WYG 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 iron and steel works from 1863 with slag heaps noted, prior to the industrial estate being noted from 1962.

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

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

The WYG Phase 2 Site Investigation then undertook the below soils contamination testing:

- 32no Metals, semi-metals, non-metals, inorganic determinants

- 32no Asbestos identification screenings
- 32no Speciated Polyaromatic Hydrocarbons (PAHs)
- 32no Total Petroleum Hydrocarbon Criteria Working Group fractions (TPHCWG)
- 6no Waste Acceptance Criteria (WAC) Tests
- 4no Polychlorinated Biphenyls (PCBs)
- 9no Volatile Organic Compounds (VOCs)
- 9no Semi-Volatile Organic Compounds (SVOCs)

In addition, the below groundwater testing was undertaken:

- 4no Metals, semi-metals, non-metals, inorganic determinants
- 4no Speciated Polyaromatic Hydrocarbons (PAHs)
- 4no Total Petroleum Hydrocarbon Criteria Working Group fractions (TPHCWG)
- 4no Volatile Organic Compounds (VOCs)
- 4no Semi-Volatile Organic Compounds (SVOCs)

For soils, generally speaking no exceedances were recorded, with the exception of pH (11no samples), beryllium (2no samples), benzo(b)fluoranthene (1no sample) and asbestos (1no sample).

For the 4no groundwater samples, exceedances were noted within each for copper, PAHs and TPH with further localised exceedances for nitrite, pH, sulphate, NH₃, NH₄, nickel and selenium.

Following the above test results, a refined conceptual model was put forth, summarised below:

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

5.2 Contamination Testing and Rationale

To provide information upon the possibility of ground contamination 13no samples of made ground were selected for shallow contamination testing. A Low to High overall contamination risk was highlighted in the Phase 1 Desk Study and subsequent Phase 2. This coupled with the end use being Commercial means that a further 13no samples are considered appropriate for testing. The samples selected are detailed below:

- TP01 – 0.10-0.20m (Made ground – topsoil)
- TP02 – 0.20-0.30m (Made ground – granular)
- TP03 – 0.50-0.60m (Made ground – slag)
- TP04 – 0.20-0.30m (Made ground – slag)
- TP05 – 0.00-0.10m (Made ground – topsoil)
- TP06 – 0.40-0.60m (Made ground – granular)
- TP07 – 0.80-0.90m (Made ground – granular)
- TP10 – 0.00-0.10m (Made ground – topsoil)
- TP12 – 0.10m (Made ground – topsoil)
- TP13 – 0.00-0.10m (Made ground – topsoil)
- TP14 – 0.20m (Made ground – slag)
- TP15 – 0.10-0.20m (Made ground – granular)
- TP16 – 0.30m (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:

- 13no Metals, semi-metals, non-metals, inorganic determinants
- 13no Asbestos identification screenings
- 13no Speciated Polyaromatic Hydrocarbons (PAHs)
- 5no Total Petroleum Hydrocarbon Criteria Working Group fractions (TPHCWG)

In addition, five samples were sent for Waste Acceptance Criteria (WAC) Testing:

- TP01 – 0.10-0.20m (Made ground – topsoil)
- TP03 – 0.50-0.60m (Made ground – slag)
- TP13 – 0.00-0.10m (Made ground – topsoil)
- TP14 – 0.20m (Made ground – slag)
- TP16 – 0.30m (Made ground – cohesive)

Leachate analysis was also undertaken on the below samples:

- TP02 – 0.20-0.30m (Made ground – granular)
- TP03 – 0.50-0.60m (Made ground – slag)
- TP07 – 0.80-0.90m (Made ground – granular)
- TP15 – 0.10-0.20m (Made ground – granular)
- TP16 – 0.30m (Made ground – cohesive)

5.3 Test Results

The contamination testing results for the testing outlined in Section 5.2 are outstanding and will be added to this report and reviewed in a future revision to the report.

5.4 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 3 identifies the potential pollution linkages present on site based on source – pathway – receptor relationships. Currently, this is based solely on the WYG results (site-wide) and will be updated once the Solmek results (specific to the two areas of development) are available.

TABLE 3: CONCEPTUAL MODEL

Source	Pathway	Receptor	Risk Rating	Comments
Asphyxiating or explosive ground gases - Made ground (<10.20m) - No shallow coal mining - Landfills within 250m	Ground gas migration - Migration through permeable soils - Inhalation	Future site users Transient adult workers	Moderate /Low	Low risk for the proposed yard therefore no monitoring is required, however there may be a risk to the proposed building therefore monitoring is underway.
		Users during development Construction workers	Low	
Areas of contamination hazardous to human health (Commercial Thresholds) 32no samples tested historically - Localised exceedances pH (11no samples), beryllium (2no), benzo(b)fluoranthene (1no) & asbestos (1no)	- Inhalation - Dust ingestion - Dermal contact	Future site users Transient adult workers	Moderate /Low	Contamination risks will be mitigated by encapsulation with by proposed structure footprint (proposed building) and hardstanding (yard area).
		Users during development Construction workers	Moderate	Mitigation measures required during construction. Consideration to be given to Health and Safety Executive: <i>Protection of Workers and the General Public During the Development of Contaminated Land</i> .
	- 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: <i>The Control of Dust and Emissions from Construction and Demolition, Best Practice Guidance</i> .
Areas of elevated Leachate/Groundwater contamination 4no groundwater samples tested historically. - Exceedances within each.	Leaching mobilised contaminants of	Solid geology Secondary Aquifer – A	Moderate /Low	Localised contamination overlying a medium sensitivity aquifer (Principal Aquifer but not in a groundwater Source Protection Zone). Limited availability of contaminants in soil analysis.
		Drift geology Secondary Aquifer – Undifferentiated	Low	The relatively low permeability and low sensitivity aquifer is not considered to be at risk.
	- Drainage - Lateral migration - Accumulation of contaminated sediment of	Surface water features Nor Beck culverted to the west	Low	Culverted watercourse not considered to be at risk.
Areas of phytotoxic contamination	Uptake via roots and leaf surfaces	Vegetation None proposed	Very Low	No potential for Vegetation impact as no vegetation is proposed.
Areas of contamination above service fabric or BRE Special Digest 1 thresholds	Direct contact	Construction Materials Concrete	Moderate	Mitigation through use of sulphate resistant concrete where in contact with made ground (made ground classified as DS-4 AC-4 in WYG report).
		Construction Materials Service Fabric	Moderate	Polyethylene and copper piping to be avoided and prudent to lay any service within a clean bedding.

The above conceptual model will be updated once the outstanding contamination results are available and further detail and recommendations will be set out in the sections below.

6.1 Users of the Site Once Development is Complete

Full revised risk assessment for end-users will be added to this report once the outstanding contamination results are available.

6.2 Construction Workers and Users of Surrounding Sites

Full revised risk assessment for construction workers and surrounding users will be added to this report once the outstanding contamination results are available.

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.

For this development, no vegetation is proposed therefore vegetation is not considered to be a sensitive receptor.

6.4 Ground and Surface Water

Full revised risk assessment for controlled waters will be added to this report once the outstanding contamination results are available.

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

Full revised risk assessment for concrete classification will be added to this report once the outstanding contamination results are available.

6.5.2 Water Supply Pipes Material Selection

Full revised risk assessment for pipe material will be added to this report once the outstanding contamination results are available.

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, full Waste Classification of the 13no samples plus review of the historic WYG waste classification will be undertaken once the outstanding results are received.

7 GROUND GAS ASSESSMENT

The proposed development includes the construction of a storage yard in the west and a new hub building in the northeast.

Ground gases such as carbon dioxide (CO₂), methane (CH₄), 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.

With respect to the historic gas monitoring, six visits were undertaken by WYG to fifteen monitoring pipes between August and November 2020.

Minimum oxygen levels ranged from 0.1 to 19.8%, with maximum CO₂ levels ranging from <0.1 to 2.6% and maximum methane levels ranging from 0.3 to 0.5%. PID levels ranged from <0.1 to 1.4ppm, CO ranged from <1 to 10ppm and H₂S was not recorded (<0.1ppm).

WYG recommended a classification of Characteristic Situation 2 for the site.

For this report, the yard is not considered to be at risk from ground gases as there are no enclosed structures, however there may be a risk to the hub building.

Further gas monitoring will therefore be undertaken via measuring emissions from two standpipes (BH07 & BH08) that were installed during the sitework. The gas monitoring will consist of four visits over a period of one month. The gas monitoring results will be presented as an addendum to this report.

8 GEOTECHNICAL TESTING AND ANALYSIS

Samples taken from the boreholes and trial pits underwent a series of geotechnical tests (BS 1377:1990) to aid foundation design and soil description. In addition, insitu Standard Penetration Tests (SPTs) and California Bearing Ratio Tests 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

Standard Penetration Tests undertaken within the made ground deposits all yielded N values of 50+ (refusal).

Standard Penetration Tests undertaken within the natural cohesive deposits yielded N values of between 8 and 24, with these results indicating medium to high strength deposits.

Standard Penetration Tests undertaken within the natural granular deposits at 1.20mbgl yielded N values of generally between 28 and 50+, indicative of loose to medium dense deposits. Locally a result of 9 (loose) was recorded within BH09 at 6.00mbgl.

SPTs upon rockhead yielded N values of 50+ (refusal).

8.1.2 Hand Shear Vanes

A hand shear vane test within the cohesive made ground of TP16 returned a result of 62kPa, indicating medium strengths.

8.2 Rock Uniaxial Compressive Strength (UCS) Tests

UCS testing results on retrieved rock core will be provided as an addendum to this report.

8.3 Point Load Testing

Point Load Testing results on retrieved rock core will be provided as an addendum to this report.

8.4 Moisture Contents

Moisture content testing results will be provided as an addendum to this report.

8.5 Slag Expansion Testing

Slag testing within the WYG report on six samples indicated that generally the slag tested was not the more expansive types of slag, with only a modest potential for future expansion (0.18% volumetric expansion recorded in tests). Despite this, it will be necessary to adopt some precautions relating to slag in the construction of the proposed yard and building, discussed further in Section 8.10.

8.6 Particle Size Distribution and Sedimentation Testing

PSD & Sedimentation testing results will be provided as an addendum to this report.

8.7 pH and Sulphate Results

pH & sulphate testing results will be provided as an addendum to this report.

8.8 CBR Tests

CBR testing was undertaken within the natural clay in TP9, TP11, TP13 and TP14, along the route of a proposed road. The in-situ CBR results are detailed below in Table 4.

TABLE 4: SUMMARY OF CBR TESTING RESULTS

Trial Pit	0.30mbgl result (%)	0.60mbgl result (%)
TP01	-	15 (0.50m M/G)
TP02	15 (M/G)	-
TP03	-	15 (M/G)
TP04	15 (M/G)	-
TP05	15 (0.10m M/G)	-
TP06	4.0 (M/G)	6.0 (M/G)
TP07	3.0 (M/G)	4.0 (M/G)
TP08	15 (0.35m M/G)	-
TP09	15 (M/G)	-
TP10	15 (0.20m M/G)	-
TP11	15 (M/G)	-

TP12	15 (0.20m M/G)	-
TP13	15 (M/G)	-
TP14	15 (0.10m M/G)	-
TP15	4.0 (M/G)	15 (M/G)
TP16	3.0 (M/G)	4.5 (M/G)
M/G denotes test within Made Ground: an equilibrium CBR of 2% should be adopted		

8.9 Mining Assessment

8.9.1 Summary of Historic Works

For this site, the WYG Phase 1 Desk Study indicated that the west of the site was within a Development High Risk Area with relation to coal. There were understood to be three coal seams worked beneath the site and eight mine entries on or within 20m of the site.

With respect to ironstone mining, a band of iron ore within the sandstone in the east and south of the site may have also been worked. It was noted that two shafts were sunk off-site for the extraction of ironstone.

The WYG Phase 2 Site Investigation encountered a coal seam within the Whitehaven Sandstone, with further seams encountered locally within the Coal Measures area of the site. There was no voids or workings encountered by WYG.

With respect to the mine shafts, there are eight shafts present on the wider site, however only two of these are considered relevant to the development proposals considered in this report, with 301515-006 & 301515-008 located either side of the proposed BOC yard in the west of the site. WYG commissioned Terradat to undertake geophysical survey of four of the eight shafts on the wider site, including 301515-006. It was not possible to investigate 301515-008 due to this area being overgrown. 301515-006 was investigated via magnetics, electromagnetic ground conductivity and gravity methods. An anomaly was noted at 301376.9, 515624.8 (named A2) that was considered unlikely to relate directly to a shaft due to the thickness of made ground in the survey area, however this low-density feature may relate to the upward crowning of a void.

WYG concluded that mine workings were not considered to pose a significant risk however mine shafts may pose a risk and further drilling may be required based on building layouts.

8.9.2 Further Works – Mine Workings

The Solmek Site Investigation consisted of an additional 9no boreholes. Two of these were (BH01 & BH02) to investigate the area proposed for the BOC Yard whilst three were drilled to investigate the area of the proposed BOC Hub Building (BH07-09). The remaining boreholes were drilled to provide additional coverage of areas of the site considered for future development.

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 ten 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.

Similarly to the WYG investigation, no voids/workings were encountered, however intact coal seams were noted locally.

A full review of the risks posed by shallow workings will be included in the final report.

8.9.3 Further Works – Mine Entries

Of the eight shafts present on the wider site, there are just two which may impact the proposed development,

with shafts 301515-006 & 301515-008 located either side of the proposed BOC yard.

GPR previously encountered an anomaly near to 301515-006 however a GPR survey was not possible or 301515-008. Slit trenching was undertaken across the areas of each of these shafts. Anecdotal evidence suggests that the slag across the site was deposited after the shafts were sunk, therefore a significant thickness of slag is anticipated to overlay the areas of the shafts, however the slit trenches were excavated to examine for possible signs of disturbance/movement at the surface of the slag, which may indicate the presence of a crowning feature.

Diagrams for each slit trench and generalised logs of the ground conditions in each area are provided in Appendix B. Generally, the same competent fused slag was encountered across the area of each slag, with no signs of disturbance. A small area located 6m north of the centre of 301515-008 encountered a small (<1m diameter) area where gravelly clay was present beneath the topsoil rather than slag, however competent fused slag was then encountered at 0.50mbgl.

BHs 01 & 02 were drilled in the area of the proposed shafts, and recorded slag to between 9.70 and 10.20mbgl, respectively. This corroborates with the findings of the WYG report which also recorded deep slag in this area (up to 8.80m). It is understood that the slag was deposited some time after the shafts were sunk, with historic maps and anecdotal evidence suggesting this was done by the 1960s.

It is understood that the proposed yard will be very lightly loaded, utilised simply for the storage of gas bottles/canisters, IBCs and forklifts.

Given that neither shaft directly underlies the proposed yard, and rather each is to the edge of the yard, and also considering the nature of the proposals, it is considered that the proposed yard can be safely developed based on the available information.

The slag encountered is fused and highly competent. Should the surface topsoil/shallow loose fill be removed and replaced with a compacted engineered fill, the yard could then be constructed atop this. It would be recommended to adopt reinforcement within the concrete hardstanding yard (450mm thick). Given the approximate size of the proposed yard, this would then effectively span a wide enough area that any increased loadings on the shafts themselves would be negligible.

Should development proposals change, and buildings be proposed in the area of the shafts, further investigation may be necessary to determine the risks to any proposed buildings.

8.10 Preliminary Ground Model

The information gathered during the intrusive works has been collated and summarised in the below preliminary ground model. The below model will be revised and updated following the publication of the geotechnical results.

TABLE 5: PRELIMINARY GROUND MODEL

Strata	Depth (mbgl)		Parameters Range (average)	Reference
	From	To		
Made Ground	0.00	1.30-10.20	CBR = 3-15% (11.2)	In-situ CBR test
			N = 50+ (50+)	In-situ SPT
Sandy Gravelly CLAYS	1.30-10.20	5.70-11.90	N = 8-16 (13.1)	In-situ SPT
SANDS & GRAVELS	5.70-9.10	7.10-18.00	N = 28-50 (38)	In-situ SPT
Solid Geology – to be updated once laboratory results are available	7.30-18.00	>40.00mbgl	To be updated once laboratory results are available	

8.11 Foundations

Two developments are proposed for this site, comprising a storage yard in the west and a new hub building in the southeast. Foundation solutions are discussed below. It is also noted that the below may be revised once geotechnical results are available.

8.11.1 Proposed BOC Storage Yard

For the proposed storage yard, given the CBRs encountered in the fused slag, it is recommended to strip the shallow topsoil/loose made ground and replaced this with imported granular material, laid down and compacted in accordance with the *Specification for Highway Works Series 600* in 150mm layers, this will yield a CBR in excess of 15%, meaning capping is not necessary and the storage yard can be constructed directly atop this.

It is recommended to reinforce the full extent of the yard as a conservative measure to mitigate against the adjacent shafts (as discussed in Section 8.8.3).

8.11.2 Proposed BOC Hub Building – Piled Foundations

In the area of the proposed building, variable made ground depths were encountered, ranging from 2.80mbgl in BH08 to 7.10mbgl in BH07. It is therefore considered to adopt piled foundations.

Information provided in this report should be made available to a competent piling contractor who can design appropriate foundations in accordance with Section 7: Pile foundations of BS EN 1997 – 1:2004 which applies to end-bearing piles, friction piles, tension piles and transversely loaded piles installed by driving, by jacking, and by screwing or boring. The piling contractor will need to take into consideration the possible effects of negative skin friction from made ground deposits, as well as issues from heave and horizontal loading due to expansion of the slag materials. Allowance should also be made for breaking through known and unknown buried obstructions.

To mitigate the risks posed from the expansive slag material, it may be necessary to sleeve the piles through the slag, with the annulus between the sleeve and the pile being filled with a compressible material (e.g. bentonite) to reduce the risk of expansion loads impacting the pile itself.

The above comments however are advisory, and the precise method of pile installation and the applicability of proprietary systems, diameters and depths required would need to be determined by a specialist piling contractor.

8.11.3 Pavements/Hardstanding

Should new hardstanding be proposed, given the slag present at shallow depth, it would be recommended to further excavate to a suitable level and replace this with inert engineered fill. Consideration should also be given to flexible pavement materials.

8.11.4 Utility Connections

Given the widespread presence of slag across the site, proposed utilities should be designed to mitigate risks from ground movement (heave). Flexible connections should be utilised.

8.11.5 General Foundation Comments

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.

8.12 Excavation

Based on the nature of the ground conditions encountered, excavations should be within the capacity of normal earthworks plant although breaking out of relic foundations, surface concrete and other obstructions should be anticipated. Stability of excavations will be poor in the made ground but should improve in the natural clay (at depth). Excavation sides should be designed, constructed and supported in accordance with the recommendations given in CIRIA Report No. 97: *Trenching Practice*.

8.13 Groundwater

Perched groundwater was noted within TP06 at 0.40mbgl with groundwater strikes noted within the boreholes between 4.70 and 17.10mbgl.

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



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

Figure Title

Site Location Plan

Project Number

S220141

Project Name

Site A, Leconfield, Cleator Moor

Client

Copeland Borough Council

Date

March 2022

DRG Number

Figure 1

Scale

1:5000 @ A4 [DO NOT SCALE]

Legend Key

 Project Bounds - Project Bounds



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

Figure Title

Exploratory Hole Location Plan

Project Number

S220141

Project Name

Site A, Leconfield, Cleator Moor

Client

Copeland Borough Council

Date

March 2022

DRG Number

Figure 2

Scale

1:3000 @ A4 [DO NOT SCALE]

- Legend Key
- Locations By Type - Empty
 - ⊕ Locations By Type - CP+RC
 - Locations By Type - RO
 - ⊕ Locations By Type - SCP
 - ⊕ Locations By Type - TP
 - ▭ Project Bounds - Project Bounds



Contains Maps® Imagery ©Google 2022

Title
Development Location Plan
Project
Site A, Leconfield Industrial Estate, Cleator Moor
Client
Copeland Borough Council
Date
March 2022
Fig No.
Figure 3
Scale
Do not Scale
Key
Approx. Area of Proposed Yard Approx. Area of Proposed Building
N
Solmek Ltd. 12 Yarm Road Stockton-on-Tees TS18 3NA Tel: +44 (0) 1642 607083 Fax: +44 (0) 1642 612355 e-mail: south@solmek.com www.solmek.com 

[illegible]



Figure 6: BH07 12.00-15.00m



Figure 7: BH07 15.00-18.00m

Title
Core Photographs
Project
Site A, Leconfield Industrial Estate, Cleator Moor
Client
Copeland Borough Council
Date
March 2022
Fig No.
Figures 6 & 7
Scale

Solmek Ltd.
12 Yarm Road
Stockton-on-Tees
TS18 3NA

Tel: +44 (0) 1642 607083
Fax: +44 (0) 1642 612355
e-mail: south@solmek.com
www.solmek.com



[illegible]



Figure 10: Area of slit trenching around Shaft 006.



Figure 11: Area of slit trenching around Shaft 006.

Title	Date	Solmek Ltd. 12 Yarm Road Stockton-on-Tees TS18 3NA Tel: +44 (0) 1642 607083 Fax: +44 (0) 1642 612355 e-mail: south@solmek.com www.solmek.com  SOLMEK
Figures 10 & 11	March 2022	
Project		
Site A, Leconfield Industrial Estate, Cleator Moor		
Client		
Copeland Borough Council		



Figure 12: Area of slit trenching around Shaft 008.



Figure 13: Area of slit trenching around Shaft 008.

Title	Date
Figures 12 & 13	March 2022
Project	
Site A, Leconfield Industrial Estate, Cleator Moor	
Client	
Copeland Borough Council	

Solmek Ltd.
12 Yarm Road
Stockton-on-Tees
TS18 3NA

Tel: +44 (0) 1642 607083
Fax: +44 (0) 1642 612355
e-mail: south@solmek.com
www.solmek.com



APPENDIX B:
Borehole Logs & Trial Pit Logs

Contract no: S220141

Site: Site A, Leconfield, Cleator Moor

Driller:	Bainbridge Brothers Ltd
Plant used:	Beretta T59/Symmetrex
Started:	01/03/2022
Ended:	01/03/2022
Backfilled:	01/03/2022

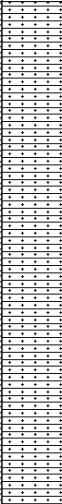
GL (AOD):	80.69m
Easting:	301394.86
Northing:	515617.71
Logged:	KW
Status:	DRAFT

Client:	Copeland Borough Council
----------------	--------------------------

Method:	Rotary Openhole
----------------	-----------------

[illegible]

 SOLMEK 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Rotary Open Hole Log						Scale 1:150 Sheet 1 of 2		BH02					
Contract no: S220141		Site: Site A, Leconfield, Cleator Moor				Driller: Bainbridge Brothers Ltd		GL (AOD): 81.30m									
						Plant used: Beretta T59/Symmetrex		Easting: 301371.93									
Client: Copeland Borough Council						Started: 01/03/2022		Northing: 515580.54									
Method: Rotary Openhole						Ended: 01/03/2022		Logged: KW									
						Backfilled: 01/03/2022		Status: DRAFT									
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing			Coring / Fractures									
					Depth (m)	Type	Results	TCR (%)	SCR (%)	RQD (%)	Fracture						
		0.40	80.90	MADE GROUND: Grass over dark brown slightly clayey very gravelly topsoil. Gravel is fine to medium subrounded to angular of sandstone, brick and slag.													
		1.30	80.00	MADE GROUND: Bluish grey slag.													
				MADE GROUND: Reddish brown sandy gravelly clay (reworked).													
		4.60	76.70	MADE GROUND: Bluish grey slag.													
		10.20	71.10	Brown very sandy gravelly CLAY.													
		11.40	69.90	Soft black silty CLAY.													
		11.90	69.40	MUDSTONE.													
		16.40	64.90	COAL Intact.													
		17.80	63.50	MUDSTONE.													
		19.40	61.90	Solid drilling noted by driller, however no flush returns so unable to log rock.													
Hole Diameter		Casing Depths		General Remarks	Flush Returns				Ground Water								
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)		From (m)	To (m)	Flush Type	Flush (%)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)				
12.00 40.00	102 150	12.00	102						9.60	9.60							

SOLMEK 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Rotary Open Hole Log							Scale 1:150 Sheet 2 of 2								
				BH02															
Contract no: S220141				Site: Site A, Leconfield, Cleator Moor				Driller: Bainbridge Brothers Ltd				GL (AOD): 81.30m							
								Plant used: Beretta T59/Symmetrex				Easting: 301371.93							
Client: Copeland Borough Council								Started: 01/03/2022				Northing: 515580.54							
Method: Rotary Openhole								Ended: 01/03/2022				Logged: KW							
								Backfilled: 01/03/2022				Status: DRAFT							
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing			Coring / Fractures											
					Depth (m)	Type	Results	TCR (%)	SCR (%)	RQD (%)	Fracture								
		40.00	41.30	Solid drilling noted by driller, however no flush returns so unable to log rock.															
				End of Borehole at 40.000m															

GL (AOD):	83.08m
Easting:	301730
Northing:	515566
Logged:	KW
Status:	DRAFT

Method:	Rotary Openhole/Coring
----------------	------------------------

[illegible]



Scale 1:150 Sheet 2 of 2

BH04

Contract no: S220141

Site: Site A, Leconfield, Cleator Moor

Driller:	Bainbridge Brothers Ltd
-----------------	-------------------------

Plant used: Beretta T59/Symmetrex

Started: 18/02/2022

Ended:	18/02/2022
--------	------------

Backfilled: 18/02/2022

GL (AOD):	83.08m
-----------	--------

Easting: 301730

Northing: 515566

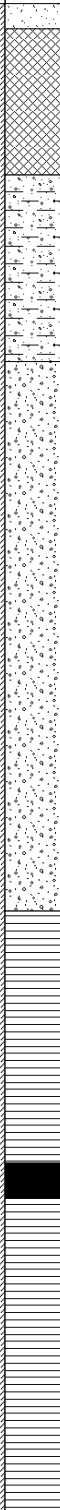
Logged: KW

Status: DRAFT

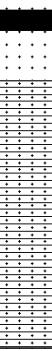
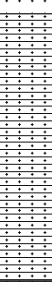
Client:	Copeland Borough Council
----------------	--------------------------

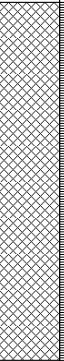
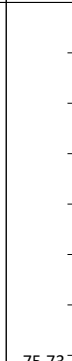
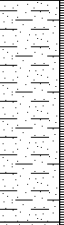
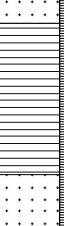
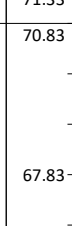
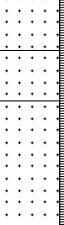
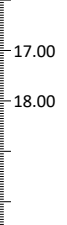
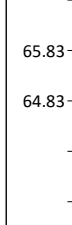
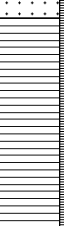
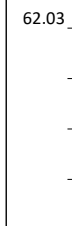
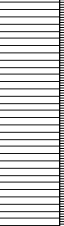
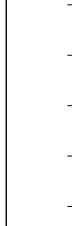
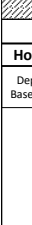
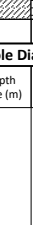
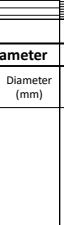
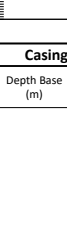
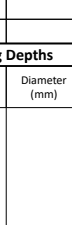
Method:	Rotary Openhole/Coring
----------------	------------------------

[illegible]

SOLMEK 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Rotary Open Hole Log						Scale 1:150 Sheet 1 of 2		BH05		
Contract no: S220141				Site: Site A, Leconfield, Cleator Moor				Driller: Bainbridge Brothers Ltd		GL (AOD): 83.04m				
								Plant used: Beretta T151/Symmetrex		Easting: 301677.34				
Client: Copeland Borough Council								Started: 17/02/2022		Northing: 515490.63				
Method: Rotary Openhole								Ended: 17/02/2022		Logged: KW				
								Backfilled: 17/02/2022		Status: DRAFT				
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing			Coring / Fractures						
					Depth (m)	Type	Results	TCR (%)	SCR (%)	RQD (%)	Fracture			
		0.50	82.54	MADE GROUND: Grey concrete.										
				MADE GROUND: Very dense bluish grey slag.										
					1.20 - 1.22	SPT (S)	N=50+ (25 for 5mm/50							
					1.20 - 1.65	D	for 10mm)							
					2.00 - 2.03	SPT (S)	N=50+ (25 for							
					2.00 - 2.45	D	10mm/50 for 20mm)							
					3.00 - 3.04	SPT (S)	N=50+ (25 for							
					3.00 - 3.45	D	10mm/50 for 35mm)							
		3.40	79.64	Firm to stiff consistency brown sandy gravelly high strength CLAY becoming reddish brown at 4.30m.	4.00 - 4.45	SPT (S)	N=13 (2,2/3,3,3,4)							
					4.00 - 4.45	D								
					5.00 - 5.45	SPT (S)	N=16 (1,2/3,4,4,5)							
					5.00 - 5.45	D								
					6.00 - 6.45	SPT (S)	N=15 (2,3/2,4,4,5)							
					6.00 - 6.45	D								
		7.10	75.94	Medium dense to very dense reddish brown SAND and GRAVELS. Gravel is medium to coarse subangular to subrounded of sandstone and mudstone.	7.50 - 7.95	SPT (S)	N=29 (4,7/10,6,5,8)							
					7.50 - 7.95	D								
					9.00 - 9.33	SPT (S)	N=50+ (10,12/16,23,11							
					9.00 - 9.45	D	for 30mm)							
					10.50 - 10.51	SPT (S)	N=50+ (25 for 5mm/50							
					10.50 - 10.95	D	for 5mm)							
					12.00 - 12.00	SPT (S)	N=50+ (25 for 0mm/50							
					12.00 - 12.45	D	for 5mm)							
					13.50 - 13.95	SPT (S)	N=30 (4,6/6,8,8,8)							
					13.50 - 13.95	D								
					15.00 - 15.45	SPT (S)	N=28 (5,7/10,6,5,7)							
					15.00 - 15.45	D								
					16.50 - 16.95	SPT (S)	N=38 (4,5/6,7,10,15)							
					16.50 - 16.95	D								
		18.00	65.04	Highly weathered weak clayey MUDSTONE.										
23.00		60.04	COAL intact no loss of flush.											
23.70		59.34	MUDSTONE.											
Hole Diameter		Casing Depths		General Remarks		Flush Returns				Ground Water				
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)			From (m)	To (m)	Flush Type	Flush (%)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)
18.00	102	18.00	102	1.2m hand excavated inspection pit.						5.90	5.90			
40.00	150			Inferred groundwater encountered at 5.90m and 17.10m.						17.10	17.10			

 SOLMEK 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Rotary Open Hole Log						Scale 1:150 Sheet 2 of 2 BH05					
Contract no: S220141				Site: Site A, Leconfield, Cleator Moor				Driller: Bainbridge Brothers Ltd				GL (AOD): 83.04m			
								Plant used: Beretta T151/Symmetrex				Easting: 301677.34			
Client: Copeland Borough Council								Started: 17/02/2022				Northing: 515490.63			
Method: Rotary Openhole								Ended: 17/02/2022				Logged: KW			
								Backfilled: 17/02/2022				Status: DRAFT			
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing			Coring / Fractures							
					Depth (m)	Type	Results	TCR (%)	SCR (%)	RQD (%)	Fracture				
				MUDSTONE.											
				COAL intact no loss of flush.											
				MUDSTONE.											
		36.20 36.50	46.84 46.54												
		40.00	43.04	End of Borehole at 40.000m											
Hole Diameter		Casing Depths		General Remarks	Flush Returns				Ground Water						
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)		From (m)	To (m)	Flush Type	Flush (%)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)		
18.00 40.00	102 150	18.00	102						5.90 17.10	5.90 17.10					

 SOLMEK 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com				Rotary Open Hole Log							Scale 1:150 Sheet 1 of 1				
				BH06											
Contract no: S220141				Site: Site A, Leconfield, Cleator Moor				Driller: Bainbridge Brothers Ltd				GL (AOD): 82.91m			
								Plant used: Beretta T59/Symmetrex				Easting: 301732.72			
Client: Copeland Borough Council								Started: 28/02/2022				Northing: 515444.99			
Method: Rotary Openhole								Ended: 28/02/2022				Logged: KW			
								Backfilled: 28/02/2022				Status: DRAFT			
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing			Coring / Fractures							
					Depth (m)	Type	Results	TCR (%)	SCR (%)	RQD (%)	Fracture				
		0.40	82.51	MADE GROUND: Bluish grey slag.											
		1.30	81.61	MADE GROUND: Sandy gravel of slag.											
				Reddish brown very sandy CLAY.											
		5.70	77.21	Gravelly SAND.											
		12.40	70.51	SANDSTONE.											
		12.90	70.01	Possible weak COAL.											
		13.40	69.51	SANDSTONE.											
															
		23.30	59.61	COAL.											
		23.70	59.21	SANDSTONE.											
															
		24.70	58.21	Solid drilling noted by driller, however no flush returns so unable to log rock.											
															
		30.00	52.91	End of Borehole at 30.000m											
Hole Diameter		Casing Depths		General Remarks	Flush Returns				Ground Water						
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)		From (m)	To (m)	Flush Type	Flush (%)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)		
3.00	102	3.00	102						4.70	3.00					
30.00	150			1.2m hand excavated inspection pit. Inferred groundwater encountered at 4.70m.											

12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com SOLMEK				Cable Percussive with Rotary Core Follow-on Log										Scale 1:150 Sheet 1 of 2 BH07								
Contract no: S220141				Site: Site A, Leconfield, Cleator Moor						Driller: Bainbridge Brothers Ltd Beretta T151/Symmetrex/Beretta T59/Symmetrex 23/02/2022 Plant used: 25/02/2022 Started: 25/02/2022 Ended: 25/02/2022 Backfilled: 25/02/2022				GL (AOD): 82.83m Easting: 301824 Northing: 515557 Logged: KW Status: DRAFT								
Client: Copeland Borough Council																						
Method: Rotary Openhole/Coring																						
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description						Samples and Insitu Testing												
										Depth (m)		Type		Results								
					MADE GROUND: Very dense bluish grey slag.						1.20 - 1.23		SPT (S)		N=50+ (25 for 10mm/50 for 15mm)							
											D											
											1.20 - 1.65		SPT (S)		N=50+ (25 for 10mm/50 for 20mm)							
											D											
											2.00 - 2.03		SPT (S)		N=50+ (25 for 15mm/50 for 10mm)							
											D											
											2.00 - 2.45		SPT (S)		N=50+ (25 for 20mm/50 for 10mm)							
											D											
											3.00 - 3.02		SPT (S)		N=50+ (25 for 10mm/50 for 15mm)							
											D											
											3.00 - 3.45		SPT (S)		N=50+ (25 for 10mm/50 for 20mm)							
											D											
											4.00 - 4.03		SPT (S)		N=8 (1,2/1,2,2,3)							
											D											
4.00 - 4.45		SPT (S)		N=9 (1,0/1,2,2,4)																		
D																						
5.00 - 5.03		SPT (S)		N=16 (2,3/3,3,4,6)																		
D																						
5.00 - 5.45		SPT (S)																				
D																						
6.00 - 6.03		SPT (S)																				
D																						
6.00 - 6.45		SPT (S)																				
D																						
					Firm consistency reddish brown very sandy medium to high strength CLAY.						7.50 - 7.95		SPT (S)		N=8 (1,2/1,2,2,3)							
											D											
											7.50 - 7.95		SPT (S)		N=9 (1,0/1,2,2,4)							
											D											
											9.00 - 9.45		SPT (S)		N=16 (2,3/3,3,4,6)							
											D											
											9.00 - 9.45		SPT (S)									
											D											
											10.50 - 10.95		SPT (S)									
											D											
											10.50 - 10.95		SPT (S)									
											D											
											12.00 - 13.00		C									
											C											
12.00 - 13.00		C																				
C																						
13.00 - 14.00		C																				
C																						
14.00 - 15.00		C																				
C																						
					Very weak to weak light reddish brown thinly bedded to thinly laminated distinctly weathered MUDSTONE. Fractures are subhorizontal to subvertical medium to closely spaced planar rough to clean.						12.00 - 13.00		C		75		70		65		NI	
											C		70		60		40		NI			
											13.00 - 14.00		C		60		30		10		NI	
											C		80		50		40		NI			
											14.00 - 15.00		C		75		60		25		NI	
											C		70		55		50		NI			
											15.00 - 16.00		C									
											C											
											16.00 - 17.00		C									
											C											
											17.00 - 18.00		C									
											C											
											18.00 - 19.00		C									
											C											
					Weak to medium strong reddish grey very thinly laminated moderately weathered micaceous SANDSTONE (coarse grained) Fractures are closely spaced planar rough clean subhorizontal (vertical 15-15.15m).						12.00 - 13.00		C		75		70		65		NI	
											C		70		60		40		NI			
											13.00 - 14.00		C		60		30		10		NI	
											C		80		50		40		NI			
											14.00 - 15.00		C		75		60		25		NI	
											C		70		55		50		NI			
											15.00 - 16.00		C									
											C											
											16.00 - 17.00		C									
											C											
											17.00 - 18.00		C									
											C											
											18.00 - 19.00		C									
											C											
					Medium strong light grey thinly bedded to thickly laminated moderately weathered siliceous SANDSTONE (coarse grained) fractures are medium to closely spaced undulating rough clean subhorizontal to horizontal.						12.00 - 13.00		C		75		70		65		NI	
											C		70		60		40		NI			
											13.00 - 14.00		C		60		30		10		NI	
											C		80		50		40		NI			
											14.00 - 15.00		C		75		60		25		NI	
											C		70		55		50		NI			
											15.00 - 16.00		C									
											C											
											16.00 - 17.00		C									
											C											
											17.00 - 18.00		C									
											C											
											18.00 - 19.00		C									
											C											
					MUDSTONE.						12.00 - 13.00		C		75		70		65		NI	
											C		70		60		40		NI			
											13.00 - 14.00		C		60		30		10		NI	
											C		80		50		40		NI			
											14.00 - 15.00		C		75		60		25		NI	
											C		70		55		50		NI			
											15.00 - 16.00		C									
											C											
											16.00 - 17.00		C									
											C											
											17.00 - 18.00		C									
											C											
											18.00 - 19.00		C									
											C											
					SANDSTONE.						12.00 - 13.00		C		75		70		65		NI	
											C		70		60		40		NI			
											13.00 - 14.00		C		60		30		10		NI	
											C		80		50		40		NI			
											14.00 - 15.00		C		75		60		25		NI	
											C		70		55		50		NI			
											15.00 - 16.00		C									
											C											
											16.00 - 17.00		C									
											C											
											17.00 - 18.00		C									
											C											
											18.00 - 19.00		C									
											C											
					MUDSTONE.						12.00 - 13.00		C		75		70		65		NI	
											C		70		60		40		NI			
											13.00 - 14.00		C		60		30		10		NI	
											C		80		50		40		NI			
											14.00 - 15.00		C		75		60		25		NI	
											C		70		55		50		NI			
											15.00 - 16.00		C									
											C											
											16.00 - 17.00		C									
											C											
											17.00 - 18.00		C									
											C											
											18.00 - 19.00		C									
											C											

Hole Diameter		Casing Depths		General Remarks			Chiselling			Ground Water				
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	1.2m hand excavated inspection pit. Inferred groundwater encountered at 10.20m			From (m)	To (m)	Time (hr)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)
										10.20	10.20			



Scale 1:150 Sheet 2 of 2

BH07

Contract no: S220141

Site: Site A, Leconfield, Cleator Moor

Driller:	Bainbridge Brothers Ltd
Plant used:	Beretta T151/Symmetrex/Beretta T59/Symmetrex
Started:	23/02/2022
Ended:	25/02/2022
Backfilled:	25/02/2022

GL (AOD):	82.83m
Easting:	301824.05
Northing:	515557.36
Logged:	KW
Status:	DRAFT

Client:	Copeland Borough Council
----------------	--------------------------

Method:	Rotary Openhole/Coring
----------------	------------------------

[illegible]

Rotary Open Hole Log

Scale 1:150 Sheet 1 of 2

BH08

Contract no: S220141

Site: Site A, Leconfield, Cleator Moor

Driller:	Bainbridge Brothers Ltd
-----------------	-------------------------

Plant used: Beretta T59/Symmetrex

Started: 21/02/2022

Ended:	21/02/2022
--------	------------

Backfilled: 21/02/2022

GL (AOD): 82.92m

Easting: 301843.16

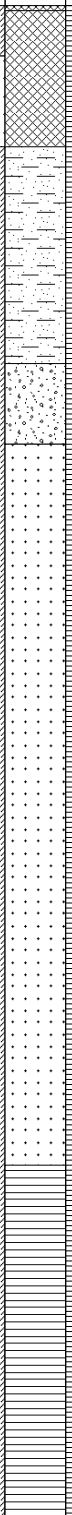
Northing: 515494.72

Logged: KW

Status: DRAFT

Client:	Copeland Borough Council
----------------	--------------------------

Method:	Rotary Openhole
----------------	-----------------

Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description	Samples and Insitu Testing			Coring / Fractures					
					Depth (m)	Type	Results	TCR (%)	SCR (%)	RQD (%)	Fracture		
		0.10	82.82	MADE GROUND: Tarmac. MADE GROUND: Bluish grey slag.									
		2.80	80.12	Reddish brown very sandy CLAY.									
		7.10	75.82	Brown SAND and GRAVELS.									
		8.70	74.22	SANDSTONE with thin beds of MUDSTONE.									
		30.00	52.92	MUDSTONE.									
Hole Diameter		Casing Depths		General Remarks	Flush Returns				Ground Water				
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)		From (m)	To (m)	Flush Type	Flush (%)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)
9.00 30.00	102 150	9.00	102		1.2m hand excavated inspection pit. Inferred groundwater encountered at 17.10m.					17.10	9.00		



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

Rotary Open Hole Log

Scale	1:150	Sheet 2 of 2
-------	-------	--------------

BH08

Contract no: S220141

Site: Site A, Leconfield, Cleator Moor

Driller:	Bainbridge Brothers Ltd
-----------------	-------------------------

Plant used: Beretta T59/Symmetrex

Started: 21/02/2022

Ended:	21/02/2022
--------	------------

Backfilled: 21/02/2022

GL (AOD):	82.92m
-----------	--------

Easting: 301843.16

Northing: 515494.72

Logged: KW

Status: DRAFT

Client:	Copeland Borough Council
----------------	--------------------------

Method:	Rotary Openhole
----------------	-----------------

[illegible]

 12-16 Yarm Road Stockton on Tees TS18 3NA 01642 607083 info@solmek.com		Cable Percussive with Rotary Core Follow-on Log										Scale 1:150 Sheet 1 of 2		BH09									
Contract no: S220141				Site: Site A, Leconfield, Cleator Moor						Driller: Bainbridge Brothers Ltd				GL (AOD): 83.11m									
Client: Copeland Borough Council				Plant used: Beretta T59/Symmetrex						Easting: 301873													
Method: Rotary Openhole/Coring				Started: 21/02/2022						Northing: 515542													
Method: Rotary Openhole/Coring				Ended: 21/02/2022						Logged: KW													
Method: Rotary Openhole/Coring				Backfilled: 21/02/2022						Status: DRAFT													
Backfill / Installation	Legend	Depth (m)	Level (m AOD)	Stratum Description						Samples and Insitu Testing													
										Depth (m)		Type		Results									
		0.40	82.71	MADE GROUND: Grass over reddish brown sandy clay. MADE GROUND: Very dense bluish grey slag.						1.20 - 1.52 1.20 - 1.65		SPT (S) D		N=50+ (10,12/15,21,14 for 25mm) N=50+ (25 for 15mm/50 for 40mm) N=50+ (25 for 10mm/50 for 20mm) N=50+ (25 for 10mm/50 for 10mm) N=50+ (25 for 25mm/50 for 10mm) N=9 (1,2/2,2,2,3)									
				Loose light brown slightly clayey SAND.						2.00 - 2.28 2.00 - 2.45		SPT (S) D											
				Stiff consistency reddish brown slightly sandy gravelly high strength CLAY.						3.00 - 3.26 3.00 - 3.45		SPT (S) D											
				SANDSTONE.						4.00 - 4.24 4.00 - 4.45		SPT (S) D											
				Weak to medium strong dark reddish to greyish brown thinly bedded to thickly laminated partially unweathered to distinctly weathered accleceaus SANDSTONE. Fractures are subhorizontal closely spaced undulating rough clean. 11.00-11.10m: Recovered as gravel. 11.80-12.00m: Recovered as gravel. 12.30-12.80m: Recovered as gravel.						5.00 - 5.26 5.00 - 5.45		SPT (S) D											
				10.50 - 11.50						C		10.50 - 11.50						C		85	55	40	NI
																				60	50	45	NI
				16.20-16.50m: Recovered as gravel. SANDSTONE with thin beds of MUDSTONE.						10.50 - 11.50		C		10.50 - 11.50		C		80	60	50	NI		
																		90	85	80	NI		
				COAL intact no loss of flush. SANDSTONE with thin beds of MUDSTONE.						10.50 - 11.50		C		10.50 - 11.50		C		70	60	50	NI		
																		70	55	10	NI		
		27.80	55.31	Solid drilling noted by driller, however no flush returns so unable to log rock.																			
Hole Diameter		Casing Depths		General Remarks						Chiselling			Ground Water										
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	1.2m hand excavated inspection pit. Inferred groundwater encountered at 15.20m.						From (m)	To (m)	Time (hr)	Depth Strike (m)	Depth Casing (m)	Depth Sealed (m)	Time Elapsed (min)	Water Level (m)						
10.50	102	10.50	102										15.20	10.50									
40.00	150																						



TrialPit No
TP01
Sheet 1 of 1

Date
16/02/2022

Scale
1:26

Logged
KW

[illegible]

Stability: Pit walls stable



TrialPit No
TP02
Sheet 1 of 1

Date
16/02/2022

Scale
1:26

Logged
KW

[illegible]

Stability: Pit walls stable



SOLMEK

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

Trial Pit Log

Trial Pit No
TP03
Sheet 1 of 1

Project Name:	Site A, Leconfield, Cleator Moor	Project No.	S220141	Co-ords:	301406E - 515607N	Date	16/02/2022
Plant Used:	JCB 3CX	Level:		Dimensions (m):	1.00	Scale	1:26
Client:	Copeland Borough Council	Depth	0.70			Logged	KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10 - 0.20	B+ES					MADE GROUND: Grass over dark brown slightly clayey very gravelly topsoil. Gravel is fine to medium subrounded to angular of sandstone, brick and slag.	
	0.20 - 0.30	B+ES		0.20			MADE GROUND: Soft consistency brown black slightly sandy very gravelly clay of low cobble and boulder content. Gravel is fine to medium subangular to angular of slag. Cobbles/boulders of angular to subangular slag.	
	0.50 - 0.60	B+ES		0.40			MADE GROUND: Grey blue fused slag recovered as gravel. Gravel is medium to coarse angular of slag.	
	0.60	CBR	15%	0.70			End of Pit at 0.700m	
								1
								2
								3
								4
								5

Remarks: Surface water run off.
Unable to excavate through slag.
Sulphurous odour noted within slag.

Stability: Pit walls stable



TrialPit No
TP04
Sheet 1 of 1

Date
16/02/2022

Scale
1:26

Logged
KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.00 - 0.20	B+ES	15%	0.20 0.30			MADE GROUND: Grass over dark brown slightly clayey very gravelly topsoil. Gravel is fine to medium subrounded to angular of sandstone, brick and slag.	
	0.20 - 0.30	B+ES					MADE GROUND: Grey blue fused slag recovered as gravel. Gravel is medium to coarse angular of slag.	
	0.30	CBR					End of Pit at 0.300m	

Stability: Pit walls stable

Trial Pit Log

TrialPit No
TP05
Sheet 1 of 1

Project Name: Site A, Leconfield, Cleator Moor

Project No.
S220141

Co-ords: 301426E - 515613N
Level:

Date
16/02/2022

Plant Used:	JCB 3CX
-------------	---------

Dimensions
(m):

0.80

Scale
1:26

Client: Copeland Borough Council

Depth
0.10

0.60

Logged
KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.00 - 0.10 0.10	B+ES CBR	15%	0.10		MADE GROUND: Grass over dark brown slightly clayey very gravelly topsoil. Gravel is fine to medium subrounded to angular of sandstone, brick and slag. Greyish blue fused slag obstruction - unable to excavate through. End of Pit at 0.100m	

Remarks:	Surface water run off. Unable to excavate through slag. Sulphurous odour noted within slag.
----------	---

Stability: Pit walls stable

**SOLMEK**

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

Trial Pit Log

Trial Pit No
TP06
Sheet 1 of 1

Project Name: Site A, Leconfield, Cleator Moor
Project No. S220141
Co-ords: 301633E - 515544N
Level: 1.30
Date: 15/02/2022

Plant Used: JCB 3CX
Dimensions (m):
Depth 0.80
Scale 1:26

Client: Copeland Borough Council
Logged KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10 - 0.20	B+ES		0.20			MADE GROUND: Grass over dark brown slightly clayey very gravelly topsoil. Gravel is fine to medium subrounded to angular of sandstone, brick and slag.	
	0.30	CBR	4.0%				MADE GROUND: Black/brown slightly sandy gravel. Sand is medium to coarse. Gravel is coarse and angular of brick, slag, ash, clinker and metal. Very strong sulphurous odour noted.	
	0.40 - 0.60	B+ES						
	0.60	CBR	6.0%	0.80				
	0.70 - 0.80	B+ES					Greyish blue fused slag obstruction - unable to excavate through. End of Pit at 0.800m	

Remarks: Groundwater seepage at 0.40m.
Unable to excavate through slag.
Sulphurous odour noted within slag.

Stability: Pit walls stable

**SOLMEK**

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

Trial Pit Log

Trial Pit No
TP07
Sheet 1 of 1

Project Name: Site A, Leconfield, Cleator Moor
Project No. S220141
Co-ords: 301650E - 515511N
Level: 15/02/2022

Plant Used: JCB 3CX
Dimensions (m): 1.00
Depth 1.10
Scale 1:26
Logged KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	CBR	3.0%	0.10			MADE GROUND: Grass over dark brown slightly clayey very gravelly topsoil. Gravel is fine to medium subrounded to angular of sandstone, brick and slag.
	0.50 - 0.60	B+ES					MADE GROUND: Firm consistency dark brown slightly sandy very gravelly clay of low cobble content. Gravel is medium to coarse subrounded to angular of brick, wood, slag and clinker. Occasional rounded cobbles of sandstone up to 30cm.
	0.60	CBR	4.0%	0.70			MADE GROUND: Fused slag recovered as multicoloured gravel. Gravel is medium to coarse angular of slag, ash and clinker.
	0.80 - 0.90	B+ES		1.10			End of Pit at 1.100m

Remarks: No groundwater encountered.
Unable to excavate through slag.
Sulphurous odour noted within slag.

Stability: Pit walls stable



TrialPit No
TP08
Sheet 1 of 1

Date
16/02/2022

Scale
1:26

Logged
KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	B+ES	15%	0.05			MADE GROUND: Red brick.
	0.20 - 0.30	B+ES		0.10			MADE GROUND: Orange coarse paving sand.
	0.35	CBR		MADE GROUND: Orange/pink very sandy gravel. Gravel is medium to coarse subangular to angular of brick and slag.			
						End of Pit at 0.350m	

Stability: Pit walls stable

 SOLMEK Solmek Ltd 12-16 Yarm Road Stockton on Tees TS18 3NA Tel: 01642 607083 Email: info@solmek.com				Trial Pit Log				TrialPit No TP09 Sheet 1 of 1	
Project Name: Site A, Leconfield, Cleator Moor				Project No. S220141		Co-ords: 301687E - 515545N Level:		Date 17/02/2022	
Plant Used: JCB 3CX				Dimensions (m): 0.70 1.10				Scale 1:26	
Client: Copeland Borough Council				Depth 0.30				Logged KW	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20 - 0.30	B+ES	15%	0.15			MADE GROUND: Concrete with rebar overlaying plastic membrane.		
	0.30	CBR				MADE GROUND: Grey/pink very sandy gravel. Gravel is medium to coarse angular of dolomite and brick.			
						Greyish blue fused slag obstruction - unable to excavate through.			
	End of Pit at 0.300m								
								1	
								2	
								3	
								4	
								5	
Remarks: No groundwater encountered. Unable to excavate through slag. Sulphurous odour noted within slag.									
Stability: Pit walls stable									



TrialPit No
TP10
Sheet 1 of 1

Date
17/02/2022

Scale
1:26

Logged
KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.00 - 0.10	B+ES	15%	0.20			MADE GROUND: Grass over light brown slightly sandy very gravelly topsoil. Gravel is fine angular of sandstone and shale.
	0.20	CBR					Greyish blue fused slag obstruction - unable to excavate through.
							End of Pit at 0.200m

Stability: Pit walls stable

Trial Pit Log

TrialPit No
TP11
Sheet 1 of 1

Project Name: Site A, Leconfield, Cleator Moor

Project No.
S220141

Co-ords: 301747E - 515450N
Level:

Date
17/02/2022

Plant Used:	JCB 3CX
-------------	---------

Dimensions
(m):

0.60

Scale
1:26

Client: Copeland Borough Council

Depth
0.30

0.60

Logged
KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	B+ES	15%	0.30			MADE GROUND: Grass over light brown very gravelly topsoil. Gravel is fine to medium angular of sandstone, shale and slag.
	0.20	B+ES					
	0.30	CBR					Greyish blue fused slag obstruction - unable to excavate through. End of Pit at 0.300m

Remarks:	No groundwater encountered. Unable to excavate through slag. Sulphurous odour noted within slag.
----------	--

Stability: Pit walls stable

Trial Pit Log

TrialPit No
TP12
Sheet 1 of 1

Project Name:	Site A, Leconfield, Cleator Moor
---------------	----------------------------------

Project No.
S220141

Co-ords: 301758E - 515480N
Level:

Date
17/02/2022

Plant Used:	JCB 3CX
-------------	---------

Dimensions
(m):

0.50

Scale
1:26

Client: Copeland Borough Council

Depth
0.20

0.60

Logged
KW

[illegible]

Remarks:	No groundwater encountered. Unable to excavate through slag. Sulphurous odour noted within slag.
----------	--

Stability: Pit walls stable



TrialPit No
TP13
Sheet 1 of 1

Date
17/02/2022

Scale
1:26

Logged
KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.00 - 0.10	B+ES	15%	0.20 0.30			MADE GROUND: Grass over dark brown slightly sandy very gravelly topsoil. Gravel is fine to coarse angular to subangular of brick and slag.
	0.20	B+ES					MADE GROUND: Fused slag recovered as grey/blue medium to coarse subangular to angular gravel.
	0.30	CBR					End of Pit at 0.300m

Stability: Pit walls stable



TrialPit No
TP14
Sheet 1 of 1

Date
17/02/2022

Scale
1:26

Logged
KW

4

Stability: Pit walls stable



TrialPit No
TP15
Sheet 1 of 1

Date
18/02/2022

Scale
1:26

0.60

- 1
- 2
- 3
- 4
- 5

Stability: Pit walls stable

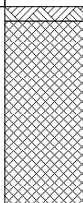


TrialPit No
TP16
Sheet 1 of 1

Date
18/02/2022

Scale
1:26

Logged
KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.05			MADE GROUND: Grass over dark brown slightly gravelly topsoil. Gravel is fine to medium subangular to angular of sandstone and shale. MADE GROUND: Firm consistency red/brown slightly sandy very gravelly clay of low cobble content. Gravel is fine to medium subrounded to angular of sandstone, shale and slag. Cobbles of full red bricks.
	0.30	B+ES					
	0.30	CBR	3.0%				
	0.50	HV	62kPa				
	0.60	B+ES					
	0.60	CBR	4.5%	0.70			
							Greyish blue fused slag obstruction - unable to excavate through.
							End of Pit at 0.700m

Stability: Pit walls stable



TrialPit No
SHAFT-006
Sheet 1 of 1

Date
15/02/2022

Scale
1:26

Logged
KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			MADE GROUND: Grass over slightly gravelly slightly clayey topsoil. Gravel is subangular to subrounded fine to medium of sandstone, mudstone and slag.
							Greyish blue fused slag obstruction - unable to excavate through. End of Pit at 0.300m

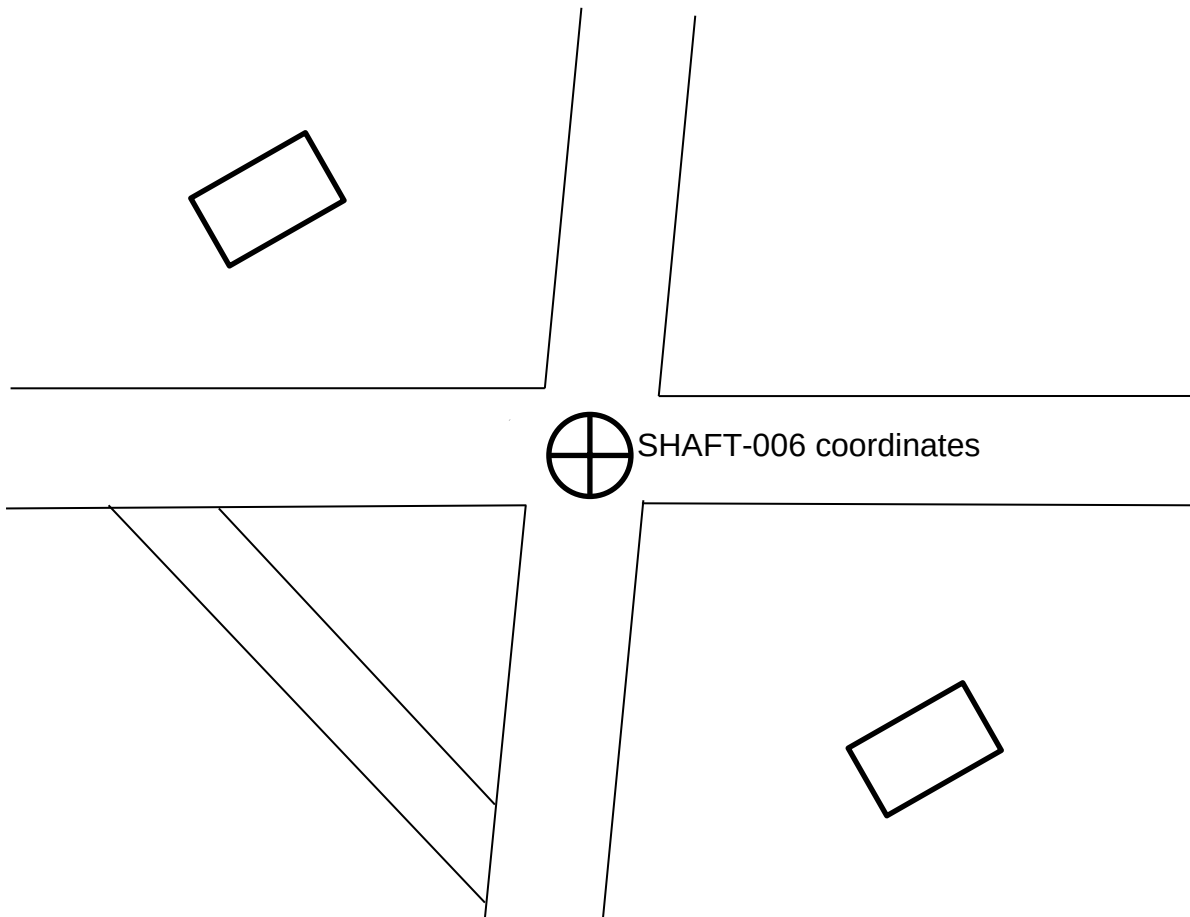
Remarks:	No groundwater encountered.
----------	-----------------------------

Stability: Pit walls stable

S220141

Site A, Leconfield, Cleator Moor

SHAFT-006



Pecked into slag from 0.30m-0.60m at
centre of shaft marked ⊕

NTS



TrialPit No
SHAFT-008
A
Sheet 1 of 1

Date
15/02/2022

Scale
1:26

Logged
KW

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.40			MADE GROUND: Grass over brown slightly clayey slightly gravelly topsoil. Gravel is fine to medium subangular to angular of sandstone, brick and slag.
							Greyish blue fused slag obstruction - unable to excavate through. End of Pit at 0.400m

Remarks:	No groundwater encountered.
----------	-----------------------------

Stability: Pit walls stable

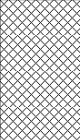
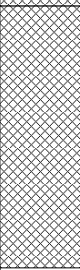


SOLMEK

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

Trial Pit Log

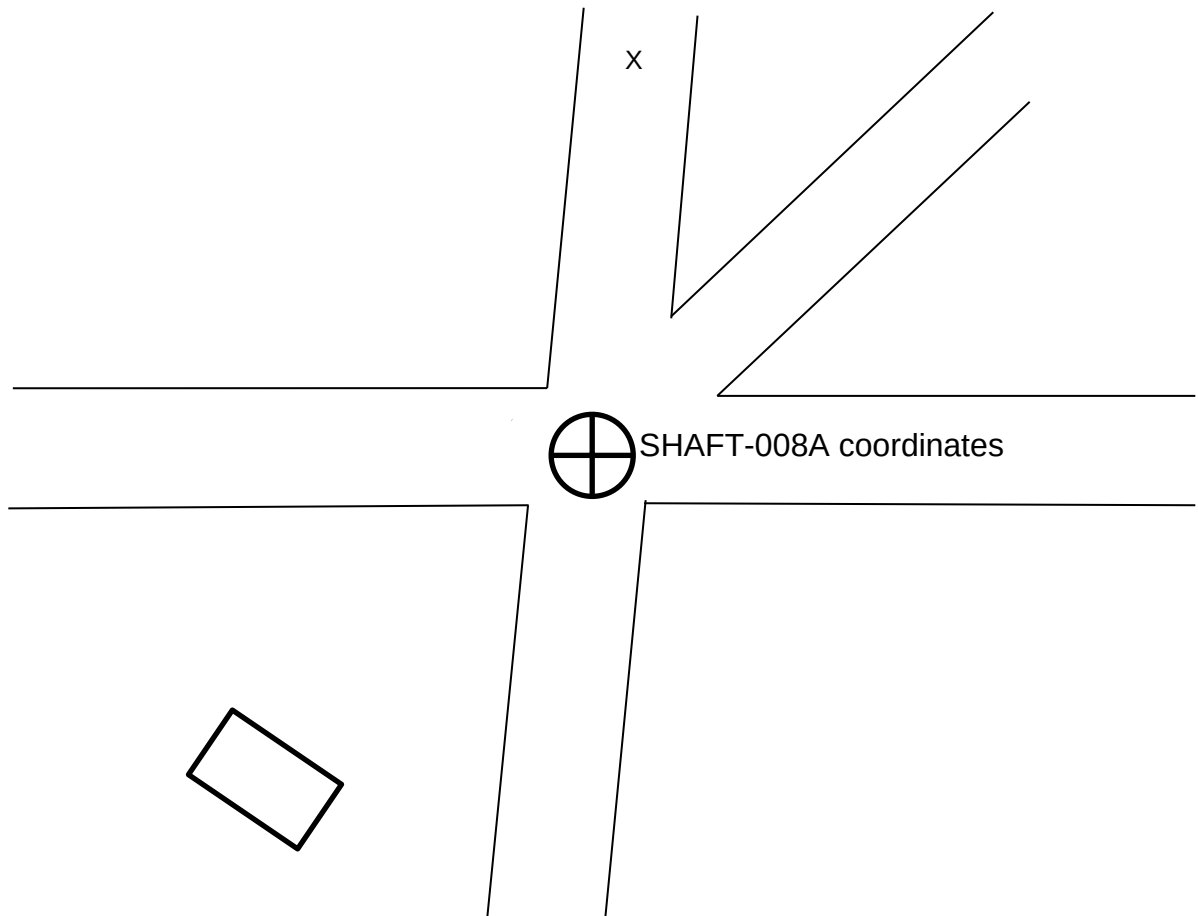
Trial Pit No
SHAFT-008
B
Sheet 1 of 1

Project Name: Site A, Leconfield, Cleator Moor				Project No. S220141		Co-ords: 301440E - 515606N Level:		Date 15/02/2022	
Plant Used: JCB 3CX						Dimensions (m): Depth 0.50		Scale 1:26	
Client: Copeland Borough Council								Logged KW	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.50			MADE GROUND: Grass over brown slightly clayey slightly gravelly topsoil. Gravel is fine to medium subangular to angular of sandstone, brick and slag.		
				1.40			MADE GROUND: Orange brown very gravelly clay. Gravel is fine to medium subangular to angular of sandstone, mudstone and slag. End of Pit at 0.500m		
							1		
							2		
							3		
							4		
							5		
Remarks: No groundwater encountered.									
Stability: Pit walls stable									

S220141

Site A, Leconfield, Cleator Moor

SHAFT-008A AND SHAFT-008B



X denotes area with slag absent until
0.50mbgl

NTS

APPENDIX C:
Contamination Laboratory Results

APPENDIX D:
Geotechnical Laboratory Results

APPENDIX E:
Notes on Limitations & Contamination Guidance

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 <i>significant harm</i> , 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 volatilised 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.

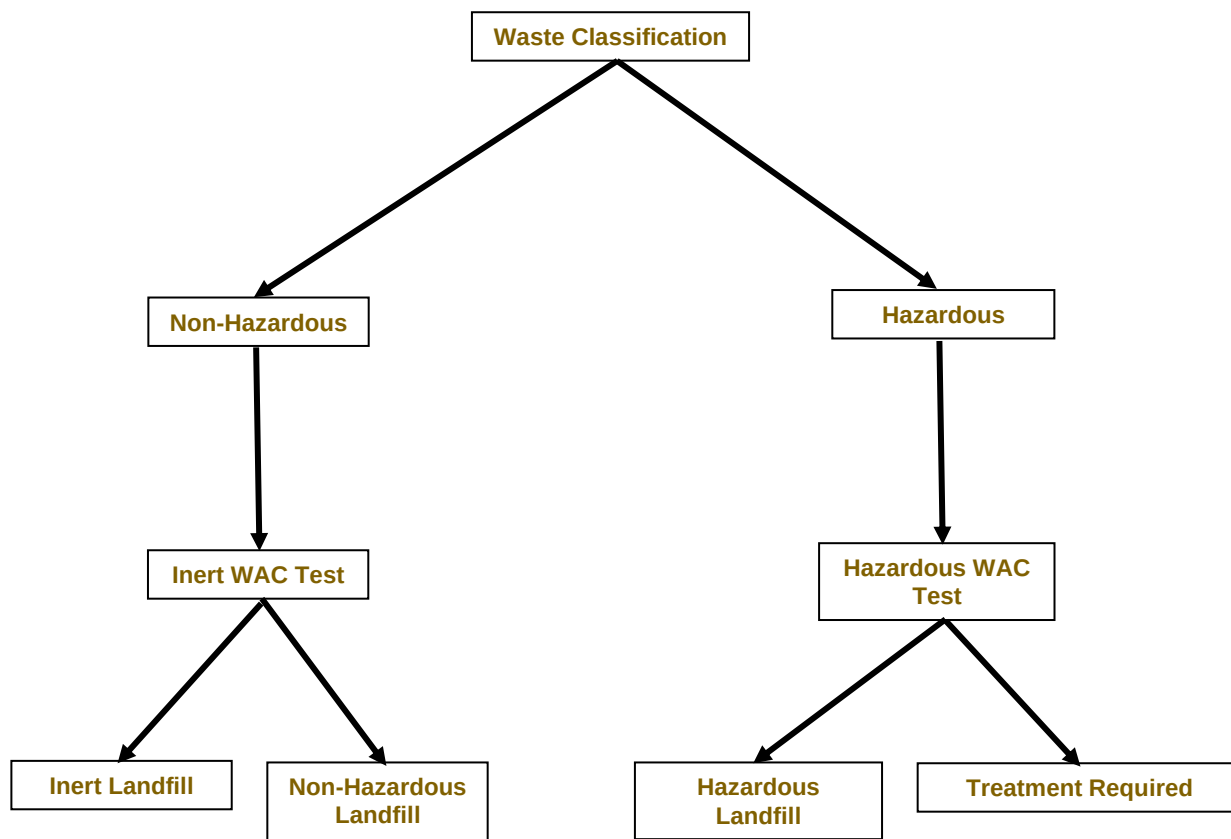
WASTE CLASSIFICATION AND WASTE ACCEPTANCE CRITERIA

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.

Parameter group	Pipe Material (Threshold concentrations in mg/kg)					
	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.