Meadow Road, Whitehaven

Phase 2 Ground Investigation Report

Curtins Ref: 067983-CUR-00-XX-RP-GE-001

Revision: V01

Issue Date: 02 July 2018

Client Name: Home Group

Client Address: Anthorne House, Irish Street, Maryport, CA15 8AD

Site Address: Meadow Road, Whitehaven, Cumbria, CA28 9JT

Curtins
Merchant Exchange
17 – 19 Whitworth Street West
Manchester, M1 5WG
Tel: 0161 236 2394
www.curtins.com

Rev	Description	Issued by	Checked	Date
01	Issue	LD	WS	02 July 2018

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Consulting Limited with respect to the information contained in the report will not extend to any third party.

Author	Signature	Date
L. Doel BSc (Hons) FGS Geo-Environmental Engineer		02 July 2018

Reviewed	Signature	Date
S. Hyde BSc (Hons) MSc Senior Geo-Environmental Engineer		02 July 2018

Authorised	Signature	Date
Joe James BSc GC EnvMgt Principal Engineer		02 July 2018

Executive Summary

Appointment	In March 2018, Curtins were instructed by Home Group to prepare a Phase 2 Ground Investigation Report (GIR) in relation to a parcel of land off Meadow Road, Whitehaven. The Phase 2 GIR has been undertaken to support development of a total of 18no. low rise residential properties with private gardens and access roads.
Current Site Status	The subject site is currently occupied by an active MOT garage with associated car park and a number of unused garages adjacent in the south of the site. The north of the site comprises demolition rubble at the surface from the previous night club which occupied the site.
Fieldworks	The site investigation fieldworks were undertaken in April 2018 by Geocore Site Investigations Ltd, supervised by a Curtins Geo-Environmental Engineer. The investigation comprised the advancement of; seven windowless sampler boreholes to depths of up to 5.00 mbgl, four cable percussion boreholes 9.30 mbgl, three in-situ plate load tests and two BRE 365 Soakaway tests. In addition, logging of soil arisings and representative sampling of the site soils for environmental and geotechnical testing was undertaken. Gas and groundwater monitoring wells were also installed in three cable percussion holes and four windowless sampling holes to allow for the monitoring of ground gas levels and to facilitate groundwater sampling.
Ground Conditions	In general, the revealed ground model was consistent with the historical use of the site and recorded geological succession. Made Ground extended from the surface to typical depths of approximately 1.00 mbgl, with localised deepening to depths >2.00 mbgl. The Made Ground predominately comprised black/dark grey sandy clayey gravel. Glacial Till was encountered underlying the Made Ground as a very sandy gravelly clay, becoming a very soft sandy silt/clay from depths of around 2.00m – 3.00m bgl. Intact siltstone bedrock was encountered from 8.00m bgl.
Laboratory Testing	Representative samples of the shallow site soils were obtained and submitted to a suitably accredited laboratory for environmental chemistry analysis. The environmental chemistry results for soils have been compared with the Tier 1 criteria for soils with respect to human health for a '*Residential with home-grown produce'* end use reflecting the proposed end use of the site (low rise residential properties with private gardens).
Generic Quantitative Risk Assessment	**Quantitative Risk Assessment – Human Health** The risk to future site users is, in general, assessed as Low with respect to a *Residential without Homegrown Produce* end use. The Made Ground soil was found to contain elevated concentrations of Polycyclic Aromatic Hydrocarbons (PAHs), asbestos and lead was identified and assessed as unacceptable for use within soft landscaping areas of the proposed development (moderate risk). It was therefore recommended that 600mm of clean imported soils be placed in areas of soft landscaping/private gardens. **Quantitative Risk Assessment – Controlled Waters** The risk to controlled waters is assessed as Low based on the findings of the ground investigation. No remedial action is recommended. **Quantitative Risk Assessment – Ground Gases** The risk presented by ground gases is assessed as Green for the northern half of the site, however due to elevated methane levels to the south, an Amber 2 classification has been adopted. This will require development plots in the south of the site to have ground gas protection measures.
Geotechnical Considerations	It is recommended that consideration is given to the adoption of piled foundations to support the structural loads of the proposed development.

Table of Contents

Appendices

1.0 Introduction

1.1 Project Background

In March 2018, Curtins were instructed by Home Group to prepare a Phase 2 Ground Investigation Report (GIR) in relation to a parcel of land off Meadow Road, Whitehaven.

The Phase 2 GIR has been undertaken to support development of a total of eighteen low rise residential properties.

A Phase 1 Preliminary Risk Assessment (PRA) for the subject site has not been undertaken; however, a coal authority report and Envirocheck data report have been acquired for this investigation.

1.2 Scope of Works

The investigation was undertaken to provide an assessment of both environmental and geotechnical ground conditions on the subject site with respect to any potential contamination in the underlying soils and or groundwater.

Specifically, the report is intended to determine,

a) If there is a risk of the proposed end user being adversely impacted upon by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use;

b) If there is a risk of groundwater and/or surface water being adversely impacted upon by potential contamination that may be present on the site due to its known current, recent and historical use;

c) Recommendations for the design of foundations and building ground floor slabs; and

d) Recommendations for the specification of sub-structure concrete.

2.0 Site Setting

2.1 Current Setting

The subject site comprises an area of land covering an area of approximately one acre illustrated in *Figure 2.1* below.

At the point of investigation, the site was occupied by an active MOT garage and a small number of unused garages to the south of the site. The northern half of the site was formerly occupied by a nightclub which has since been demolished, with a large soil bund blocking the entrance to the north east.

Figure 2.1 *Site Location Plan.*
Approximate development site boundary identified in red.
Centre of site located at National Grid Reference: 297752, 516340.

2.2 Preliminary Risk Assessment – Curtins

No PSA has been completed for this site; however, a site check report from Envirocheck and a Coal Mining report from the Coal Authority have been acquired for this investigation. From reviewing the Envirocheck and Coal Authority data, it has been noted that the site is an active MOT garage, and previously was a larger garage complex in the south of the site. Underground storage tanks (USTs) have been identified in the south of the site. The north of the site was formerly a nightclub which has been demolished with rubble present at the surface. There are 3no. mine entries within 75m of the site boundary, each of which is listed as a development high risk area. The risk posed by coal mining is addressed in Section 6.2.

3.0 Preliminary Conceptual Site Model and Qualitative Risk Assessment

3.1 Preliminary Conceptual Site Model

The conceptual site model (CSM) and Qualitative Risk Assessment (QRA) are presented in the table within this section.

The CSM details the source-pathway-receptor linkages or potential contaminant linkages (PCL) that have been identified for the site. The QRA details the associated level of risk relating to these PCLs.

The CSM and QRA concern risk to human health and controlled waters with additional, more specific risk assessment protocols contained within the main body of this reporting, as detailed in Section 3.1 below.

The QRA follows the framework outlined within CIRIA C552 which is summarised within Appendix E.

The 'risk rating' within the QRA refers to the risk that the source, pathway, receptor linkage or PCL is complete. Unless specifically stated it does not necessarily refer to an immediate risk and is intended to be used as a tool to assess the necessity for further assessment/investigation.

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk. It has been assumed that any future construction works on site will be undertaken in compliance with these requirements and therefore construction workers involved in the building works at the site have been discounted as a human receptor in the conceptual site model.

- The table below represents the first stage in the land quality risk assessment process; **the Qualitative Risk Assessment**.
- For a development site to be deemed 'suitable for use' the level of risk needs to be brought down to acceptable levels, i.e. low risk. The purpose of each stage of risk assessment is ultimately to establish if there is a requirement for additional levels of assessment to be made to have sufficient confidence to support a risk characterisation or management decision, e.g. remedial action.

Conceptual Site Model			Qualitative Risk Assessment			Action
Source	**Pathway(s)**	**Receptor(s)**	**Consequence (Potential Severity)**	**Likelihood of Occurrence**	**Risk Rating**	
On-site sources of potential contamination: Localised spillages of oil and fuel range hydrocarbons associated with active MOT centre (southern portion of the site only). Potential for hydrocarbon contamination due to USTs on site. Potential for major inclusions of general Made Ground (demolition rubble) in around site; potentially containing asbestos.	**Direct contact, ingestion, inhalation (dust and vapours)**	**End users of site** Residents, staff (commercial extension), trespassers and visitors	**Medium** Chronic health risk	**Likely** There is potential for significant inclusions of Made Ground beneath areas of hardstanding and in the area of the former nightclub, as well as potential for localised hydrocarbons in shallow soils from UST and MOT Garage. At this stage, the potential for on-site sources of contamination presenting an unacceptable risk to human health is considered likely.	**Moderate**	Confirm no free phase or mobile contamination is present on-site as part of a ground investigation in support of structural and civil design
	Vertical migration through the residual soils May occur due to processes including; capillary action, burrowing animals inducing soil mixing and downwards into the natural deposits through infiltration.	**Controlled waters (Groundwater)** Bedrock – Secondary A Aquifer No abstractions within 500m of the site.	**Medium** Pollution of sensitive water resources	**Low Likelihood** There is potential for significant inclusions of Made Ground beneath areas of hardstanding and in the area of the former nightclub, as well as potential for localised hydrocarbons in shallow soils from UST and MOT Garage. In general, the mobility of these potential pollutants is likely to be low and therefore isolated to discrete areas, if and where present. At this stage, the potential for on-site sources of contamination impacting controlled waters is considered unlikely.	**Moderate / Low**	Confirm no free phase or mobile contamination is present on-site as part of a ground investigation in support of structural and civil design
Off-site sources of potential contamination: No discernible off-site sources of potential contamination were noted, with historically the subject site surrounding predominately residential end uses. However, there is a graveyard immediately north of the site.						
On and off-site soils with the potential to generate ground gases No potential, significant sources of ground gas identified on site or within 250 m of the site. • Presumed limited thickness (<1m) of Made Ground on-site. • The subject is not present within a Coal Mining Development High Risk Area or within an area of probable shallow coal workings so is unlikely to be susceptible to potential mine gas migration. • The historical graveyard adjacent site to the north.	**Vertical and horizontal migration through subsurface soils.**	**End user of site** Residents, staff (commercial extension), trespassers and visitors	**Severe** Acute health risk, e.g. asphyxiation or risk from explosion	**Unlikely** With reference to BS8576 (2013) *Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds,* organic inclusions within Made Ground sources are considered to have a Very Low gassing potential.	**Moderate / Low**	Qualitative Gas Risk Assessment; with option for a Quantitative Risk Assessment subject to findings of the ground investigation.

4.0 Fieldwork

4.1 General

The ground investigation fieldworks were undertaken in April 2018. A summary of the scope and rationale for the phases of investigation are summarised in Table 4.1 below.

The ground investigation was designed by Curtins with reference to the proposed development and in general accordance with current UK guidance including CLR11 (2), British Standard (BS) 10175 (3), BS5930:2010 (4) and Eurocode 7 (5).

Table 4.1 *Ground Investigation Scope and Rationale*

Activity	Rationale
7 No. windowless sampling boreholes (referenced WS01 to WS07) to depths of up to 5.0m bgl	To determine shallow ground conditions beneath the development footprint.
Four Cable Percussion boreholes (referenced CP01 to CP04) to depths of up to 9.2m bgl.	To determine deep ground conditions beneath the development site.
Three shallow CBR tests (maximum depth 0.7m bgl).	To determine indicative CBR values for shallow soils.
Two BRE365 Soakaway Tests	To determine infiltration characteristics of site soils.
Installation of groundwater and gas monitoring wells.	To allow for gas monitoring and groundwater monitoring/sampling.
Description and logging of soil arisings from exploratory holes.	To provide a characterisation of ground conditions and inform sample selection for laboratory analysis.
Collection of representative soil samples from exploratory hole arisings.	To enable laboratory Environmental and Geotechnical analysis of recovered soil samples.

Curtins drawing ref. 067983-CUR-00-XX-DR-GE-80-002-V01_EHLP records the locations of all exploratory hole locations a copy of which is contained within Appendix A.

4.2 Soil Logging and Sampling

Exploratory hole arisings were logged on site by a Curtins Engineer in accordance with the requirements of BS5930 (4), including recording any observed visual and olfactory indications of contamination. Copies of the exploratory hole logs are provided in Appendix B.

Representative soil samples were selected for laboratory chemical analysis, based on field observations and to provide a characterisation of both the Made Ground and natural strata encountered. Selected soil samples were placed in laboratory provided containers and stored in cool boxes prior to

being transported to the nominated laboratory under the laboratory's chain of custody documentation. Additionally, representative soil and rock samples were collected and scheduled for laboratory geotechnical analysis. The laboratory selected by Curtins for chemical and geotechnical analysis was i2 Analytical, a UKAS and MCerts accredited laboratory.

4.3 In-Situ Tests

A programme of *in-situ* testing was undertaken to develop the preliminary ground model for the site and determine geotechnical properties of the strata revealed. In-situ testing was undertaken as detailed in Table 4.3 below.

Table 4.3 *Programme of In-Situ Testing*

Activity	Rationale
SPT tests within window sample boreholes	Assess relatively density or consistency of various strata.
BRE 365 Soakaway tests	To determine infiltration characteristics of site soils.

4.4 Monitoring Well Installations

Gas and groundwater monitoring installations (50mm OD) were installed within six boreholes. A bentonite seal was placed above the screened section of the borehole (and below where relevant) to minimise potential for downward migration of contaminants and the creation of a preferential migratory pathway. A gravel surround was installed in the annulus between the sides of the borehole and the slotted sections of pipe. A summary of the response zones is presented in Table 4.4 below.

Table 4.4 *Borehole Response Zones*

Borehole Reference	Response Zone(s) (m bgl)	**Strata Description(s)** (Principal strata in capitals)
WS03	1.0 – 4.0	Firm orange and brown mottled grey very sandy very gravelly CLAY with rare white coarse grained angular sandstone cobbles. (GLACIAL TILL) / Very soft grey very sandy SILT/CLAY. (GLACIAL TILL).
WS04	1.0 – 4.0	Dense dark grey and orange very sandy very clayey angular concrete and sandstone GRAVEL. (MADE GROUND) / Very soft grey very sandy SILT/CLAY. (GLACIAL TILL).
WS05	1.0 – 4.0	Firm brown to light brown very sandy slightly gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal and shale. (GLACIAL TILL). / Very soft grey very sandy SILT/CLAY. (GLACIAL TILL).
WS06	1.0 – 4.0	Light grey to grey mottled orange very sandy gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal. (GLACIAL TILL). / Very soft orange and grey very sandy SILT/CLAY. (GLACIAL TILL).

Borehole Reference	Response Zone(s) (m bgl)	**Strata Description(s)** (Principal strata in capitals)
CP02	5.0 – 8.0	Firm to stiff blueish grey very sandy very gravelly CLAY. Gravel is fine to coarse rounded to subangular siltstone. Sand is fine to coarse. (GLACIAL TILL).
CP03	5.5 – 9.0	Firm to stiff blueish grey very gravelly sandy CLAY. Gravel is fine to medium angular to subrounded sandstone and siltstone. (GLACIAL TILL).
CP04	6.0 – 9.0	Stiff to very stiff blueish grey very gravelly CLAY. Gravel is fine to coarse rounded to angular mudstone. (GLACIAL TILL).

Copies of borehole logs provided by Curtins can be referred to in Appendix A2 of this report.

4.5 Post-Investigation Monitoring

4.5.1 Ground Gas and Groundwater Level Monitoring

An initial programme of six gas and groundwater level monitoring visits over two months was proposed to confirm Preliminary Conceptual Site Model as presented in Section 3.0.

Gas and groundwater level monitoring has been undertaken on the following five occasions; 26th April, 10th May, 29th May, 7th June and 19th June 2018.

5.0 Laboratory Testing

5.1 Environmental Chemistry Testing

A programme of environmental chemistry testing was scheduled, with analytical suites developed reflecting the Preliminary Conceptual Site Model (as outlined in Section 3.0) and any observations made during the ground investigation.

Given the potential for a site wide source of contamination (Made Ground) the sampling positions were generally located in a semi-targeted array to give adequate and representative coverage of the site accounting for the historical site use, proposed end use and the immediate environmental setting.

A number of sampling locations, including groundwater monitoring points, were specifically positioned to target potential contaminative incidents from the identified USTs.

5.1.1 Soil Analysis

Soil samples were taken from shallow (<0.60 m) Made Ground across the site and tested for Curtins Suite A. The nature and type of soil contamination potentially present on the site was considered to include, amongst others; organic matter, ash and fill, heavy metals, TPH including BTEX and asbestos the extent of which is captured by the broad environmental testing suite detailed in Table 5.1.1.

Copies of the environmental chemistry testing certificates can be referred to in Appendix C of this report.

Table 5.1.1 *Environmental Chemistry Analysis Suite: Soils*

Suite Reference	Analysis	LOD
Curtins Suite A	Asbestos Screen & ID	NAD
	pH	+/- 0.1
	Organic Matter	<0.1
	Arsenic	<1
	Boron – Water Soluble	<0.2
	Cadmium	<0.2
	Chromium	<1
	Chromium – Hexavalent	<1.2
	Copper	<1
	Lead	<1
	Mercury	<0.3
	Nickel	<1
	Selenium	<1
	Zinc	<1
	Cyanide	<1
	Sulphate (as SO_4) – Water Soluble (2:1)	<1.25 (mg/l)
	PAH – Speciated (EPA 16)	<0.05 - <0.1
	TPH CWG inc BTEX & MTBE	<0.1 – <10

5.2 Geotechnical Testing

A programme of geotechnical testing was scheduled by Curtins to develop the preliminary ground model for the site and inform geotechnical design. Geotechnical samples representative of the main soil types encountered on site were tested for the suites detailed in Table 5.2 below and results presented in Appendix C.

Table 5.*2* *Geotechnical Analysis Suite*

Geotechnical Analysis
Water soluble sulphate & pH (BS 1377-3: 1990 Clauses 3, 5.2, 5.5, 7.2 & 9)
Moisture Content (BS 1377: 1990 Part 2 : 3.2)
Plasticity testing (BS 1377-2: 1990 Clauses 4.3 and 5)
Particle Size Distribution (Wet Sieve).

6.0 Ground Conditions

The revealed site geology was generally consistent with the anticipated geology and historical use of the site. The generalised ground model for the development site is summarised below in Table 6.1.

6.1 Encountered Ground Conditions

Table 6.1 *Summary of Ground Conditions Encountered*

Stratum	Depth to top of strata (m bgl)		Thickness (m)		General Description
	Min	Max	Min	Max	
Made Ground	0.00	0.0	0.10	3.6	Made Ground was encountered across site as a gravel with varying proportions of sand and clay. The gravel comprised primarily concrete and brick rubble with rare inclusions of clinker.
Glacial Till	0.1	3.6	0.44	7.2	Encountered as a gravelly very sandy clay to depths of around 2m – 3m bgl when it becomes a very soft sandy silt/clay. Further strata description is available in Section 6.1.2.
Intact Bedrock	8.1	9.3	Base not proven		Intact bedrock was encountered as a SILTSTONE unit which consisted of a light/dark grey predominantly fine grained laminated siltstone.

6.1.1 Made Ground

During the ground investigation Made Ground was encountered in all exploratory holes. It was often found at the surface as a dark grey/black very sandy, clayey to very clayey GRAVEL of brick, concrete and mixed lithologies. An angular red coarse gravel (sub-base) was encountered beneath the concrete slabs across the site.

6.1.2 Glacial Till

The glacial till present across site was encountered in two different strata. Immediately underlying the Made Ground across site was a brown/light brown often mottled grey, orange and yellow, gravelly very sandy CLAY. The gravel comprised of mixed lithologies, primarily siltstone and sandstone. In areas near the suspected UST (WS03, WS04 and WS06) the top 300-400mm of the Till strata was stained grey/dark grey.

Underlying this stratum, was a very soft, grey, very sandy SILT/CLAY. The SPT values in this stratum were very low (0 – 5), on-site observations noted the SPT rods penetrating this strata under their own weight.

6.1.3 Intact Bedrock

Intact bedrock (Pennine Lower Coal Measures) was encountered across the site from depths of 8.1m bgl (CP02) to 9.3m bgl (CP03) comprising dark grey SILTSTONE.

6.2 Mining

The site is not within a development high risk area; however, there are 3no. mine entries within 75m of the site boundary, each of which are classed as development high risk areas.

6.3 Groundwater

Shallow groundwater was encountered in three exploratory holes across site. In WS02 it was encountered as a shallow perched water body within the Made Ground at depths of <0.5m. Elsewhere, in CP02 to CP04 it was encountered at depths between 5.6m and 6.3m bgl.

6.4 In-Situ Testing

In-Situ Standard Penetration Testing (SPT) was undertaken within the window sample and cable percussion boreholes and the results are presented on the exploratory hole logs (Appendix B) and discussed in more detail in Section 9.0.

7.0 Geochemical Ground and Groundwater Risk Assessment

This section of the report includes the assessment of the potential contamination, solid, liquid and gas, identified on the subject site which may present a risk to the proposed end users, associated utilities and the wider environment.

In guidance published by the Environment Agency, the risk to human health or controlled waters is determined through an assessment of contaminant linkages between a source of contamination (within the ground or groundwater either on or off site) and a sensitive receptor such as end users of the site, building materials, edible plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship. The same model is applied to the assessment of risk arising from ground gases as detailed within BS8576:2013 (6).

These models have a common approach, which is one of a tiered assessment. At each stage of the assessment further detail can be applied to the conceptual site model to provide a detailed interpretation on a site by site basis. As part of the planning process this approach is adopted to establish either if the site is 'suitable for use' or whether additional work or else remedial work is required for the site to be deemed so.

The sub-sections hereafter therefore incorporate the first tier (Tier 1) of this approach otherwise referred to as the Generic Quantitative Risk Assessment (GQRA). The GQRA builds on the qualitative risk assessment presented in the Phase 1 (1) in conjunction with observations made during the ground investigation and is based solely on the results of the chemical and other testing data obtained as part of Curtins Consulting's ground investigation.

The following sections present more detail on the risk assessment methodology rationale for the main receptors.

7.1 Human Health GQRA (Tier 1 Screening)

Detailed guidance on human health risk assessment is available within several documents, published by both the Environment Agency and Defra. Guidance includes Contaminated Land Exposure Assessment (CLEA) v1.07 model (7), Science Report 2 (8) and Science Report 3 (9).

A generic quantitative risk assessment (GQRA) has been carried out for the Potential Contaminant Linkages (PCLs) investigated by screening of soil contamination data against relevant Generic Assessment Criteria (GAC) where available, including:

i) **Soil Guideline Values (SGVs):** These have been published by the Environment Agency and are trigger values for screening out low risk areas of land contamination. SGV's give an indication of representative average concentrations of chemicals in soil, below which long-term health risks are likely to be minimal. SGVs have been published for several contaminants including arsenic, cadmium, mercury, nickel, selenium, BTEX, phenols and dioxins, furans and dioxin-like PCB substances for land uses including residential, allotments and commercial. The SGVs have been developed for a sandy loam soil with 6% soil organic matter (SOM) content;

ii) **Supplementary Screening Values:** In addition to the SGVs developed by the EA other third-party organisations have derived GACs for a wider range of contaminants and land uses using the CLEA Model. Curtins have adopted these numbers where applicable, including those developed by Atkins AtriskSoil™, the LQM/CIEH Suitable for Use Levels (S4UL) and EIC/AGS/CL:AIRE published thresholds.

iii) **Category 4 Screening Levels (C4SLs):** In March 2014 Defra published C4SLs for arsenic, benzene, benzo(a)pyrene, cadmium, hexavalent chromium and lead. These values were derived to support the revised Part 2A Statutory Guidance issued in 2012 (10) in which four categories of contaminated land are included, ranging from Category 1 (significant/high risk) to Category 4 (low risk). C4SLs are not representative of significant possibility of significant harm (SPoSH) and are low risk levels which, and therefore where the C4SLs are not exceeded, land can be demonstrated to be in Category 4 and cannot be determined as contaminated land.

The development proposals comprise the redevelopment of the site for 18no. low rise residential properties with private gardens and areas of general open space. The provision of private garden areas is illustrated on development plans current at the point of issue and therefore, generic screening criteria for a '*Residential with home-grown produce*' end use scenario has been adopted at this stage.

Details of the GAC's adopted for the GQRA are provided in Appendix D.

7.1.1 Soils

Representative samples of the Made Ground and Glacial Till (14 samples in total) were taken from exploratory holes across the site and tested for Curtins Suite A.

As discussed within the previous section, comparison of the soil analysis results has been undertaken against Generic Assessment Criteria (GAC) for a '*Residential with home-grown produce*' end-use scenario.

Soil organic matter (SOM) has a strong bearing on the availability of potential contaminants and therefore influences the GAC. The SOM typically ranged from 1.0% to 7.4%, with an average of 3.5%. As such, the comparison has been made against GACs developed for a sandy soil with an SOM of 2.5%.

The results of the environmental testing can be referred to in Appendix C. Copies of the adopted Tier 1 thresholds are contained within Appendix D.

With respect to the proposed end use of the site and the adopted generic screening criteria (*Residential with Homegrown Produce),* three out of the fifteen. tested exceeded the relevant GACs for PAHs and Arsenic.

Table 7.1.1 Summary of exceedances in environmental testing.

Contaminant	GAC (mg/kg)	Exceedance (mg/kg)	Location/Depth
Benzo(b)fluoranthene	3.3	9.4	WS05 – 0.2m bgl
Benzo(a)Pyrene	2.7	8.8	
Dibenz(a,h)Anthracene	0.28	0.62	
Arsenic	32	46	WS02 – 0.3m bgl
Asbestos	n/a	<0.001%	WS07 – 0.45

The identification of such concentrations at a shallow depth (<0.60m bgl), could present a potential risk to future site users through inhalation of dust and ingestion/dermal contact of soils should they remain at site surface.

7.1.2 Site Groundwater

Groundwater was encountered in four exploratory holes (WS02, CP02, CP03 and CP04), groundwater in WS02 was a perched groundwater body within the shallow, granular Made Ground. No evidence of gross visual or olfactory evidence contamination was noted within the groundwater.

Samples of groundwater were collected from monitoring installations at WS03, WS05, WS06, CP02 and CP04. When compared against the WSVs for residential land use, there are no exceedances.

As such based on the above, groundwater is not considered to represent a significant source of potential contamination and thus present a low risk to end users of the site.

7.2 Generic Quantitative Risk Assessment – Controlled Waters

Elevated concentrations of PAHs within WS03, WS05, WS06 & CP02. Concentrations are highest at close proximity to the area of the former USTs (WS03 and WS05). It is likely that this is localised contamination within a perched water body, with low potential for extensive off-site migration.

The primary risk this groundwater contamination poses, is to the nearby surface water feature, Pow Beck. The groundwater levels that have been monitored over time across site, display a gradual

groundwater gradient sloping to the south east. The highly cohesive ground conditions underlying the site will restrict the flow of water, and the surface water feature becomes culverted approximately 400m to the south east of the site. Due to the above, it is unlikely that this will pose a risk to Pow Beck.

As such based on the above, groundwater is not considered to represent a significant source of potential contamination and thus present a low risk to end users of the site.

The provision of the same PPE and sanitary facilities for construction workers with respect to soils quality is considered adequate to mitigate the potential risk presented by shallow groundwater encountered on site.

On this basis, no further investigation/assessment or specific remedial action is recommended.

7.3 Ground Gas – Qualitative Risk Assessment

The assessment of risk presented by ground gases is assessed with reference to guidance published by CIRIA (Assessing Risks Posed by Hazardous Ground Gases to Buildings, C665 (11), BSI Publication (Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings BS8485:2015 (12), BSI Publication (Guidance on Investigations for Ground Gas-Permanent gases and Volatile Organic Compounds (VOCs) (6) and other broadly accepted references such as the Ground Gas Handbook 2009 (13).

The gas risk assessment adopts a tiered approach. In the first instance this involves a re-evaluation of the Conceptual Site Model described within Section 3 and thereafter validating this conceptual model with the data from a ground investigation, with a further qualitative assessment.

7.3.1 Asphyxiant, Noxious or Explosive Gases

The Preliminary Conceptual Site Model (PCSM) presented within Section 3.0 noted the potential for gases to arise from the uncontrolled deposition of Made Ground.

The ground investigation encountered Made Ground on-site to a maximum depth of 3.60m bgl with natural deposits consisting of sandy gravelly clays and silts overlying Siltstone bedrock encountered from depths of between 8.10 to 9.30 mbgl.

The Made Ground deposits identified as the primary source of on-site ground gas, were encountered across the site and were found to contain evidence of putrescible or degradable material. With reference to BS 8576:2013, this material would be considered to have a very low gas generation potential.

To confirm the ground gas regime on site and validate the qualitative assessment of ground gas risk, standpipe installations were incorporated within six exploratory borehole locations as detailed in Table 4.3 within Section 4.0.

A programme of six gas monitoring visits was proposed. Gas and groundwater level monitoring has been undertaken on the following five occasions: 26th April 2018, 10th May 2018, 29th May 2018, 7th June 2018 and 19 June 2018. The remaining visit will be undertaken in due time, this will then be released as a gas addendum to this report. Gas monitoring visits were undertaken during a steady atmospheric pressure state, with barometric pressure ranging from 1007 to 1013 mb.

A summary of the soil gas monitoring results to date is presented in Table 7.3.1 below and copies of the log sheets presented in Appendix A3.

Table 7.3.1 *Summary of Soil Gas Monitoring Results*

Borehole Reference	Flow (l/hr)		CO_2 Range (% $^{vol}/_{vol}$)	CH_4 Range (% $^{vol}/_{vol}$)	O2 Range (% $^{vol}/_{vol}$)	Response Zone Strata Description(s) Principal strata in capitals
	Max	SS				
WS03	0.40	0.40	<0.10 – 1.60	<0.10	9.70 – 21.60	Response zone 1.0 – 4.0m bgl.
WS04	0.00	0.00	<0.10 – 0.20	<0.10	20.00 – 20.50	Response zone 1.00 – 4.00m bgl.
WS05	0.00	0.00	<0.10 – 2.70	<0.10	20.30	Response zone 1.00 – 4.00m bgl.
WS06	0.00	0.00	<0.10 – 2.10	7.00	1.00-11.40	Response zone 1.00 – 4.00m bgl.
CP02	0.00	0.00	<0.10 – 0.40	<0.10	20.00 – 20.80	Response zone 5.00 – 8.00m bgl.
CP03	0.00	0.00	<0.10 – 0.20	<0.10	20.40 – 21.90	Response zone 5.50 – 9.00m bgl
CP04	0.00	0.00	<0.10 – 0.40	<0.10	20.30 – 21.50	Response zone 5.50 – 9.00m bgl

Maximum concentrations of carbon dioxide and methane were recorded at 4.80 and 7.00 % $^{vol}/_{vol}$ respectively. These ground gas concentrations are consistent with the very low gassing potential of the on-site ground gas sources, i.e. shallow Made Ground (<5.00 m deep) with low degradable organic matter content.

A maximum, absolute, steady state soil gas flow rate of 0.40 l/hr was determined.

Considering both a 'worst credible scenario' (maximum 'absolute' flow rate, maximum gas concentration within a single borehole location) and 'worst possible scenario' (maximum 'absolute' flow rate, maximum gas concentration across all borehole locations) the Hazardous Gas Flow Rates (Q_{hg}) for the Site are evaluated as 0.0192(carbon dioxide) and 0.028 (methane).

The calculated Q_{hg} values can be directly equated to Gas Screening Values (GSVs) and indicate the Site to fall within a Characteristic Situation (CS1 – Very Low Risk) classification or, with respect to the NHBC traffic light system, a Green classification. As such, the provision of ground gas protection measures is not recommended within the proposed developments. However, elevated levels of CO2 and CH4 in WS06 on the 4th visit; these elevated values are significant enough to increase the Characteristic Situation from CS1 to CS2/Amber 2 with respect to the NHBC traffic light system.

Due to the elevated methane levels being encountered in the same location, it is recommended that the ground gas protection measures associated with the Amber 2 classification are only adopted in proposed residential plots within the footprint of the garage and USTs to the south of the site.

7.3.2 Radon

The Envirocheck Report (1) confirms the site is situated in a radon area less than 1% of homes are at or above the action level.

On this basis, basic radon protection measures are required within the proposed development.

8.0 Revised Conceptual Site Model

The preliminary conceptual site model (PCSM) presented and discussed in Section 3.0 of this report has been revised following the GQRA in Section 7.0 above. The revised Conceptual Site Model (CSM) is presented in the table below.

The CSM details the source-pathway-receptor linkages or potential contaminant linkages (PCL) that have been identified for the site. The GQRA details the associated level of risk relating to these potential contaminant linkages.

The CSM concerns risk to human health and Water Environment with additional, more specific risk assessment protocols contained within the main body of this reporting as detailed in Section 8.1 below.

The CSM follows the framework outlined within CIRIA C552 which is summarised within Appendix E.

The 'risk rating' within the CSM refers to the risk that the source, pathway, receptor linkage or PCL is complete. Unless specifically stated it does not necessarily refer to an immediate risk and is intended to be used as a tool to assess the necessity for further assessment/investigation.

8.1 Additional Risk Assessments

The following risk assessments, listed below, are not included within the main CSM and GQRA but none-the-less can be of critical importance to the onward development of the site.

The risk presented by **Mining** is assessed in Section 6.2.

The risk presented by **Unexploded Ordnance** is assessed in 9.6.2.

The risk from **Radon** is assessed in Section 7.3.2.

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk. It has been assumed that any future construction works on site will be undertaken in compliance with these requirements and therefore construction workers involved in the building works at the site have been discounted as a human receptor in the conceptual site model. Reference should be given to the environmental testing results discussed within Section 7.1 and presented within Appendix A3.

- The table below represents the first stage in the land quality risk assessment process; **the Generic Quantitative Risk Assessment**.
- For a development site to be deemed 'suitable for use' the level of risk needs to be brought down to acceptable levels, i.e. low to very low risk. The purpose of each stage of risk assessment is ultimately to establish if there is a requirement for additional levels of assessment to be made to have sufficient confidence to support a risk characterisation or management decision, e.g. remedial action.

Conceptual Site Model			Qualitative Risk Assessment			Action
Source	**Pathway(s)**	**Receptor(s)**	**Consequence (Potential Severity)**	**Likelihood of Occurrence**	**Risk Rating**	
Exceedances of PAHs and Lead of above the adopted GACs (*Residential with home-grown produce end use*) were recorded within the Made Ground material.	**Direct contact, ingestion, inhalation (dust and vapours)**	**End users of site** Residents, staff (commercial extension), trespassers and visitors.	**Medium** Chronic health risk	**Low** The identification of such PAH, Arsenic and Asbestos concentrations within the Made Ground material at a shallow depth (<0.60m bgl), could present a potential risk to future site users through inhalation of dust and ingestion/dermal contact of soils should they remain at site surface. As such, it is recommended that remedial action is undertaken to negate the current potential risk to future site users and reduce overall risk to Low.	**Moderate / Low**	**1.** Capping of Made Ground soils in areas of soft landscape with clean, imported fill. **2.** Confirmation of no further 'unsuitable' material being present on site through visual inspection.
No Exceedances of WSVs for groundwater encountered within perched water body within Made Ground material surrounding area of former UST.	**Vertical migration through the Made Ground and Glacial Till** May occur due to processes including; capillary action, burrowing animals inducing soil mixing and downwards into the natural deposits through infiltration.	**Controlled waters** Bedrock – Secondary A Aquifer Not within a SPZ No groundwater abstractions within 500 m of the site.	**Medium** Pollution of a sensitive water resources	**Unlikely** In light of the findings of the ground investigation; the overall limited nature of contamination revealed on site, it is considered unlikely to present a risk to controlled waters.	**Low**	No further action required
Elevated levels of methane within WS06, likely associated with Made Ground/USTs	**Vertical and horizontal migration through the Made Ground and fractured bedrock deposits**	**End users of site** Residents, staff, trespassers and visitors	**Severe** Acute health risk, e.g. asphyxiation or risk from explosion	**Low** Based on the results of the ground investigation, the majority of the site is not at risk from ground gas (Green NHBC classification). However due to the elevated levels of methane identified within WS06, the NHBC classification for this area of the site has been increased to Amber 2 which will enforce the requirement for gas protection measures.	**Moderate**	Plot specific gas protection measures required. See Section 10.2.

9.0 Geotechnical Assessment

9.1 Structural Design Details

It is understood that the main proposed development is to comprise of a total of total of 18no. low rise residential buildings with private landscaped gardens, access roads, and public areas of soft landscaping.

The proposed masterplan, at the point of issue, is presented in Appendix A.

The main design considerations are therefore identified as follows;

- Low imposed loads on the main structures;
- Very soft clays at depths of between 1m – 7m;
- A deep bedrock profile across site (>8m bgl.);
- Proximity of surrounding structures and sub-surface features, e.g. existing utility alignments, retaining walls and adjacent buildings;
- Floor slab options;
- Earthworks appraisals – materials classification and practicalities of material on-site; and,
- Materials management, e.g. suitability of existing soils for re-use on site and waste classification of existing soils.

9.2 Ground Conditions

The generalised geological succession is outlined in Section 6.0 and copies of the exploratory hole logs presented within Appendix B.

In general, the revealed ground model was consistent with the historical use of the site and recorded geological succession.

Made Ground extended from the surface to average depths of 1.27m mbgl, with localised deepening to depths of 3.6m bgl. The unit predominately comprised a general fill (cohesive and granular) adjacent to buildings and existing roadways, thereafter Glacial Till soils were encountered consisting of gravelly clays. Intact bedrock was encountered from 8.1m bgl to 9.3m bgl consisting of a grey siltstone.

Characteristic values for the different strata revealed on site are tabled overleaf.

9.2.1 Made Ground

The Made Ground deposits are characterised by granular strata with various anthropogenic material across the site with the following properties:

Topsoil	Minimum	Maximum	Mean
Made Ground (m)	0.1	3.6	1.27
pH Value	7.2	11.7	8.3
Water Soluble Sulphate Content (mg/l)	27.7	492	162.6

9.2.2 Glacial Till

The Glacial Till deposits are characterised by granular strata with various anthropogenic material across the site with the following properties:

Glacial Till	Minimum	Maximum	Mean
pH Value	6	8.9	7.3
Water Soluble Sulphate Content (mg/l)	16.5	183	68
N Values (Density)	0	44	8.2 (very Dense)
Approximate Undrained Shear Strengths (derived from N x empirical value of 4.5)	0	198	36.9
Moisture Content	12	30	24.9
Liquid Limit	26	56	35.2
Plastic Limit	16	26	19.2
Plasticity Index	12	30	20

9.2.3 Bedrock

The bedrock deposits were only encountered in 3no. exploratory holes (CP02 – CP04) as a grey siltstone. SPT's undertaken on the bedrock produced values more than 50, CP02 – CP04 were terminated on the siltstone bedrock.

9.3 Foundation Design

Foundation selection for the proposed 18no. low rise residential buildings is guided by the following key factors;

- The low imposed loads associated with the residential buildings;
- Buildability (preference for a single foundation solution where feasible);
- The presence of very soft shallow clays across the site;
- Sloping development plots;

With reference to these factors, it is recommended that building loads are taken down onto a consistent formation stratum comprising the bedrock deposits.

At this stage it is recommended that consideration is given to the adoption of piled foundations to support the **proposed residential properties**.

General advice on piled foundations is presented in Section 9.3.1.

9.3.1 Piled Foundations

For piled foundations specific attention should also be given to:

- The requirement for piling platforms across varying topography.
- The presence of 'hard' bedrock deposits that may warrant the adoption of a rotary bored pile to achieve target depths.
- The presence of very soft clays across site may warrant temporary casing.

In general, it is recommended that for piled foundations are advanced into sufficient uniform bedrock strata that will result in typical end bearing depths of between 8.50 to 9.50 mbgl across the site.

Given the evolving nature of pile design and pile technology it is recommended that a specialist contractor is commissioned to undertaken detailed design of the piles. The following commentary is therefore offered as preliminary guidance with respect to their design.

Pile Type: Considering the ground conditions revealed an augured, e.g. Continuous Flight Auger (CFA), piled solution is considered likely to be favorable the residual gravels and weak to strong sandstone, would preclude the adoption of a driven pile solution. The 'strong' sandstone bands will need to be assessed as a potential constraint to a CFA piled system with rotary boring an alternative option.

The use of a non-standard, small piling rig may be preferable given the anticipated short pile length, low loads, presence of shallow and deep utility alignments and requirement for piling platforms across development plots with sloping/varied topography.

Potential Obstructions: Relic and existing on-site utilities are noted as potential obstructions.

Temporary Casing: Very soft clays were encountered across the site. The use of temporary casing shall be at the discretion of the piling specialist.

Piling Platforms: In their current condition, the site shallow soils across the development site are not considered suitable to support the load of a traditional piling rig. As noted previously, the use of a smaller, non-standard piling rig may result in sufficiently low loads that the adoption of a temporary platform may not be necessary. In either instance, earthworks will be required to ensure a level development platform.

Environmental Risk: Given the overall quality of the site soils and nature of the low levels of potential contamination encountered (predominantly polycyclic aromatic hydrocarbons of low mobility) the risk associated with the generation of preferential pathways through the adoption of a piled foundation solution is assessed as low for all pile systems/types.

9.4 Ground Floor Slabs

The ground floor slabs across the **proposed residential properties** are likely to require suspending to account for the adoption of a piled foundation solution.

9.4.1 Ground Gas Protection Measures

The provision of basic radon protection measures is not recommended within the proposed residential properties. Additionally, ground gas protection measures are required in plots across the south of the site. Where the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

9.5 Settlement and Heave Considerations

With reference to the proposed shallow foundation solution and presumed bearing capacity provided stated within Section 9.3.1, settlement will be limited to acceptable levels (<25mm).

With reference to the proposed piled foundation solution settlement levels should be limited to tolerable levels as agreed with the Structural Engineer.

9.6 Excavations

General advice on excavation support is given in CIRIA Report No 97: Trenching Practice (14).

Based on observations on site, together with the results of in-situ and laboratory tests, it is considered likely that most shallow excavations will stand unsupported in the short term within areas of shallow Made Ground and Glacial Till.

Shallow excavations in certain areas of the site are likely to encounter very granular Made Ground and an existing concrete slab which conventional excavation methods are likely to struggle to advance through the material, with the potential requirement for 'breaking out' or ripping of material to aid advancement.

Side support for safety purposes should be provided to all excavations which appear unstable and those more than 1.20 m deep, in accordance with Health and Safety Regulations. Excavations below 1.20 m requiring personnel access will require closed side support.

9.6.1 Groundwater Control

General advice on de-watering is given in CIRIA Report No C515: Groundwater Control (15).

Groundwater was encountered across the site as a perched water body with the Made Ground. Additionally, deeper groundwater bodies were encountered in CP02 and CP04 within the Glacial Till at 5.6m bgl and 6.3m bgl

9.6.2 Unexploded Ordnance

A Preliminary Unexploded Ordnance Risk Assessment has not been completed for this investigation. Based on review of historical maps and UXO risk maps, it has been concluded that there is a low likelihood of UXO being encountered on site as part of the ground investigation or development works but recommended the provision of toolbox talks for all groundworks operatives.

In any event, the following procedure should be adopted should any unexploded ordnance be encountered on site: **stop work immediately, prevent access to the area and inform the police**.

9.6.3 Re-use of Site Soils

It is assumed that re-use of soils will be considered as part of the development works but that, in general, proposed development levels will necessitate the removal and disposal of a portion of arisings off site.

Based on the environmental testing, and proposed development plans, in general, there is no specific reason for the site soils to be removed from site. However, due to the presence of asbestos and elevated PAHs and lead within the Made Ground, and the granular nature of the material, it is unsuitable for use within areas of soft landscaping and private gardens. Therefore, the import of clean soils will be required. These materials should be used to construct all soft

landscaping areas and private gardens, where they overly areas of Made Ground. In areas of the site underlying roads, hardstanding, and buildings, there is no requirement to remove the Made Ground.

In addition to quality, the re-use of site-won soils is governed by the following principles: i) the geotechnical suitability of the material needs to be confirmed; ii) the re-use of the material needs to be covered as part of the planning approval, e.g. site levels maintained within agreed limits; iii) the volume of the material being re-used needs to be confirmed and traceable and iv) regulatory approval from the relevant authorities has been sought.

These principles are outlined within the CL:AIRE Code of Practice (v2) and if and where the re-use of site-won soils is proposed as part of the development works it is recommended that a Materials Management Plan is produced in line with the Code of Practice to detail and document the process.

9.6.4 Waste Classification of Soils

It is the responsibility of the contractor and/or their appointed groundworks contractor to confirm waste classifications of soils requiring disposal off site.

Where any site soils are to be disposed of off-site guidance on the disposal of contaminated soils is provided within the following documents published by the Environment Agency.

a) Guidance on the classification and Assessment of Waste Technical Guidance WM3 (1st Edition 2015) (16).

Guidance states that the principal contractor (or any other sub-contractor undertaking excavations) should, in conjunction with the proposed disposal facility, use where possible the relevant environmental chemistry analyses results to classify any surplus material identified for off-site disposal. However, it should be noted that this information is for guidance only and material identified for disposal should be tested and assessed in accordance with WM3 to enable classification during the works.

An initial assessment for the waste classification of the Made Ground and natural soils encountered on site has been carried out through a comparison of the soil testing results using the Waste Soils Characterisation Assessment Tool, Cat-Waste^{Soil}, developed by M^{c}Ardle and Atkins. This online tool gives a rapid assessment of contaminated soils and their classification as either hazardous or non-hazardous waste.

The initial CAT Waste assessment has revealed that the majority of the Made Ground soils may be considered non-hazardous waste for off-site disposal as a preliminary classification. However, one soil sample (WS03, 0.3m) is classified as hazardous as it exceeded values with respect to pH.

As discussed preliminary waste classification is undertaken to offer indicative advice with respect to disposal requirements. Furthermore, landfill operators are not obliged to accept waste and, if they were to do so, may have specific requirements beyond those outlined above prior to acceptance. WAC testing will be required for the disposal as hazardous or inert waste.

9.7 Concrete Design

In accordance with BRE Special Digest 1 (17) the site has been classified as 'brownfield land unlikely to contain pyrite' and laboratory testing undertaken accordingly within the Made Ground and natural deposits.

The results of chemical tests in the Made Ground and bedrock deposits indicate sulphate concentrations in the soil of <0.50 g/l as a 2:1 water/soil extract.

pH values were found to be in the range of 7.20 to 7.8 for the Made Ground.

pH values were found to be in the range of 4.80 to 7.80 for the Glacial Till soils.

It is recommended that the groundwater should be regarded as mobile for shallow ground conditions.

The Made Ground and natural deposits tested, fall within DS-1, AC-1s classification category and as such it is recommended that the concrete should be designed accordingly.

9.8 Roads and Hard-standing Design

In-situ CBR testing was undertaken in 3 No. locations across site in the form of plate load testing from depths up to 0.60m bgl, with testing sheets presented in Appendix C.

Based on site observations, it is recommended that: a CBR value of no more than 4% is adopted for preliminary design purposes. This should be confirmed through testing prior to road and hard-standing design and localised soft spots should be expected.

As the Made Ground is variable it is suggested that the formation be proof rolled prior to the installation of the required sub-base layers. It is recommended that with proof rolling higher CBR values may be achievable, where required this should be confirmed with additional testing.

In general, any areas of soft or deleterious material in the site shallow soils should be excavated and replaced with a properly compacted granular fill to suit both road and hard-standing design as well as other ground bearing structures.

9.9 Soakaways

Soil infiltration testing was undertaken as part of the ground investigation.

Two soakaway tests were undertaken in the north of the site (SA1, SA2). Neither of the two tests achieved any significant infiltration, with a maximum loss of head of 50mm over 24 hours. Full records of the soakaway testing are available in Appendix C.

Based on the findings of ground investigation, it is considered that the infiltration potential of the site shallow soils will not exhibit suitable infiltration characteristics that allow for the adoption of soakaways.

Consideration could be given to the adoption of deep infiltration systems (boreholes installed into the bedrock deposits) however, again, the viability for infiltration drainage will need to be assessed on a system-by-system the cost of which may preclude their adoption.

10.0 Conclusions & Recommendations

10.1 Conclusions

10.1.1 Ground Model

In general, the revealed ground model was consistent with the historical use of the site and recorded geological succession. Made Ground extended from the surface to average depths of 1.27 mbgl, with localised deepening to depths of 3.60 mbgl in areas, however deeper Made Ground deposits comprised a reworked Glacial Till. The Made Ground predominately comprised a dark grey to black gravel, thereafter Glacial Till soils were encountered consisting of gravelly clays and very soft silts. Intact bedrock was typically encountered from 8.60 mbgl comprising a grey siltstone.

10.1.2 Risk Assessments

A revised tabulated Conceptual Site Model (CSM) has been derived following the findings on the Generic Quantitative Risk Assessment and is presented in Section 8.0.

The risk to future site users is, in general, assessed as Low with respect to a *Residential with Homegrown Produce* end use.

The Made Ground across site contained elevated concentrations of Polycyclic Aromatic Hydrocarbons (PAHs), lead and asbestos was identified and assessed as unacceptable for use within soft landscaping areas of the proposed development (moderate risk). It was therefore recommended that these soils were capped with clean, imported soils, in areas of soft landscaping and private gardens.

The risk to controlled waters is assessed as Low based on the findings of the ground investigation.

The risk presented by ground gases is assessed as Green in the north of the site, and Amber 2 in the south of the site. Additionally, no radon protection measures are required.

10.1.3 Geotechnical Considerations

It is recommended that consideration is given to the adoption of piled foundations to support the structural loads of the proposed residential properties due to the very soft site-wide clays that cause the adoption of shallow foundations to be unfeasible.

10.2 Recommendations

With reference to the foregoing conclusions the following recommendations are made for both the development works and final, end use of the site.

Geotechnical recommendations are presented within Section 9.0.

10.2.1 Risk Mitigation Measures – Development Works

- **Provision of appropriate PPE and sanitary facilities**

  As detailed within Section 8.1 it is recommended that construction workers are provided with appropriate PPE and sanitary facilities with reference to the environmental testing results presented herein.

- **UXO risk**

  The likelihood of encountering UXO on site is assessed as low, however it is recommended that toolbox talks for all groundwork operatives and appropriate management strategies are adopted with the latter clearly laid out within the site Health and Safety File.

- **Ground Gas Risk**

  Due to 'Amber 2' NHBC classification due to elevated methane levels, ground gas protection measures are required in plots across the south of the site, in the area of the garage and its associated car park and USTs.

10.2.2 Risk Mitigation Measures – End Use

- **Removal of Unsuitable Made Ground Soils across site and disposal to suitably licensed off-site facility**

  Owing to the low volume of unsuitable material across site it is considered that this work can be completed by the groundworks contractor under supervision by a suitably qualified engineer without the requirement for a specific remedial strategy. Supervision of the works by a suitably qualified engineer is recommended to satisfy the requirement for provision of documented evidence that this work has been completed to a satisfactory standard.

- **Verification of Site Won and Imported Materials**

  If and where any imported soils, i.e. Topsoil or sub-soil, are proposed within the development then adequate and appropriate verification testing will be needed to demonstrate that the material is 'suitable for use'. The advice of a suitably qualified

engineer should be sought and specific requirements of local planning authority, i.e. YALPAG, followed.

- **Unforeseen Contamination**

  A strategy for dealing with unforeseen contamination is presented in Appendix F.

10.2.3 Follow-on Works and Reporting

The requirement for specific, follow-on reporting, i.e. Phase 3 Remediation Strategy, is not recommended owing to the low-level nature of the recommended risk mitigation works and outline strategies detailed herein (Section 10.2.1 and 10.2.2).

- **Completion Report**

  It is however recommended that a Completion Report is compiled to serve as a record of the foregoing risk mitigation actions having been completed satisfactorily.

11.0 References

1 **Curtins** *Banner Cross Hall Redevelopment, Phase 1 Preliminary Site Assessment.*January 2018

2 **Environment Agency (EA)** *Model Procedures for the Management of Land Contamination, Contaminated Land Report (CLR) 11* September 2004

3 **British Standard Institution (BSI)** *Investigation of Potentially Contaminated Sites (report no. BS10175)* 2011

4 **British Standards (BS)** *BS5930, Code of practice for site investigations* 2010

5 **British Standards Institution***Eurocode 7: Geotechnical Design (report no. BS EN 1997* 2006

6 **British Standards (BS)** *BS8576, Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs)* 2013

7 **Environment Agency***Contamined Land Exposure Assessment (CLEA) v.1.07 Model*September 2009

8 *Human health toxicological assessment of contaminants in soil. Science report 2.*January 2009

9 *Updated technical background to the CLEA model. Science Report 3*January 2009

10 **Department for Food, Environment and Rural Affairs (DEFRA)***Environmental Protection Act 1990: Part 2A* 2012

11 **CIRIA** *CIRIA C665, Assessing risk posed by hazardous grounbd gases to buildings*December 2007

12 **British Standards***BS 8485, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*June 2015

13 **S.Wilson, G.Card and S.Haines***Ground Gas Handbook*2009

14 **CIRIA** *CIRIA Report 97 - Trenching Practice - Second Edition*November 1992

15 **CIRIA** *CIRIA Report No C515 Groundwater Control* 2001

16 **Environment Agency** *Guidance on the classification and assessment of waste (1st edition 2015). Technical Guidance WM3*May 2015

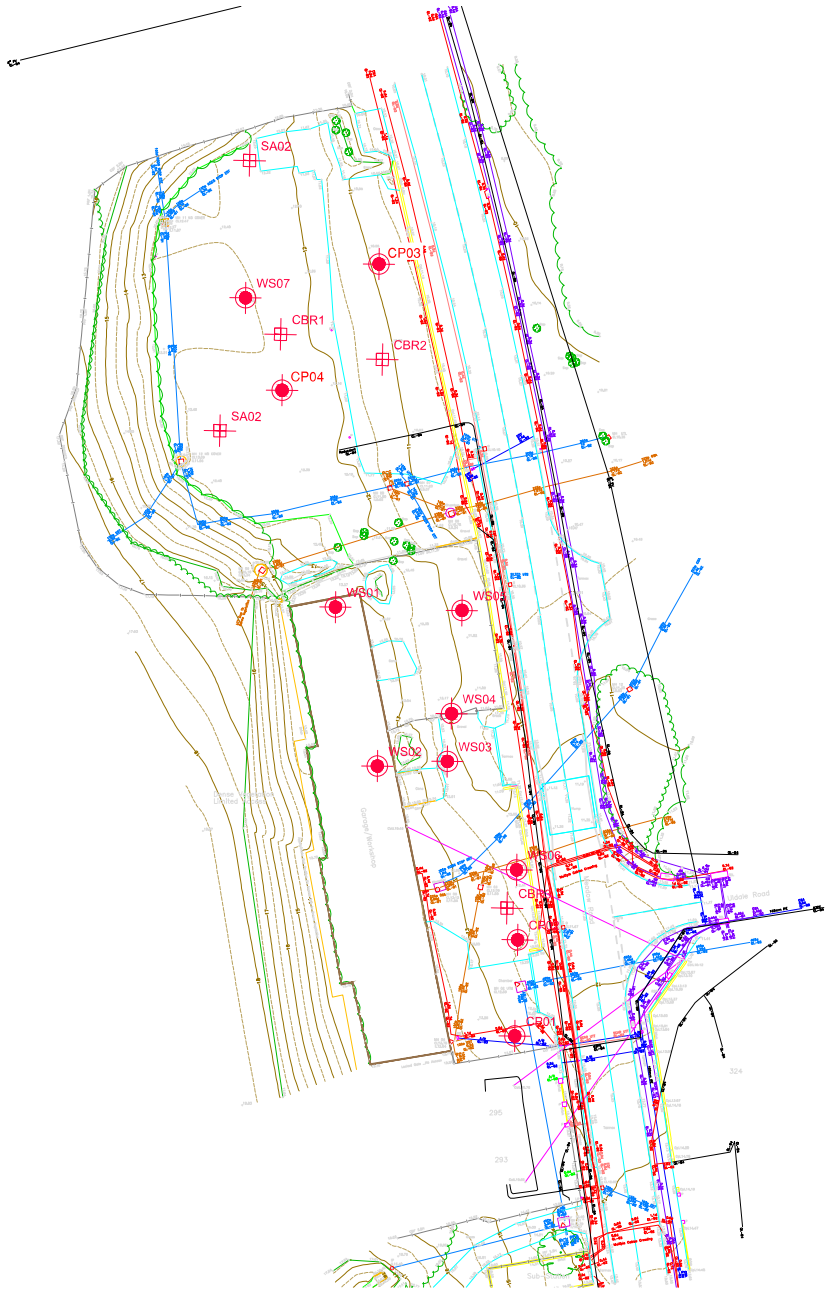
17 **BRE** *BRE Special Digest 1 (SD1:2005), Concrete in aggresive ground, 3rd Edition* 2005

Appendices

Appendix A - Drawings
Appendix B - Exploratory Hole Logs
Appendix C - Laboratory Testing & Monitoring Results
Appendix D - Tier 1 Thresholds
Appendix E - Qualitative/Quantitative Risk Assessment Rationale
Appendix F - Strategy for Dealing with Unforeseen Contamination

Appendix A – Drawings

- 067381-CUR-00-XX-DR-GE-001 - Exploratory Hole Location Plan.



Machine excavated Trial Pits and CBR's

Exploratory Borehole Locations

Rev:	Description:	Date:	By:	Chkd:

curtins

Curtins Consulting Ltd,
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
www.curtins.com

Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status: INFORMATION

Project: MEADOW ROAD, WHITEHAVEN

Drg Title: BOREHOLE LOCATION PLAN

Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	02/07/18	ST	JJ

Drg No: 067983-CUR-00-XX-DR-GE-80-002-V01_EHLP

Rev: V01

Location Plan Housing Site Meadow Road, Mirehouse, Whitehaven. scale 1:2500

This drawing is for the sole purpose of obtaining copeland borough council planning approval 1:2500

PCL DEVELOPMENTS

28 Foxhouses Rd
Whitehaven
Cumbria
CA28 8AF

HOUSING DEVELOPMENT AT MEADOW ROAD MIREHOUSE SCHEME 2.

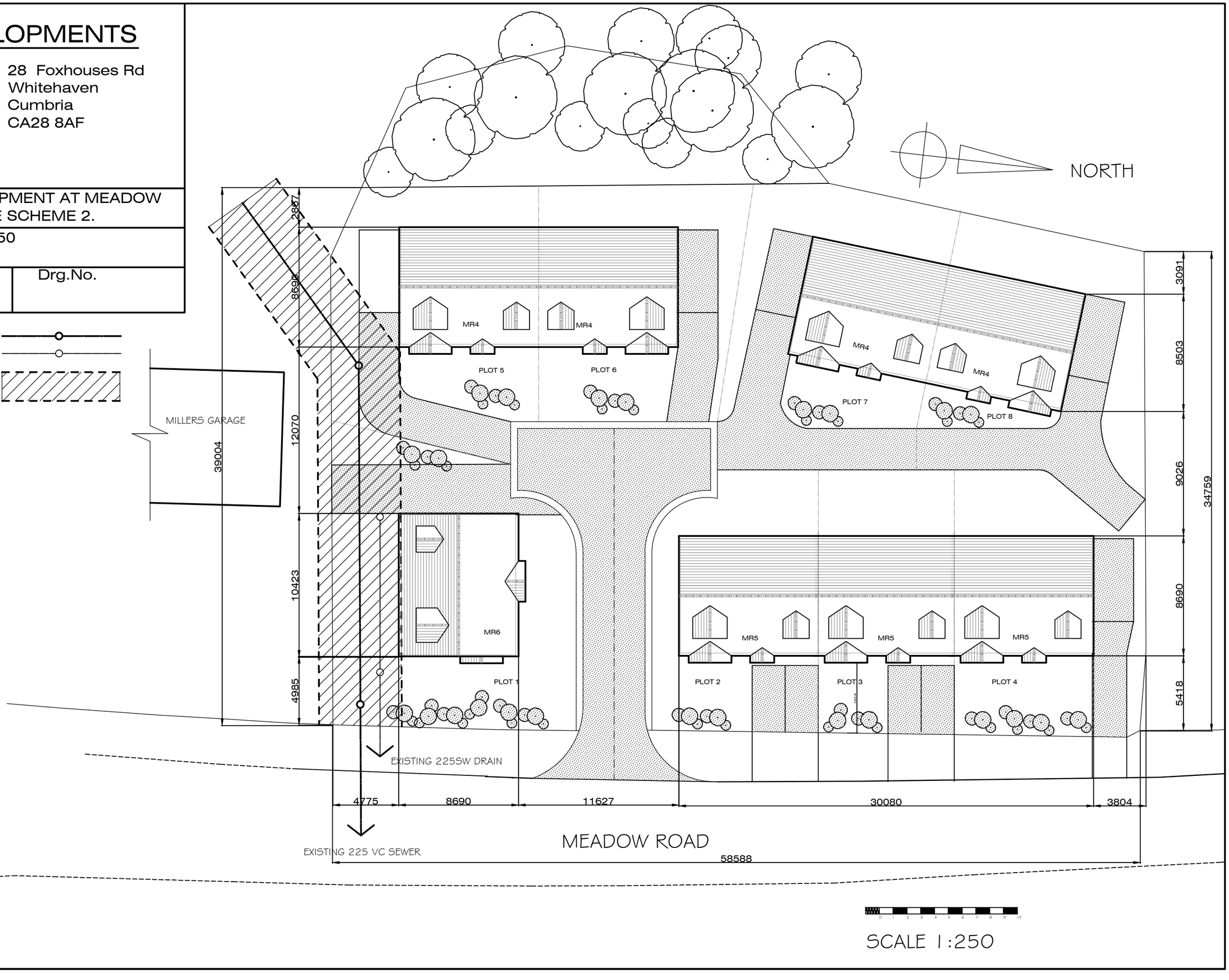
Site Layout 1.250

Date:	Drg.No.

EXISTING 225 VC SEWER

EXISTING 225 SW DRAIN

6.0M EASMENT PARTIALLY ON ADJOINING OWNERS LAND WITH OWNERS APPROVAL / PERMISSION



SCALE 1:250

Quality Assessment: Question 1

Meadow Road | Mirehouse

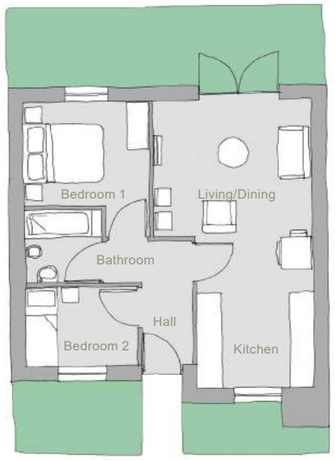
Please provide sketch layouts of the sites considering, local context, arrival, where you envisage key points, character area and how this will integrate with the surrounding areas.

home group

P+HS architects

Mini Tender Bid Submission
8 November 2017

ENTRANCE GATEWAY



TYPICAL INTERNAL LAYOUT

CHARACTER AND PLACE

The new scheme creates a delightful entrance to the existing estate, revitalising the public realm and improving the current streetscape.

A series of dwelling types create new, low rise, intimately scaled streets to improve connectivity across the estates, overlooking of public space and security.

Importantly, the proposals aim to respect the existing homes around the site, enhancing the established community rather than imposing on it.

The aesthetic of the new dwellings takes inspiration from the existing character whilst injecting a modern aesthetic to revitalise the streetscape and provide an exemplar for any further development to the estate.

New layout of intimately scaled dwellings reinforce the edges of public spaces, with new high quality landscaping to bring routes down to street level.

Each dwelling makes best use of natural daylight and its orientation.

Each unit has two bedrooms, kitchen with large window and a living room that opens out onto a landscaped rear garden.

Principle windows where possible look in to the gardens providing private view for inhabitants

Arrangement of internal layout allows for visual connections across the site increasing natural surveillance

Communal parking areas are within direct access from the highway and provide turning for vehicles to avoid having a through route for cars

Gateway entrance with linked green spaces. Active frontages and ramped entrance definies access to the site

Linear arrangement creates a strong new sense of arrival into the community with views of the green space opposite

Street and building form will respond to the existing linear street frontage rather than replicate building forms

Individual gardens break up the site and further allow personal ownership of the site by individual inhabitants

Positioning of dwellings re-activates the street frontage enhancing the visual appearance of the site and surrounding landscape

Orientation creates a permeability to the site, reducing the overlooking to surrounding area

SITE LAYOUT PLAN

Quality Assessment: Question 2

Meadow Road | Mirehouse

Please provide an indication of which typologies you think are appropriate for this scheme.

T 01 DWELLING FORM

T 02 DWELLING FORM

T 01 DWELLING FORM

T 02 DWELLING FORM

T 01 DWELLING FORM

T 02 DWELLING FORM

TYPOLOGIES

The proposals will include two house types, characterised by brick chimneys and pitched roofs. The dwellings have been designed so that they can be rotated on site to respond to size, aspect and topography.

The aesthetic of the dwellings reference typical suburban typologies whilst utilising a contemporary design with traditional materials and proportions.

Dwellings with a large chimney define the new development and create a strong aesthetic along the existing street frontage. Dwellings without chimneys complement these dwellings in both scale and arrangement.

Within the site the dwellings can either been arranged as a pair or singular elements providing a permeable site layout with intrigue and variety.

The dwellings consist of a living room, kitchen, bathroom and two bedrooms arranged within. This arrangement has been designed to take advantage of the site's features including, daylight, views and access.

The landscaping within the site intends to provide the dwellings with individual private gardens as well as small incidental places for the community to meet.

home group

P+HS architects

Mini Tender Bid Submission
8 November 2017

SITE LAYOUT AERIAL PERSPECTIVE

Quality Assessment: Question 3

Meadow Road | Mirehouse

Please could you please provide a brief account of any relevant expertise you may have working within this area.

home group

P+HS architects

Mini Tender Bid Submission
8 November 2017

PREVIOUS WORK

P+HS Architects has worked in the residential sector for over 30 years. As such we have extensive experience in Masterplanning new residential neighbourhoods, and have undertaken schemes involving both the development of new urban extensions on greenfield sites and the regeneration of existing urban areas.

Some of these projects involve only the design and development of new housing, but the majority have included a mix of uses often involving working in partnership with both residential and commercial developers.

Front Elevation

Side Elevation

Side Elevation

SCARBOROUGH

This new development consists of 20 single storey dwellings across two sites in Scarborough, North Yorkshire. The dwellings have simple plan forms, continuing the tradition of the flat fronted houses found in the Scarborough villages, This enables them to be used to enclose and define spaces, building a series of frontages that will structure the layout and combine with the soft and hard landscaping to create an attractive public realm.

Generally the feeling is urban and informal. On road frontages and face to face distances are generally kept close enough to give an appropriate sense of enclosure in the public realm.

In keeping with Scarborough villages historical vernacular barge boards and soffits will be painted or stained to follow the design principles of the wider site. The elevational treatments are simple and robust with window heads and cills being constructed in art stone or brick soldier courses.

RICHMOND HOUSE

This new development of 12 houses and 8 apartments in the historic market town of Richmond, North Yorkshire is developed for private sale. As the site is of particularly high value: close to the town and with exceptional views over historic gardens and the valley to the river Swale, it has been developed wholly for private sale, facilitating the extension to affordable housing developed elsewhere in the town.

The scheme comprises a mix of two and three bed apartments and terraced and detached houses varying in size from three to five beds. To the south of the site a row of houses is created in the style of a Georgian terrace, set into the slope giving two storeys to the north side and three to the south. These units are oriented east to west affording south facing gardens and views over the Grade II listed Temple Grounds Park and valley beyond. The south of the site is subject to a covenant and will be retained as green space in the form of a communal orchard area. The apartments are located along the northern edge of the site and a mews is created between the apartments and housing which is typical of other areas in the town and will help to create an inhabited space with an identity responding to the urban context.

In keeping with the surroundings, traditional materials and detailing are used: random limestone with sawn ashlar stone around entrances, slate roofs with water tables emphasising the rhythm of the buildings and lead flashings.

OSMOTHERLEY

Westfields is a small residential development on a rural exception site on the edge of the village of Osmotherley, in the North York Moors National Park. The scheme is the result of several years of endeavour by the housing association, architects, local councils and the community to address an acute shortage of affordable homes in the area.

Once agreement had been reached on the site, community consultation events were held in Osmotherley to inform and involve immediate neighbours and the wider community in the design process from the start.
The site is a sensitive one right at the entrance to the village, offering the opportunity for a new gateway. The design comprises two apartments and ten houses arranged to form a strong ‘L’ shape at the site entrance and a courtyard behind.

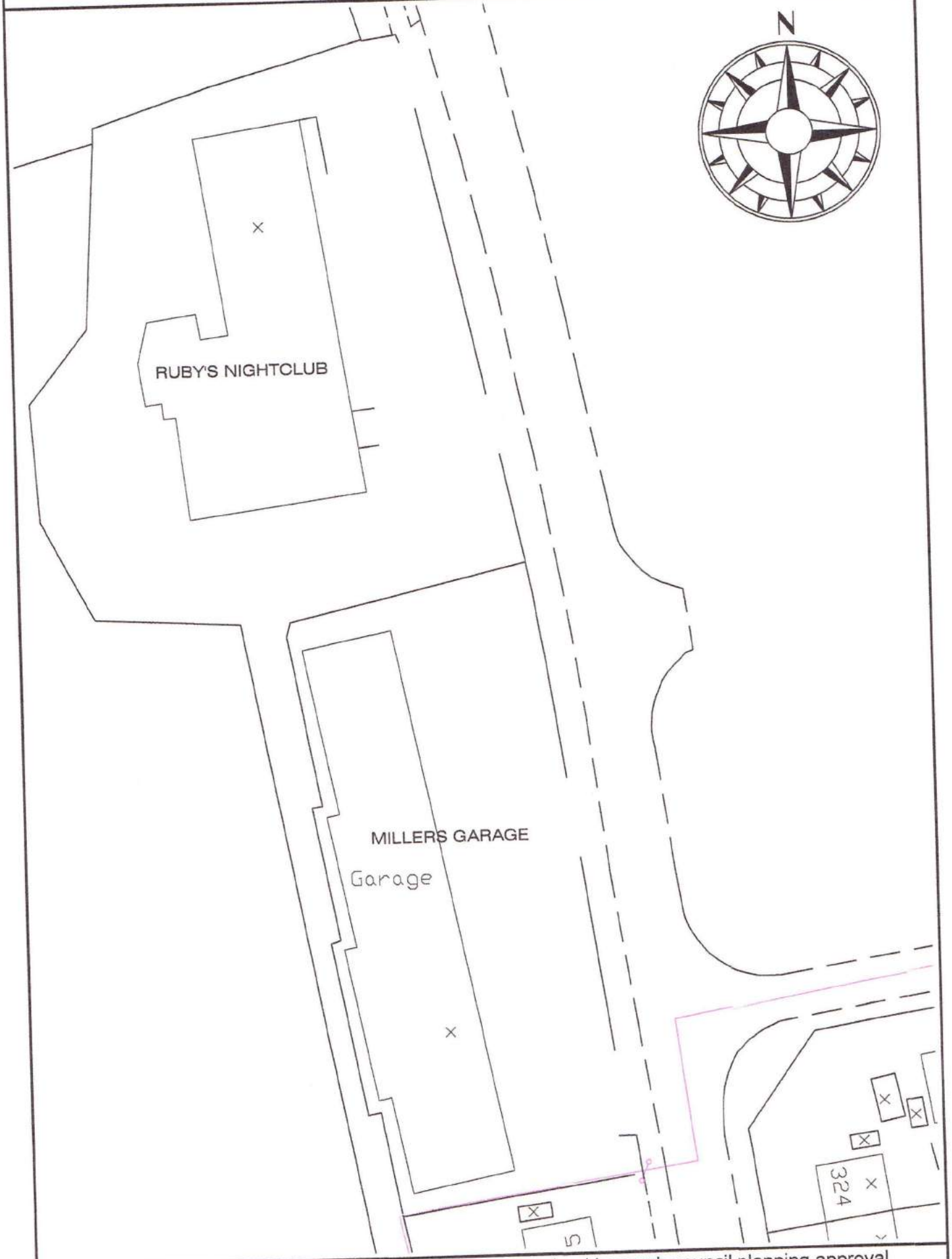
The scale, massing and design is intended to reflect the historic village vernacular of residential and agricultural buildings, with formal ‘farmhouses’ standing over ‘converted barns’ constructed predominantly in etched stonework and clay pantiles, with brickwork, stone lintels and timber lintels, boarding and windows.

Internal layouts were designed to make good use of space and maximise natural light and ventilation. Layouts were discussed with potential occupants, with ‘open plan’ and ‘traditional cellular’ options being adopted in roughly equal numbers. The open plan option in particular was able to benefit with extra daylight from the large ‘barn door’ window openings.
Westfields has been selected as one of the best examples in its sector by Inside Housing as one of the top 50 affordable housing developments of 2014.

land at Meadow Road, formerly Ruby's Nightclub and Millers Garage. 1.1250

This drawing is for the sole purpose of obtaining copeland borough council planning approval

land at Meadow Road, formerly Ruby's Nightclub and Millers Garage. 1.500



This drawing is for the sole purpose of obtaining copeland borough council planning approval

Appendix B – Exploratory Hole Logs

- Windowless Sampling Logs.
- Cable Percussive Logs
- Trial Pit Logs

Borehole Log

Borehole No. **WS01**

Sheet 1 of 1

Project Name: Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297748.00 - 516331.00	Hole Type Windowless Sampling
Location: Whitehaven, Cumbria		Level: 18.00	Scale 1:50
Client: Home Group		Dates: 04/04/2018 - 04/04/2018	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.17	17.83		Concrete. (MADE GROUND).
		0.30	ES		0.45	17.55		Dense dark grey and orange very sandy very clayey angular concrete and sandstone GRAVEL. (MADE GROUND).
		1.00	D					Light brown to brown mottled orange and occasionally grey very sandy gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal and shale. (GLACIAL TILL).
		1.20		N=24 (3,4/5,6,6,7)				
					1.55	16.45		
					1.65	16.35		Light brown to brown mottled orange and occasionally grey very sandy clayey fine to medium angular coal GRAVEL. (GLACIAL TILL).
		1.80	D		1.90	16.10		
		2.00		N=19 (3,3/4,4,5,6)				Light brown to brown mottled orange and occasionally grey very sandy gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal and shale. (GLACIAL TILL).
					2.60	15.40		
		3.00		N=2 (1,0/1,0,1,0)	3.00	15.00		Light brown to brown mottled orange and occasionally grey very sandy gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal. Rare white coarse grained angular sandstone cobbles. (GLACIAL TILL).
		3.30	D					
		4.00		N=2 (1,0/0,0,1,1)				Light grey to grey mottled orange very sandy gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal. (GLACIAL TILL).
								Very soft grey very sandy SILT/CLAY. (GLACIAL TILL).
		5.00		N=3 (1,0/0,0,1,2)	5.00	13.00		End of borehole at 5.00 m

Remarks

AGS

Borehole Log

Borehole No. **WS02**

Sheet 1 of 1

Project Name:	Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297753.00 - 513311.00
Location:	Whitehaven, Cumbria		Level: 18.00
Client:	Home Group		Dates: 04/04/2018 - 04/04/2018

Hole Type: Windowless Sampling

Scale: 1:50

Logged By:

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.07	17.93		Concrete. (MADE GROUND).
					0.50	17.50		Dense to very dense red and black fine to coarse subangular to angular GRAVEL of concrete, sandstone and whole bricks with brick fragments. (MADE GROUND).
								End of borehole at 0.50 m

Remarks

Borehole Log

Borehole No. **WS03**

Sheet 1 of 1

Project Name: Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297763.00 - 516311.00	Hole Type Windowless Sampling
Location: Whitehaven, Cumbria		Level: 17.00	Scale 1:50
Client: Home Group		Dates: 04/04/2018 - 04/04/2018	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.10	16.90		Dense black angular sandstone GRAVEL. (MADE GROUND).
		0.70	D					Firm orange and brown mottled grey very sandy very gravelly CLAY with rare white coarse grained angular sandstone cobbles. (GLACIAL TILL).
		1.20		N=17 (2,3/4,4,4,5)				
		2.00		N=4 (1,0/1,2,0,1)	2.10	14.90		Very soft grey very sandy SILT/CLAY. (GLACIAL TILL).
		2.30	ES					
		2.70 - 3.20	B					
		3.00		N=0 (1,0/0,0,0,0)				
					4.00	13.00		End of borehole at 4.00 m

Remarks

AGS

Borehole Log

Borehole No. **WS04**

Sheet 1 of 1

Project Name:	Meadow Road, Whitehaven	Project No. B067983	Co-ords:	297762.00 - 516320.00	Hole Type Windowless Sampling
Location:	Whitehaven, Cumbria		Level:	17.00	Scale 1:50
Client:	Home Group		Dates:	05/04/2018 - 05/04/2018	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	ES					Black and grey sandy very clayed fine to coarse angular GRAVEL of brick, sandstone and concrete. (MADE GROUND).
		1.00	ES					
		1.20		N=14 (2,4/4,3,3,4)	1.30	15.70		
		1.50	D					Dense dark grey and orange very sandy very clayey angular concrete and sandstone GRAVEL. (MADE GROUND).
		2.00		N=4 (1,0/1,2,0,1)				
		2.50	D		2.30	14.70		Very soft grey very sandy SILT/CLAY. (GLACIAL TILL).
		3.00		N=0 (1,0/0,0,0,0)				
					4.00	13.00		End of borehole at 4.00 m

Remarks

Borehole Log

Borehole No. **WS05**

Sheet 1 of 1

Project Name:	Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297765.00 - 516335.00
Location:	Whitehaven, Cumbria		Level: 17.00
Client:	Home Group		Dates: 05/04/2018 - 05/04/2018

Hole Type: Windowless Sampling

Scale: 1:50

Logged By:

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.10	16.90		Dense black slightly clayey fine to coarse angular brick, concrete and sandstone GRAVEL. (MADE GROUND).
		0.50	ES		0.40	16.60		Dense red angular GRAVEL. (MADE GROUND).
		1.20	D					Firm brown to light brown very sandy slightly gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal and shale. (GLACIAL TILL).
		1.20		N=4 (1,0/0,0,2,2)				
		2.00		N=4 (1,1/1,1,1,1)	2.10	14.90		Very soft grey very sandy SILT/CLAY. (GLACIAL TILL).
		2.50	D					
		3.00		N=0 (1,0/0,0,0,0)				
					4.00	13.00		End of borehole at 4.00 m

Remarks

Borehole Log

Borehole No. **WS06**

Sheet 1 of 1

Project Name:	Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297739.00 - 516383.00
Location:	Whitehaven, Cumbria		Level: 16.00
Client:	Home Group		Dates: 05/04/2018 - 05/04/2018

Hole Type: Windowless Sampling

Scale: 1:50

Logged By:

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.10	15.90		Dense dark grey slighy sandy GRAVEL of concrete, brick and tarmacadam. (MADE GROUND).
		0.80	ES					Firm black mottled grey very sandy slightly gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal and shale with rare brick fragments. (MADE GROUND).
		1.20		N=6 (1,0/0,0,3,3)	1.30	14.70		
		1.50	D					Light grey to grey mottled orange very sandy gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal. (GLACIAL TILL).
		2.00		N=10 (1,1/2,2,3,3)	2.10	13.90		
		2.40	D					Very soft orange and grey very sandy SILT/ CLAY. (GLACIAL TILL).
		3.00		N=3 (1,0/0,1,1,1)				
					4.00	12.00		End of borehole at 4.00 m

Remarks

Borehole Log

Borehole No. **WS07**

Sheet 1 of 1

Project Name:	Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297739.00 - 516383.00
Location:	Whitehaven, Cumbria		Level: 17.00
Client:	Home Group		Dates: 05/04/2018 - 05/04/2018

Hole Type: Windowless Sampling

Scale: 1:50

Logged By:

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.45	ES		0.80	16.20		Dense black slightly clayey fine to coarse angular brick, concrete and sandstone GRAVEL. (MADE GROUND).
		1.20		N=14 (3,3/3,3,4,4)	1.00	16.00		Firm black mottled grey very sandy slightly gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal and shale with rare brick fragments. (MADE GROUND).
		1.50	D		1.30	15.70		Light grey to grey mottled orange very sandy gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal. (GLACIAL TILL).
		2.00		N=3 (1,1/0,1,1,1)				Very soft orange and grey very sandy SILT/ CLAY. (GLACIAL TILL).
		3.00		N=1 (1,0/0,0,0,1)	3.00	14.00		End of borehole at 3.00 m

Remarks

Rose Wharf
Ground Floor
Leeds
L29 8EE
T. 0151 726 2000
leeds@curtins.com

Borehole Log

Borehole No.
CP01
Sheet 1 of 1

Project Name: Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297771.00 - 516276.00	Hole Type Cable Percussion
Location: Whitehaven, Cumbria		Level: 13.00	Scale 1:50
Client: Home Group		Dates: 10/04/2018 - 10/04/2018	Logged By LD

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.15	12.85		MADE GROUND: Concrete.
					0.25	12.75		MADE GROUND: Dense red angular GRAVEL.
								MADE GROUND: Firm black mottled grey very sandy slightly gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal and shale with rare brick fragments.
					1.20	11.80		End of borehole at 1.20 m

Remarks

AGS

Rose Wharf
Ground Floor
Leeds
L29 8EE
T. 0151 726 2000
leeds@curtins.com

Borehole Log

Borehole No.
CP02
Sheet 1 of 1

Project Name: Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297771.00 - 516291.00	Hole Type Cable Percussion
Location: Whitehaven, Cumbria		Level: 12.20	Scale 1:50
Client: Home Group		Dates: 11/04/2018 - 12/04/2018	Logged By ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.15	12.05		MADE GROUND: Concrete.
								MADE GROUND: Soft grey yellow and orange with rare red mottling gravelly sandy CLAY. Gravel is fine angular to subrounded sand is fine to coarse contains elliptical fragments of black subrounded siltstone. (Reworked)
		1.20 1.20 - 1.65	D	N=1 (0,1/0,0,1,0)				
		1.80	D					
		2.00 2.00 - 2.45	D	N=6 (1,1/2,1,1,2)				
		2.70	B					
		3.00 3.00 - 3.45	D	N=2 (0,1/0,1,0,1)	2.80	9.40		Soft yellow very sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded siltstone and sandstone. Sand is fine to medium.
		3.80	D		3.20	9.00		Very soft to soft grey very sandy silty CLAY. Sand is fine.
		4.00 4.00 - 4.45	D	N=5 (1,0/1,1,1,2)				
		4.60	B		4.40	7.80		Firm to stiff blueish grey very sandy very gravelly CLAY. Gravel is fine to coarse rounded to subangular siltstone. Sand is fine to coarse.
		5.00 5.00 - 5.95	D	N=18 (3,3/4,6,4,4)				
		6.00	D					*Becomes very stiff at 6.0m*
		6.50 6.50 - 6.95	D	N=44 (5,6/10,10,12,12)				
		7.50	B					
					8.10	4.10		End of borehole at 8.10 m

Remarks

AGS

Rose Wharf
Ground Floor
Leeds
L29 8EE
T. 0151 726 2000
leeds@curtins.com

Borehole Log

Borehole No.
CP03
Sheet 1 of 1

Project Name: Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297739.00 - 516366.00	Hole Type Cable Percussion
Location: Whitehaven, Cumbria		Level: 12.30	Scale 1:50
Client: Home Group		Dates: 11/04/2018 - 11/04/2018	Logged By ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	12.10		MADE GROUND: Concrete.
								MADE GROUND: Dense red very clayey sandy GRAVEL. Gravel is angular fine to coarse.
		1.20 1.20 - 1.60	D	N=4 (1,0/1,1,1,1)				
		2.00 2.00 - 2.45	D	N=11 (2,3/3,3,3,2)	1.90	10.40		MADE GROUND: Soft to firm grey mottled yellow and red sandy very gravelly CLAY. Gravel is fine to coarse subrounded to angular siltstone and rare clinker fragments, sand is fine to coarse.
		2.80	B		2.40	9.90		MADE GROUND: Firm brown gravelly sandy CLAY. Gravel is fine to coarse rounded angular mudstone and siltstone. (Reworked).
		3.00 3.00 - 3.45	D	0 (,/,,,)				
		3.60	D		3.60	8.70		Very soft yellowish grey sandy silty CLAY with rare fine gravels of mixed lithologies.
		4.00 4.00 - 4.45	D	N=2 (0,0/0,1,1,0)				
		4.80	D					
		5.00 5.00 - 5.45	D	N=0 (1,0/0,0,0,0)				
	▼	5.60	B					
		6.50 6.50 - 6.95	D	N=13 (3,3/3,3,4,3)	6.50	5.80		Firm to stiff blueish grey very gravelly sandy CLAY. Gravel is fine to medium angular to subrounded sandstone and siltstone.
		7.30	D					
		8.00 8.00 - 8.45	D	N=19 (3,5/5,3,5,6)				
								Becomes very stiff below 8.5m
		9.30 9.30 - 9.75	D	0 (75 for 85mm/,,,)	9.30	3.00		End of borehole at 9.30 m

Remarks

AGS

Rose Wharf
Ground Floor
Leeds
L29 8EE
T. 0151 726 2000
leeds@curtins.com

Borehole Log

Borehole No.
CP04
Sheet 1 of 1

Project Name: Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297754.00 - 516377.00	Hole Type Cable Percussion
Location: Whitehaven, Cumbria		Level: 10.95	Scale 1:50
Client: Home Group		Dates: 10/04/2018 - 10/04/2018	Logged By ST

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		1.20	ES					MADE GROUND: Greyish brown sandy clayey GRAVEL of mixed lithologies. Gravel is fine to coarse with angular cobbles throughout.
		1.20		N=4 (1,1/0,1,1,2)				
		1.20 - 1.65	D					
		1.50	D					
		2.00		N=4 (1,1/1,1,1,1)	2.00	8.95		
		2.00 - 2.45	D					Very soft greyish yellow and orange very silty slightly sandy CLAY. (Possibly reworked).
		3.00	B		3.00	7.95		
		3.00		0 (,/,,,)				Very soft blueish grey silty slightly sandy CLAY. Sand is fine.
		3.00 - 3.45	D					
		4.00		N=3 (0,0/1,1,1,0)				
		4.00 - 4.45	D					
		4.50	D					
		5.00		N=3 (0,1/0,1,1,1)				
		5.00 - 5.45	D					
		5.50	B					
		6.00	D					
	▼	6.20	D		6.20	4.75		Stiff to very stiff blueish grey very gravelly CLAY. Gravel is fine to coarse rounded to angular of mudstone. *At 6.5m occasional rounded Siltstone cobbles.*
		6.80		N=30 (3,3/6,6,6,12)				
		6.80 - 7.25	D					
		8.20	B					
		8.50		N=34 (3,5/8,10,8,8)				
		8.50 - 8.95	D					
	▼	9.20	D		9.20	1.75		End of borehole at 9.20 m
		9.20		0 (75 for 15mm/,,,)				

Remarks

AGS

Trial Pit Log

Trialpit No
SA2
Sheet 1 of 1

Project Name: Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297737.00 - 516392.00 Level: 12.30	Date 03/04/2018
Location: Whitehaven, Cumbria		Dimensions (m): Depth 1.80	Scale 1:25
Client: Home Group			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dense grey and red coarse angular GRAVEL of concrete and bricks, fragmented and whole. Plastics and metal rebar throughout. Angular concrete and brick cobbles also present. (MADE GROUND).
				1.00	11.30		Grey mottled orange sandy very gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal and shale. (GLACIAL TILL).
				1.80	10.50		End of pit at 1.80 m

1
2
3
4
5

Remarks:

Stability:

Trial Pit Log

Trialpit No
SA1
Sheet 1 of 1

Project Name: Meadow Road, Whitehaven	Project No. B067983	Co-ords: 297733.00 - 516346.00 Level: 12.50	Date 03/04/2018
Location: Whitehaven, Cumbria		Dimensions (m): Depth 1.40	Scale 1:25
Client: Home Group			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dense grey and red coarse angular GRAVEL of concrete and bricks, fragmented and whole. Plastics and metal rebar throughout. Angular concrete and brick cobbles also present. (MADE GROUND).
				0.75	11.75		Grey mottled orange sandy gravelly CLAY. Gravel is primarily fine to medium subangular sandstone with occasional fine and medium angular coal and shale. (GLACIAL TILL).
				1.40	11.10		End of pit at 1.40 m

Remarks:

Stability:

Appendix C – Laboratory and Monitoring Results

- Environmental Testing Results;
- Geotechnical Testing Results; and,
- In-situ CBR Testing Results.
- Gas Monitoring Results
- Soakaway Results

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 731144-1

Date of Report: 27-Apr-2018

Customer: Curtins Consulting Ltd.
17-19 Whitworth Street West
Manchester
M1 5WG

Customer Contact: Mr Samuel Thomas

Customer Job Reference: B067983
Customer Purchase Order: TBCEBMA1195
Customer Site Reference: White Haven
Date Job Received at Concept: 20-Apr-2018
Date Analysis Started: 23-Apr-2018
Date Analysis Completed: 27-Apr-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

Report checked and authorised by :
Aleksandra Pacula
Senior Customer Service Advisor

Issued by :
Aleksandra Pacula
Senior Customer Service Advisor

Concept Reference: 731144
Project Site: White Haven
Customer Reference: B067983

Water Analysed as Water
Curtins Water Suite 1

				Concept Reference	**731144 001**	**731144 002**	**731144 003**	**731144 004**	**731144 005**
				Customer Sample Reference	**WS06**	**CP02**	**WS05**	**WS03**	**CP04**
				Top Depth	**1.9**	**3.0**	**1.42**	**1.6**	**1.1**
				Date Sampled	**19-APR-2018**	**19-APR-2018**	**19-APR-2018**	**19-APR-2018**	**19-APR-2018**
				Sample Received (ml)	**2000**	**2000**	**2000**	**2000**	**2000**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
As (Dissolved)	T281	F	0.2	µg/l	**0.9**	**1.5**	**1.4**	**1.0**	**1.2**
Cd (Dissolved)	T281	F	0.02	µg/l	**0.06**	**0.04**	**0.02**	<0.02	**0.03**
Cr (Dissolved)	T281	F	1	µg/l	<1	**4**	<1	**4**	<1
Cu (Dissolved)	T281	F	0.5	µg/l	**0.5**	<0.5	<0.5	**4.1**	<0.5
Pb (Dissolved)	T281	F	0.3	µg/l	<0.3	<0.3	<0.3	<0.3	<0.3
Hg (Dissolved)	T281	F	0.05	µg/l	<0.05	<0.05	<0.05	<0.05	<0.05
Ni (Dissolved)	T281	F	1	µg/l	**4**	**4**	**6**	**2**	**1**
Se (Dissolved)	T281	F	0.5	µg/l	**2.9**	**6.6**	**0.8**	**13**	<0.5
Zn (Dissolved)	T281	F	2	µg/l	**6**	**6**	**13**	**6**	**5**
B (Dissolved)	T373	AR	0.01	mg/l	**0.16**	**0.09**	**0.10**	**0.13**	**0.10**
Cyanide(Total)	T4	AR	0.05	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05
Hardness expressed as CaCO3	T6	AR	10	mg/l	**150**	**180**	**160**	**97**	**190**
pH	T7	AR			**7.34**	**7.64**	**6.54**	**7.47**	**7.41**
Sulphate	T686	F	0.5	mg/l	**53**	**14**	**34**	**85**	**1.1**
Sulphide	T4	AR	0.05	mg/l	<0.05	<0.05	<0.05	**0.06**	**0.06**

Concept Reference: 731144
Project Site: White Haven
Customer Reference: B067983

Water Analysed as Water
Curtins Water Suite 1

				Concept Reference	**731144 006**
				Customer Sample Reference	**CP03**
				Top Depth	**4.7**
				Date Sampled	**19-APR-2018**
				Sample Received (ml)	**2000**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
As (Dissolved)	T281	F	0.2	µg/l	**1.8**
Cd (Dissolved)	T281	F	0.02	µg/l	<0.02
Cr (Dissolved)	T281	F	1	µg/l	<1
Cu (Dissolved)	T281	F	0.5	µg/l	**0.6**
Pb (Dissolved)	T281	F	0.3	µg/l	<0.3
Hg (Dissolved)	T281	F	0.05	µg/l	<0.05
Ni (Dissolved)	T281	F	1	µg/l	<1
Se (Dissolved)	T281	F	0.5	µg/l	<0.5
Zn (Dissolved)	T281	F	2	µg/l	**6**
B (Dissolved)	T373	AR	0.01	mg/l	**0.10**
Cyanide(Total)	T4	AR	0.05	mg/l	<0.05
Hardness expressed as CaCO3	T6	AR	10	mg/l	**170**
pH	T7	AR			**7.63**
Sulphate	T686	F	0.5	mg/l	**3.9**
Sulphide	T4	AR	0.05	mg/l	**0.07**

Concept Reference: 731144
Project Site: White Haven
Customer Reference: B067983

Water Analysed as Water
PAH USEPA16

				Concept Reference	**731144 001**	**731144 002**	**731144 003**	**731144 004**	**731144 005**
				Customer Sample Reference	**WS06**	**CP02**	**WS05**	**WS03**	**CP04**
				Top Depth	**1.9**	**3.0**	**1.42**	**1.6**	**1.1**
				Date Sampled	**19-APR-2018**	**19-APR-2018**	**19-APR-2018**	**19-APR-2018**	**19-APR-2018**
				Sample Received (ml)	**2000**	**2000**	**2000**	**2000**	**2000**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Naphthalene	T149	AR	0.01	µg/l	(13) **0.03**	(13) **0.13**	(13) **0.19**	(13) **0.40**	(13) <0.01
Acenaphthylene	T149	AR	0.01	µg/l	(100,13) <0.02	(13) <0.01	(13) **0.05**	(13) **0.60**	(13) <0.01
Acenaphthene	T149	AR	0.01	µg/l	(100,13) <0.02	(13) **0.02**	(13) **0.17**	(13) **2.4**	(13) **0.01**
Fluorene	T149	AR	0.01	µg/l	(13) **0.04**	(13) **0.06**	(13) **0.13**	(13) **1.1**	(13) **0.02**
Phenanthrene	T149	AR	0.01	µg/l	(13) **0.29**	(13) **0.22**	(13) **0.67**	(13) **7.0**	(13) **0.08**
Anthracene	T149	AR	0.01	µg/l	(13) **0.04**	(13) **0.01**	(13) **0.20**	(13) **2.3**	(13) <0.01
Fluoranthene	T149	AR	0.01	µg/l	(13) **0.35**	(13) **0.11**	(13) **2.6**	(13) **31**	(13) **0.01**
Pyrene	T149	AR	0.01	µg/l	(13) **0.33**	(13) **0.11**	(13) **2.2**	(13) **26**	(13) **0.01**
Benzo(a)Anthracene	T149	AR	0.01	µg/l	(13) **0.20**	(13) **0.07**	(13) **1.4**	(13) **19**	(13) **0.01**
Chrysene	T149	AR	0.01	µg/l	(13) **0.25**	(13) **0.11**	(13) **1.3**	(13) **16**	(13) **0.02**
Benzo(b)fluoranthene	T149	AR	0.01	µg/l	(13) **0.23**	(13) **0.09**	(13) **1.6**	(13) **18**	(13) **0.01**
Benzo(k)fluoranthene	T149	AR	0.01	µg/l	(13) **0.18**	(13) **0.07**	(13) **1.3**	(13) **15**	(13) **0.01**
Benzo(a)Pyrene	T149	AR	0.01	µg/l	(13) **0.20**	(13) **0.08**	(13) **1.7**	(13) **19**	(13) **0.01**
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	(13) **0.16**	(13) **0.07**	(13) **1.3**	(13) **13**	(13) **0.01**
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	(13) **0.05**	(13) **0.02**	(13) **0.30**	(13) **3.3**	(13) <0.01
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	(13) **0.23**	(13) **0.16**	(13) **1.4**	(13) **13**	(13) **0.02**
PAH(total)	T149	AR	0.01	µg/l	**2.6**	**1.3**	**16**	**190**	**0.22**

Concept Reference: 731144
Project Site: White Haven
Customer Reference: B067983

Water Analysed as Water
PAH USEPA16

				Concept Reference	**731144 006**
				Customer Sample Reference	**CP03**
				Top Depth	**4.7**
				Date Sampled	**19-APR-2018**
				Sample Received (ml)	**2000**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Naphthalene	T149	AR	0.01	µg/l	(13) **0.01**
Acenaphthylene	T149	AR	0.01	µg/l	(13) <0.01
Acenaphthene	T149	AR	0.01	µg/l	(13) <0.01
Fluorene	T149	AR	0.01	µg/l	(13) <0.01
Phenanthrene	T149	AR	0.01	µg/l	(13) **0.04**
Anthracene	T149	AR	0.01	µg/l	(13) <0.01
Fluoranthene	T149	AR	0.01	µg/l	(13) **0.01**
Pyrene	T149	AR	0.01	µg/l	(13) **0.01**
Benzo(a)Anthracene	T149	AR	0.01	µg/l	(13) **0.01**
Chrysene	T149	AR	0.01	µg/l	(13) **0.02**
Benzo(b)fluoranthene	T149	AR	0.01	µg/l	(13) **0.01**
Benzo(k)fluoranthene	T149	AR	0.01	µg/l	(13) **0.01**
Benzo(a)Pyrene	T149	AR	0.01	µg/l	(13) **0.01**
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	(13) **0.01**
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	(13) <0.01
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	(13) **0.02**
PAH(total)	T149	AR	0.01	µg/l	**0.16**

Concept Reference: 731144
Project Site: White Haven
Customer Reference: B067983

Water Analysed as Water
TPH (CWG) with MTBE, BTEX

				Concept Reference	**731144 001**	**731144 002**	**731144 003**	**731144 004**	**731144 005**
				Customer Sample Reference	**WS06**	**CP02**	**WS05**	**WS03**	**CP04**
				Top Depth	**1.9**	**3.0**	**1.42**	**1.6**	**1.1**
				Date Sampled	**19-APR-2018**	**19-APR-2018**	**19-APR-2018**	**19-APR-2018**	**19-APR-2018**
				Sample Received (ml)	**2000**	**2000**	**2000**	**2000**	**2000**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Benzene	T54	AR	1	µg/l	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1
Toluene	T54	AR	1	µg/l	**1**	**1**	<1	**1**	<1
EthylBenzene	T54	AR	1	µg/l	<1	<1	<1	<1	<1
M/P Xylene	T54	AR	1	µg/l	<1	<1	<1	<1	<1
O Xylene	T54	AR	1	µg/l	<1	<1	<1	<1	<1
Methyl tert-Butyl Ether	T54	AR	1	µg/l	<1	<1	<1	<1	<1
TPH (C5-C6 aliphatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C6-C8 aliphatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C8-C10 aliphatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C10-C12 aliphatic)	T910	AR	0.01	mg/l	**(13) 0.01**	(13) <0.01	(13) <0.01	(100,13) <0.10	(13) <0.01
TPH (C12-C16 aliphatic)	T910	AR	0.01	mg/l	**(13) 0.01**	**(13) 0.01**	**(13) 0.01**	(13,100) <0.10	(13) <0.01
TPH (C16-C21 aliphatic)	T910	AR	0.01	mg/l	**(13) 0.02**	**(13) 0.03**	**(13) 0.03**	**(13) 0.24**	(13) <0.01
TPH (C21-C35 aliphatic)	T910	AR	0.01	mg/l	**(13) 0.02**	(13) <0.01	**(13) 0.21**	**(13) 1.8**	(13) <0.01
TPH (C6-C7 aromatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C7-C8 aromatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C8-C10 aromatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C10-C12 aromatic)	T910	AR	0.01	mg/l	**(13) 0.06**	(13) <0.01	(13) <0.01	(13,100) <0.10	(13) <0.01
TPH (C12-C16 aromatic)	T910	AR	0.01	mg/l	**(13) 0.19**	**(13) 0.02**	**(13) 0.01**	(100,13) <0.10	(13) <0.01
TPH (C16-C21 aromatic)	T910	AR	0.01	mg/l	**(13) 0.05**	**(13) 0.01**	**(13) 0.03**	(13,100) <0.10	(13) <0.01
TPH (C21-C35 aromatic)	T910	AR	0.01	mg/l	(13) <0.01	**(13) 0.02**	**(13) 0.04**	(100,13) <0.10	(13) <0.01

Concept Reference: 731144
Project Site: White Haven
Customer Reference: B067983

Water Analysed as Water
TPH (CWG) with MTBE, BTEX

				Concept Reference	**731144 006**
				Customer Sample Reference	**CP03**
				Top Depth	**4.7**
				Date Sampled	**19-APR-2018**
				Sample Received (ml)	**2000**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Benzene	T54	AR	1	µg/l	(13) <1
Toluene	T54	AR	1	µg/l	<1
EthylBenzene	T54	AR	1	µg/l	<1
M/P Xylene	T54	AR	1	µg/l	<1
O Xylene	T54	AR	1	µg/l	<1
Methyl tert-Butyl Ether	T54	AR	1	µg/l	<1
TPH (C5-C6 aliphatic)	T215	AR	0.010	mg/l	<0.010
TPH (C6-C8 aliphatic)	T215	AR	0.010	mg/l	<0.010
TPH (C8-C10 aliphatic)	T215	AR	0.010	mg/l	<0.010
TPH (C10-C12 aliphatic)	T910	AR	0.01	mg/l	(13) <0.01
TPH (C12-C16 aliphatic)	T910	AR	0.01	mg/l	(13) <0.01
TPH (C16-C21 aliphatic)	T910	AR	0.01	mg/l	(13) <0.01
TPH (C21-C35 aliphatic)	T910	AR	0.01	mg/l	(13) <0.01
TPH (C6-C7 aromatic)	T215	AR	0.010	mg/l	<0.010
TPH (C7-C8 aromatic)	T215	AR	0.010	mg/l	<0.010
TPH (C8-C10 aromatic)	T215	AR	0.010	mg/l	<0.010
TPH (C10-C12 aromatic)	T910	AR	0.01	mg/l	(13) <0.01
TPH (C12-C16 aromatic)	T910	AR	0.01	mg/l	(13) <0.01
TPH (C16-C21 aromatic)	T910	AR	0.01	mg/l	(13) <0.01
TPH (C21-C35 aromatic)	T910	AR	0.01	mg/l	(13) <0.01

Index to symbols used in 731144-1

Value	Description
AR	As Received
F	Filtered
100	LOD determined by sample aliquot used for analysis
13	Results have been blank corrected.
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

These samples have been analysed exceeding recommended holding times for pH. It is possible therefore that the results provided may be compromised.
Samples submitted for GC/MS (Headspace) analysis were submitted in inappropriate containers. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T149	GC/MS (SIR)
T6	ICP/OES
T4	Colorimetry
T215	GC/MS (Headspace)(LV)
T686	Discrete Analyser
T910	GCxGC (LV)
T281	ICP/MS (Filtered)
T373	ICP/OES (Filtered)
T7	Probe
T54	GC/MS (Headspace)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
As (Dissolved)	T281	F	0.2	µg/l	U	001-006
Cd (Dissolved)	T281	F	0.02	µg/l	U	001-006
Cr (Dissolved)	T281	F	1	µg/l	U	001-006
Cu (Dissolved)	T281	F	0.5	µg/l	U	001-006
Pb (Dissolved)	T281	F	0.3	µg/l	U	001-006
Hg (Dissolved)	T281	F	0.05	µg/l	U	001-006
Ni (Dissolved)	T281	F	1	µg/l	U	001-006
Se (Dissolved)	T281	F	0.5	µg/l	U	001-006
Zn (Dissolved)	T281	F	2	µg/l	U	001-006
B (Dissolved)	T373	AR	0.01	mg/l	N	001-006
Cyanide(Total)	T4	AR	0.05	mg/l	U	001-006
Hardness expressed as CaCO3	T6	AR	10	mg/l	N	001-006
pH	T7	AR			U	001-006
Sulphate	T686	F	0.5	mg/l	U	001-006
Sulphide	T4	AR	0.05	mg/l	N	001-006
Naphthalene	T149	AR	0.01	µg/l	U	001-006
Acenaphthylene	T149	AR	0.01	µg/l	U	001-006
Acenaphthene	T149	AR	0.01	µg/l	U	001-006
Fluorene	T149	AR	0.01	µg/l	U	001-006
Phenanthrene	T149	AR	0.01	µg/l	U	001-006
Anthracene	T149	AR	0.01	µg/l	U	001-006
Fluoranthene	T149	AR	0.01	µg/l	U	001-006
Pyrene	T149	AR	0.01	µg/l	U	001-006
Benzo(a)Anthracene	T149	AR	0.01	µg/l	U	001-006
Chrysene	T149	AR	0.01	µg/l	U	001-006
Benzo(b)fluoranthene	T149	AR	0.01	µg/l	U	001-006
Benzo(k)fluoranthene	T149	AR	0.01	µg/l	U	001-006
Benzo(a)Pyrene	T149	AR	0.01	µg/l	U	001-006
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	U	001-006
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	U	001-006
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	U	001-006
PAH(total)	T149	AR	0.01	µg/l	U	001-006
Benzene	T54	AR	1	µg/l	U	001-006
Toluene	T54	AR	1	µg/l	U	001-006
EthylBenzene	T54	AR	1	µg/l	U	001-006

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
M/P Xylene	T54	AR	1	µg/l	U	001-006
O Xylene	T54	AR	1	µg/l	U	001-006
Methyl tert-Butyl Ether	T54	AR	1	µg/l	U	001-006
TPH (C5-C6 aliphatic)	T215	AR	0.010	mg/l	N	001-006
TPH (C6-C8 aliphatic)	T215	AR	0.010	mg/l	N	001-006
TPH (C8-C10 aliphatic)	T215	AR	0.010	mg/l	N	001-006
TPH (C10-C12 aliphatic)	T910	AR	0.01	mg/l	N	001-006
TPH (C12-C16 aliphatic)	T910	AR	0.01	mg/l	N	001-006
TPH (C16-C21 aliphatic)	T910	AR	0.01	mg/l	N	001-006
TPH (C21-C35 aliphatic)	T910	AR	0.01	mg/l	N	001-006
TPH (C6-C7 aromatic)	T215	AR	0.010	mg/l	N	001-006
TPH (C7-C8 aromatic)	T215	AR	0.010	mg/l	N	001-006
TPH (C8-C10 aromatic)	T215	AR	0.010	mg/l	N	001-006
TPH (C10-C12 aromatic)	T910	AR	0.01	mg/l	N	001-006
TPH (C12-C16 aromatic)	T910	AR	0.01	mg/l	N	001-006
TPH (C16-C21 aromatic)	T910	AR	0.01	mg/l	N	001-006
TPH (C21-C35 aromatic)	T910	AR	0.01	mg/l	N	001-006

Lewis Doel
Curtins
Rose Wharf
Ground Floor
78-80 East Street
Leeds
LS9 8EE

e: Lewis.Doel@curtins.com

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 18-81864

Replaces Analytical Report Number : 18-81864, issue no. 1

Project / Site name:	Whitehaven	**Samples received on:**	09/04/2018
Your job number:	67983	**Samples instructed on:**	11/04/2018
Your order number:	EBLE427	**Analysis completed by:**	30/04/2018
Report Issue Number:	2	**Report issued on:**	30/04/2018
Samples Analysed:	23 soil samples		

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 18-81864

Project / Site name: Whitehaven
Your Order No: EBLE427

Lab Sample Number				941347	941348	941349	941350	941351
Sample Reference				WS01	WS02	WS03	WS04	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.30	0.30	0.50	1.00
Date Sampled				04/04/2018	04/04/2018	04/04/2018	04/04/2018	04/04/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	18	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	15	21	22	28	31
Total mass of sample received	kg	0.001	NONE	1.5	1.6	1.9	1.4	1.4
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.6	11.7	7.8	7.4	7.2
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	%	0.005	MCERTS	-	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.23	0.083	0.097	0.076	0.11
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	227	82.8	97.2	76.1	107
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	-	-
Total Sulphur	%	0.005	MCERTS	-	-	-	-	-
Organic Matter	%	0.1	MCERTS	1.7	4.2	1.4	6.7	7.4
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.32	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.36	< 0.05	0.33	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.40	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.33	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.27	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.29	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.27	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.18	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.27	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	2.34	< 0.80

Analytical Report Number: 18-81864

Project / Site name: Whitehaven
Your Order No: EBLE427

Lab Sample Number				941347	941348	941349	941350	941351
Sample Reference				WS01	WS02	WS03	WS04	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.30	0.30	0.50	1.00
Date Sampled				04/04/2018	04/04/2018	04/04/2018	04/04/2018	04/04/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7.4	46	7.1	23	7.6
Boron (water soluble)	mg/kg	0.2	MCERTS	1.4	2.8	1.0	0.8	1.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	14	22	19	17	16
Copper (aqua regia extractable)	mg/kg	1	MCERTS	9.6	160	14	40	15
Lead (aqua regia extractable)	mg/kg	1	MCERTS	21	14	12	81	25
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	0.5	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	79	14	37	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	2.2	1.6	2.5	1.5	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	23	23	35	53	25
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	-	-
Monoaromatics								
Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	19	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	150	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	170	< 10	< 10	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	3.3	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	19	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	77	< 10	32	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	99	< 10	36	< 10

Analytical Report Number: 18-81864

Project / Site name: Whitehaven
Your Order No: EBLE427

Lab Sample Number				941352	941353	941354	941355	941356
Sample Reference				WS05	WS05	WS06	WS06	WS07
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.50	0.30	0.80	0.45
Date Sampled				05/04/2018	05/04/2018	04/04/2018	04/04/2018	04/04/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	35	< 0.1	36	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	7.5	13	23	26	8.8
Total mass of sample received	kg	0.001	NONE	0.43	1.7	1.4	1.5	1.8
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	Amosite
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	< 0.001
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	< 0.001
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.3	8.0	9.0	7.4	11.3
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	%	0.005	MCERTS	-	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.028	0.19	0.49	0.27	0.18
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	27.7	191	492	269	182
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	-	-
Total Sulphur	%	0.005	MCERTS	-	-	-	-	-
Organic Matter	%	0.1	MCERTS	2.4	2.5	4.3	4.9	1.0
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.84	< 0.05	< 0.05	< 0.05	1.6
Fluorene	mg/kg	0.05	MCERTS	0.83	< 0.05	< 0.05	< 0.05	1.6
Phenanthrene	mg/kg	0.05	MCERTS	7.0	1.4	< 0.05	< 0.05	30
Anthracene	mg/kg	0.05	MCERTS	1.9	0.22	< 0.05	< 0.05	4.3
Fluoranthene	mg/kg	0.05	MCERTS	17	1.9	< 0.05	< 0.05	25
Pyrene	mg/kg	0.05	MCERTS	14	1.5	< 0.05	< 0.05	16
Benzo(a)anthracene	mg/kg	0.05	MCERTS	9.1	1.0	< 0.05	< 0.05	9.1
Chrysene	mg/kg	0.05	MCERTS	7.0	0.76	< 0.05	< 0.05	6.2
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	9.4	0.98	< 0.05	< 0.05	6.2
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	4.0	0.31	< 0.05	< 0.05	3.7
Benzo(a)pyrene	mg/kg	0.05	MCERTS	8.8	0.74	< 0.05	< 0.05	5.8
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	4.5	0.39	< 0.05	< 0.05	3.1
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.62	< 0.05	< 0.05	< 0.05	0.53
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	4.5	0.36	< 0.05	< 0.05	2.6
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	89.6	9.58	< 0.80	< 0.80	115

Analytical Report Number: 18-81864

Project / Site name: Whitehaven
Your Order No: EBLE427

Lab Sample Number				941352	941353	941354	941355	941356
Sample Reference				WS05	WS05	WS06	WS06	WS07
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.50	0.30	0.80	0.45
Date Sampled				05/04/2018	05/04/2018	04/04/2018	04/04/2018	04/04/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.7	11	14	17	6.6
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6	1.0	5.4	3.0	1.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	12	11	11	14	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	16	19	24	28	19
Lead (aqua regia extractable)	mg/kg	1	MCERTS	18	36	37	52	15
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	15	19	26	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	3.9	1.1	1.4	1.6	1.4
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	27	29	43	47	29
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	-	-
Monoaromatics								
Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	36
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	9.9	< 8.0	< 8.0	< 8.0	130
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	240	81	< 8.0	< 8.0	110
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	250	90	< 10	< 10	280
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	7.5	< 2.0	< 2.0	< 2.0	21
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	120	12	< 10	< 10	240
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	710	100	< 10	< 10	240
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	840	120	< 10	< 10	500

Analytical Report Number: 18-81864

Project / Site name: Whitehaven
Your Order No: EBLE427

Lab Sample Number				941357	941358	941359	941360	941361
Sample Reference				WS03	CP01	CP02	WS03	WS01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.30	0.50	0.50	2.70-3.20	1.80
Date Sampled				04/04/2018	05/04/2018	05/04/2018	Deviating	04/04/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	22	28	23	19	12
Total mass of sample received	kg	0.001	NONE	2.0	1.6	0.41	0.35	0.39
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	-	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.0	7.3	7.2	7.7	7.4
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	-	-
Total Sulphate as SO_4	%	0.005	MCERTS	-	-	-	0.030	0.038
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.036	0.15	0.10	0.076	0.18
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	35.5	153	104	75.5	183
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	4.2	4.9
Total Sulphur	%	0.005	MCERTS	-	-	-	0.016	0.018
Organic Matter	%	0.1	MCERTS	0.7	5.1	3.4	-	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	< 2.0	< 2.0
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	-	-

Analytical Report Number: 18-81864

Project / Site name: Whitehaven
Your Order No: EBLE427

Lab Sample Number				941357	941358	941359	941360	941361
Sample Reference				WS03	CP01	CP02	WS03	WS01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.30	0.50	0.50	2.70-3.20	1.80
Date Sampled				04/04/2018	05/04/2018	05/04/2018	Deviating	04/04/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	3.2	12	8.8	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	2.0	2.2	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	-	-
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	14	16	17	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	19	27	25	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	11	45	33	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.4	< 0.3	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	18	33	24	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.4	< 1.0	< 1.0	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	34	35	39	-	-
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	15	22
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	7.4	11
Monoaromatics								
Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	< 10	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	-	-

Analytical Report Number: 18-81864

Project / Site name: Whitehaven
Your Order No: EBLE427

Lab Sample Number				941362	941363	941364	941365	941366
Sample Reference				WS01	WS03	WS04	WS05	WS05
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.30	0.70	2.50	1.20	2.50
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	20	22	21	33	19
Total mass of sample received	kg	0.001	NONE	0.39	0.28	0.32	0.32	0.36
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.9	7.8	6.0	6.3	6.4
Total Cyanide	mg/kg	1	MCERTS	-	-	-	-	-
Total Sulphate as SO_4	%	0.005	MCERTS	0.027	0.050	0.032	0.032	0.017
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.076	0.10	0.055	0.038	0.025
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	75.8	105	55.0	37.9	24.5
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	5.1	5.8	3.1	5.8	3.4
Total Sulphur	%	0.005	MCERTS	0.115	0.022	0.013	0.014	0.012
Organic Matter	%	0.1	MCERTS	-	-	-	-	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-	-	-

Analytical Report Number: 18-81864

Project / Site name: Whitehaven
Your Order No: EBLE427

Lab Sample Number				941362	941363	941364	941365	941366
Sample Reference				WS01	WS03	WS04	WS05	WS05
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.30	0.70	2.50	1.20	2.50
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	-	-
Chromium (hexavalent)	mg/kg	1.2	MCERTS	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Magnesium (water soluble)	mg/kg	5	NONE	14	17	7.8	18	25
Magnesium (leachate equivalent)	mg/l	2.5	NONE	6.8	8.5	3.9	9.0	13
Monoaromatics								
Benzene	ug/kg	1	MCERTS	-	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
p & m-xylene	µg/kg	1	MCERTS	-	-	-	-	-
o-xylene	µg/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-

Analytical Report Number: 18-81864

Project / Site name: Whitehaven
Your Order No: EBLE427

Lab Sample Number				941367	941368	941369		
Sample Reference				WS06	WS06	WS07		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				1.50	2.40	1.50		
Date Sampled				05/04/2018	05/04/2018	Deviating		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1		
Moisture Content	%	N/A	NONE	17	17	17		
Total mass of sample received	kg	0.001	NONE	0.35	0.43	0.37		
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-		
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-		
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-		
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-		
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.0	7.0	8.0		
Total Cyanide	mg/kg	1	MCERTS	-	-	-		
Total Sulphate as SO_4	%	0.005	MCERTS	0.026	0.026	0.051		
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.017	0.046	0.13		
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	16.5	45.7	131		
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	4.7	3.6	9.1		
Total Sulphur	%	0.005	MCERTS	0.032	0.051	0.019		
Organic Matter	%	0.1	MCERTS	-	-	-		
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0		
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-		
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	-	-		
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-		
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-		
Fluorene	mg/kg	0.05	MCERTS	-	-	-		
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-		
Anthracene	mg/kg	0.05	MCERTS	-	-	-		
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-		
Pyrene	mg/kg	0.05	MCERTS	-	-	-		
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-		
Chrysene	mg/kg	0.05	MCERTS	-	-	-		
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-		
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-		
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-		
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-		
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-		
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-		
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-		

Analytical Report Number: 18-81864

Project / Site name: Whitehaven
Your Order No: EBLE427

Lab Sample Number				941367	941368	941369		
Sample Reference				WS06	WS06	WS07		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				1.50	2.40	1.50		
Date Sampled				05/04/2018	05/04/2018	Deviating		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-		
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-		
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-		
Chromium (hexavalent)	mg/kg	1.2	MCERTS	-	-	-		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-		
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-		
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-		
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-		
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-		
Magnesium (water soluble)	mg/kg	5	NONE	< 5.0	46	< 5.0		
Magnesium (leachate equivalent)	mg/l	2.5	NONE	< 2.5	23	< 2.5		
Monoaromatics								
Benzene	ug/kg	1	MCERTS	-	-	-		
Toluene	µg/kg	1	MCERTS	-	-	-		
Ethylbenzene	µg/kg	1	MCERTS	-	-	-		
p & m-xylene	µg/kg	1	MCERTS	-	-	-		
o-xylene	µg/kg	1	MCERTS	-	-	-		
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-		
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-		
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-		
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-		
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-		
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-		
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-		
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-		
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-		
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-		
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-		
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-		
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-		
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-		
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-		
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-		
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-		

Analytical Report Number: 18-81864
Project / Site name: Whitehaven
Your Order No: EBLE427

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006 based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
941356	WS07	0.45	153	Loose Fibres	**Amosite**	< 0.001	**< 0.001**

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 18-81864

Project / Site name: Whitehaven

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
941347	WS01	None Supplied	0.30	Light brown clay and sand with stones.
941348	WS02	None Supplied	0.30	Brown sand with clinker and brick.
941349	WS03	None Supplied	0.30	Light brown clay with gravel.
941350	WS04	None Supplied	0.50	Brown clay and loam with gravel.
941351	WS04	None Supplied	1.00	Grey clay with vegetation.
941352	WS05	None Supplied	0.20	Brown clay and gravel with vegetation and stones.
941353	WS05	None Supplied	0.50	Brown clay and loam with vegetation and gravel
941354	WS06	None Supplied	0.30	Brown clay and loam with vegetation and stones.
941355	WS06	None Supplied	0.80	Brown clay and loam.
941356	WS07	None Supplied	0.45	Brown loam and sand with vegetation and rubble.
941357	WS03	None Supplied	2.30	Brown clay.
941358	CP01	None Supplied	0.50	Grey clay and loam with gravel.
941359	CP02	None Supplied	0.50	Brown clay and loam with gravel.
941360	WS03	None Supplied	2.70-3.20	Light brown sandy clay.
941361	WS01	None Supplied	1.80	Brown clay and sand with gravel and chalk.
941362	WS01	None Supplied	3.30	Grey clay.
941363	WS03	None Supplied	0.70	Light brown clay with gravel.
941364	WS04	None Supplied	2.50	Light brown sandy clay.
941365	WS05	None Supplied	1.20	Light brown clay with gravel.
941366	WS05	None Supplied	2.50	Grey clay.
941367	WS06	None Supplied	1.50	Light brown clay with chalk.
941368	WS06	None Supplied	2.40	Brown sandy clay.
941369	WS07	None Supplied	1.50	Brown clay with vegetation.

Analytical Report Number : 18-81864

Project / Site name: Whitehaven

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests. 2:1 extraction.	L082-PL	D	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L038	D	MCERTS

Analytical Report Number : 18-81864

Project / Site name: Whitehaven

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L088/76-PL	W	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
CP01		S	18-81864	941358	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
CP01		S	18-81864	941358	b	TPHCWG (Soil)	L088/76-PL	b
CP02		S	18-81864	941359	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
CP02		S	18-81864	941359	b	TPHCWG (Soil)	L088/76-PL	b
WS01		S	18-81864	941347	bc	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS01		S	18-81864	941347	bc	TPHCWG (Soil)	L088/76-PL	b
WS01		S	18-81864	941347	bc	Total cyanide in soil	L080-PL	c
WS01		S	18-81864	941362	a			
WS02		S	18-81864	941348	bc	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS02		S	18-81864	941348	bc	TPHCWG (Soil)	L088/76-PL	b
WS02		S	18-81864	941348	bc	Total cyanide in soil	L080-PL	c
WS03		S	18-81864	941349	bc	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS03		S	18-81864	941349	bc	TPHCWG (Soil)	L088/76-PL	b
WS03		S	18-81864	941349	bc	Total cyanide in soil	L080-PL	c
WS03		S	18-81864	941357	bc	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS03		S	18-81864	941357	bc	TPHCWG (Soil)	L088/76-PL	b
WS03		S	18-81864	941357	bc	Total cyanide in soil	L080-PL	c
WS03		S	18-81864	941360	a			
WS03		S	18-81864	941363	a			
WS04		S	18-81864	941350	bc	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS04		S	18-81864	941350	bc	TPHCWG (Soil)	L088/76-PL	b
WS04		S	18-81864	941350	bc	Total cyanide in soil	L080-PL	c
WS04		S	18-81864	941351	bc	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS04		S	18-81864	941351	bc	Monohydric phenols in soil	L080-PL	b
WS04		S	18-81864	941351	bc	Speciated EPA-16 PAHs in soil	L064-PL	b
WS04		S	18-81864	941351	bc	TPHCWG (Soil)	L088/76-PL	b
WS04		S	18-81864	941351	bc	Total cyanide in soil	L080-PL	c
WS04		S	18-81864	941364	a			
WS05		S	18-81864	941352	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS05		S	18-81864	941352	b	Monohydric phenols in soil	L080-PL	b
WS05		S	18-81864	941352	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS05		S	18-81864	941352	b	TPHCWG (Soil)	L088/76-PL	b
WS05		S	18-81864	941353	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS05		S	18-81864	941353	b	TPHCWG (Soil)	L088/76-PL	b
WS05		S	18-81864	941365	a			
WS05		S	18-81864	941366	a			
WS06		S	18-81864	941354	bc	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS06		S	18-81864	941354	bc	TPHCWG (Soil)	L088/76-PL	b
WS06		S	18-81864	941354	bc	Total cyanide in soil	L080-PL	c
WS06		S	18-81864	941355	bc	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS06		S	18-81864	941355	bc	TPHCWG (Soil)	L088/76-PL	b
WS06		S	18-81864	941355	bc	Total cyanide in soil	L080-PL	c
WS07		S	18-81864	941356	bc	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS07		S	18-81864	941356	bc	TPHCWG (Soil)	L088/76-PL	b
WS07		S	18-81864	941356	bc	Total cyanide in soil	L080-PL	c
WS07		S	18-81864	941369	a			

Key: a - No sampling date b - Incorrect container
c - Holding time d - Headspace e - Temperature

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

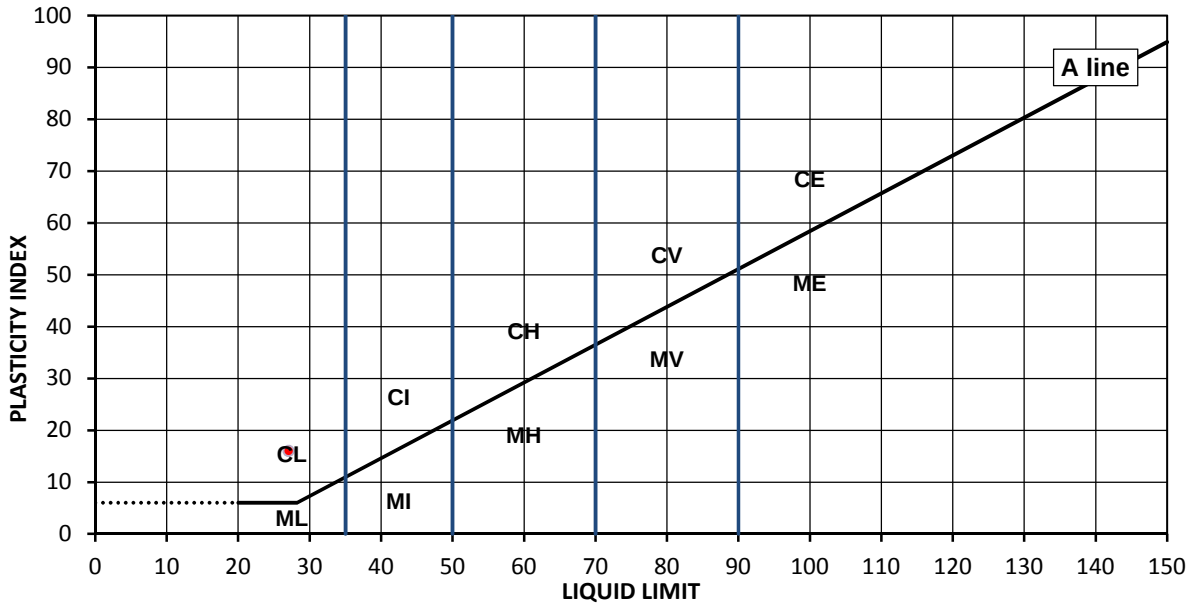
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944014	Depth Top [m]:	1.50
Hole No.:	CP04	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Brown slightly gravelly very sandy CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
15	27	11	16	67



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

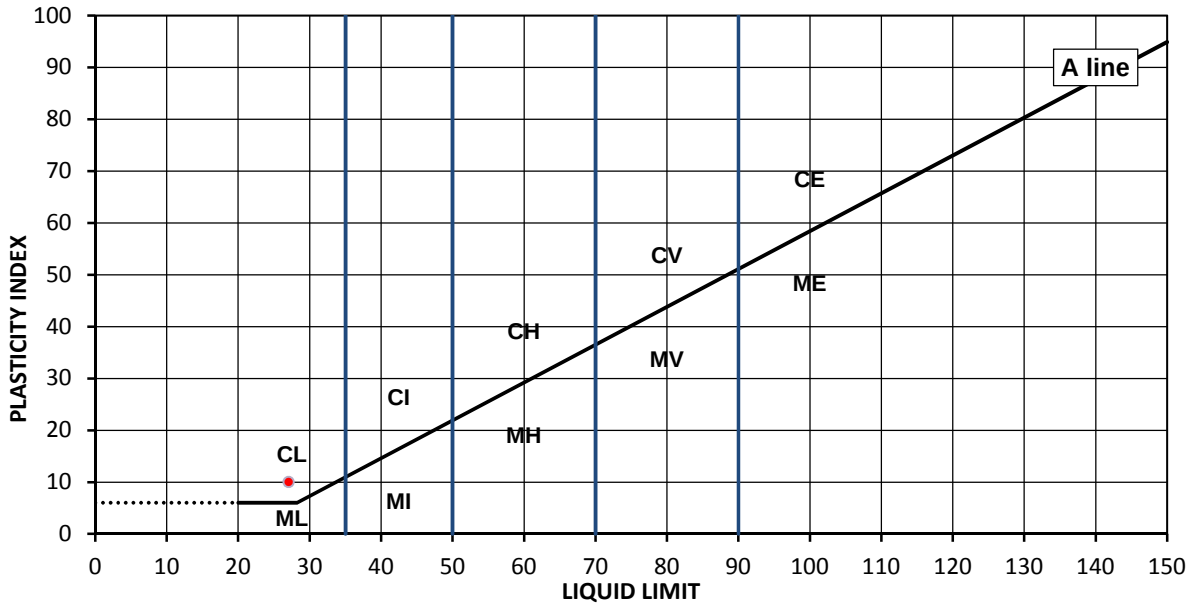
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944015	Depth Top [m]:	3.00
Hole No.:	CP04	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Brownish grey very sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
24	27	17	10	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

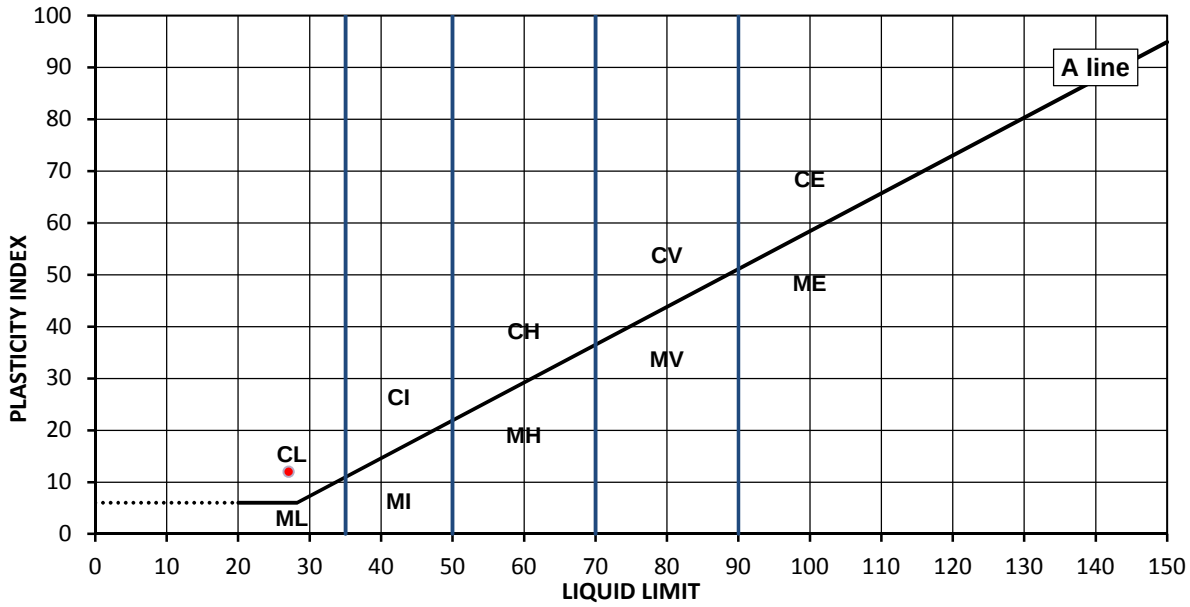
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944016	Depth Top [m]:	5.00
Hole No.:	CP04	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Brownish grey very sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	27	15	12	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

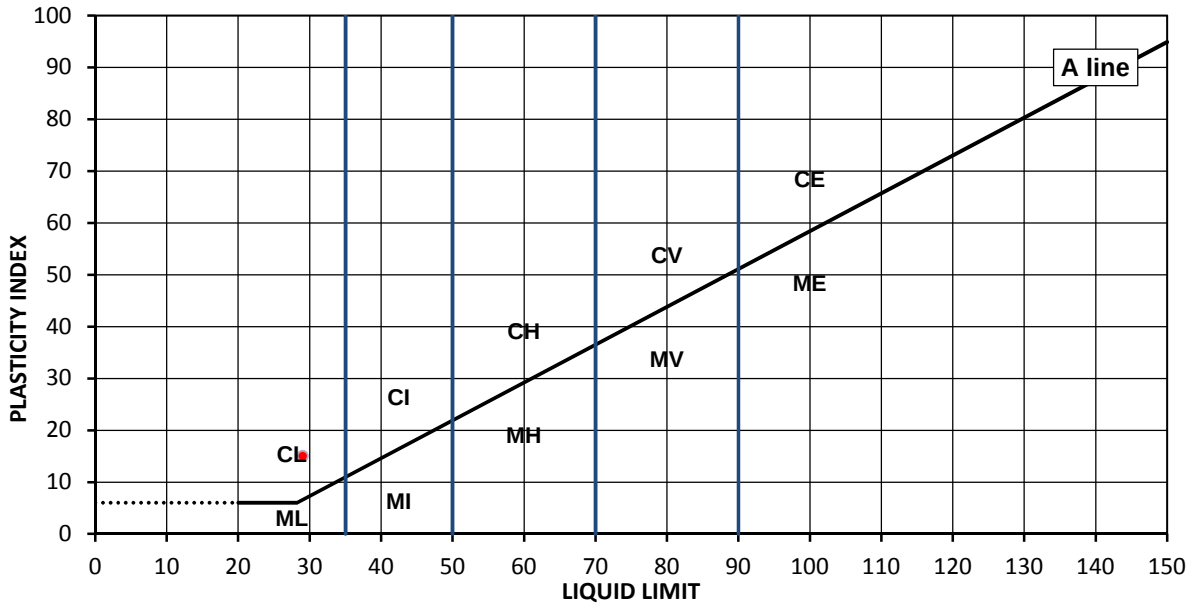
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944017	Depth Top [m]:	6.20
Hole No.:	CP04	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Grey gravelly very sandy CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
11	29	14	15	55



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

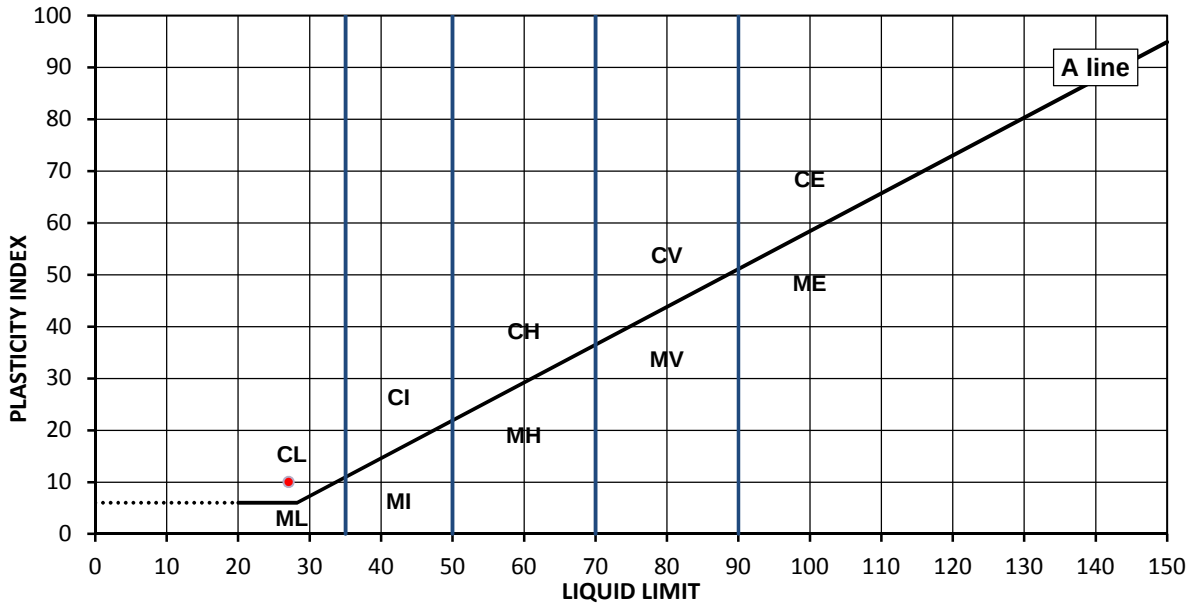
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944018	Depth Top [m]:	2.00
Hole No.:	CP03	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Yellowish brown slightly gravelly very sandy CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
16	27	17	10	76



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

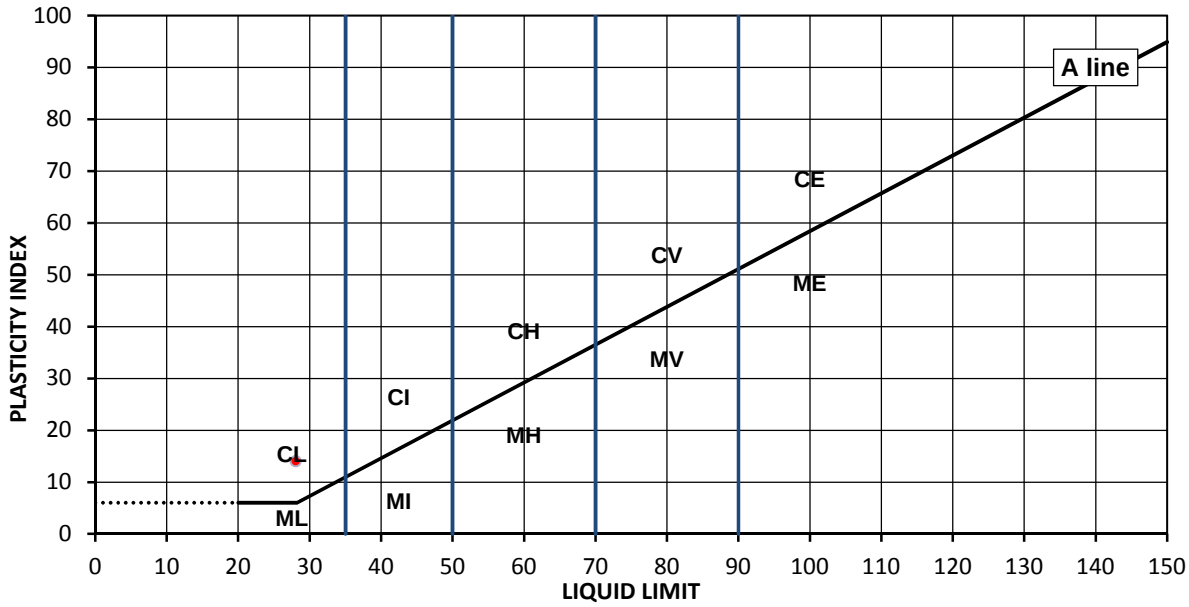
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944019	Depth Top [m]:	4.00
Hole No.:	CP03	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Brownish grey very sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
23	28	14	14	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

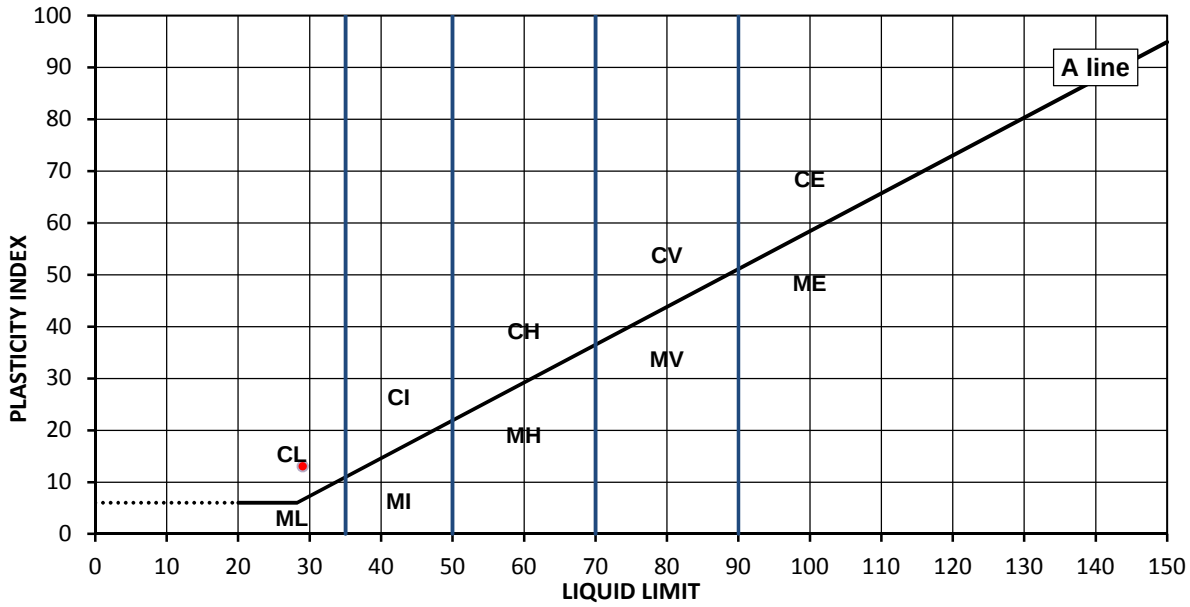
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944020	Depth Top [m]:	7.30
Hole No.:	CP03	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Brownish grey very sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
18	29	16	13	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

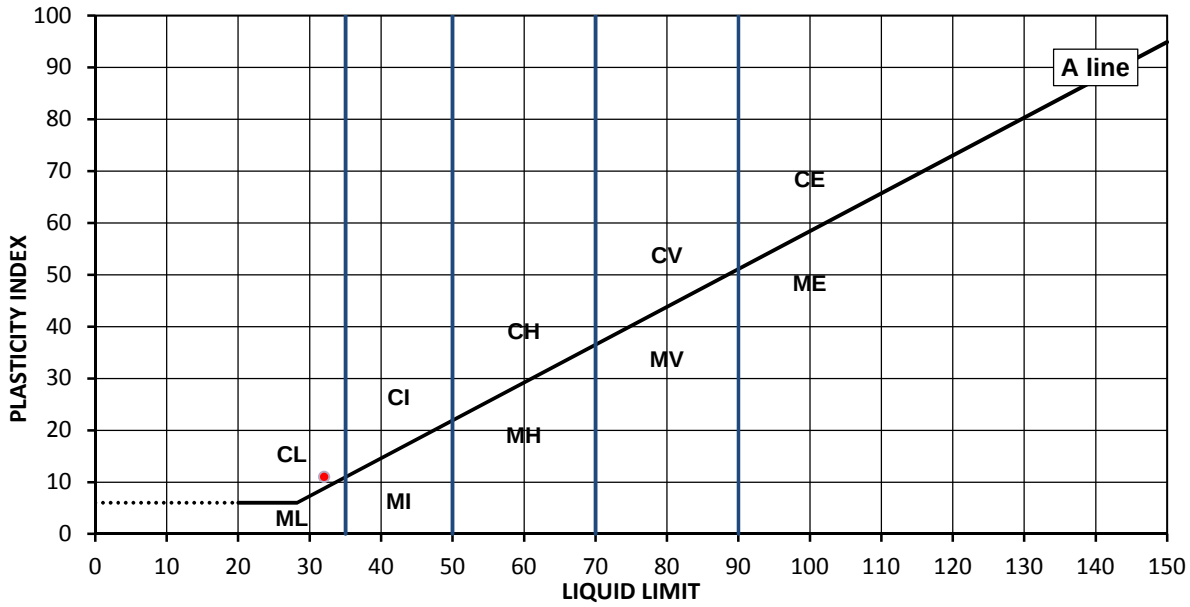
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944021	Depth Top [m]:	8.00
Hole No.:	CP03	Depth Base [m]:	8.45
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Greyish brown sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
25	32	21	11	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

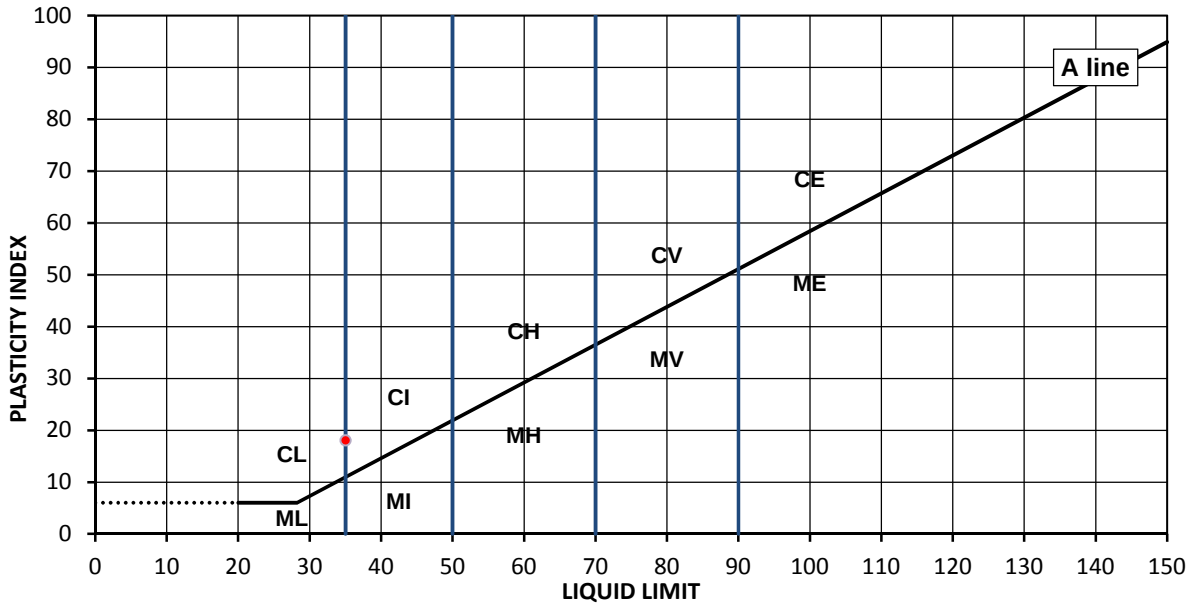
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944022	Depth Top [m]:	1.20
Hole No.:	CP02	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Mottled brown very sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
26	35	17	18	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

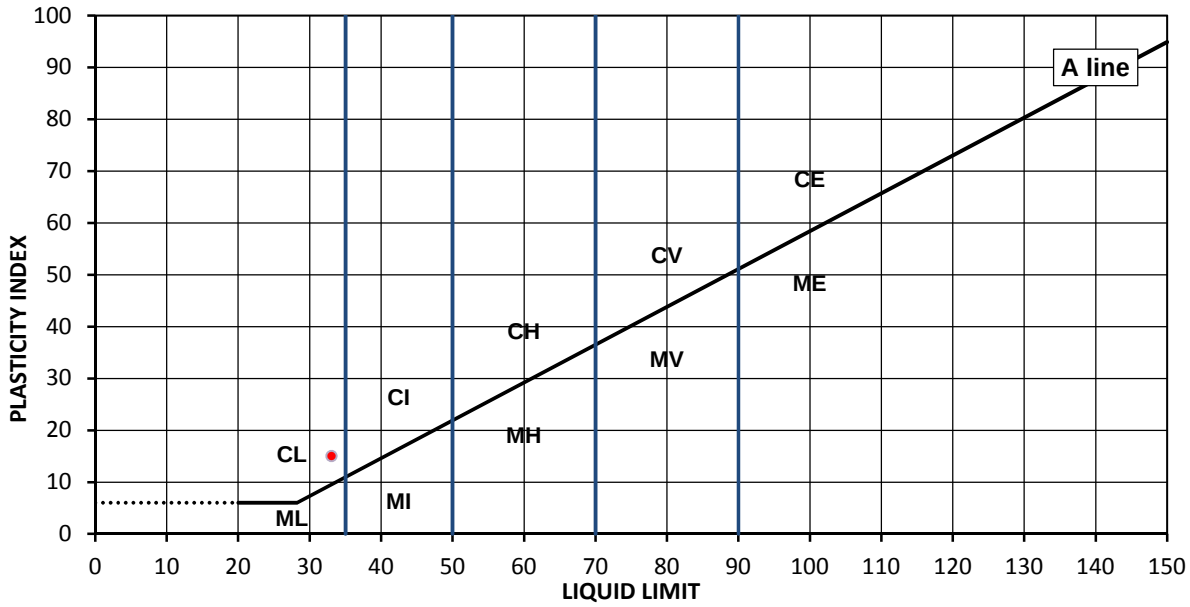
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944023	Depth Top [m]:	2.00
Hole No.:	CP02	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Yellowish brown slightly gravelly sandy silty CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	33	18	15	86



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

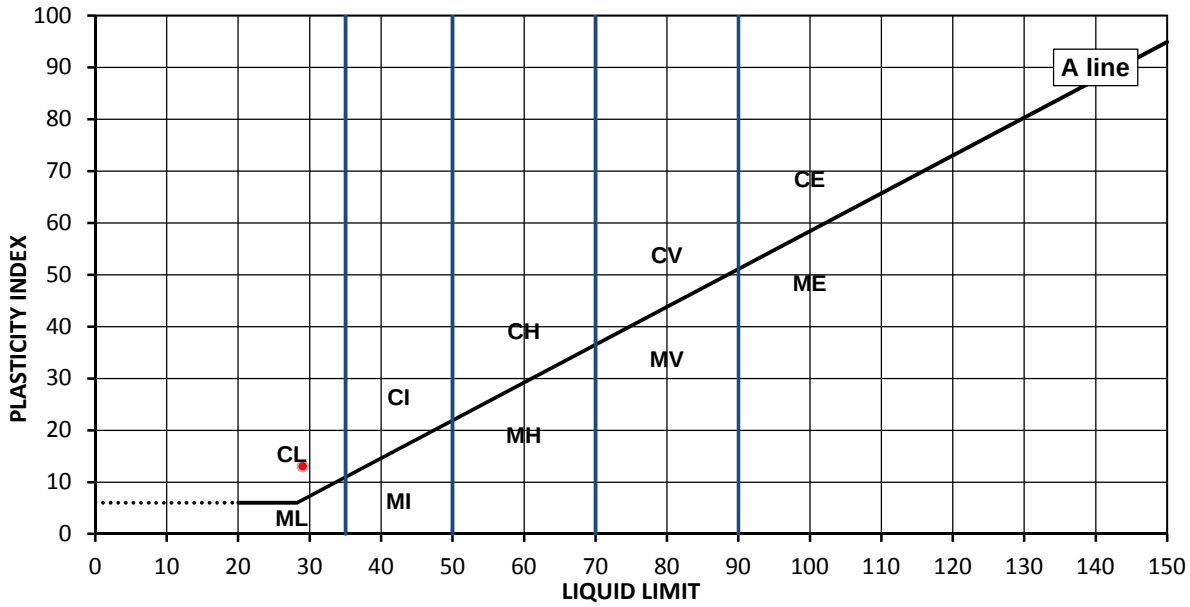
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944024	Depth Top [m]:	3.00
Hole No.:	CP02	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Mottled brown very sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
23	29	16	13	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

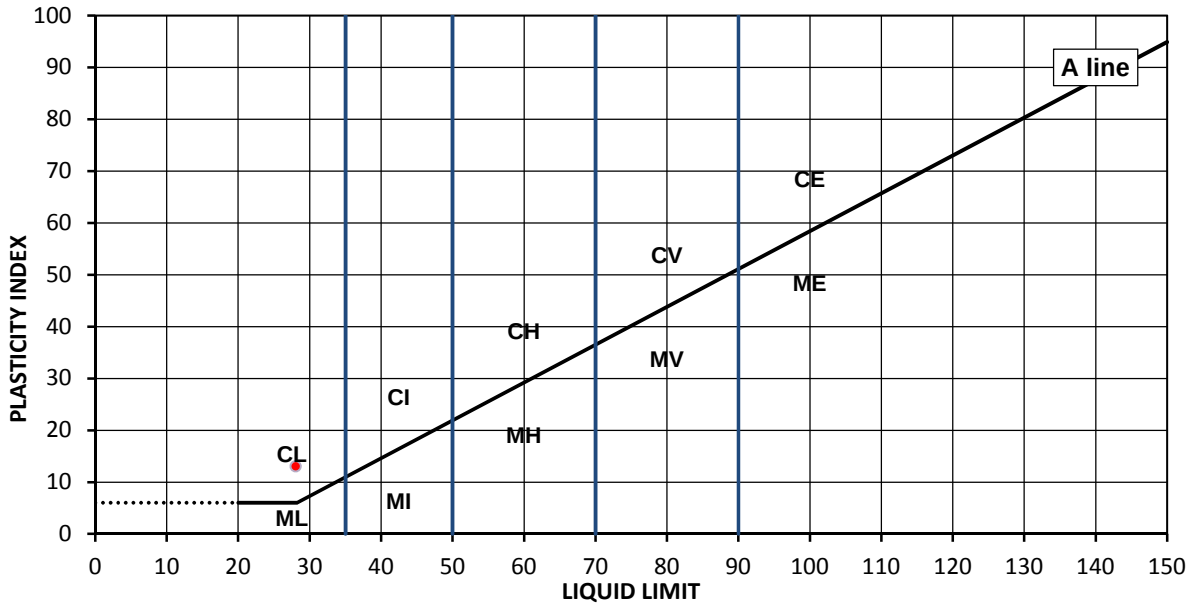
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	23/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	944026	Depth Top [m]:	6.50
Hole No.:	CP02	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Grey slightly gravelly very sandy CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
11	28	15	13	94



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: CURTINS
Client Address: Rose Wharf
Ground Floor
78-80 East Street
Leeds
LS9 8EE
Contact: Lewis Doel
Site Name: Whitehaven
Site Address: Not Given

Client Reference: 67983
Job Number: 18-82356
Date Sampled: Not Given
Date Received: 13/04/2018
Date Tested: 23/04/2018
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	M/C	Atterberg				Density		Total Porosity
		Reference	Top depth [m]	Base depth [m]	Type			% Passing 425um	LL	PL	PI	bulk	PD	
							%	%	%	%	%	Mg/m3	Mg/m3	Mg/m3
944022	CP02	Not Given	1.20	Not Given	D	Mottled brown very sandy CLAY	26	100	35	17	18			
944023	CP02	Not Given	2.00	Not Given	D	Yellowish brown slightly gravelly sandy silty CLAY	22	86	33	18	15			
944024	CP02	Not Given	3.00	Not Given	D	Mottled brown very sandy CLAY	23	100	29	16	13			
944025	CP02	Not Given	5.00	Not Given	D	Grey slightly gravelly sandy CLAY	9.1							
944026	CP02	Not Given	6.50	Not Given	D	Grey slightly gravelly very sandy CLAY	11	94	28	15	13			
944018	CP03	Not Given	2.00	Not Given	D	Yellowish brown slightly gravelly very sandy CLAY	16	76	27	17	10			
944019	CP03	Not Given	4.00	Not Given	D	Brownish grey very sandy CLAY	23	100	28	14	14			
944020	CP03	Not Given	7.30	Not Given	D	Brownish grey very sandy CLAY	18	100	29	16	13			
944021	CP03	Not Given	8.00	8.45	D	Greyish brown sandy CLAY	25	100	32	21	11			
944014	CP04	Not Given	1.50	Not Given	D	Brown slightly gravelly very sandy CLAY	15	67	27	11	16			

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: CURTINS
Client Address: Rose Wharf
Ground Floor
78-80 East Street
Leeds
LS9 8EE
Contact: Lewis Doel
Site Name: Whitehaven
Site Address: Not Given

Client Reference: 67983
Job Number: 18-82356
Date Sampled: Not Given
Date Received: 13/04/2018
Date Tested: 23/04/2018
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	M/C	Atterberg				Density		Total Porosity
		Reference	Top depth [m]	Base depth [m]	Type		%	% Passing 425um %	LL %	PL %	PI %	bulk Mg/m3	PD Mg/m3	Mg/m3
944015	CP04	Not Given	3.00	Not Given	D	Brownish grey very sandy CLAY	24	100	27	17	10			
944016	CP04	Not Given	5.00	Not Given	D	Brownish grey very sandy CLAY	22	100	27	15	12			
944017	CP04	Not Given	6.20	Not Given	D	Grey gravelly very sandy CLAY	11	55	29	14	15			

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 27/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

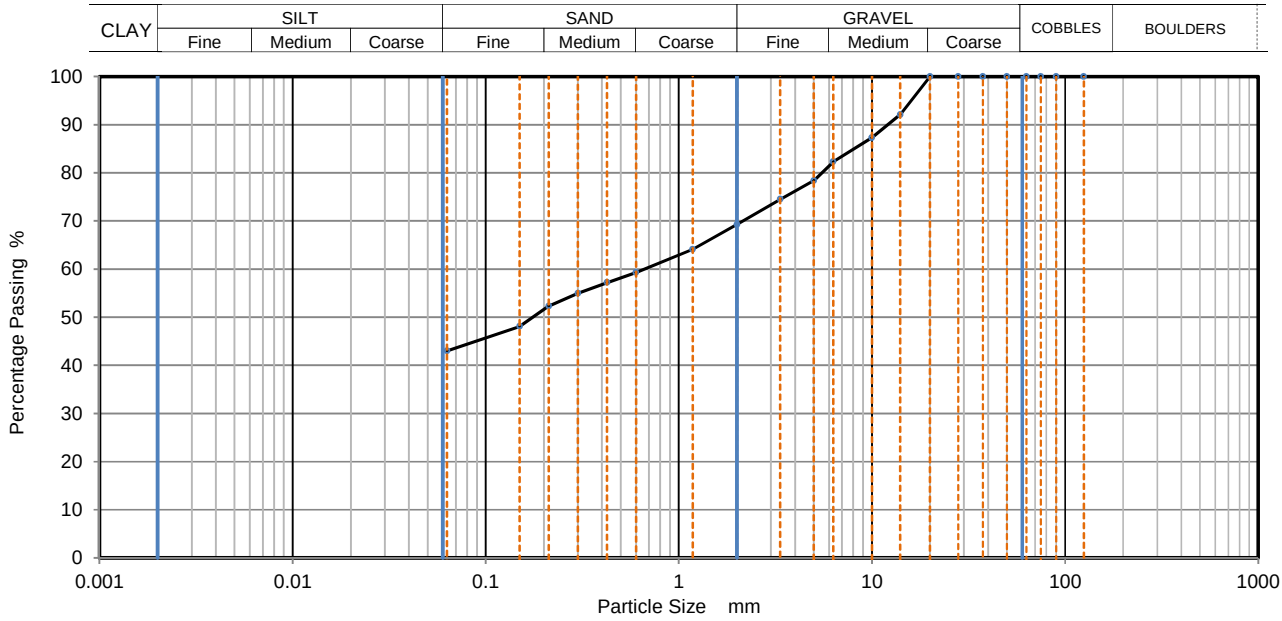
UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

TEST RESULTS Laboratory Reference: 944010

Sample description:	Grey slightly sandy slightly gravelly CLAY	Sample Reference:	Not Given
Location:	CP04	Sample Type:	B
Supplier:	Not Given	Depth Top [m]:	8.20
		Depth Base [m]:	Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	92		
10	87		
6.3	82		
5	78		
3.35	75		
2	69		
1.18	64		
0.6	59		
0.425	57		
0.3	55		
0.212	52		
0.15	48		
0.063	43		

Dry Mass of sample [g]: 878

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	30.70
Sand	26.20
Fines <0.063mm	43.10

Grading Analysis		
D100	mm	20
D60	mm	0.664
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 27/04/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

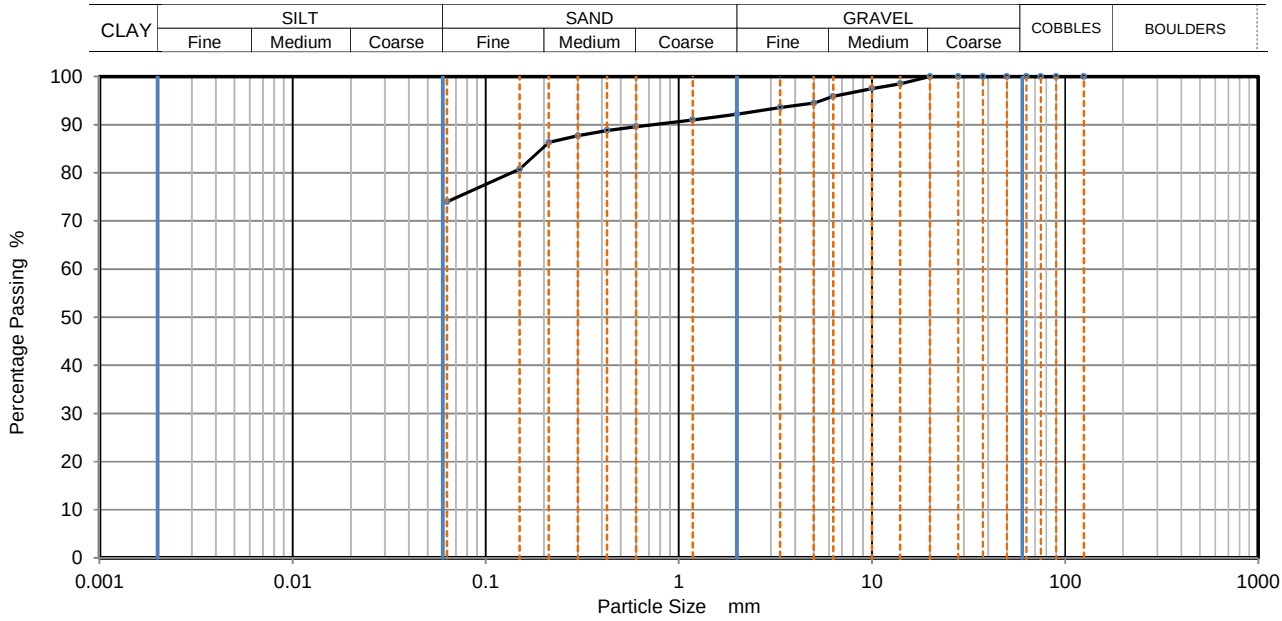
UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

TEST RESULTS Laboratory Reference: 944011

Sample description:	Brown slightly gravelly slightly sandy CLAY	Sample Reference:	Not Given
Location:	CP03	Sample Type:	B
Supplier:	Not Given	Depth Top [m]:	2.80
		Depth Base [m]:	Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	98		
6.3	96		
5	95		
3.35	94		
2	92		
1.18	91		
0.6	90		
0.425	89		
0.3	88		
0.212	86		
0.15	81		
0.063	75		

Dry Mass of sample [g]: 737

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	7.80
Sand	17.60
Fines <0.063mm	74.60

Grading Analysis		
D100	mm	20
D60	mm	
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 27/04/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

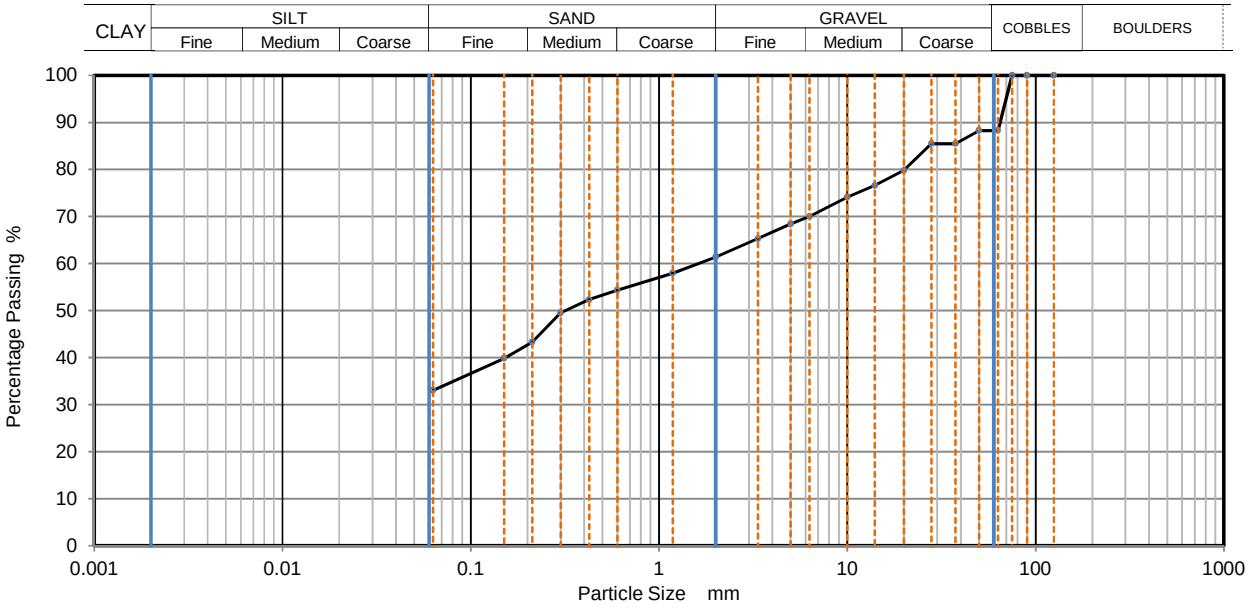
4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

TEST RESULTS

	Laboratory Reference: 944012	Sample Reference:	Not Given
Sample description:	Grey slightly gravelly slightly sandy CLAY with cobbels	Sample Type:	B
Location:	CP02	Depth Top [m]:	4.60
Supplier:	Not Given	Depth Base [m]:	Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	88		
50	88		
37.5	86		
28	86		
20	80		
14	77		
10	74		
6.3	70		
5	68		
3.35	65		
2	61		
1.18	58		
0.6	54		
0.425	52		
0.3	50		
0.212	43		
0.15	40		
0.063	33		

Dry Mass of sample [g]: 3528

Sample Proportions	% dry mass
Very coarse	11.70
Gravel	26.90
Sand	28.20
Fines <0.063mm	33.20

Grading Analysis		
D100	mm	75
D60	mm	1.62
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below
The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 27/04/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

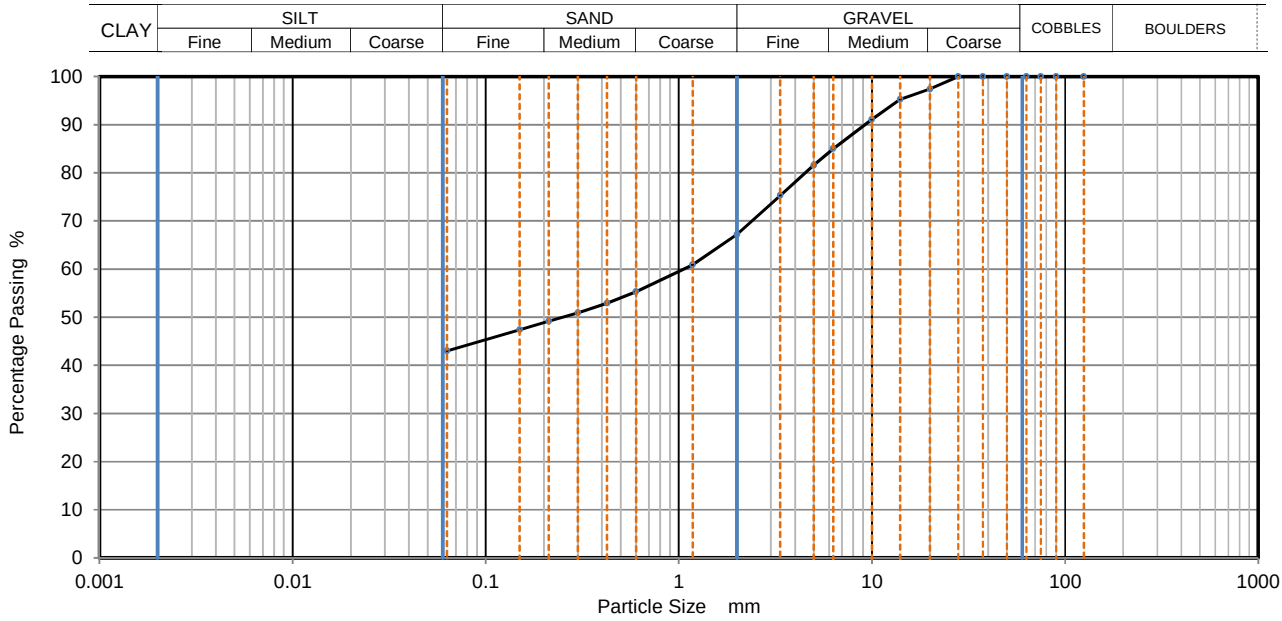
UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-82356
		Date Sampled:	Not Given
		Date Received:	13/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

TEST RESULTS Laboratory Reference: 944013

Sample description:	Grey slightly sandy gravelly CLAY	Sample Reference:	Not Given
Location:	CP02	Sample Type:	B
Supplier:	Not Given	Depth Top [m]:	7.50
		Depth Base [m]:	Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	97		
14	95		
10	91		
6.3	85		
5	82		
3.35	75		
2	67		
1.18	61		
0.6	55		
0.425	53		
0.3	51		
0.212	49		
0.15	47		
0.063	43		

Dry Mass of sample [g]: 2268

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	32.80
Sand	24.10
Fines <0.063mm	43.20

Grading Analysis		
D100	mm	28
D60	mm	1.06
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 27/04/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

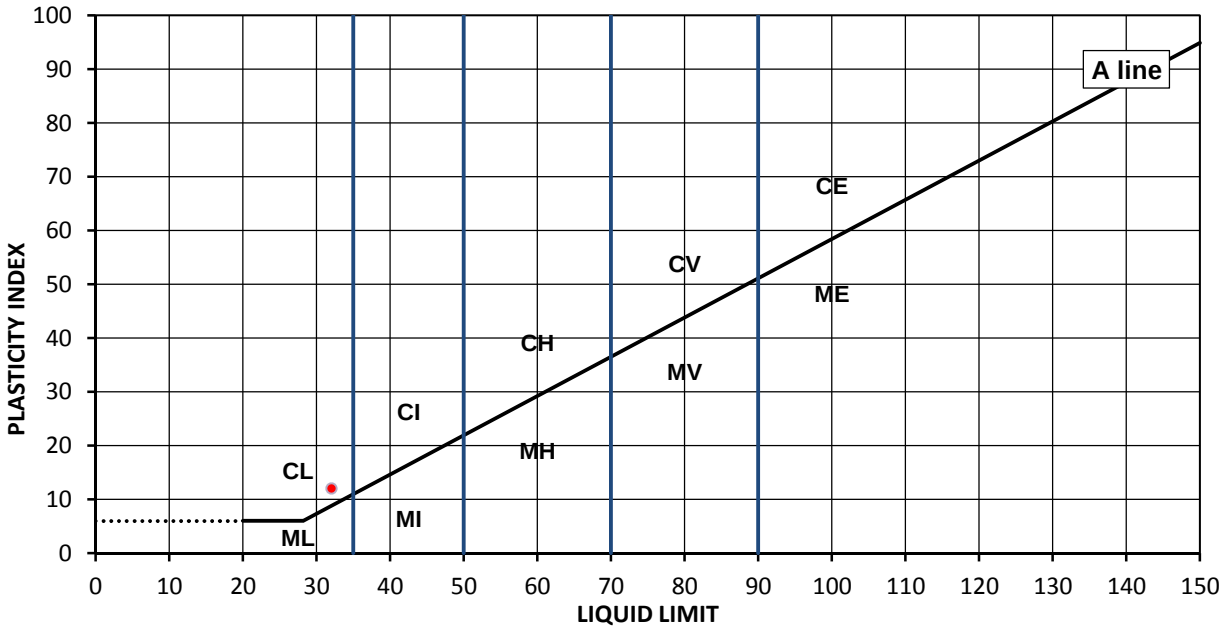
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-81989
		Date Sampled:	Not Given
		Date Received:	09/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	942011	Depth Top [m]:	1.80
Hole No.:	WS01	Depth Base [m]:	1.80
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown slightly gravelly very sandy CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
12	32	20	12	68



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 25/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

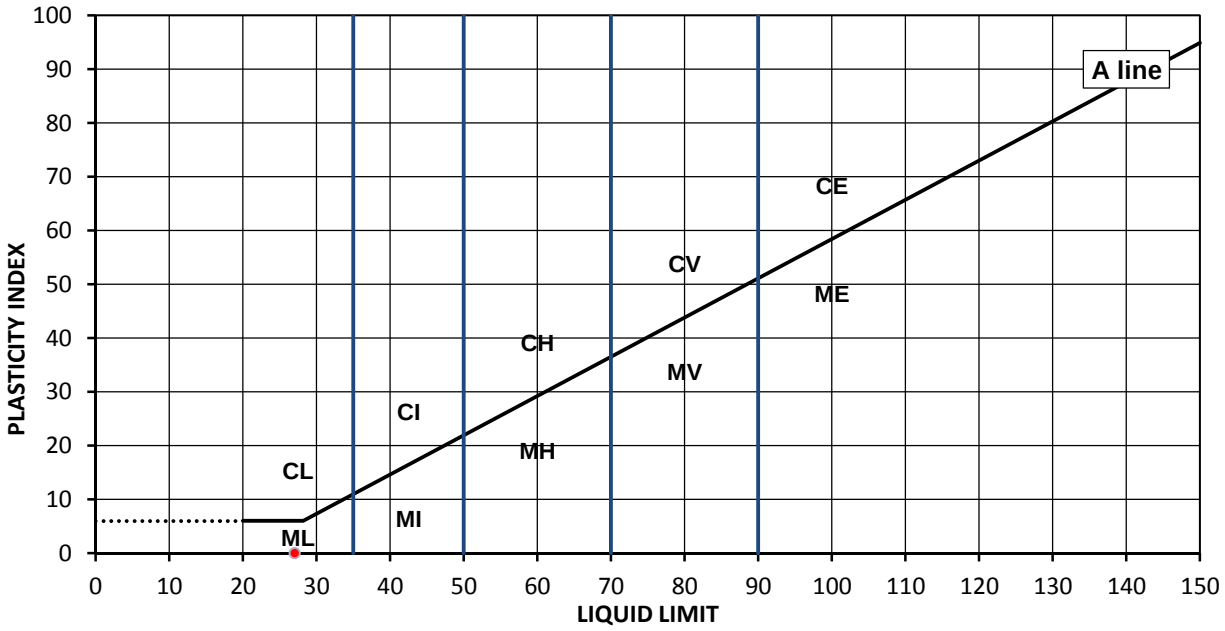
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-81989
		Date Sampled:	Not Given
		Date Received:	09/04/2018
Contact:	Lewis Doel	Date Tested:	18/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	942012	Depth Top [m]:	3.30
Hole No.:	WS01	Depth Base [m]:	3.30
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown clayey SAND		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
28	27	NP	NP	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks: NP – non plastic

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 25/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

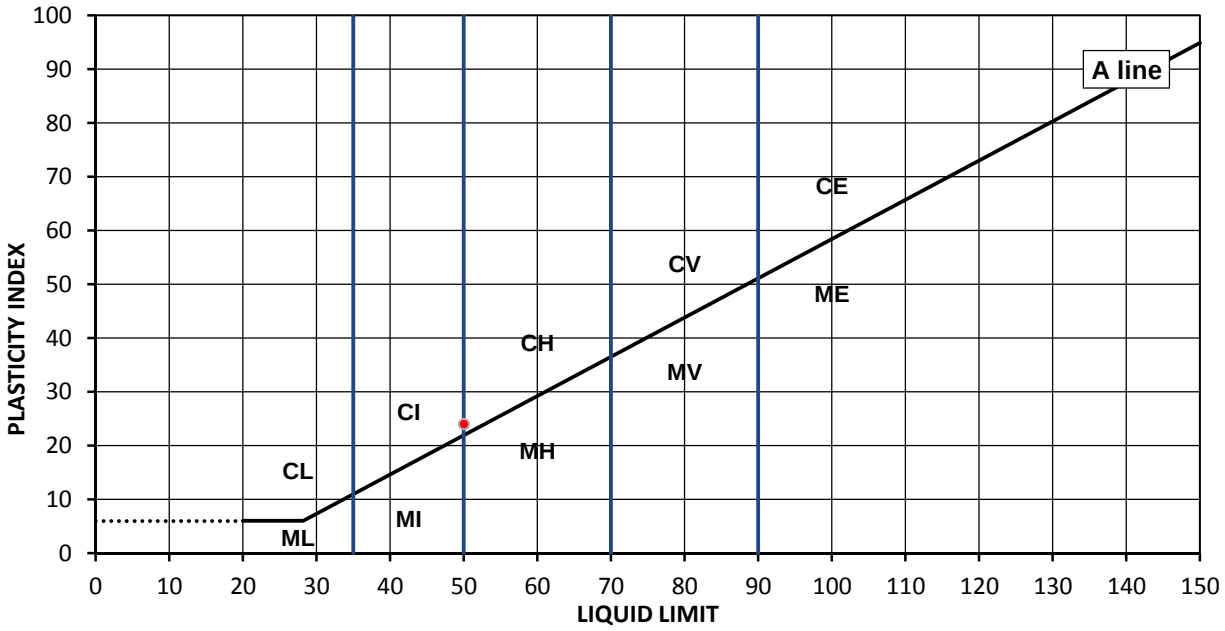
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-81989
		Date Sampled:	Not Given
		Date Received:	09/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	942013	Depth Top [m]:	0.70
Hole No.:	WS03	Depth Base [m]:	0.70
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Yellowish brown slightly gravelly slightly sandy CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
30	50	26	24	87



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 25/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

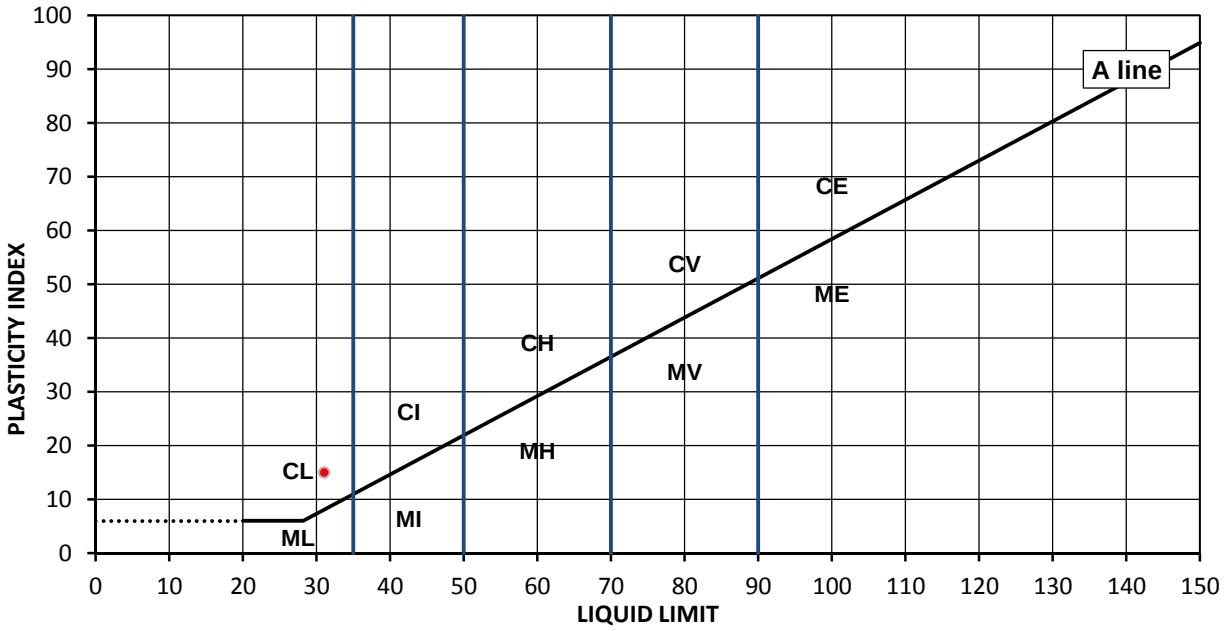
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-81989
		Date Sampled:	Not Given
		Date Received:	09/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	942014	Depth Top [m]:	2.50
Hole No.:	WS04	Depth Base [m]:	2.50
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Yellowish brown very sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
30	31	16	15	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 25/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

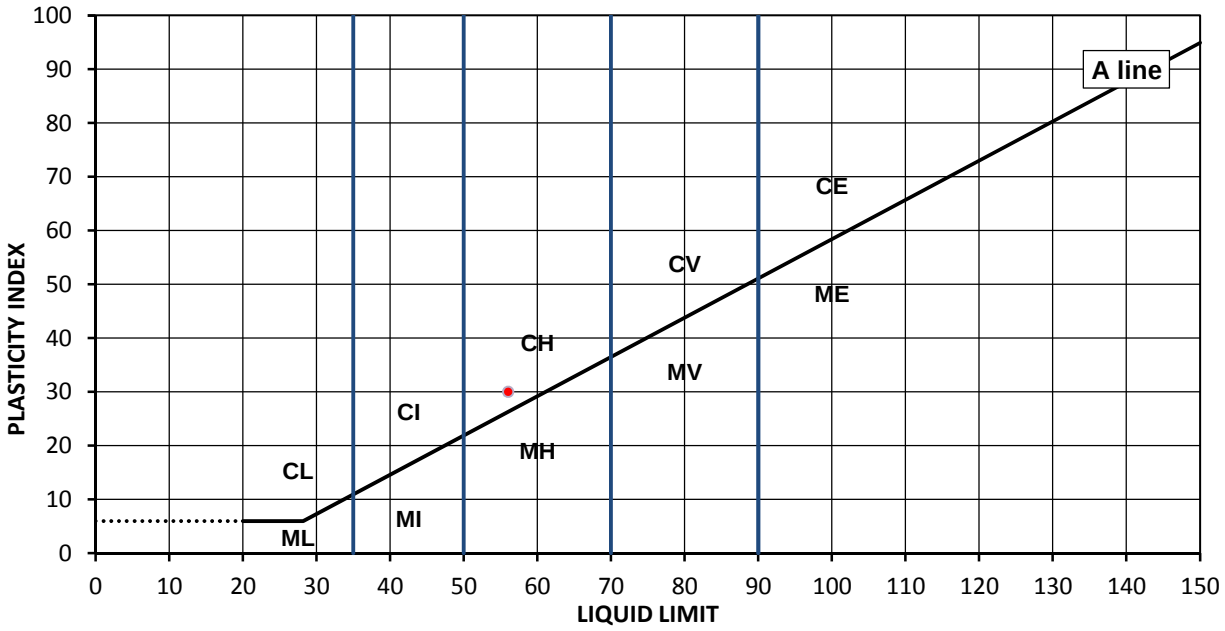
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-81989
		Date Sampled:	Not Given
		Date Received:	09/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	942015	Depth Top [m]:	1.20
Hole No.:	WS05	Depth Base [m]:	1.20
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Yellowish brown slightly gravelly slightly sandy CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
24	56	26	30	95



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 25/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

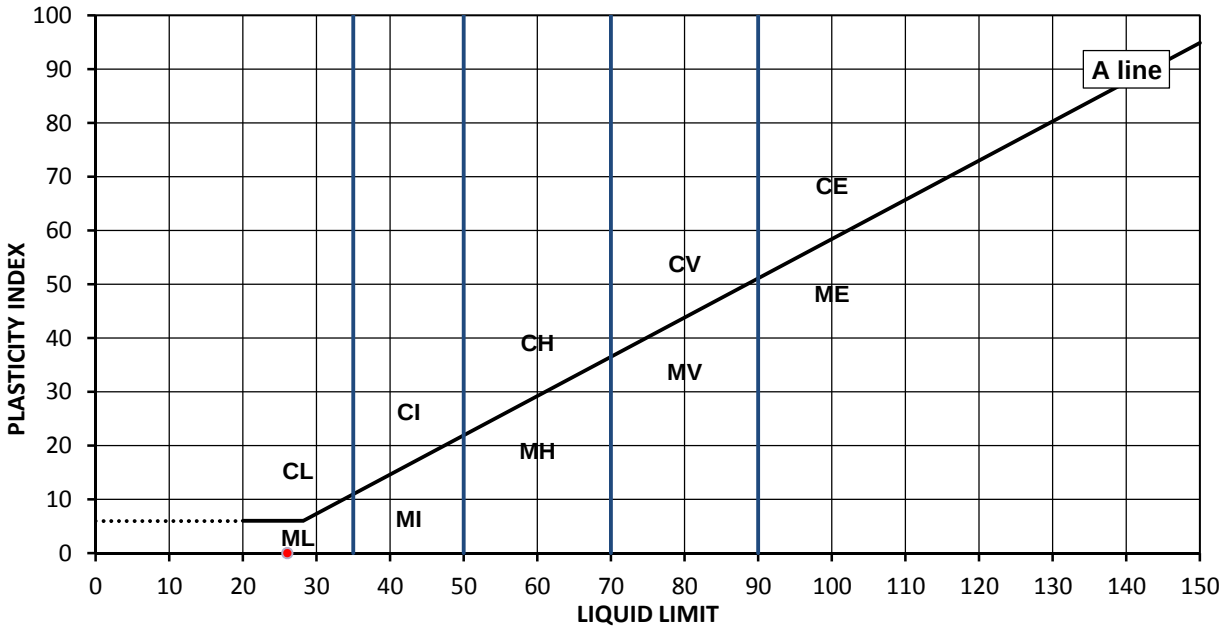
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-81989
		Date Sampled:	Not Given
		Date Received:	09/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	942016	Depth Top [m]:	2.50
Hole No.:	WS05	Depth Base [m]:	2.50
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown slightly gravelly clayey SAND		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
23	26	NP	NP	94



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks: NP – non plastic

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 25/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

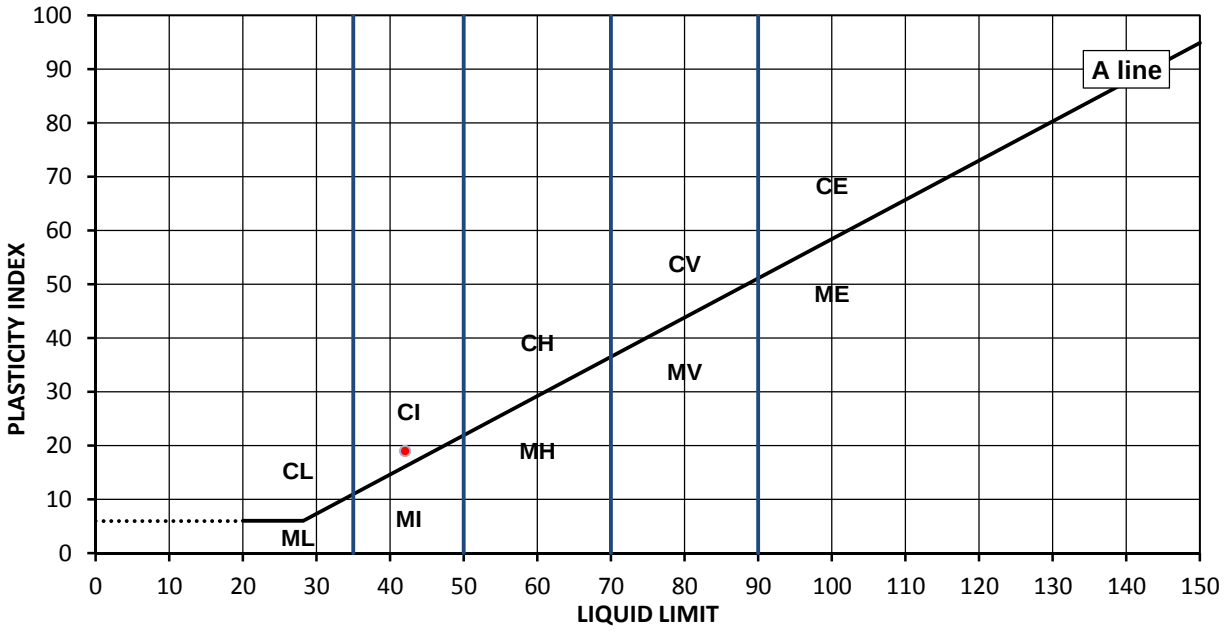
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-81989
		Date Sampled:	Not Given
		Date Received:	09/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	942017	Depth Top [m]:	1.50
Hole No.:	WS06	Depth Base [m]:	1.50
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Yellowish brown sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
28	42	23	19	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 25/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

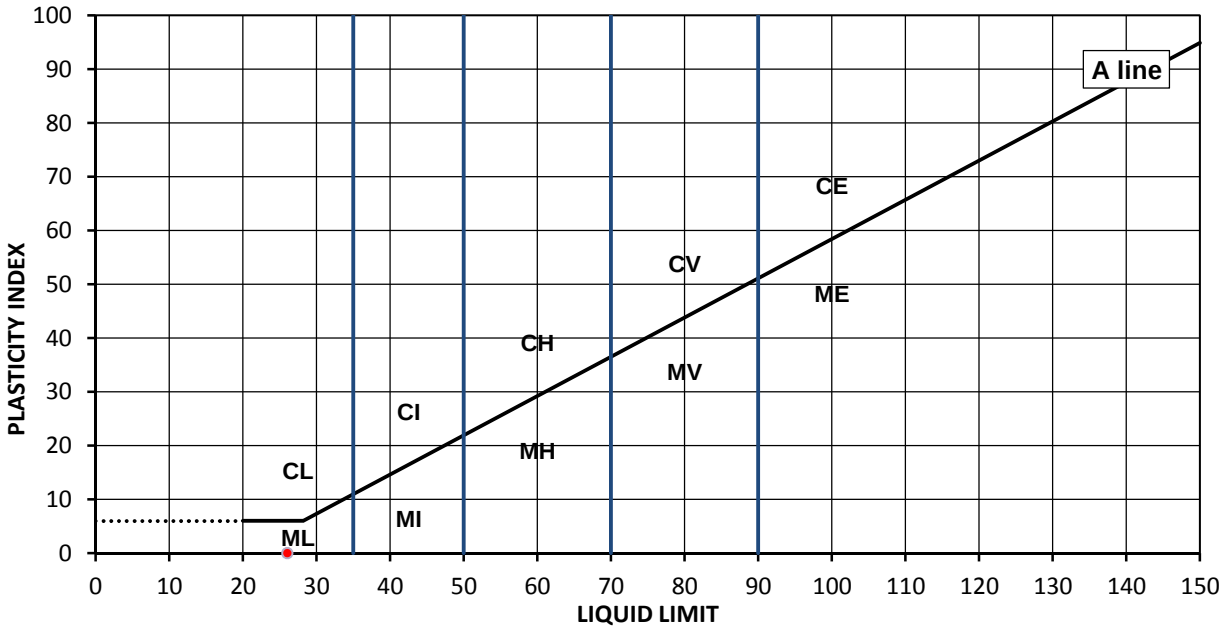
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-81989
		Date Sampled:	Not Given
		Date Received:	09/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	942018	Depth Top [m]:	2.40
Hole No.:	WS06	Depth Base [m]:	2.40
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Yellowish brown clayey SAND		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
22	26	NP	NP	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks: NP – non plastic

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 25/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

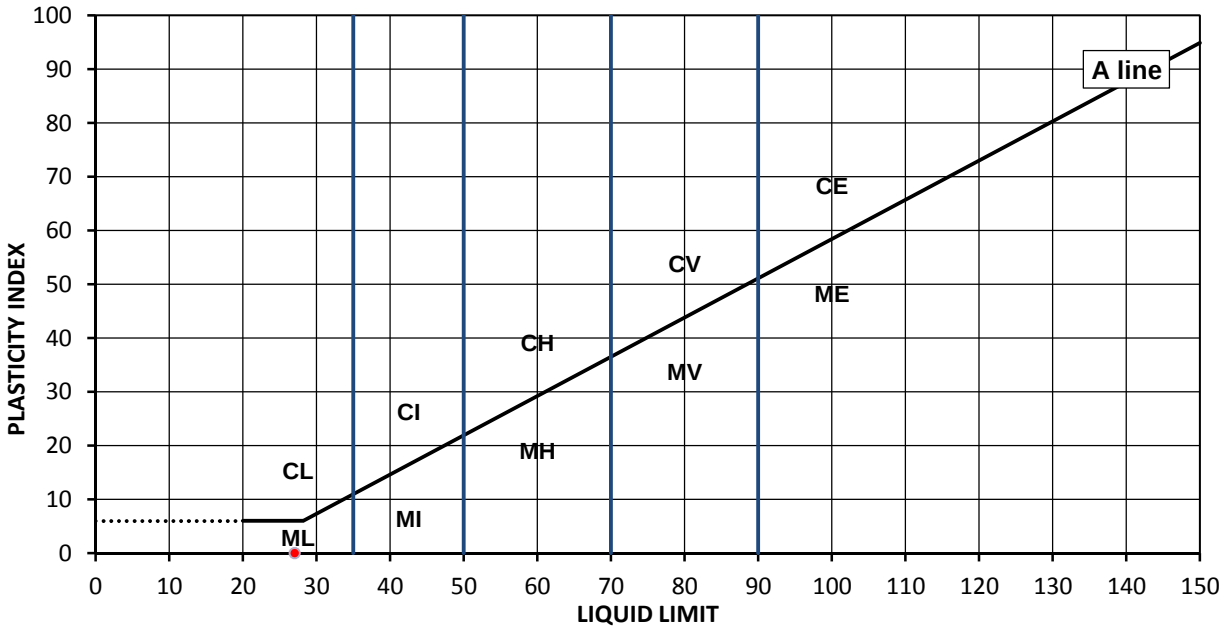
4041

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-81989
		Date Sampled:	Not Given
		Date Received:	09/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	942019	Depth Top [m]:	1.50
Hole No.:	WS07	Depth Base [m]:	1.50
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Yellowish brown slightly gravelly clayey SAND		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
27	27	NP	NP	82



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks: NP – non plastic

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 25/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

GF 232.1

TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: CURTINS
Client Address: Rose Wharf
Ground Floor
78-80 East Street
Leeds
LS9 8EE
Contact: Lewis Doel
Site Name: Whitehaven
Site Address: Not Given

Client Reference: 67983
Job Number: 18-81989
Date Sampled: Not Given
Date Received: 09/04/2018
Date Tested: 18/04 - 20/04/2018
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	M/C	Atterberg				Density		Total Porosity
		Reference	Top depth [m]	Base depth [m]	Type			% Passing 425um	LL	PL	PI	bulk	PD	
							%	%	%	%	%	Mg/m3	Mg/m3	Mg/m3
942011	WS01	Not Given	1.80	1.80	B	Brown slightly gravelly very sandy CLAY	12	68	32	20	12			
942012	WS01	Not Given	3.30	3.30	B	Brown clayey SAND	28	100	27	NP	NP			
942013	WS03	Not Given	0.70	0.70	B	Yellowish brown slightly gravelly slightly sandy CLAY	30	87	50	26	24			
942014	WS04	Not Given	2.50	2.50	B	Yellowish brown very sandy CLAY	30	100	31	16	15			
942015	WS05	Not Given	1.20	1.20	B	Yellowish brown slightly gravelly slightly sandy CLAY	24	95	56	26	30			
942016	WS05	Not Given	2.50	2.50	B	Brown slightly gravelly clayey SAND	23	94	26	NP	NP			
942017	WS06	Not Given	1.50	1.50	B	Yellowish brown sandy CLAY	28	100	42	23	19			
942018	WS06	Not Given	2.40	2.40	B	Yellowish brown clayey SAND	22	100	26	NP	NP			
942019	WS07	Not Given	1.50	1.50	B	Yellowish brown slightly gravelly clayey SAND	27	82	27	NP	NP			

Comments: NP - non plastic

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 25/04/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

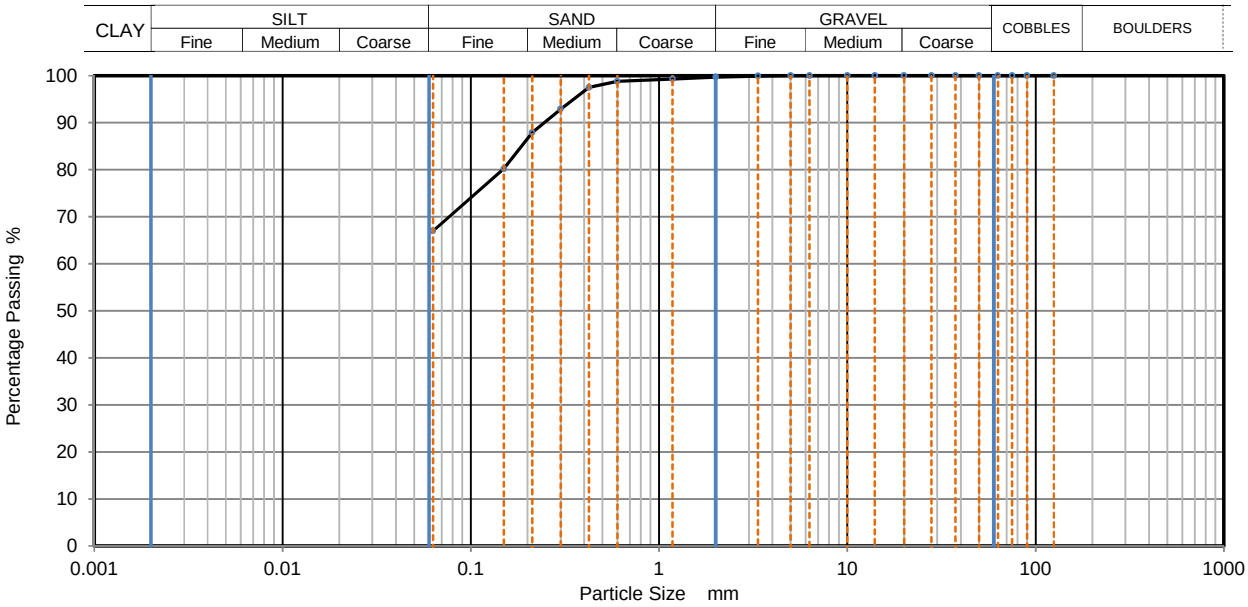
UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client:	CURTINS	Client Reference:	67983
Client Address:	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE	Job Number:	18-81989
		Date Sampled:	Not Given
		Date Received:	09/04/2018
Contact:	Lewis Doel	Date Tested:	20/04/2018
Site Name:	Whitehaven	Sampled By:	Not Given
Site Address:	Not Given		

TEST RESULTS Laboratory Reference: 942010

Sample description:	Yellowish brown sandy CLAY	Sample Reference:	Not Given
Location:	WS03	Sample Type:	B
Supplier:	Not Given	Depth Top [m]:	2.70
		Depth Base [m]:	3.20



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	99		
0.425	98		
0.3	93		
0.212	88		
0.15	80		
0.063	67		

Dry Mass of sample [g]: 223

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.30
Sand	32.60
Fines <0.063mm	67.10

Grading Analysis		
D100	mm	6.3
D60	mm	
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 25/04/2018

for and on behalf of i2 Analytical Ltd

LABORATORY REPORT

4043

Contract Number: PSL18/1561

Report Date: 05 April 2018

Client's Reference:

Client Name: Geocore Site Investigations Ltd
Tralee Close
Kirkleatham Business Park
Redcar
Cleveland
TS10 5SG

For the attention of: Eddie Lodge

Contract Title: Meadow Road, Whitehaven, Cumbria

Date Received: 3/4/2018
Date Commenced: 3/4/2018
Date Completed: 5/4/2018

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
R Berriman (Quality Manager)

L Knight (Senior Technician)
S Eyre (Senior Technician)
A Fry (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

PSL
Professional Soils Laboratory
Independent Laboratory Testing Services.

Professional Soils Laboratory
5 -7 Hexthorpe Road
Hexthorpe
Doncaster, DN4 0AG.
tel: 0844 8156641 . fax: 0844 8156642
e-mail: awatkins@prosoils.co.uk

VERTICAL DEFORMATION TESTS.

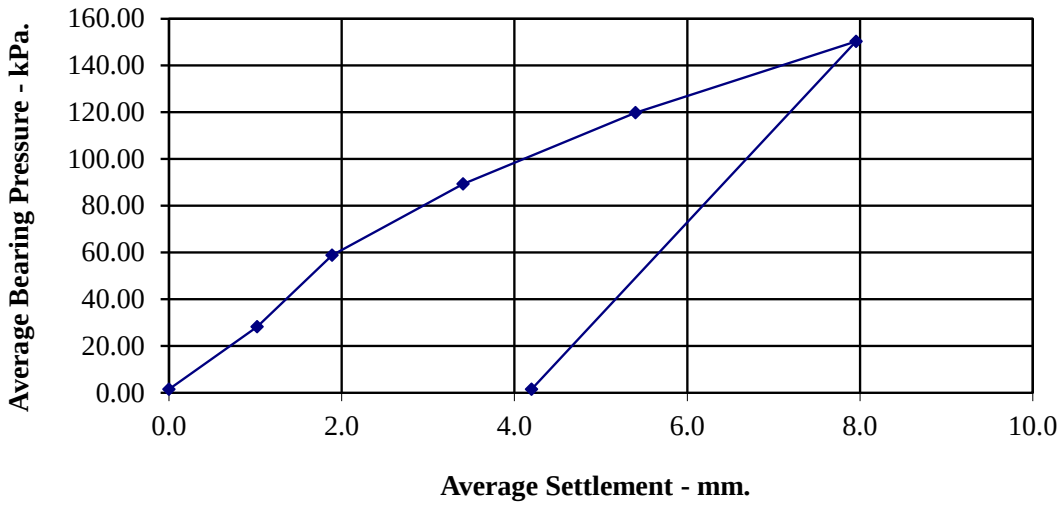
BS 1377 : Part 9 : 1990.

Date of Test: 03-Apr-18

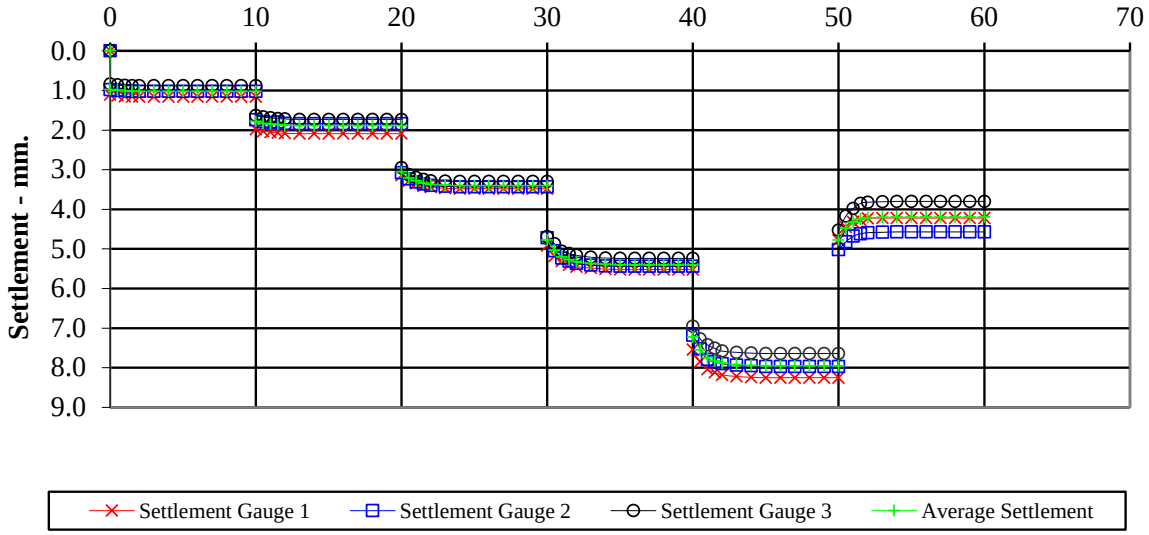
Test Position: CBR 1 **Depth (m):** 0.60

Plate Area (m2): 0.2922467 **Type of Kentledge:** Wheeled

Maximum Applied Pressure (kPa): 150.32
Maximum Deformation (mm): 7.95
Description: Brown slightly gravelly CLAY.



Time - minutes.



Compiled By	Date	Checked By	Date	Approved By	Date	Contract No.
	05/04/18		05/04/18		05/04/18	PSL18/1561
Meadow Road, Whitehaven						Page of

PSL
Professional Soils Laboratory

Professional Soils Laboratory Ltd.
5-7 Hexthorpe Road
Hexthorpe
Doncaster, DN4 0AR.
tel: 0844 8156641
fax: 0844 8156642

Calculation of Equivalent CBR Value from Plate Bearing Test

Design Manual for Roads and Bridges Volume 7 Section 2 Chapter 4
Incorporating IAN 73/06

Date of Test	**3-Apr-18**	
Test Position	**CBR 1**	
Depth (m)	**0.60**	
Description	**Brown slightly gravelly CLAY.**	
Maximum Deflection	**7.95**	**mm**
Deflection required for CBR value	**1.25**	**mm**
Load(@1.25mm)	**36.0**	**kN/m^2**
Plate diameter	**610**	**mm**
Conversion factor for plate diameter	**0.816**	
K_{762}(modulus of subgrade reaction)	**23.5**	**kN/m^2/mm**
CBR Value	**2.3**	**%**

Checked/Approved	Date
EKH	05/04/18

Meadow Road, Whitehaven	**Contract No.** **PSL18/1561**

PSL
Professional Soils Laboratory
Independent Laboratory Testing Services.

Professional Soils Laboratory
5 -7 Hexthorpe Road
Hexthorpe
Doncaster, DN4 0AG.
tel: 0844 8156641 . fax: 0844 8156642
e-mail: awatkins@prosoils.co.uk

VERTICAL DEFORMATION TESTS.

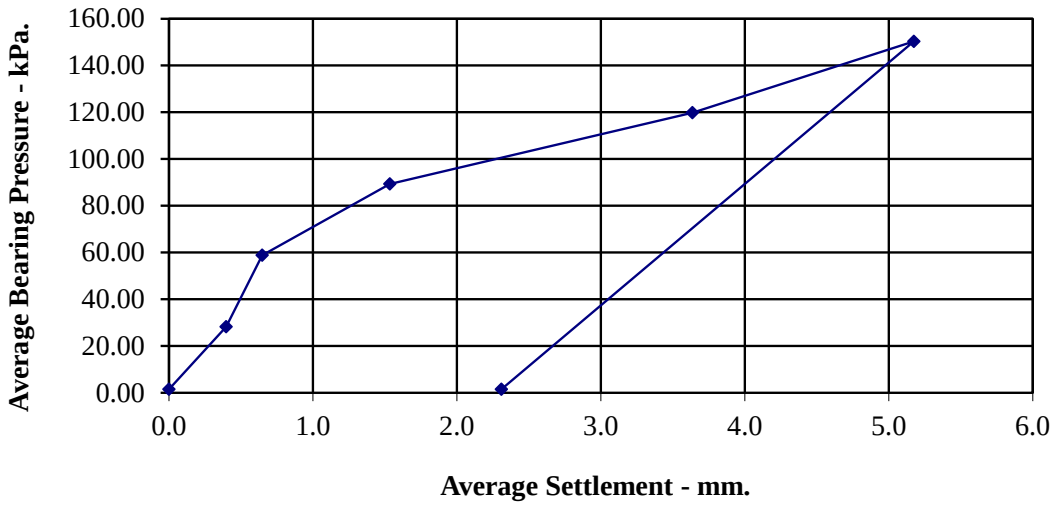
BS 1377 : Part 9 : 1990.

Date of Test: 03-Apr-18

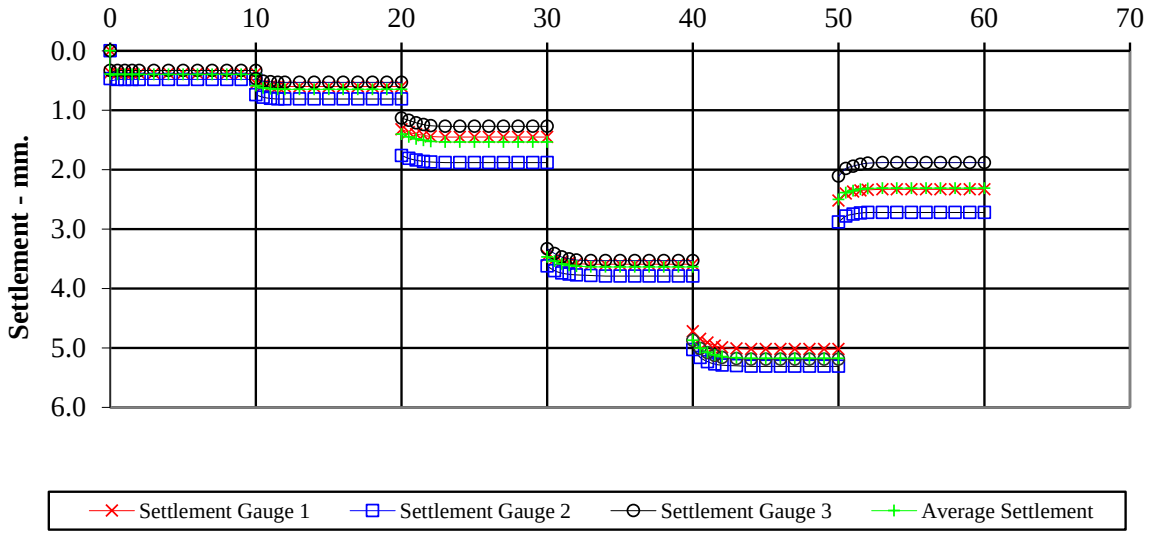
Test Position: CBR 2 **Depth (m):** GL

Plate Area (m2): 0.2922467 **Type of Kentledge:** Wheeled

Maximum Applied Pressure (kPa): 150.32
Maximum Deformation (mm): 5.17
Description: MADE GROUND brown gravelly sandy clay.



Time - minutes.



Compiled By	Date	Checked By	Date	Approved By	Date	Contract No.
	05/04/18		05/04/18		05/04/18	PSL18/1561
Meadow Road, Whitehaven						Page of

PSL
Professional Soils Laboratory

Professional Soils Laboratory Ltd.
5-7 Hexthorpe Road
Hexthorpe
Doncaster, DN4 0AR.
tel: 0844 8156641
fax: 0844 8156642

Calculation of Equivalent CBR Value from Plate Bearing Test

Design Manual for Roads and Bridges Volume 7 Section 2 Chapter 4
Incorporating IAN 73/06

Date of Test	**3-Apr-18**	
Test Position	**CBR 2**	
Depth (m)	**GL**	
Description		
	MADE GROUND brown gravelly sandy clay.	
Maximum Deflection	**5.17**	**mm**
Deflection required for CBR value	**1.25**	**mm**
Load(@1.25mm)	**80.0**	**kN/m^2**
Plate diameter	**610**	**mm**
Conversion factor for plate diameter	**0.816**	
K_{762}(modulus of subgrade reaction)	**52.3**	**kN/m^2/mm**
CBR Value	**9.2**	**%**

Checked/Approved	Date
	05/04/18

Meadow Road, Whitehaven	**Contract No.** **PSL18/1561**

PSL
Professional Soils Laboratory
Independent Laboratory Testing Services.

Professional Soils Laboratory
5 -7 Hexthorpe Road
Hexthorpe
Doncaster, DN4 0AG.
tel: 0844 8156641 . fax: 0844 8156642
e-mail: awatkins@prosoils.co.uk

VERTICAL DEFORMATION TESTS.

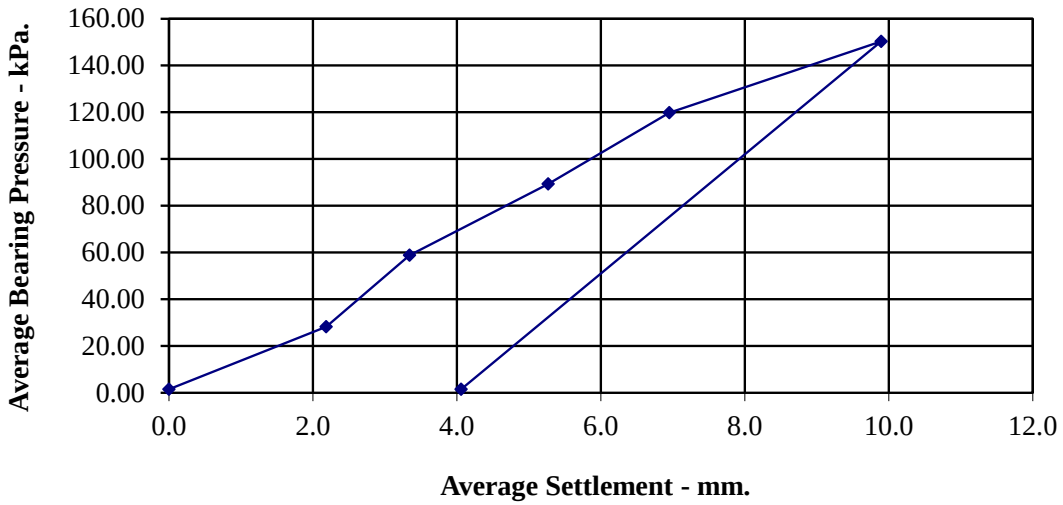
BS 1377 : Part 9 : 1990.

Date of Test: 03-Apr-18

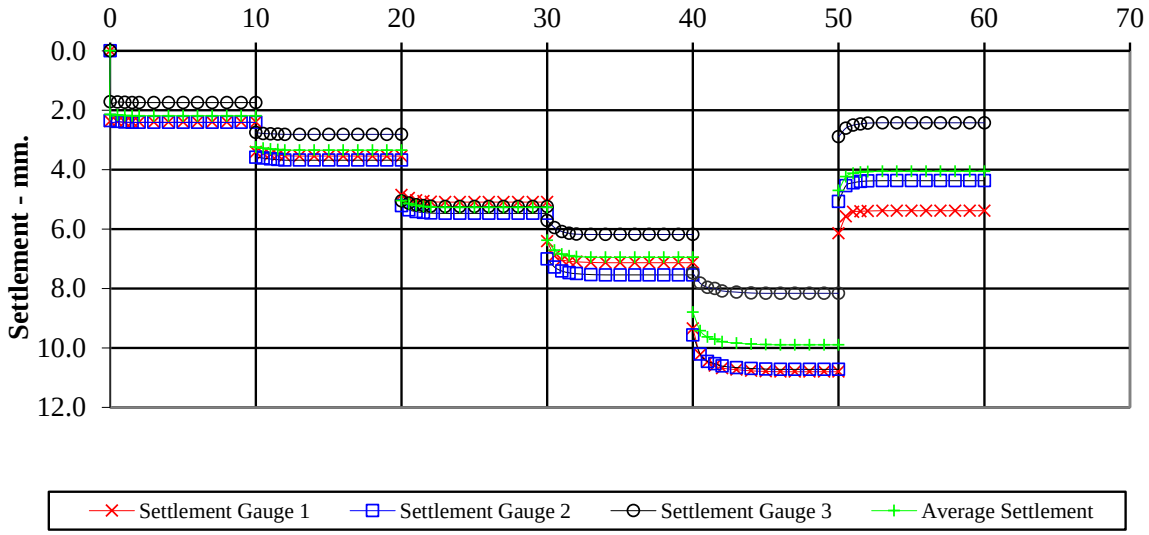
Test Position: CBR 3 **Depth (m):** 0.10

Plate Area (m2): 0.2922467 **Type of Kentledge:** Wheeled

Maximum Applied Pressure (kPa): 150.32
Maximum Deformation (mm): 9.89
Description: Natural Ground



Time - minutes.



Compiled By	Date	Checked By	Date	Approved By	Date	Contract No.
	05/04/18		05/04/18		05/04/18	PSL18/1561
Meadow Road, Whitehaven						Page of

PSL
Professional Soils Laboratory

Professional Soils Laboratory Ltd.
5-7 Hexthorpe Road
Hexthorpe
Doncaster, DN4 0AR.
tel: 0844 8156641
fax: 0844 8156642

Calculation of Equivalent CBR Value from Plate Bearing Test

Design Manual for Roads and Bridges Volume 7 Section 2 Chapter 4
Incorporating IAN 73/06

Date of Test	**3-Apr-18**	
Test Position	**CBR 3**	
Depth (m)	**0.10**	
Description	**Natural Ground**	
Maximum Deflection	**9.89**	**mm**
Deflection required for CBR value	**1.25**	**mm**
Load(@1.25mm)	**17.0**	**kN/m^2**
Plate diameter	**610**	**mm**
Conversion factor for plate diameter	**0.816**	
K_{762}(modulus of subgrade reaction)	**11.1**	**kN/m^2/mm**
CBR Value	**0.6**	**%**

Checked/Approved	Date
EKH	05/04/18

Meadow Road, Whitehaven	**Contract No.** **PSL18/1561**

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Meadow Rd, Whitehaven	**Date:**	19/06/2018
Job Number:	B067983	**Visit:**	5
Client:	Home Group	**Weather:**	Clear, dry
Barometric State:	steady	**Ground Conditions:**	Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	1017	0.0	0.0	0.0	0.0	1.6	1.6	11.8	0	12	1.00	2.57	
WS04	1017	0.0	0.0	0.0	0.0	0.1	0.1	20.0	0	6	1.05	2.42	
WS05	1017	0.0	0.0	0.0	0.0	4.8	2.7	14.2	0	5	1.40	2.15	
WS06	1017												1
CP02	1018	-0.4	-0.4								1.33	7.50	2
CP03	1019	0.0	0.0	0.0	0.0	0.3	0.2	20.5	0	3	0.77	8.75	
CP04	1018	0.0	0.0	0.0	0.0	0.4	0.4	20.3	1	3	1.20	9.10	
0													
0													
0													
0													
0													
0													
0													
0													

Notes

1 Car parked over well
2 Well flooded

Logged by

JB

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Meadow Rd, Whitehaven	**Date:**	26/04/2018
Job Number:	B067983	**Visit:**	1
Client:	Home Group	**Weather:**	Cloudy
Barometric State:	Steady	**Ground Conditions:**	Saturated

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	1007	0.0	0.0	0.0	0.0	0.6	0.6	9.7	1	0	0.90	2.80	
WS04	1007	0.0	0.0	0.0	0.0	0.0	0.0	20.5	2	0	0.60	2.70	
WS05	1007	0.0	0.0	0.0	0.0	0.2	0.0	20.3	2	0	1.00	2.20	
CP02	1007	0.0	0.0	0.0	0.0	0.0	0.0	20.2	3	2	1.25	7.70	
CP03	1008	0.0	0.0	0.0	0.0	0.0	0.0	20.5	2	0	0.70	8.70	
CP04	1008	0.0	0.0	0.0	0.0	0.0	0.2	20.3	2	1	0.95	9.00	
WS06	1008												1

Notes

1 Car parked over well

Logged by

ST

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Meadow Rd, Whitehaven	**Date:**	10/05/2018
Job Number:	B067983	**Visit:**	2
Client:	Home Group	**Weather:**	dry, sunny
Barometric State:	Rising	**Ground Conditions:**	dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	1010	0.4	0.4	0.0	0.0	0.5	0.5	19.40	2	3	0.6	2.68	
WS04	1013	0.0	0.0	0.0	0.0	0.0	0.0	20.10	1	1	0.86	2.40	
WS05	1013	0.0	0.0	0.0	0.0	0.1	0.0	20.30	1	0	1	2.16	
WS06	1011	0.0	0.0	1.6	1.6	0.5	0.5	11.40	2	8	1.45	2.75	
CP02	1011	0.0	0.0	0.0	0.0	0.0	0.0	20.70	2	0	1.08	7.76	
CP03	1012	0.0	0.0	0.0	0.0	0.0	0.0	20.4	2	0	0.60	8.75	
CP04	1012	0.0	0.0	0.0	0.0	0.0	0.0	20.4	1	0	1.01	9.00	

Notes

Logged by

ST

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Meadow Rd, Whitehaven	**Date:**	29/05/2018
Job Number:	B067983	**Visit:**	3
Client:	Home Group	**Weather:**	Sunny
Barometric State:	Falling	**Ground Conditions:**	Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	1020	0.0	0.0	0.0	0.0	0.1	0.1	21.6	1	3	1.00	2.62	
WS04	1019	-4.6	-4.6	0.0	0.0	0.2	0.2	20.4	1	5	0.50	2.40	
WS05	1019	0.0	0.0	0.0	0.0	0.4	0.2	21.1	0	3	1.60	2.20	
CP02	1018	0.0	0.0	0.0	0.0	0.0	0.0	20.0	1	5	1.36	7.65	
CP03	1018	0.0	0.0	0.0	0.0	0.0	0.0	21.9	3	5	0.88	8.90	
CP04	1018	-0.4	-0.4	0.0	0.0	0.4	0.4	21.5	3	5	1.10	9.05	
WS06													1

Notes

1 Car parked over well

Logged by

AHW

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Meadow Rd, Whitehaven	**Date:**	07/06/2018
Job Number:	B067983	**Visit:**	4
Client:	Home Group	**Weather:**	Clear, sunny
Barometric State:	steady	**Ground Conditions:**	Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	1017	0.0	0.0	0.0	0.0	0.0	0.0	20.8	1	0	0.97	2.60	
WS04													1
WS05	1017	0.0	0.0	0.0	0.0	0.5	0.2	20.5	1	0	1.58	2.20	
WS06	1017	0.0	0.0	7.0	7.0	2.1	2.1	1.0	1	0	1.10	2.80	
CP02	1017	0.0	0.0	0.0	0.0	0.1	0.0	20.8	0	0	1.40	7.60	
CP03	1017	0.0	0.0	0.0	0.0	0.0	0.0	20.6	0	0	0.67	8.78	
CP04	1017	0.0	0.0	0.0	0.0	0.3	0.2	20.5	1	0	1.10	9.05	

Notes

1. Could not be monitored due to removal of rubber bung seal.

Logged by

ST

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins Ltd
Rose Wharf, 78-80 East Street, Leeds, LS9 8EE
Tel: 0113 234 8509

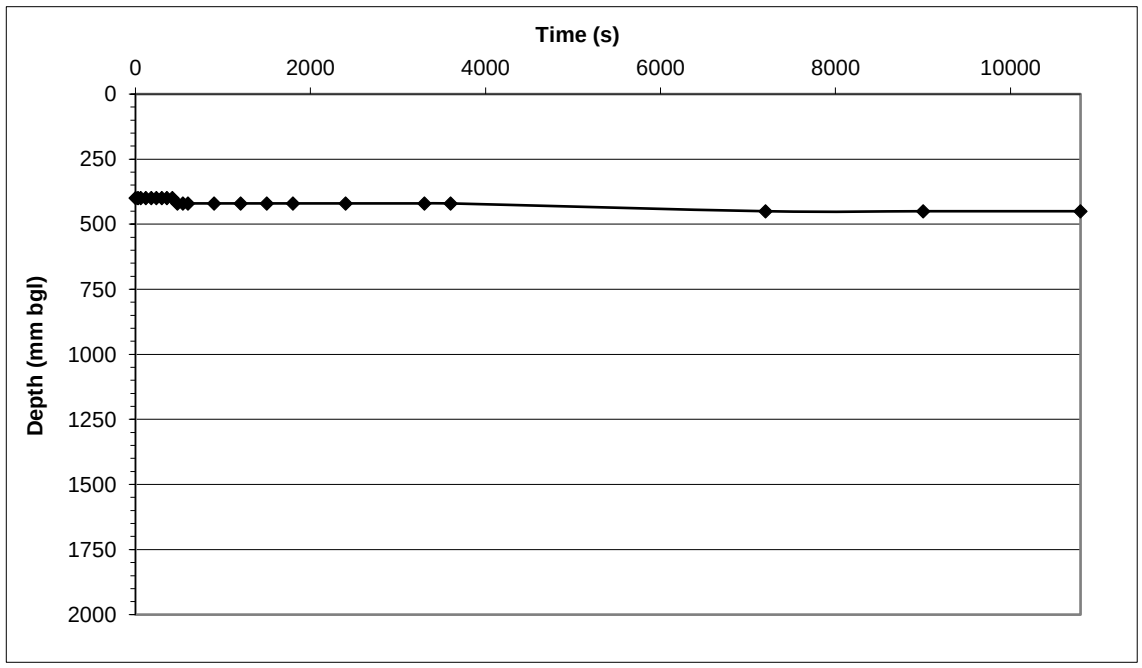
CALCULATION SHEET - SOIL INFILTRATION RATE

Project:	Meadow Road, Whitehaven
Job Number:	B067983
Author:	LD

Hole Ref.:	SA1
Test Date:	09/04/2018
Test No.:	1 of 1

1.60	m	Length of trial pit
0.60	m	Width of trial pit
1.40	m	Depth (total) of trial pit
0.96	m^2	Area of trial pit base
0.40	m bgl	Water level at start of test (approximate invert level)
0.45	m bgl	Water level at end of test
1.000	m	Effective storage depth
0.650	m bgl	Effective storage depth (75% full)
1.150	m bgl	Effective storage depth (25% full)
0.480	**m^3**	**Effective storage volume (V_{75-25})**
3.160	**m^2**	**Internal surface area (50% effective depth) (a_{50})**
N/A	**s**	**Time for head to fall from 75% to 25% effective depth (t_{75-25})**

#VALUE!	**m/s**	**Soil infiltration rate (f)**



Note 1: No gravel backfill

Note 2: Effective storage assumed to be full depth and t_{75-25} estimated as 24 hours.

RAW DATA

Project:	Meadow Road, Whitehaven
Job Number:	B067983
Author:	LD

Hole Ref.:	SA1
Test Date:	09/04/2018
Test No.:	1 of 1

Time (min)	Time (s)	Depth (mm bgl)	Stratum
0	0	400	Made Ground: Grey/Red GRAVEL.
0.5	30	400	
1	60	400	
2	120	400	
3	180	400	
4	240	400	
5	300	400	
6	360	400	
7	420	400	
8	480	420	Glacial Till:Grey sandy gravelly CLAY.
9	540	420	
10	600	420	
15	900	420	
20	1200	420	
25	1500	420	
30	1800	420	
40	2400	420	
55	3300	420	
60	3600	420	
120	7200	450	
150	9000	450	
180	10800	450	
240	14400	450	

Appendix D – Adopted Generic Assessment Criteria

- Residential without Homegrown Produce (2.5% SOM)

Adopted Soil Generic Assessment Criteria
Sandy loam with 2.5% SOM

curtins

Contaminants	Residential with home grown produce	Residential without home grown produce	Allotments	Commercial	Public open space near residential housing POS_{resi}	Public park POS_{park}
Metals						
Beryllium	*1.7*	*1.7*	*35*	*12*	*2.2*	*63*
Boron	*290*	*11,000*	*45*	*240,000*	*21,000*	*46,000*
Cadmium	**10**[13] 22	**85**[13] 150	**1.8** 3.9	**230** 410	*120* 220	*560* 880
Chromium III	*910*	*910*	*18,000*	*8,600*	*1,500*	*33,000*
Chromium VI	*6* 21	*6* 21	*1.8* 170	*33* 49	*7.7* 21	*220* 250
Lead	200	310	80	2,300	630	1,300
Mercury *(elemental)*	**1**	**1**	**26**	**26**	*16*	**26**[8] [*30*]
Mercury (inorganic)	**170**	**240**	**80**	**3600**	*120*	*240*
Nickel	*130*[10]	*180*[10]	*53*[11]	*980*[10]	*230*	*800*
Vanadium	*410*	*1200*	*91*	*9000*	*2000*	*5000*
Copper	*2400*	*7100*	*520*	*68000*	*12000*	*44000*
Zinc	*3700*	*40000*	*620*	*730000*	*81000*	*170000*
Semi-Metals and non-metals						
Arsenic	**32**[12] 37	**35**[12] 40	**43**[12] 49	**640**[12] 640	*79* 79	*170* 170
Antimony		***550***		***7500***	***1500***	***3300***
Selenium	**350**	**600**	**120**	**13000**	*1100*	*1800*
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
Aliphatic risk banded hydrocarbons - TPHCWG method						
$EC_{>5}$ - EC_6	*78*	*78*	*1700*	*5900*	*590000*	*130000*
$EC_{>6}$ - EC_8	*230*	*230*	*5600*	*17000*	*610000*	*220000*
$EC_{>8}$ - EC_{10}	*65*	*65*	*770*	*4800*	*13000*	*18000*
EC_{10}-EC_{12}	*330*	*330*	*4400*	*23000*	*13000*	*23000*
EC_{12}-EC_{16}	*2400*	*2400*	*13000*	*82000*	*13000*	*25000*
$EC_{>16}$ - EC_{35}	*92000*	*92000*	*270000*	*1700000*	*250000*	*480000*
$EC>_{35}$ - EC_{44}	*92000*	*92000*	*270000*	*1700000*	*250000*	*480000*
Aromatic risk banded hydrocarbons - TPHCWG method						
$EC>_5$ - EC_7	*140*	*690*	*27*	*46000*	*56000*	*84000*
$EC>_7$ - EC_8	*290*	*1800*	*51*	*110000*	*56000*	*95000*
$EC_{>8}$ - EC_{10}	*83*	*110*	*21*	*8100*	*5000*	*8500*
EC_{10} - EC_{12}	*180*	*590*	*31*	*28000*	*5000*	*9700*
EC_{12} - EC_{16}	*330*	*2300*	*57*	*37000*	*5100*	*10000*
$EC_{>16}$ - EC_{21}	*540*	*1900*	*110*	*28000*	*3800*	*7700*
$EC_{>21}$ - EC_{35}	*1500*	*1900*	*820*	*28000*	*3800*	*7800*
$EC>_{35}$ - EC_{44}	*1500*	*1900*	*820*	*28000*	*3800*	*7800*
Aliph + Arom EC >44-70	*1800*	*1900*	*2100*	*28000*	3800	7800
Aromatic						
Benzene	**0.16**	**0.49**	**0.035**	**50**	*72*	*100*
Ethyl benzene	**150**	**380**	**39**	**1200**[8] [35000]	**1200**[8] [*24000*]	**1200**[8] [*22000*]
Toluene	**270**	**1300**	**51**	**1900**[8] [110000]	**1900**[8] [*56000*]	**1900**[8] [*95000*]
Xylene[9]	**98**	**120**	**70**	**1200**[8] [14000]	**1200**[8] [*42000*]	**1200**[8] [*23000*]
Phenol	**290**	**420**	**140**	**1500**[14] (35000)	**1500**[14] (*10000*)	**1500**[14] (*8300*)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	*5.6*	*5.6*	*10*	*460*	*4900*	*1900*
Acenaphthylene	*420*	*4600*	*69*	*97000*	*15000*	*30000*
Acenaphthene	*510*	*4700*	*85*	*97000*	*15000*	*30000*
Fluorene	*400*	*3800*	*67*	*68000*	*9900*	*20000*
Phenanthrene	*220*	*1500*	*38*	*22000*	*3100*	*6200*
Anthracene	*5400*	*35000*	*950*	*540000*	*74000*	*150000*
Fluoranthene	*560*	*1600*	*130*	*23000*	*3100*	*6300*
Pyrene	*1200*	*3800*	*270*	*54000*	*7400*	*15000*
Benz(a)anthracene	*11*	*14*	*6.5*	*170*	*29*	*56*
Chrysene	*22*	*31*	*9.4*	*350*	*57*	*110*
Benzo(b)fluoranthene	*3.3*	*4.0*	*2.1*	*44*	*7.2*	*15*
Benzo(k)fluoranthene	*93*	*110*	*75*	*1200*	*190*	*410*
Benzo(a)pyrene	*2.7*	*3.2*	*2*	*35*	*5.7*	*12*
Indeno(123cd)pyrene	*36*	*46*	*21*	*510*	*82*	*170*
Dibenzo(ah)anthracene	*0.28*	*0.32*	*0.27*	*3.6*	*0.57*	*1.3*
Benzo(ghi)perylene	*340*	*360*	*470*	*4000*	*640*	*1500*
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	*0.00087*	*0.001*	*0.001*	*0.077*	*3.5*	*5*
Trichloroethene (TCE)	*0.034*	*0.036*	*0.091*	*2.6*	*120*	*91*
1,1,1,2 Tetrachlorethane	*2.8*	*3.5*	*1.9*	*250*	*1400*	*1800*
Tetrachlorethene (PCE)	*0.39*	*0.4*	*1.5*	*42*	*1400*	*1100*
1,1,1 Trichlorethane	*18*	*18*	*110*	*1300*	*140000*	*76000*

Notes

1. All values above are in mg/kg
2. **Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters**, *numbers in italics are S4ULs*, ***numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters*** and underlined numbers are C4SLs
3. Soil organic matter (SOM) is assumed to be 2.5% - DEFAULT VALUE
4. Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
5. For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
6. For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
7. For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m^{-3}
8. Based on vapour saturation limt as suggested by EA / [ ] model value
9. Lowest of o-, m- and p-xylene
10. Based on comparison of inhalation exposure with inhalation TDI
11. Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
12. Based on a comparison of oral and dermal soil exposure with oral Index Dose only
13. Averaged over and based on lifetime exposure
14. Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
15. NA: Not applicable

Appendix E - Qualitative/Quantitative Risk Assessment Rationale

The methodology for site-specific qualitative/quantitative risk assessment of environmental harm, undertaken in Sections 3.0 and 8.0 of this reporting, is summarised hereafter; the principle being to establish whether connecting links exist between a hazardous source to a potential receptor via an exposure pathway.

The qualitative/quantitative risk assessment corresponds with the total site area and incorporates both descriptive (qualitative) and, where available, numerical (quantitative) lines of evidence.

Risk assessment is the process of collating known information on a hazard or set of hazards in order to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem or future construction materials. Receptors can be connected to the hazardous source by one or several exposure pathways such as direct contact for example. Risks are generally managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway and receptor there can be no risk. Therefore, the presence of hazard on a site does not necessarily mean there is a risk.

By considering where a viable pathway exists which connects a source with a receptor the risk assessment in Section 3.0 and 8.0 identifies where pollutant linkage exists. If there is no pollutant linkage there is no risk and only where a pollutant linkage is established does the risk assessment consider the level of risk.

The risk assessment considers the likelihood of a particular event taking place (accounting for the presence of the hazard and receptor and the integrity of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment the consequence of the hazard has been classified as severe or medium or mild or minor and the probability (likelihood) of the circumstances actually occurring classified as high likelihood or likely or low likelihood or unlikely.

The consequences and probabilities are subsequently cross-correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability (Likelihood)	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	High/Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem or organisation forming part of such ecosystem.	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of such ecosystem.	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a Principal or Secondary A aquifer. Death of a species within a designated nature reserve. Lesser toxic and asphyxiate effects
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater (inc. Secondary B aquifers). Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

In accordance with DoE guidance, the following categorisation of **probability** has been developed.

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the 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 pollution 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 pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

Classification	Definition
Very High Risk	There is a *high probability* that *severe harm* could arise to a designated receptor from an identified hazard at the site without appropriate further action.
High Risk	*Harm* is *likely to arise* to a designated receptor from an identified hazard at the site without appropriate further action.
Moderate Risk	*It is possible* that without appropriate further action *harm could arise* to a designated receptor. It is relatively *unlikely* that any such harm would be *severe**,*** and if any harm were to occur it is *more likely* that such harm would be *relatively mild.*
Low Risk	*It is possible* that *harm could arise* to a designated receptor from an identified hazard. It is *likely* that, at worst, if any harm was realised any effects would be *mild.*
Very Low Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

The term ‘risk’ in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.

Appendix F – Outline Strategy for Dealing with Unforeseen Contamination

1 Unforeseen Contamination

The site is shown to be within is current configuration from the earliest available mapping.

Whilst considered unlikely the potential for unforeseen contamination to be encountered during development works cannot be ruled out. Potential unforeseen sources may include pockets of ash in the near surface soils or localised fuel spillages.

In the unlikely event that unforeseen contamination is revealed during the development works the outline strategy detailed below is recommended.

2 Outline Strategy

In the unlikely event that material is revealed on the site of a nature that does not accord with the anticipated ground conditions (natural sandy clays) the following procedure is to be complied with.

a) Cease and make safe all excavations in this location and report observations to the Site Manager.

b) The Site Manager is to notify the Engineer.

c) Under guidance of the Engineer take representative samples of the suspect materials and forward to a suitably accredited laboratory for analysis.

d) Await Engineers instructions with respect to re-commencement of the works and or removal from of suspect material to a suitably licensed disposal facility.

e) Sheffield Council and if relevant the Environment Agency are to be kept fully informed of any site such occurrences.

Our Locations

Birmingham
2 The Wharf
Bridge Street
Birmingham
B1 2JS
T. 0121 643 4694
birmingham@curtins.com

Bristol
Quayside
40-58 Hotwell Road
Bristol
BS8 4UQ
T. 0117 302 7560
bristol@curtins.com

Cambridge
50 Cambridge Place
Cambridge
CB2 1NS
T. 01223 631 799
cambridge@curtins.com

Cardiff
3 Cwrt-y-Parc
Earlswood Road
Cardiff
CF14 5GH
T. 029 2068 0900
cardiff@curtins.com

Douglas
Varley House
29-31 Duke Street
Douglas
Isle of Man
IM1 2AZ
T. 01624 624 585
douglas@curtins.com

Dublin
39 Fitzwilliam Square
Dublin 2
Ireland
T. 00353 1 507 9447
dublin@curtins.com

Edinburgh
1a Belford Road
Edinburgh
EH4 3BL
T. 0131 225 2175
edinburgh@curtins.com

Glasgow
Queens House
29 St Vincent Place
Glasgow
G1 2DT
T. 0141 319 8777
glasgow@curtins.com

Kendal
28 Lowther Street
Kendal
Cumbria
LA9 4DH
T. 01539 724 823
kendal@curtins.com

Leeds
Rose Wharf
Ground Floor
Leeds
L29 8EE
T. 0113 274 8509
leeds@curtins.com

Liverpool
51-55 Tithebarn Street
Liverpool
L2 2SB
T. 0151 726 2000
liverpool@curtins.com

London
40 Compton Street
London
EC1V 0BD
T. 020 7324 2240
london@curtins.com

Manchester
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG
T. 0161 236 2394
manchester@curtins.com

Nottingham
56 The Ropewalk
Nottingham
NG1 5DW
T. 0115 941 5551
nottingham@curtins.com

Registered in England and Wales number: 2054159
Registered office: 51-55 Tithebarn Street, Liverpool L2 2SB