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GEOENVIRONMENTAL APPRAISAL

of land at

**PHASE 4, EDGEHILL PARK,
WHITEHAVEN**

Prepared for

STORY HOMES

Report No. 4046-G-R024

Date: December 2021

EXECUTIVE SUMMARY

The site is located off Wilson Pit Road, Whitehaven, Cumbria, approximately 2km southwest of Whitehaven town centre (NGR 297360, 515800). The site occupies an area of 3.95 hectares. The site comprises a single open field, bound by wire fencing to the north and west and a wrought iron fence to the north and east. The southern boundary is not demarcated. The site slopes gently from north to south, progressing into moderately steep slopes, which fall down to the eastern and south eastern boundaries. A hollow of circa 2.0m depth and hummocky ground in the northwest of the site are indicative of historical clay and potentially coal excavation from outcrop.

IDG have previously issued Preliminary Geoenvironmental (Desk Study) and Coal Mining Risk Assessment (CMRA) Report reference 4046-G-R015 which provided a conceptual site model and the results of an exploratory rotary probehole investigation. The CMRA identified shallow unrecorded shallow coal mineworkings beneath the east of the site.

IDG were commissioned by Story Homes to provide a geoenvironmental appraisal of the site and to carry out further rotary probing to assess the influence of shallow unrecorded coal workings. Story Homes Block Plan reference 66D-STO 005 Rev D indicates that the site is to be redeveloped with two/three storey housing.

IDG's investigation included a ground investigation comprising twenty-six trial pits and sixteen rotary probeholes.

A summary of salient geoenvironmental issues is provided in the following table.

Issue	Remarks
Ground Conditions	A nominal 0.3m of Topsoil/Topsoil Made Ground present across site. Up to 0.9m of Cohesive & Granular Made Ground in the northwest of the site. A thin, 1.2m thickness of Glacial Till present in the west of the site. Residual mudstone (sandy silty clay) to 1.0-1.5m progressing into partially weathered mudstone, sandstone & siltstone bedrock. Thin 0.2-0.5m thick coal encountered locally at outcrop.
Mining & Quarrying	Up to four coal seams proven. Unrecorded abandoned shallow mineworkings encountered in one seam between depths of 18.4m and 27.8m bgl which dips beneath the east of the site. Historical clay/coal surface excavation to approximately 2.0m bgl has occurred in the northwest of the site which will require infilling to achieve consistent development levels.
Hazardous Gas	Preliminary ground gas monitoring carried out in 2020 indicates CS1. Supplementary monitoring is ongoing to establish potential for migration of hazardous mines gases associated with abandoned shallow mineworkings.
Radon	No radon protection measures required.
Contamination & Remediation	No significant contamination encountered or remediation required.
Foundations	Initial zoning plan indicates a combination of strip/trenchfill, piles and rafts are appropriate.
Groundwater & Excavations	Groundwater has not been encountered and is not anticipated to occur in shallow excavations.
Highways	The firm/stiff clay and weathered coal measures bedrock should provide CBR's in excess of 2%.
Flooding & Drainage	The site is not located in a zone of flooding by rivers or sea. Ground conditions are not appropriate for a soakaway drainage solution. Story Homes Levels and SUDS drawing indicates drainage will comprise a combination of SUDS and SWALE features.

Geoenvironmental issues with potential for significant 'abnormal' costs include:

- Treatment of shallow mineworkings & mine shaft

This brief summary should not be assumed to represent a complete account of all the potential geo-environmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.

- Raft foundations
- Locally deepened foundations due to soft ground
- Substantial cut and fill earthworks
- Cut, import of suitable engineered fill materials with the former claypit/coal excavation area in the northwest of the site to achieve consistent site levels.

Some further work is required, notably:

- Rotary probeholes and trial pits in the southeast of the site to establish risks from shallow mineworkings in respect of the Block Plan layout presented as drawing 66D-ST0 005 Rev D dated September 2021

This brief summary should not be assumed to represent a complete account of all the potential geo-environmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.

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APPENDICES

Appendix A - Drawings

Drawing No.	Title
4046-G-D038	Site Location Plan
4046-G-D040 Rev D	Exploratory Hole Location Plan
4046-G-D054	Geological Cross Sections
4046-G-D055	Mining Influence Plan
4046-G-D056	Foundation Zoning Plan
66D-STO 005 Rev D	Story Homes Block Plan
7843/SK01	Coopers Levels & SUDS Strategy Drawing

Appendix B - Exploratory Records

Appendix C - Contamination Analysis & Chemical Test Results

Appendix D - Geotechnical Test Results

Appendix E - Gas Monitoring Results

Appendix F - General Notes

Appendix G - Commission

01	Environmental Setting
02	Ground Investigation Fieldwork
03	Geotechnical Testing
04	Contamination Laboratory Analysis & Interpretation (including WAC)
05	Hazardous Gas
07	MMP Guidance

Revision History

From	Date	Comments
4046-G-R024	December 2021	Original Report

FOREWORD (Geoenvironmental Investigation Report)

This report has been prepared for the sole internal use and reliance of the Client named on page 1. This report shall not be relied upon or transferred to any other parties without the express written authorisation of ID Geoenvironmental Limited (IDG); such authorisation not to be unreasonably withheld. If any unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill.

The report presents observations and factual data obtained during our site investigation, and provides an assessment of geoenvironmental issues with respect to information provided by the Client regarding the proposed development. Further advice should be sought from IDG prior to significant revision of the development proposals.

The report should be read in its entirety, including all associated drawings and appendices. IDG cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context.

The findings and opinions conveyed in this report (including review of any third party reports) are based on information obtained from a variety of sources as detailed within this report, and which IDG believes are reliable. All reasonable care and skill has been applied in examining the information obtained. Nevertheless, IDG cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

The report represents the findings and opinions of experienced geo-environmental consultants. IDG does not provide legal advice and the advice of lawyers may also be required.

Intrusive investigation can only investigate shallow ground beneath a small proportion of the total site area. It is possible therefore that the intrusive investigation undertaken by IDG, whilst fully appropriate, may not have encountered all significant subsurface conditions. Consequently, no liability can be accepted for conditions not revealed by the exploratory holes. Any opinion expressed as to the possible configuration of strata between or below exploratory holes is for guidance only and no responsibility is accepted as to its accuracy.

It should be borne in mind that the timescale over which the investigation was undertaken may not allow the establishment of equilibrium groundwater levels. Particularly relevant in this context is that groundwater levels are susceptible to seasonal and other variations and may be higher during wetter periods than those encountered during this commission.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

This report assumes that ground levels will not change significantly from those existing at present. If this is not to be the case, then some modification may be required.

ID Geoenvironmental Limited cannot be responsible for the consequences of changing practices, revisions to waste management legislation etc that may affect the viability of proposed remediation options.

IDG reserve the right to amend their conclusions and recommendations in the light of further information that may become available.

GEOENVIRONMENTAL APPRAISAL & SUPPLEMENTARY MINING INVESTIGATION

of land at

PHASE 4, EDGEHILL PARK, WHITEHAVEN

1 INTRODUCTION

1.1 The Commission and Brief

1.1.1 ID Geoenvironmental Limited (IDG), have been commissioned by Story Homes to undertake a geoenvironmental appraisal and supplementary mining investigation of land at Phase 4, Edgehill Park, Whitehaven, hereafter referred to as 'the site'.

1.1.2 IDG have previously issued the following reports:

- Preliminary Geoenvironmental Investigation & Coal Mining Risk Assessment, Edgehill Park Whitehaven, Reference 4046-G-R015, dated October 2020 (Rev A issued November 2021)
- Hazardous Ground Gas Risk Assessment- Phase 4, Edgehill Park, Whitehaven, Cumbria, reference 4046-G-LR014, dated December 2020.

1.1.3 Reference should be made to report reference 4046-G-R015 for details of the site's history and environmental setting.

1.1.4 The agreed scope of works for this phase of investigation comprised:

- Review of the conceptual model for the site and design of an intrusive investigation.
- An intrusive investigation comprising 26 trial pits and 16 rotary probeholes
- Installation of two supplementary monitoring wells and monitoring of groundwater levels and hazardous ground gases on 4 occasions over a two month period.
- Undertaking a quantitative contamination risk assessment using generic assessment criteria.
- Identification of site development constraints and provision of recommendations for site remediation works
- Provision of recommendations for appropriate foundation solutions

1.1.5 Correspondence regarding IDG's appointment, including the brief for this investigation, is included in Appendix G.

1.2 Geotechnical Category of Proposed Development

1.2.1 It is understood that consideration is being given to residential redevelopment of the site as described in Section 2.3.1 below.

1.2.2 IDG have classified the proposed development as Geotechnical Category 2.

1.2.3 The principal objective of this exploratory phase of investigation is to identify salient geoenvironmental issues affecting the site. Supplementary investigation to satisfy the Local Planning Authority, develop a Remediation Strategy and enable refinement of development proposals may be required.

1.3 Report Format and Limitations

1.3.1 All standard definitions, procedures and guidance are contained within Appendix F, which includes background, generic information on:

- Assessment of the environmental setting of the site
- Ground investigation fieldwork
- Geotechnical Testing
- Contamination Testing
- Hazardous Gas

- 1.3.2 General notes and limitations relevant to all IDG investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.

2 SITE DESCRIPTION AND DEVELOPMENT PROPOSALS

2.1 General

- 2.1.1 The site location is shown on Drawing No. 4046-G-D038 presented in Appendix A. Site details are summarised in table 2.1

Table 2.1: Summary of Site Location Details

Location	2.0 km southwest of Whitehaven town centre
NGR	297360, 515800
Approximate Area	3.95ha
Known services	None depicted on service drawings

2.2 Site Features

- 2.2.1 An IDG Engineer completed a walkover survey of the site on 5th August 2020. Existing site features together with a photographic record of the site at the time of the walkover survey are presented in Drawing No. 4046-G-D039 in Appendix A and are summarised in the following table.
- 2.2.2 Detailed discussion of salient site features at the time of the walkover survey are presented in IDG's Preliminary Geoenvironmental Investigation report.

Table 2.2: Summary of Site Details

Current Access	Off Gameriggs Road
Topography	Majority of site in NW slopes gently from north to south, progressing into moderately steep slopes, which fall down to the eastern and south eastern boundaries Shallow former claypit/coal excavation with marshy base in NW up to 2.0m lower than site to the east and adjacent site to the west.
Approximate areas	2100m ² marsh area 37,400m ² grass
Surrounding land uses	North & east – housing on Wastwater Road and Valley View Road respectively South – Farm and outbuildings, access track and open fields. West – Open fields.

- 2.2.3 The site is currently used for cattle grazing.

2.3 Proposed Development

- 2.3.1 The Proposed Story Homes Block Plan reference 66D-STO 005 Rev D shows that consideration is being given to redevelopment of the site with two/three storey domestic dwellings, associated gardens, Public Open Space (POS) areas and adoptable roads and sewers.
- 2.3.2 The majority of the site slopes gently from north to south, progressing into moderately steep slopes, which fall down to the eastern and south eastern boundaries.. It is anticipated that cut and fill operations will be required to create the desired development platform and retaining structures are likely to be required.
- 2.3.3 A 2m deep marshy hollow and hummocky ground considered evidence of clay or surface coal extraction is present within the northwester corner of the site, which progresses southwards within the site's western boundary. This zone will require cutting back to expose competent natural strata and backfilling with appropriately re-engineered layers of suitable material to achieve levels consistent with the remainder of the site to the east and adjacent site to the west.
- 2.3.4 The marshy hollow and hummocky ground are depicted on Drawing No. 4046-G-D039 Site Features in Appendix A. It should be noted that the Topographic survey reproduced in Drawing 4046-G-D039 is not sufficiently detailed to describe the hummocky nature of this area.

3 PREVIOUS INVESTIGATION FINDINGS

3.1 General

3.1.1 The findings of IDG Report reference 4046-G-R015 and the Ground Gas Risk Assessment reference 4046-G-LR014 are summarised below:

- The site is underlain by Carboniferous Middle Coal Measures comprising interbedded mudstone, sandstone and siltstone with coal seams. The Black Metal coal seam is indicated to outcrop within the site and to dip to the west below the western part of the site. The Slaty Coal is depicted to outcrop to the immediate east of the site and to dip at a shallow angle below the site.
- The site has remained relatively undeveloped, however a brickworks, clay and potentially extraction of coal at outcrop is indicated to have encroached into the west of the site where hummocky ground and a marshy hollow are evident. Minor localised contamination associated with made ground/colliery spoil may be present.
- Coal Authority mine shaft reference 297515-008 (Watson Pit) is located in the southwest corner of the site. Shaft references 297515-002 (Banks Pit) and 297515-003 (Baxter Pit) are located within 20m north of the site and shaft reference 297515-007 is located approximately 70m south of the site. None of the shafts are recorded as being treated.
- The east of the site is depicted as being within a Coal Authority Development High Risk Zone associated with the outcrop of the Black Metal and Slaty Coal seams.
- An exploratory intrusive ground investigation comprising 6 rotary probeholes was undertaken to assess for the presence of coal seams.
- The Black Metal Coal was proven between depths of 5.5m (PH634) and 22.6m bgl (PH633) and is between 0.7m and 1.2m in thickness (including a 200mm parting). The Slaty Coal was proven between 14.4m (PH634) and 30.8m bgl (PH633) and is nominally of 1.0m thickness.
- Probable shallow coal mineworkings were encountered within Probehole PH630 between 26.6m and 27.8m bgl at the site's centre were interpreted to be associated with the Slaty Coal seam. No evidence of workings was encountered in the Black Metal Coal.
- Based upon the indicated strata dip to the west, workings within the Slaty Coal were anticipated to affect stability of structures in the east of the site where the site slopes steeply down to the boundary, although it was considered unlikely that any development would take place within this zone.
- Further assessment of the risk from shallow mineworkings within the shallower Black Metal Coal seam was recommended.
- Shallow mine workings are considered a potential source of hazardous ground gas. Ground gas monitoring wells were installed in four shallow boreholes with response zones in shallow bedrock and where coal was close to outcrop. Six ground gas monitoring visits did not detect any significant concentrations of methane or carbon dioxide or positive ground gas flow rates.
- The monitoring programme indicated the site should be classified Characteristic Situation 1 (CS1). However, further assessment of the sites ground gas regime was recommended once the further investigation and potentially treatment of shallow mineworkings had taken place.

3.1.2 A copy of the Preliminary Conceptual Model provided in Report 4046-G-R015 is presented as Table 3.1 overleaf.

Table 3.1: Summary of Potential Pollutant Linkages

Potential Contamination Source	Receptors	Plausible Pathways	Evidence / Site Features
Metals in Colliery Spoil Made Ground	Human Health (future site users – residential with consumption of home-grown produce)	Ingestion, direct contact, inhalation of dust	i.e. Colliery Spoil associated with mine shafts
PAH in Colliery Spoil Made Ground	Human Health (future site users – residential with gardens)	Direct contact, inhalation of dust	i.e. coal burnt around shaft entrances
Hazardous Gas (CO ₂ , CH ₄)	Human Health	Migration of Carbon Dioxide through granular strata and ingress into confined spaces leading to potential asphyxiating mixtures of gas	Mines gases migrating via onsite and offsite mineshafts and potentially abandoned shallow mineworkings.
	Proposed Buildings	Migration of Methane through granular strata and ingress into confined spaces leading to potential explosive mixtures of gas	

4 GROUND INVESTIGATION DESIGN

4.1 Ground Investigation Design & Strategy

4.1.1 The preliminary conceptual site model was used as a basis for design of an appropriate ground investigation, the scope of which is summarised below.

Table 4.1: Initial Ground Investigation Strategy

Exploratory Holes	Purpose
Trial Pits	To determine the general nature of soils underlying the site, including the: <ul style="list-style-type: none"> Suitability of Topsoil for re-use Nature, distribution and thickness of any Made Ground deposits Proportion of undesirable elements e.g. biodegradable matter, etc. Suitability of the ground for founding structures and highways
Rotary probeholes	<ul style="list-style-type: none"> To check for the presence of voids or broken ground associated with possible unrecorded shallow mine workings To install monitoring wells across the site in order to monitor for hazardous gas.

4.1.2 Proposed exploratory hole locations were selected to provide a representative view of the strata beneath the site and to target potential areas of interest noted in the preceding sections of this report. Additional exploratory locations are typically scheduled by the site engineer in light of the ground conditions actually encountered.

4.1.3 The site's history does not indicate that significant contamination is likely to be encountered. Consequently chemical analysis to assess for the presence of the following common determinands is considered appropriate:

- pH, metals and metal oxides
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Asbestos fibres

5 FIELDWORK

5.1 Exploratory Hole Location Constraints

5.1.1 It was not possible to drill any rotary holes within 40m of the site's eastern boundary due to the instability of the rotary drilling rig upon the steep slope.

5.2 Scope of Works

5.2.1 Fieldwork was supervised by IDG between 1st and 5th September 2021 which comprised the exploratory holes listed in Table 5.1.

Table 5.1: Scope of Ground Investigation Works

Technique	Exploratory holes	Final depth(s)	Remarks
Trial Pitting	TP750-TP775	1.2m - 2.5m	Vane tests in cohesive soils.
Rotary Probeholes	PH901 – PH916	18m – 42.0m	Monitoring wells installed in PH902 & PH907

5.2.2 Notes describing ground investigation techniques, in-situ testing and sampling are included in Appendix F.

5.2.3 Exploratory hole locations are shown on Drawing No. 4046-G-D040 Rev D presented in Appendix A.

5.3 General

5.3.1 Detailed descriptions of the ground conditions are provided on the exploratory logs presented in Appendix B, A general summary of ground conditions is provided below.

5.3.2 The exploratory hole logs include:

- Details of the samples taken
- Descriptions of the strata
- Details of groundwater conditions encountered
- Results of in-situ testing
- Details of monitoring wells installed

5.3.3 Detailed discussion of the rotary probehole findings is provided in the Mining Investigation Section.

5.4 Topsoil

5.4.1 Trial pits outside of the excavation areas in the northwest of the site proved between 0.2m and 0.4m thickness of natural Topsoil comprising slightly gravelly silty sandy clayey loam. Up to 0.2m of reworked Topsoil was proven within the excavation area (over Made Ground) which included occasional anthropogenic items such as brick cobbles/gravel.

5.5 Made Ground

5.5.1 Reworked Topsoil, Granular and Cohesive Made Ground was proven to depths of between 0.15m and 0.9m bgl in TP750-TP753 and TP755 in the northwest and west of the site within hummocky ground indicative of clay extraction and/or coal excavation.

5.5.2 The Cohesive and Granular Made Ground comprised sandy gravelly clay/gravelly sand with varying proportions of brick, sandstone and coal gravel, brick cobbles and pottery fragments.

5.5.3 Concrete and brick cobbles and masonry were also encountered in TP753 and up to 0.9m thickness of Cohesive Made Ground comprising metal pipes, rods and wire with brick and rubber tubing were also encountered in TP755.

5.6 Natural Ground

Superficial Deposits

5.6.1 Up to 1.2m thickness of Glacial Till generally comprising stiff brown clay with varying proportion of gravel and cobbles and pockets of sand was encountered in the western half of the site within Trial Pits TP751, TP754, TP756 & TP759-TP763. Hand shear vane tests within the Glacial Till generally recorded values in excess of 100kPa, indicating high strength.

5.6.2 Localised deposits of soft/low strength (i.e. 22-36kPa) reworked clay were however locally proven between 0.5 and 1.3m bgl in TP756, TP757 above relict clay land drains.

Solid Strata

5.6.3 Middle Coal Measures comprising mudstone, siltstone and sandstone beds and locally coal seams, was proven between depths of 0.2m (TP764 beneath Topsoil) and 1.4m bgl (TP754 beneath Glacial Till).

5.6.4 Residual mudstone bedrock was recovered as yellow sandy clay or grey and brown silty clay

between depths of 0.4m (TP758) and 1.5m (TP765), although typically to 1.0m bgl.

- 5.6.5 Distinctly weathered siltstone and sandstone recovered as friable siltstone and sandstone gravel respectively was encountered between depths of 0.3 (TP753) and 1.9m (TP771).
- 5.6.6 Destructured/partially weathered light brown mudstone was also recovered as slightly sandy gravel sized particles, typically from 1.0m (TP751) depth.
- 5.6.7 Coal seams were encountered at shallow (i.e. founding) depth within trial pits TP751 (1.2 – 1.7m bgl), TP761 (1.6 – 2.1m bgl) and rotary probehole PH901 (1.0 - 1.5m bgl). Deeper coal seams were also encountered between depths of 6.5m bgl and 39.5m bgl. Further discussion of the distribution of coal seams is presented in Section 6.
- 5.6.8 The distinctly weathered graded into partially weathered Mudstone, Sandstone and Siltstone, and became difficult to excavate between depths of 1.0 – 2.0m bgl.
- 5.6.9 Where possible, hand shear vanes were carried out within the cohesive weathered mudstone bedrock which returned values between 56kPa (TP765) and 135kPa (several locations from 1.0m bgl). Overall the results indicate stiff / high strength clay to be present from a depth of 1.0m bgl.

5.7 Visual & Olfactory Evidence of Hydrocarbon Contamination

- 5.7.1 No evidence of significant hydrocarbon contamination was noted in any of the exploratory holes.

5.8 Groundwater

- 5.8.1 No evidence of a shallow or deeper groundwater body was encountered during the investigation.
- 5.8.2 A slight inflow of perched water was recorded within a granular deposit at 1.2-1.3m bgl beneath a relict land drain in TP756.

5.9 Stability

- 5.9.1 Stability of excavations within both the made ground and natural ground was generally good.

6 SHALLOW MINING INVESTIGATION

6.1 Geological Interpretation

- 6.1.1 The supplementary intrusive investigation undertaken between 1st and 5th September 2021, comprised sixteen rotary probeholes (PH901 to PH916), drilled to a maximum depth of 42m using air/water flush to supplement PH630-PH636 drilled during September 2020.
- 6.1.2 Copies of the 2020 & 2021 probehole investigation logs are presented in Appendix B. The findings of both 2020 and 2021 rotary investigations & applicable trial pits are considered below.
- 6.1.3 The exploratory holes encountered four seams of coal between depths of 1.0m and 40.5m bgl, although only three rotary probeholes boreholes (PH905, PH908 & PH912), were drilled to depths sufficient to prove the deepest seam.
- 6.1.4 Interpretation of the coal seam sequence is based upon the Geological Cross Sections presented in Drawing reference 4046-G-D054 presented in Appendix A.
- 6.1.5 Three coal seams were proven in the probeholes which broadly correlate with the BGS stratigraphic column. Based on the BGS geological map, the stratigraphically upper or shallowest of these seams is interpreted to be the Black Metal Coal seam which appears close to outcrop at in PH901 (1.0-1.5m), PH630 (1.8-2.0m) and TP761 (1.6-2.1m).
- 6.1.6 Two leaves of coal each between 0.1-0.4m thick with a thin (0.1-0.8m thick) parting of mudstone (generally black in colour) were encountered between 5.5m in PH634 and 17.8m in PH630. This split seam was proven in the majority of probeholes. In terms of stratigraphical succession, the split seam could potentially represent the Slaty Coal. However, extrapolation of the dip of a (typically 7.5m) deeper, more substantial coal seam of up to 1.3m thickness, encountered between depths of 14.4m in PH634 and 26.7m in PH636, more readily accords with the BGS inferred outcrop of the

Slaty Coal seam immediately east of the site.

- 6.1.7 In the northeast of the site the inferred Slaty Coal seam is up to 1.3m in thickness (PH901). However, drilling records indicate it thins towards the southwest where it reduces to between 0.6m (PH914) and 0.8m (PH912) thickness.
- 6.1.8 The deepest seam was proven at depths of 30.3 – 32.0m (PH912), 31.1 - 32.9m (PH908) and 39.5 - 40.5m (PH905). Based upon extrapolation of seam dip and the inferred outcrop east of the site, this seam is interpreted to be the Ten Quarters Coal.
- 6.1.9 Broken ground accompanied by loss of flush indicative of probable shallow mineworkings was proven in the north-eastern quarter of the site in six locations between depths of 18.4m (PH902) and 27.8m bgl (PH630). The Geological Cross Sections A=A' & B-B' indicate these workings are likely to be within the Slaty Coal seam.
- 6.1.10 No evidence of workings has been encountered in the shallow split seam or Ten Quarters Coal.
- 6.1.11 A shallow coal seam encountered in trial pit TP751 (1.2-1.7m) and PH633 (7.3-7.7m) in the northwest of the site is considered to be associated with a sequence of thin seams which dip at shallow depth beneath the adjacent Phase 3 site immediately west. These thin seams are not considered to be sufficiently thick enough to have been worked underground although may have been worked at surface in the northwest of the site and the adjacent Phase 3 (where there is evidence of either clay pitting or surface coal excavation).
- 6.1.12 Table 6.1 summarises the records of exploratory holes where coal was encountered, including relative depth to coal seams, probable workings and risk to the stability at the site surface.

Table 6.1: Summary of Exploratory Records

Hole ID*	Final Depth (m bgl)	Depth to Rockhead (m bgl)	Depth to Coal (m bgl)	Coal Thickness (m)	Probable workings (m bgl)	Top of Coal/workings (m AOD)	Influencing Distance of surface? (m bgl)
TP751 (90.6)	1.9	1.0	1.2	0.5	-	89.4	Yes
TP761 (90.8)	2.3	0.9	1.6	0.5	-	89.2	Yes
PH630 (90.5)	28.8	1.5	1.8	0.2	-	88.7	Yes
			17.8	0.5	-	72.7	No
			18.5	0.5	-	72.0	No
				26.6 – 27.8		63.9	No
PH631 (83.0)	4.5	0.5	-	-	-	-	-
PH632 (83.7)	30.0	0.8	7.0	0.3	-	76.7	No
			7.6	0.4	-	76.1	No
			16	1.0	-	67.7	No
PH633 (92.0)	33.0	0.8	7.3	0.4	-	84.7	No
			22.6	0.5	-	69.4	No
			30.8	1.0	-	61.2	No
PH634 (87.9)	24.0	1.0	5.5	0.4	-	82.0	No
			6.1	0.3	-	82.4	No
			14.4	0.9	-	73.5	No
PH635 (86.9)	21.0	1.0	9.2	0.8	-	77.7	Yes
			10.6	0.3	-	76.3	No
			18.5	1.0	-	68.4	No
PH636 (87.8)	30.0	1.0	9.2	0.8	-	78.6	Yes
			26.7	0.5	-	61.1	No
PH901 (92.95)	30.00	0.3	1.0	0.5	-	91.95	Yes
			18.0	0.3	-	74.95	No
			25.5	1.3	-	67.45	No

Hole ID*	Final Depth (m bgl)	Depth to Rockhead (m bgl)	Depth to Coal (m bgl)	Coal Thickness (m)	Probable workings (m bgl)	Top of Coal/workings (m AOD)	Influencing Distance of surface? (m bgl)
PH902 (91.67)	24.00	0.3	12.4 13.0	0.1 0.1	- - 18.4 – 21.4	79.27 78.67 73.27	No No No
PH903 (88.2)	24.00	0.3	6.5 15.00	0.1 0.5		81.7 73.2	No No
PH904 (90.0)	21.0	0.3	11.5 12.1 19.0	0.1 0.1 0.8	18.5 – 19.0	78.5 77.9 71.5 -	No No No No
PH905 (91.75)	42.0	0.3	15.0 39.5	0.1 1.0	23.0 – 24.4	79.25 68.75 52.25	No No No
PH906 (88.24)	24.0	0.3	6.5 7.4 15.5	0.1 0.1 0.6		81.74 80.84 72.74	No No No
PH907 (89.7)	21.0	0.3	10.2 10.8	0.2 0.1	18.3 – 19.5	79.67 78.87 71.37	No No No
PH908 (87.0)	34.0	0.3	7.2 8.0 16.0 31.1	0.1 0.1 0.6 1.8		79.8 79.0 71.0 55.9	No No No No
PH909 (89.85)	24.0	0.3	12.0 12.6	0.1 0.1	20.0 – 21.5	77.85 77.25 69.85	No No No
PH910 (88.3)	21.0	0.3	9.7 10.5 18.5	0.1 0.1 0.8		78.6 77.8 69.8	No No No
PH911 (86.72)	18.0	0.3	5.9 6.5 14.7	0.1 0.1 0.7		80.82 80.22 72.02	No No No
PH912 (86.15)	33.0	0.3	6.5 7.1 15.3 30.3	0.1 0.1 0.6 1.7		79.65 79.05 70.85 55.85	No No No No
PH 913 (88.3)	24.0	0.3	10.7 11.8 19.5	0.2 0.1 0.8		77.6 76.5 68.8	No No No
PH914 (85.62)	18.0	0.3	6.5 7.1 15.2	0.1 0.2 0.8		78.7 78.1 70.0	No No No
PH915 (85.5)	24.0	0.3	12.0 12.6 20.8	0.1 0.2 0.7		73.5 72.9 64.7	No No No
PH916 (89.25)	27.0	0.3	14.8 15.5 23.6	0.1 0.2 0.8		74.45 73.75 65.85	No No No

* Collar elevation mAOD

6.1.13 In summary, the Geological Cross Sections depicted on Drawing 4046-G-D054 indicate that abandoned shallow mineworkings are present within a seam of coal of up to 1.3m in thickness, which is likely to be the Slaty Coal. Abandoned workings have been encountered between depths of 18.3m bgl (PH907) and 27.8m bgl (PH630). Comparison of Table 1 with the Exploratory Hole Plan 4046-G-D040 Rev D indicates that evidence of workings within this seam predominate in the north-eastern quarter of the investigation area.

6.2 Phase 4 Ground Stability Risks

- 6.2.1 Table 6.1 indicates thin seams were encountered close to outcrop in TP751 and PH633 in the west of the site. These thin seams may have been worked at outcrop in the northwest of the site.
- 6.2.2 A thin (0.2-0.5m thick) coal seam has also been encountered close to outcrop in PH630, PH901 and TP761 which is inferred to be the Black Metal Coal. This seam would be anticipated to dip at shallow depth beneath the west of the site. This seam is not considered to be consistently thick enough to warrant underground extraction.
- 6.2.3 No evidence of workings has been encountered in the two thin seams which are present at shallow depth beneath the east of the site, which when considered as one potentially extractable coal (i.e. PH635 & PH636) could influence the surface. Extraction of these closely spaced seams of coal would require simultaneous excavation of the intervening rock parting. Based upon the number of probeholes and absence of evidence of workings within any of the probeholes, the split seam is unlikely to have been worked.
- 6.2.4 The cross sections A-A' and B-B' indicate workings are present within a seam inferred to be the Slaty Coal.
- 6.2.5 It is generally accepted that void migration will not migrate upwards for a distance greater than approximately 10x the worked seam thickness (i.e. 13m based upon maximum recorded seam thickness). There are no superficial deposits present at the site, however the surface of the mudstone bedrock has weathered to clay and we have therefore assumed the upper 1.0m of weathered bedrock to have the properties of superficial deposits. On this basis a total of 14m of overburden is required to mitigate against void migration from the worked seam.
- 6.2.6 Table 1 suggests that workings within the Slaty Coal are not within influencing distance of the site surface. However, structure contours based upon the relative depth of the *base* of the Slaty Coal indicate the seam dips at approximately 7-10 degrees towards the west and further consideration is required to establish whether workings could potentially influence the surface in the east of the site where the seam becomes shallower. Structure contours based upon the seams base are depicted on Drawing 4046-G-D055 in Appendix A. The area of the site which is potentially within influencing distance of the worked seam is shown hatched in red.
- 6.2.7 It should be noted that the structure contours indicate the worked seam beneath the southwest of the site abruptly dips down to the southwest. The structure contours are based upon triangulation of the seam position within boreholes. This does not take into account the effects of faulting and it remains possible that the seam is displaced and that strata and seam dip remain constant.
- 6.2.8 The development layout depicted on Story Homes drawing 66D-ST0 Rev D and reproduced in Drawing 4046-G-D055 was provided to IDG in September 2021, after completion of the ground investigation drilling. Additional development within the southwest of the site had not been anticipated by IDG and consequently the ground investigation focused upon the Proposed Development Area boundary. Given the uncertainty surrounding the worked seams position in relation to the site surface, further assessment (rotary probing) is recommended to assess risks from shallow mining beneath the revised development area.
- 6.2.9 Treatment of the known shaft will be required in the southwest of the site. At this stage, the shaft depth is unknown and it is assumed to be 2.0m diameter.

7 HAZARDOUS GAS

7.1 General

- 7.1.1 An initial ground gas risk assessment based upon three shallow monitoring wells and four monitoring visits has been undertaken as described in Section 3. Based on this assessment, the site has been tentatively classified as CS1. However, the detailed mining assessment discussed above has identified further evidence of mining beneath the north eastern corner of the site. In order to assess deep gas monitoring wells (PH902 & PH907) have been installed in two boreholes to further

assess risks from mines gases, including gases being generated within shallow workings and their capacity to migrate to the surface; details of the installations are shown on the exploratory records presented in Appendix B.

7.1.2 The generation potential of the gas source(s) was initially considered to be VERY LOW. Therefore, in accordance with guidance given in CIRIA Report C665 (Section 5.5), and given the proposed residential end use, an extended monitoring period of four visits over two months was selected.

7.2 Scope of Works

7.2.1 To date, the wells have been monitored on three occasions to record flow rates, hazardous gas concentrations and groundwater levels.

7.2.2 A standard procedure was followed, in accordance with CIRIA guidance, comprising measurement of the following:

- Ambient oxygen concentration
- Atmospheric pressure
- Methane, oxygen and carbon dioxide concentrations and borehole flow rate using a GFM 430 gas analyser
- Ambient oxygen concentration (to provide a check for instrument drift)
- Standing water level using a dipmeter

7.3 Monitoring Results

7.3.1 The results of the monitoring completed to date are presented in Appendix E and are summarised in the Table 7.1.

Table 7.1: Summary of Gas Monitoring Results

Hole ID	Range of Methane Concentrations (% v/v)	Range of Carbon Dioxide Concentrations (% v/v)	Range of Positive Flow Rates (litre/hour)	Implied Characteristic Situation (CS)
PH631	ND	1.1 – 3.9	ND	1
PH633A	ND	1.0 – 1.0	0.0 – 0.2	1
PH634A	ND	0.2 – 1.2	ND	1
PH902	0.3 – 0.4	5.9 – 6.4	7.5 – 18.9	3
PH907	1.2 – 1.5	6.0 – 6.1	7.4 – 9.7	2

ND: None detected

7.4 Discussion

7.4.1 To date carbon dioxide concentrations of up to 6.4% and methane concentrations of up to 1.5% have been detected within PH902 and PH907 which have deep response zones within the abandoned mine workings (i.e. 18.3 – 21m bgl. Positive gas flow rates of between 7.4l/hr and 18.9l/hr have also been detected at the deep monitoring wells. The high flows are considered to represent gases confined within the workings.

7.4.2 However, monitoring prior to installation of the deep wells and contemporary monitoring visits have only detected concentrations of between 0.2 – 3.9% carbon dioxide with no significant positive gas flows within shallow monitoring wells. The results suggest that while relatively low concentrations of methane and carbon dioxide are present within the abandoned workings, there is no evidence to indicate they are being transmitted to surface via the intervening bedrock.

7.4.3 A hazardous gas risk assessment incorporating all of the results will be issued on completion of monitoring. In the meantime, the following scenarios are envisaged:

- Worst case: CS2
- Best case: CS1

8 CHEMICAL ANALYSIS

8.1 General

8.1.1 An assessment of potential contaminants associated with the former uses of the site has been undertaken as outlined in the Preliminary Geoenvironmental Report (4046-G-R015). In addition, chemical testing of the topsoil is required in order to determine its suitability for re-use.

8.2 Testing Scheduled

8.2.1 Based on the above assessment, an IDG Engineer submitted a test schedule (summarised in the following table) to a UKAS accredited laboratory.

Table 8.1: Chemical Testing Scheduled

Type of Sample	No. of Samples	Determinands
Made Ground	4	pH and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc)
	2	Leachable total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc)
	4	Speciated PAH
	4	Asbestos
Topsoil/Topsoil made Ground	8	pH and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc)
	8	Speciated PAH
	8	Asbestos
Natural Soil (Glacial Till/weathered bedrock)	2	pH and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc)
	1	Speciated PAH
	1	Asbestos
	4	Soluble Sulphate

8.3 Human Health Generic Risk Assessment

8.3.1 The soil contamination test results are shown in Tables 1 & 2 presented in Appendix C, together with the laboratory test results. The results have been classified by comparison with the relevant LQM/CIEH S4UL (2015) and C4SL (lead only) UK guidance threshold values for an end use including residential with consumption of homegrown produce.

8.3.2 Notes outlining current guidance with respect to the interpretation of analytical data are included in Appendix F.

Topsoil

8.3.3 In accordance with current industry practice, topsoil samples were tested for selected inorganic determinands, together with selected polycyclic aromatic hydrocarbon compounds (PAHs).

8.3.4 A mean TOC content of 5.8%, equivalent to a SOM of 10%, was recorded within the eight topsoil/topsoil made ground samples tested. Based upon this, human health GAC for a 6% SOM content have been utilised for screening purposes.

8.3.5 None of the samples contained elevated concentrations of determinands when compared to the threshold criteria.

Made Ground

8.3.6 A mean TOC content of 5.5%, equivalent to a SOM of 9.5%, was recorded within the four Made Ground samples tested. However, made ground would not be anticipated to have a high SOM and the TOC detected may be attributable to coal or anthropogenic material. In this instance, human health GAC for a 1% SOM content have been utilised for screening purposes.

8.3.7 None of the samples contained elevated concentrations of determinands when compared to the threshold criteria.

Natural Soil

- 8.3.8 One sample of the natural Glacial Till deposits with a SOM of 0.4% was also tested to assess background concentrations of inorganic determinands and polycyclic aromatic hydrocarbon compounds (PAHs). The sample was compared against human health GAC for a 1% SOM content.
- 8.3.9 The Glacial Till did not contain elevated concentrations of determinands when compared to the threshold criteria.

8.4 Phytotoxic Generic Risk Assessment

- 8.4.1 An assessment of the topsoil and Made Ground was carried out to determine the potential for phytotoxic effects. The test results were classified by comparison with the relevant UK guidance threshold value as shown in Table 3. One sample of Cohesive made Ground obtained from TP755 at 0.1m contained a slightly elevated concentration of zinc when compared to the relevant screening criteria (DEFRA CoP for Agricultural Use of Sewage Sludge (2006)).

8.5 Controlled Waters Generic Risk Assessment**Soil Leachability**

- 8.5.1 The results of the soil contaminant leachability tests are summarised in Tables 4 & 5 in Appendix C together with the laboratory test results. The significance of the results has been assessed by comparison with Water Framework Directive (England and Wales) Directions (2015) guidance thresholds.
- 8.5.2 Elevated concentrations of copper, lead, nickel and zinc were detected in leachates derived from Granular and Cohesive Made Ground samples.

9 CONTAMINATION AND REMEDIATION**9.1 Introduction**

- 9.1.1 The Preliminary Conceptual Site Model was reproduced in table 3.1 in Section 3 of this report. In order to produce a Revised Conceptual Site Model, consideration has been given to the following:
- the nature and distribution of Made Ground
 - the nature and distribution of contamination sources
 - sources of hazardous gas and initial ground gas monitoring results
- 9.1.2 The above issues have been discussed in preceding sections of this report and are summarised in the sections below. The Revised Conceptual Site Model also includes consideration of the nature of natural strata below the site, the presence of coal/shallow mineworkings and surface excavations in the northwest of the site.

9.2 Contaminant Sources

- 9.2.1 The results of the chemical testing have been presented in the preceding section of this report; an assessment of the significance of the results is summarised below.

Topsoil

- 9.2.2 Topsoil/Topsoil Made Ground, typically 300mm thick is present across the majority of the site. Testing suggests that this material is suitable for re-use.

Natural Subsoil

- 9.2.3 Natural subsoil is present from 0.2 – 0.4m depth beneath Topsoil across the majority of the site. Testing confirms that this material is suitable for re-use.

Made Ground

- 9.2.4 Topsoil Made Ground in the northwest of the site is underlain by Cohesive and Granular Made

Ground which is typically between 0.2 and 0.9m thick and comprises reworked natural clay with anthropogenic material such as pottery and brick & concrete gravel, cobbles and masonry and locally (TP755), metal rods, wire, pipe and rubber tubing.

9.2.5 The Made Ground in TP755 would generally be considered undesirable as a near-surface material in garden areas. Granular Made Ground comprising oversize brick, concrete and masonry may be re-used beneath hardstanding or plot footprints.

9.2.6 However, there is no evidence that the Made Ground contains any contamination which represents a risk to end users.

Petroleum Hydrocarbon Contamination

9.2.7 No areas of significant hydrocarbon contamination have been identified.

Groundwater

9.2.8 Elevated concentrations of leachable metals were detected in two samples of Made Ground which exceed Water Framework (Surface Water Impact) screening criteria. However, post investigation it was established that a surface water course which issued into a ravine southwest of the site is associated with an historical surface water drain and not a groundwater issue. Given that groundwater has also not been encountered beneath the Phase 4 site, the risk of infiltration, leaching and migration of the relatively low concentrations of metals to groundwater or to nearby watercourses is considered negligible.

Hazardous Gas

9.2.9 A potential hazardous ground gas source has been identified and gas monitoring is ongoing; therefore, the Revised Conceptual Site Model has been based on preliminary data.

9.2.10 The site is not considered to be at risk from Radon gas.

9.3 Pollutant Linkages

9.3.1 The revised Conceptual Site Model is summarised in Table 9.1 below, together with viable remediation options.

Table 9.1: Revised Conceptual Site Model and Potential Remediation Options

Sources	Receptors	Plausible Pathways	Potential Remediation Options	Post-Remediation Pollutant Linkage
Hazardous Gas (carbon dioxide, methane)	Human Health	Migration of Carbon Dioxide through granular strata and ingress into confined spaces leading to potential asphyxiating mixtures of gas	Gas protection measures within proposed properties	Pollutant linkage broken
	Proposed Buildings	Migration of Methane through granular strata and ingress into confined spaces leading to potential explosive mixtures of gas		

9.4 Remediation Strategy Report

9.4.1 Redevelopment of this site will may be subject to planning conditions relating to remediation and validation of installation of ground gas protection measures, treatment of mine shafts or (dependent upon the final development layout), treatment of shallow mineworkings. However based on the Revised Conceptual Model presented above, no significant pollutant linkages have been identified at the site and a Remediation Strategy Report in respect of contaminated soil should not be required by the Local Planning Authority.

9.5 New Utilities

- 9.5.1 A water pipeline risk assessment is likely to be required by the Statutory Utility Provider.
- 9.5.2 Providers of utility services including water, electricity, gas and telecommunications should be provided with a copy of this report and requested to undertake their own assessment of whether ground conditions could affect their buried apparatus, and inform the developer of any potential abnormal costs.

9.6 Preparatory Works

- 9.6.1 As noted above in Section 9.2.4, unsuitable material was noted in TP755. It is recommended that the unsuitable material (i.e. metal wire, pipe tubes and rubber hose) be excavated and disposed to an appropriate waste management facility as part of the preparatory works.

10 RE-USE, DISPOSAL AND IMPORT OF MATERIALS

10.1 Background

- 10.1.1 Materials are considered to be waste if they are discarded, if there is an intention to discard, or if there is a requirement to discard. Waste can only be disposed of at a site holding an environmental permit.
- 10.1.2 Soils (Made Ground or natural deposits) are considered to be waste at the point of excavation. If these “waste” soils are placed back into the ground or transferred to other sites, it could be deemed that waste has been disposed of without a permit. The person disposing of the waste and anyone who knowingly facilitates the disposal may be liable for payment of Landfill Tax. All parties involved could also be liable to penalties for non-compliance and face criminal prosecution.
- 10.1.3 A Materials Management Plan (MMP) should be produced for the receiving site in accordance with the CL:AIRE *Definition of Waste, Construction Industry Code of Practice*. This will provide details of excavation, stockpiling, and placement or disposal in relation to each material type. An MMP will provide evidence of the intended purpose of excavated materials and avoid the possibility of the materials becoming subject to either waste management legislation by the Environment Agency or landfill tax by HM Revenue and Customs (HMRC).

10.2 Re-use of Materials

- 10.2.1 Natural topsoil or subsoil generated by site development which is re-used on the site of origin is excluded from the Waste Framework Directive (WFD) and does not require an MMP or Declaration by a QP provided it has been subject to detailed assessment by means of an appropriate Desk Study and Site Investigation which demonstrates that it does not present a risk to human health or to environmental receptors.
- 10.2.2 Made Ground can be re-used on the site of origin provided it has been subject to detailed assessment by means of an appropriate Desk Study and Site Investigation which demonstrates it is suitable for re-use in a way that it does not present a risk to human health or to environmental receptors. A Remediation Strategy and Verification Plan must be agreed by the LPA prior to its re-use. An MMP must be prepared and a QP Declaration will need to be submitted prior to re-use of the material.
- 10.2.3 Low volumes (i.e. 1000 tonnes) of uncontaminated Made Ground may be re-used subject to the submission of a U1 Exemption.
- 10.2.4 With reference to the contamination assessment undertaken in Section 9, Made Ground and Natural Materials are considered to be suitable for retention and re-use on this site. The exceptions to this are:
- Unsuitable anthropogenic material encountered in TP755
- 10.2.5 In accordance with sustainable development principles, and for economic reasons, the developer

should ensure that the groundworker forms separate stockpiles of the following excavated materials:

- Topsoil & Topsoil Made Ground
- Cohesive and Granular Made Ground
- Natural soils.

10.2.6 Stockpiles should be enclosed by fencing once complete, and measures put in place to ensure that further materials are not added. This will enable re-use of materials to be maximised, and minimise off-site disposal costs.

10.2.7 There is the potential for the above noted materials to be re-used as shown in Table 10.1.

Table 10.1: Potential Re-use of Materials

Material Type	Potential for re-use on site
Topsoil & Topsoil Made Ground	Re-use within gardens and soft landscaped areas
Cohesive and Granular Made Ground	Place beneath plots drives and footpaths; small volumes may be placed beneath plots where suspended floors are to be used

10.3 Waste Classification

10.3.1 As noted above, the developer should aim to ensure that soil arisings are retained on site wherever possible. However, should material be required to be disposed of off-site, indicative waste classification information is provided in Table 10.2.

Table 10.2: Indicative Waste Classification

Material Type	Waste Classification	Remarks
Topsoil	Non-Hazardous	Topsoil cannot normally be classed as inert due to its organic matter content
Cohesive & Granular Made Ground	Non-Hazardous	Subject to removal of metal wire, rods tubing and rubber hose.
Glacial Till/Weathered Coal Measures bedrock	Non-Hazardous or inert	WAC test may be required for material to be accepted as inert.

10.3.2 The approximate extents of the material types shown above can be inferred from the exploratory hole records and Drawing No. 4046-G-D040. Groundworks contractors should be asked to review the content of this report and make their own estimates of the likely volumes and categories of waste to be disposed of.

10.4 Import of Materials

10.4.1 Development of the site may require importation of materials such as subsoil, topsoil, and crushed brick and concrete (6F2 or similar) to site. These materials are likely to be designated 'waste' upon export from their donor sites and will be subject to waste management legislation. In addition, changes to landfill tax rules in April 2018 could also mean that illegal deposits of 'waste' could attract landfill tax and fines.

10.4.2 To ensure that waste materials are not illegally deposited, any imported waste for use in the proposed development should comply with importation criteria which will be set out in the agreed Remediation Strategy. Materials must be imported in accordance with one of the following:

- A Materials Management Plan (MMP) for the receiving site which identifies a donor site providing clean naturally occurring materials
- A Waste Exemption as defined by the EA, typically *U1 Use of Waste in Construction*
- A Standard Rules Permit under the Environmental Permitting Regulations (England and Wales) 2010 (e.g. SR2015 No39 Use of waste in a deposit for recovery operation Construction, reclamation, restoration or improvement of land other than by mobile plant)
- A "bespoke" Environmental Permit where it not possible to meet the requirement of the rules of a Standard Rules Permit.

11 GEOTECHNICAL TESTING

11.1 General

11.1.1 Six samples of natural soil were delivered to a suitably accredited laboratory with a schedule of geotechnical testing drawn up by IDG.

11.1.2 The geotechnical laboratory test results are presented in Appendix D and are summarised below.

11.2 Soil Classification Testing

11.2.1 The Atterberg limit test is used to determine arbitrarily defined boundaries between the liquid and plastic states, and between the plastic and brittle states of fine grained soils, expressed as water percentage. Testing for moisture content, liquid limit, plastic limit and plasticity index was carried out on selected soil samples in accordance with guidance contained in BS1377-2:1990.

11.2.2 Plasticity index results have been modified in accordance with guidance contained in Chapter 4.2 of the NHBC Standards. The results are summarised in the following table, together with an assessment of Volume Change Potential (shrinkability).

Table 11.1: Plasticity Index Results

Soil type	Range of Modified Plasticity Indices (Average)	Volume Change Potential
Glacial Till	18.6	Medium
Weathered Coal Measures	19-43 (33.6)	High

11.2.3 The exploratory records indicate that samples of the weathered Coal Measures which recorded high plasticity (TP772, TP773) were associated with distinctly weathered mudstone bedrock, recovered as clayey sandy gravel sized peds of mudstone. This material is considered to be bedrock and to not exhibit plastic behaviour. Residual mudstone recovered as silty sandy clay was also encountered at founding depth, which testing indicates to be of medium to high plasticity. Given this material is only locally present as a thin bedrock carapace, typically within the upper 1.0m of the site, there is unlikely to be a significant change in volume. It is considered that medium volume change potential is most appropriate classification for design purposes.

11.2.4 For the purposes of foundation design, it is recommended that all cohesive soils be regarded as being of medium volume change potential.

11.3 Particle Size Distribution

11.3.1 PSDs tests were carried out on four samples of material in order to evaluate the range of grain sizes. The results of the PSD tests are summarised in the table 11.2.

Table 11.2: Particle Size Distribution Results

		Sample Location	TP772	TP773
		Sample Depth	0.2-0.7m	0.2-0.7m
		Material Type	Weathered Mudstone	Weathered Mudstone
Soil Fraction	Particle Size (mm)			
Cobbles	<200		0%	0%
Gravel	2.0 - 200		0%	0%
Sand	0.063 - 2.0		2%	1%
Silt	0.002 – 0.063		48%	51%
Clay	<0.002		50%	48%

11.3.2 In accordance with BS5930:1999+A2:2010, these materials would be described as 'CLAY'.

11.3.3 Classification of the materials in accordance with Table 6/2 of the 600 Series Earthworks

specification for highway works is provided in table 11.3.

Table 11.3: 600 Highways Series Material Classification

Sample Location and Depth	TP5 – 2.3m-2.6m	TP9 – 1.5m-1.8m
Material Type	Distinctly weathered Mudstone	Distinctly weathered Mudstone
Materials Classification	Class 2A/B	Class 2A/B

11.4 Soluble Sulphate and pH

11.4.1 An assessment to determine the appropriate specification for buried concrete, testing has been carried out in accordance with guidance contained in BRE Special Digest 1:2005 *Concrete in Aggressive Ground*.

11.4.2 The site has been classified as natural ground. The groundwater regime has been classified as static.

11.4.3 Samples of Made Ground and natural strata taken from depths ranging from 0.6m to 2.0m below ground level (bgl) have been submitted for testing for pH and water-soluble sulphate.

11.4.4 The highest water-soluble sulphate concentration and the lowest pH value for each soil type analysed are shown in the following table.

Table 11.4: Summary of Sulphate and pH results

Soil type	Lowest pH value	Highest Soluble Sulphate Concentration (g/l)
Glacial Till	5.1	0.05
Weathered Mudstone	5.5	0.02

11.4.5 Therefore, in accordance with Tables C1 and C2 of BRE Special Digest 1:2005, sub-surface concrete should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-1. However, concrete that comes into contact with coal should be AC-3z.

11.5 Compaction Tests

11.5.1 Two samples of weathered mudstone bedrock were tested for particle size distribution and laboratory compaction testing (using a 2.5kg rammer) to determine their suitability for re-engineering. Testing was carried out in accordance with guidance contained in BS1377-4:1990.

11.5.2 Laboratory compaction tests are only appropriate if the material grading demonstrates that:

- At least 70% of the material passes the 20mm sieve and/or
- At least 90% of the material passes the 37.5mm sieve

11.5.3 If particle sizes are only slightly in excess of the above limits, compaction tests can be useful in order to indicate target densities, but the results should be treated with caution and used for guidance only. However, if a particular material type is significantly coarser than the above limits allow, the results of laboratory compaction testing would be meaningless and a field trial would be necessary. Particle size distribution results are shown in the following table.

Table 11.5: Summary of Particle Size Distribution Results

Sample location & depth	Material description	% passing 37.5mm sieve	% passing 20mm sieve
TP772 (0.2-0.7m)	Weathered Mudstone	100	100
TP773 (0.2-0.7m)	Weathered Mudstone	100	100

11.5.4 The test results show that the weathered bedrock is suitable for compaction testing.

11.5.5 The compaction testing results are summarised in table 11.6.

Table 11.6: Compaction Testing Results

Sample location & depth	G _s (Mg/m ³)	MDD (Mg/m ³)	OMC (%)	Allowable mc range for 95% MDD & <5% air voids	In-situ moisture content (%)
TP772 (0.2-0.7m)	2.68	1.55	25	24.0 – 27.0	23
TP773 (0.2-0.7m)	2.67	1.55	25	23.5 – 27.0	27

G_s – Particle Specific Gravity, MDD – Maximum Dry Density, OMC – Optimum Moisture content

- 11.5.6 Based on the above results it is apparent that the in-situ moisture content of the weathered mudstone bedrock is generally not within the allowable moisture content range to achieve 95% of the maximum dry density.

12 GEOTECHNICAL ASSESSMENT

12.1 Introduction

- 12.1.1 Story Homes Block Plan Drawing reference 66D-ST0 Rev D dated September 21, indicates it is proposed to develop the site with two storey dwellings, adoptable roads, and sewers as described in Section 2. It should be noted that the development area depicted on the Block Plan extends beyond the original site boundary which informed IDG's ground investigation. It is anticipated that further investigation comprising rotary probeholes will be required to assess risks from shallow mining where the revised layout extends south of the original site boundary.
- 12.1.2 The site occupies a relatively undeveloped field the majority of which slopes gently from north to south, progressing into moderately steep slopes, which fall down to the eastern and south eastern boundaries.
- 12.1.3 A marshy hollow of up to 2.0m depth and hummocky ground in the northwest of the site is indicative of historical clay and potentially coal excavation from outcrop. The topographical survey indicates the excavation extends up to 2.0m beneath the adjacent site, although it should be noted that the survey does not provide sufficient detail of the hummocky nature within the zone of excavation. The deepest part of the hollow & hummocky ground was noted to be boggy due to perched water following prolonged rainfall or in winter months.
- 12.1.4 A shallow trough runs south within the site's western boundary from the zone of excavation. There are trees and hedges present beyond the site's northern boundary.
- 12.1.5 The revised Conceptual Site Model has been outlined in Section 9. Geotechnical issues affecting the site are described below.

12.2 Mining and Quarrying

- 12.2.1 The site is underlain by the several coal seams. Exploratory probeholes drilled during 2020 identified probable shallow mineworkings within 30m of the surface within the centre of the site within a coal seam predicted to outcrop immediately east of the site. Further probeholes drilled during 2021 identified probable shallow mine workings, inferred to be within the Slaty Coal seam which are indicated to influence the site surface in the east of the site.
- 12.2.2 In addition Coal Authority shaft reference 297515-008 has been located in the southwest of the site, which will require treatment by drilling and pressure grouting, followed by construction of a reinforced shaft cap. Trial pits indicate 1.0m of Glacial Till underlain by weathered mudstone bedrock. The shaft is assumed to be 2.0m diameter and of unknown depth. It is recommended that the shaft be assumed to be 2.5m diameter and at least 69m deep (depth to known workings within the Main Coal seam beneath the site). Based upon shaft diameter, depth of overburden and weathered bedrock, it is anticipated that a shaft cap will be 5m², constructed at 2.0m depth in competent bedrock. A 3.5m standoff will be required.
- 12.2.3 Treatment to stabilise workings within the worked (Slaty) coal seam will be required prior to development of the site. Treatment will be required within the zone of influence depicted on Drawing No. 4046-G-D055 in Appendix A, although the extent of treatment will depend upon the

final development layout.

- 12.2.4 The site slopes steeply down to the east and southeast and there may be requirement for cut and fill operations. Story Homes Levels & SUDS Strategy Drawing reference 7843-SK01 prepared by Coopers Ltd presented in Appendix A, indicates it is proposed to raise levels in the east and southeast by up to 3.0m. However, should revision of these proposals result in cut operations to create the desired development platform, removal of rock cover could influence the area of the development where there is sufficient rock cover to mitigate against void migration. Further assessment of the influence of mineworkings will be required on completion of the proposed further rotary probing in the southeast of the site and receipt of the final layout/development levels.

12.3 Site Regrade & Preparatory Works

- 12.3.1 There is hollow and hummocky ground indicative of a former clay pit and/or coal excavation in the northwest corner of the site. Thin deposits of Made Ground within this area locally contains unsuitable metal, rubber and oversize which will require removal. It is likely that in excess of 2.0m thickness of suitable fill material will also be required to achieve levels consistent with the land to the east.
- 12.3.2 It is recommended that the hollow and zone of marshy and hummocky ground be scraped to remove vegetation, topsoil and soft subsoil to provide a level excavation base prior to placement of suitable clean fill material in appropriately engineered layers to achieve the desired development levels.
- 12.3.3 While the majority of the site falls steadily to the south, the site also slopes steeply down to the east and the southeast. As stated above it is anticipated that cut and fill operations will be required to create appropriate a development platform at the top of the eastern slope and on the south-eastern slope. Retaining structures are likely to be required.

12.4 Summary of Ground Conditions

- 12.4.1 Locally, up to 0.9m thickness of cohesive and granular made ground is present in the northwest of the site where there is evidence of clay pitting and/or coal extraction.
- 12.4.2 A thin layer of up to 1.2m thickness of stiff Glacial Till is present in the west of the site. Bedrock comprises residual mudstone, sandstone and siltstone to approximately 1.0-1.5m depth. Coal seams have been encountered at shallow depth (i.e. 1.0m bgl). As discussed above, shallow coal mineworkings have been encountered which influence the surface in the east of the site.
- 12.4.3 Clay classification tests suggest that natural cohesive soils at the site should be regarded as being of medium volume change potential.

12.5 Foundation Recommendations

- 12.5.1 The foundation recommendations presented below assume that the proposed development will comprise two storey houses with line loads not exceeding 60kN/m run. It has also been assumed that ground levels will not change significantly from those existing at present. If this is not the case, significant alteration to these recommendations will be required.
- 12.5.2 Based on the information presented in the preceding sections, anticipated foundation solutions are shown in Table 12.1. Potential foundation zonings are depicted on drawing No. 4046-G-D056 in Appendix A. The final foundation solution should be specified by the Structural Engineer responsible for design.

Table 12.1: Anticipated Foundation Solutions

Area	Anticipated Foundation Solution	Influencing Factors
West	Strips/trenchfill at 0.9 to 2.0m	Medium volume change potential clay – mature trees and hedges beyond sites northern boundary
West	Piles	Subject to infilling of hollow and hummocky ground within northwest
East	Rafts	Treatment of shallow mineworkings required

12.5.3 The anticipated foundation solutions are discussed further below. Further trial pitting is recommended in the southeast of the site to establish shallow ground conditions and inform foundation design.

Strip/Trench Fill Foundations

12.5.4 The following should be noted in relation to strip and trench fill foundations. Reference should also be made to guidance contained in NHBC Standards (Chapters 4.2 and 4.4).

12.5.5 Made Ground is not considered to be a suitable foundation material and foundations should therefore be taken through these materials into underlying natural strata of adequate bearing capacity.

12.5.6 The firm gravelly clay and weathered mudstone is of medium volume change potential and a minimum depth of 0.9m below external levels is therefore recommended for strip foundations.

12.5.7 Assuming a strip foundation of 10m length and 0.6m width, founding at 0.9m depth, the firm gravelly clay with a undrained shear strength of 100kPa is generally considered to have a **safe bearing capacity** of 225kN/m². Settlements less than 25mm would be anticipated and this is considered likely to be acceptable.

12.5.8 There are several situations where foundation depths may need to be increased as follows:

- foundations should be placed below a line drawn up at an angle of 45° from the base of any adjacent existing *or proposed* services or excavation.
- where relict foundations or excavations are present, foundations should be deepened to extend into undisturbed natural ground of adequate bearing capacity
- where unexpected ground conditions (such as soft spots) are encountered in foundation excavations, foundation depths may need to be increased and further advice should be sought from IDG
- where trees are present, the foundation depth should be determined in accordance with guidance contained in NHBC Standards (Chapter 4.2)
- where rock is encountered at shallow depth, foundations should be placed entirely on rock, and not partly on rock and partly on superficial deposits; this may result in deeper foundations.

12.5.9 Coal has been proven at shallow depth (i.e. 1.0m bgl). Care should be taken not to unnecessarily overdeepen foundations, in order to minimise the chance of encountering coal.

12.5.10 Where foundation excavations do come into contact with coal, the foundation should be taken through the coal seam, into underlying natural in-situ strata of adequate bearing. The full thickness of coal should then be immediately sealed with concrete to create a trench fill foundation.

12.5.11 Sub-surface concrete in contact with the Made Ground and natural ground should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-1.

Piled Foundations

12.5.12 Piled foundations represent an option for dwellings constructed in areas where it is anticipated that it will be necessary to infill the deepest zone of historical excavation to achieve consistent levels with the adjacent site. The following general comments relating to piling are provided for initial guidance, and further advice should be sought from a specialist-piling contractor.

12.5.13 Piled foundations should normally extend into the rock beneath the site. The safe working load that may be supported on a pile is dependent on the pile diameter, its founding depth and the method of installation. Preliminary estimates are for pile lengths in the order of 5-8m.

12.5.14 Strata encountered in the boreholes has indicated that competent mudstone, sandstone and siltstone rock lies at depths of between 2-3m below current ground levels.

12.5.15 As piles would be founded in rock, they will be essentially end bearing, although there may also be some shaft adhesion in Glacial Till overburden.

- 12.5.16 It is recommended that flexible service connections are specified in order to minimise possible damage due to self-settlement of the weak strata once the site is developed.
- 12.5.17 The installation of driven piles will induce some ground vibration and assessment of vibration risk to adjacent structures and/or existing site features should be undertaken by the pile designer.
- 12.5.18 Ground conditions at this site are considered likely to require provision of a piling mat (working platform) and further advice should be sought from the appointed piling contractor regarding the proposed plant loadings and resulting pressures. These data, together with a knowledge of the strength and variability of the near-surface ground conditions is required in order that design of a mat can be undertaken in accordance with guidance provided in BRE document *BR 470: Working platforms for tracked plant* (2004). IDG can provide further advice on this if required.

Raft Foundations

- 12.5.19 Raft Foundations are considered most appropriate where it has been necessary to treat shallow mineworkings. However, subject to verification of a satisfactory treatment specification, the Structural Engineer may provide a bespoke foundation solution appropriate to the ground conditions.
- 12.5.20 Drawing 7843-SK01 Levels and SUDS indicates that it is proposed to raise levels by up to 3.0m in the area of the site where there is potential influence from shallow mineworkings. Fill placed beneath rafts should be re-engineered to an appropriate specification.
- 12.5.21 Raft design should be undertaken by a Structural Engineer in accordance with NHBC Standards, Chapter 4.5. Granular sub-base material should be placed in accordance with relevant current guidance contained in the Highways Agency *Specification for Highway Works*.
- 12.5.22 NHBC generally recommend that rafts be founded on a minimum 150mm thickness of suitable granular sub-base product. Granular sub-base should extend laterally for at least 0.5m beyond the edges of the raft. The base of the granular sub-base must be at least 600mm below original or finished level, whichever is the lower.
- 12.5.23 Where rafts are within the influence of mature trees, the depth of crushed stone placed should be equal to 50% of the trench fill foundation depth determined in accordance with NHBC Chapter 4.2.
- 12.5.24 Placement of a 'blanket' of granular sub-base directly on top of engineered fill would normally be acceptable immediately after placement of the final layer of fill. However, if placement is delayed, cohesive engineered fill may experience deterioration due to softening caused by rainfall, or by desiccation in dry conditions, and should therefore be 'blinded' with granular sub-base within 48 hours of placement of the final layer of fill. Where this is not possible, it is recommended that a minimum 300mm depth of fill is excavated from beneath the plot footprint, prior to placement of the granular sub-base.
- 12.5.25 Furthermore, it may be necessary to remove any desiccated material if the engineered fill is left exposed during a prolonged spell of dry weather.
- 12.5.26 Where the engineered fill is granular, deterioration may be caused by frost (unless the fill contains less than 10% fines). Granular fill should therefore be 'blinded' with granular sub-base prior to frosty weather.

12.6 Floor Construction

- 12.6.1 No significant Made Ground was encountered across the majority of this site and ground bearing floor slabs may be utilised. A suspended ground floor construction will be required in the northwest of the site where it is anticipated ground levels will be achieved by infilling of the historical excavation.
- 12.6.2 A suspended ground floor construction should be used in areas where the depth of Made Ground beneath a plot exceeds 600mm.

12.7 Groundwater and Excavations

- 12.7.1 Based on the results of this investigation it is unlikely that major groundwater flows will be encountered in shallow excavations.
- 12.7.2 Weathered bedrock was encountered in all of the exploratory holes. Excavation to depths greater than 2.0-3.0 m is likely to prove difficult. It would therefore be prudent to allow for excavation of hard rock in any deep excavations such as those that may be required for service trenches.
- 12.7.3 Coal seams have been encountered at shallow depth during the ground investigation. Consequently, excavations (such as for foundations and services) may come into contact with coal. In order to minimise the likelihood of encountering coal, such excavations should be taken to the minimum depth required. Where foundation excavations come into contact with coal, the foundation should be taken through the coal seam into underlying rock strata of adequate bearing capacity. The full thickness of coal should then be sealed with concrete to create a trench fill foundation. To prevent the ingress of air, the mass concrete fill should be placed as soon as possible after exposing the seam.

12.8 Highways

- 12.8.1 The natural gravelly clay deposits and weathered mudstone will have a CBR value of at least 2% (as noted in Highways Agency Interim Advice Note 73/06 Rev 1 [2009] *Design Guidance for Road Pavement Foundations*). This estimate is based on visual inspection of the soils and the recorded plasticity index results; CBR values should be confirmed on site prior to road construction.

12.9 Flooding and Drainage

- 12.9.1 Based on the ground conditions encountered, it is not considered that soakaways would represent an effective method of surface water drainage. Story Homes Levels and SUDS drawing No. 7843/SK01 indicates drainage will comprise a combination of SUDS and SWALE features.

12.10 External Works

- 12.10.1 It will be necessary to remove topsoil, made ground and soft subsoil within the hollow and zone of hummocky ground in the northwest to create a level zone prior to infilling. Infilling will require placement of clean geotechnically suitable materials placed in engineered layers.
- 12.10.2 The site slopes steeply down to the eastern and south-eastern boundaries and it is considered likely that there will be a requirement for retaining walls in order to facilitate development.

13 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

13.1 General

- 13.1.1 The conclusions below are summarised from the preceding sections of this report.
- 13.1.2 Redevelopment of the site with domestic dwellings is being considered. Story Homes Block Layout and Levels & SUDS Strategy Drawings indicate levels will be lifted on the fringes of the development where the site slopes steeply down to the east and southeast.
- 13.1.3 The site has not been previously developed. However clay and potentially coal excavation has taken place within the northwest of the site.

13.2 Ground Conditions

- 13.2.1 The site is surfaced with a nominal 0.3m thickness of topsoil/topsoil made ground. A thin (1.2m thick) deposit of Glacial Till is present in the west of the site.
- 13.2.2 Bedrock comprises residual mudstone, sandstone and siltstone up to 1.5m bgl. Partially weathered bedrock has been proven from 0.3m to 1.5m.

13.3 Mining and Quarrying

- 13.3.1 Rotary probing has encountered probable unrecorded abandoned mineworkings which potentially

influence development in the east and southeast of the site. An untreated mine shaft of unknown depth is present in the southwest of the site which will require treatment and capping. Proof drilling/treating of shallow mineworkings is recommended in the east of the site where the mineworkings are indicated to be within influencing distance of the proposed development depicted on Drawing 66D-ST0 005 Rev D.

- 13.3.2 Additional probing is needed in the southeast of the site to establish risks to the proposed development depicted on 66D-ST0 005 Rev D which extends beyond the initial site boundary.

13.4 Hazardous Gas

- 13.4.1 Hazardous ground gas monitoring to update the sites ground gas model is ongoing. Best case is CS1, worst case CS2.

13.5 Contamination and Remediation

- 13.5.1 No significant contamination has been detected and no remediation strategy is required.

13.6 Foundations

- 13.6.1 The majority of plots may be constructed with strip/trenchfill foundations. Piled foundations may be required in the northwest of the site, subject to infilling of the excavation and final site levels. Raft foundations are recommended in the east of the site where there is potential influence from shallow mine workings. However, the Structural Engineer may recommend bespoke foundation designs (subject to fill treatment of shallow mineworkings).

13.7 Groundwater and Excavations

- 13.7.1 Based on the results of this investigation it is unlikely that major groundwater flows will be encountered in shallow excavations.
- 13.7.2 Excavations to relatively shallow depth should remain stable in the short term; where excavations are to be left open for a significant period of time, these will require shoring to prevent collapse, especially in Made Ground and granular soils.

13.8 Highways

- 13.8.1 The natural clay deposits and weathered bedrock will have a CBR value of at least 2%.

13.9 Flooding and Drainage

- 13.9.1 The EA indicate that the site is not located within an indicative floodplain.
- 13.9.2 Soakaways are not considered to represent an effective method of surface water drainage, based on the ground conditions encountered during this investigation. Story Homes Levels and SUDS drawing indicates drainage will comprise a combination of SUDS and SWALE features.

13.10 Further Works

- 13.10.1 As noted above, further investigation comprising rotary probeholes and trial pits is required in the south east of the site to establish risks from shallow mining and to assess shallow ground conditions within the latest development layout.
- 13.10.2 A Foundation Zoning Plan has been provided to enable assessment of the influence of ground conditions and mineworkings upon the desired layout and development levels. A foundation schedule will be required once a final layout and levels are agreed. The foundation schedule will be subject to mines treatment and anticipated earthworks. Specifications for treatment of shallow workings and the known shaft and a specification for re-engineering of soils will also be required once the final layout has been agreed.

APPENDIX A



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CLIENT	Story Homes
JOB TITLE	Phase 4, Edgehill Park, Whitehaven
DRAWING TITLE	Site Location Plan

DRAWN BY NW	SIGNATURE	DATE 5-10-20	STATUS FINAL
APPROVED BRB	SIGNATURE	DATE 5-10-20	SCALE 1:25,000@A4
			DRG No. 4046-G-D038



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- KEY**
- Phase 4 Boundary
 - Phase 3 Boundary
 - Phase 2 Boundary
 - CA Recorded Mine Shaft
 - BGS Geological Fault
 - BGS Inferred Coal Seam Outcrop
 - Hollow - Hummocky Ground
 - View Direction

Revision	Description	Date

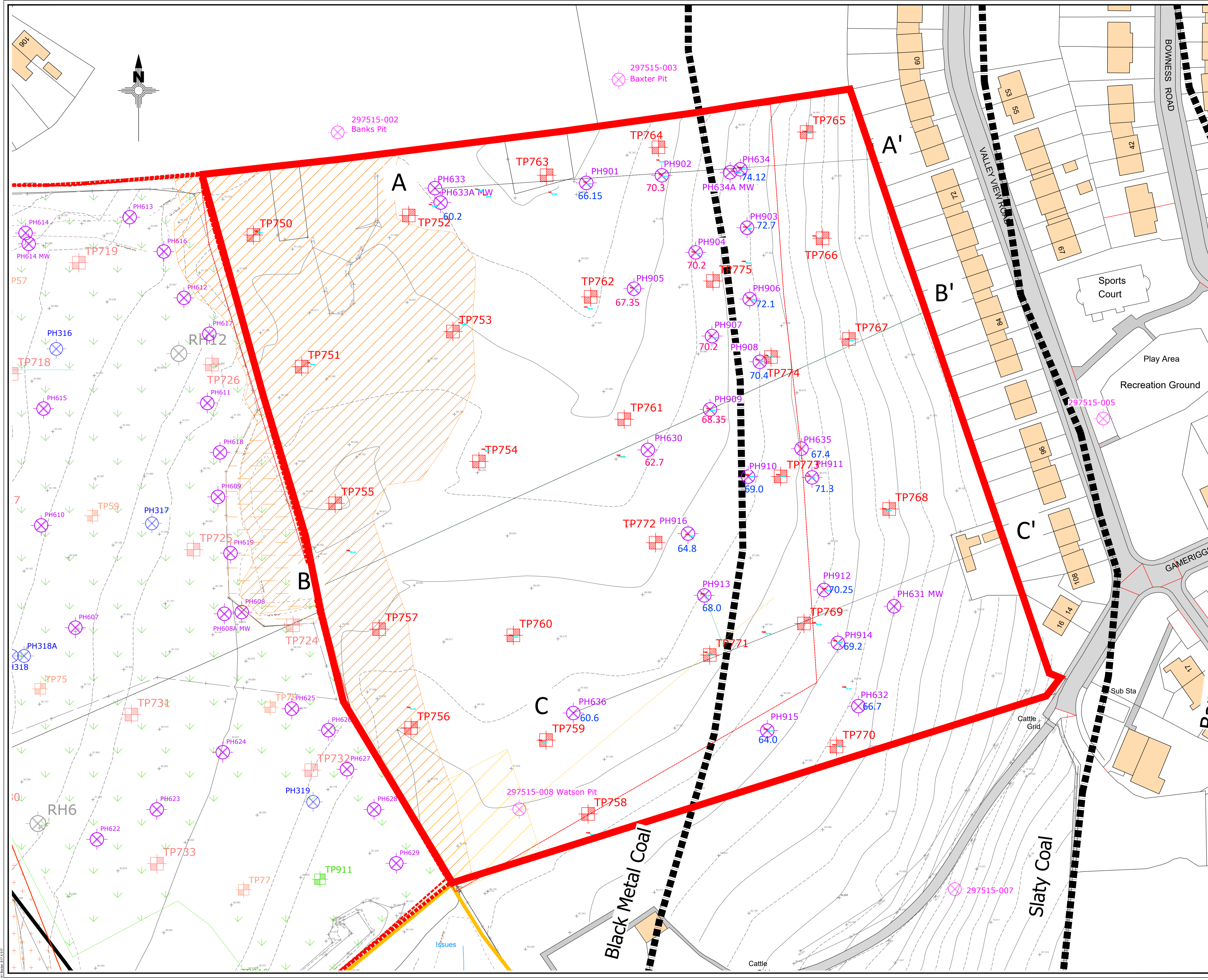
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CLIENT	Story Homes		
PROJECT TITLE	Phase 4, Edgehill Park, Whitehaven.		
DRAWING TITLE	Site Features & Photographs Plan		
STATUS	FINAL		
DRAWN BY	NW	SIGNATURE	DATE
APPROVED BY	BRB	SIGNATURE	DATE
SCALE	1:500@AD	DWG No.	4046-G-D039

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- KEY**
- Phase 4 CA Permit Boundary
 - Proposed Development Area 2021
 - ⊗ PH900 IDG Probehole 2021
 - ⊗ PH600 IDG Probehole 2020
 - ⊗ TP750- IDG Trial Pit 2021
 - ⊗ PH300 IDG Probehole Dec 2016
 - A-A'** Geological Cross Section (Drawing 4046-G-D054_)
 - ▨ Evidence of Surface Excavation
 - ▬▬ BGS Inferred Coal Seam Outcrop
 - ⊗ 296515-001 CA Recorded Mine Shaft

Revision	Description	Date
D	Geological Section A-A', B-B' & C-C'	15-12-21
C	Final Exploratory Hole Positions	29-9-21
B	Revised Proposed RH NO. & Positions	5-7-21
A	Supplementary Probeholes & Trial Pits	6-6-20

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CLIENT: **Story Homes**

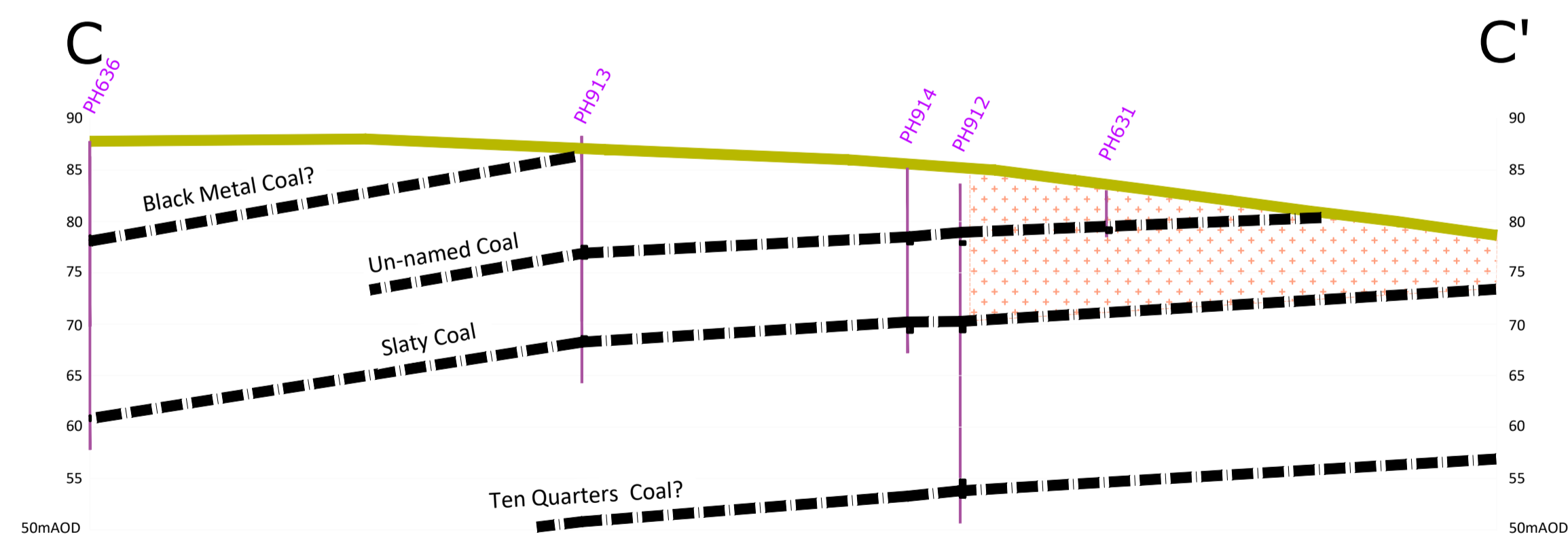
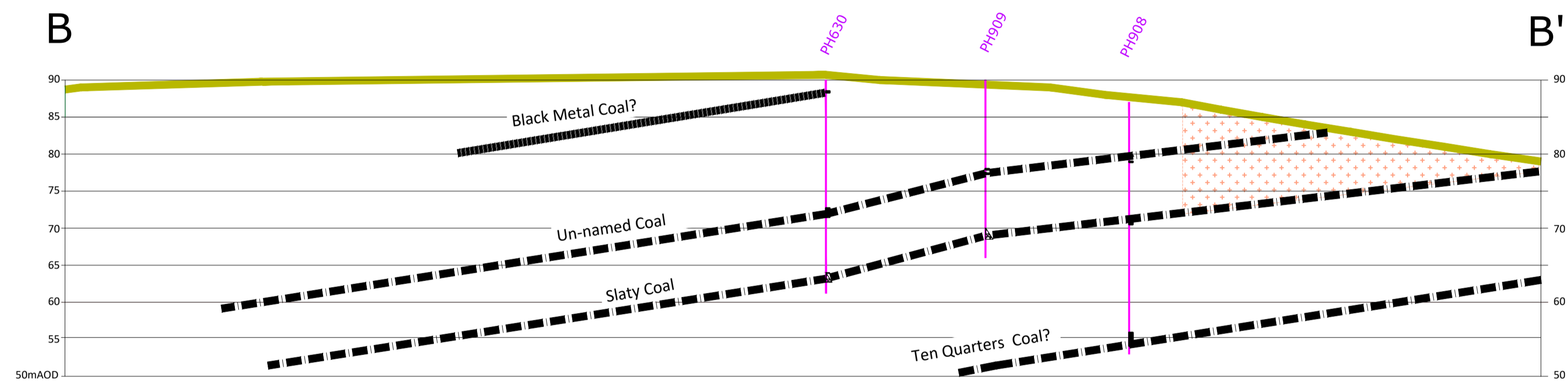
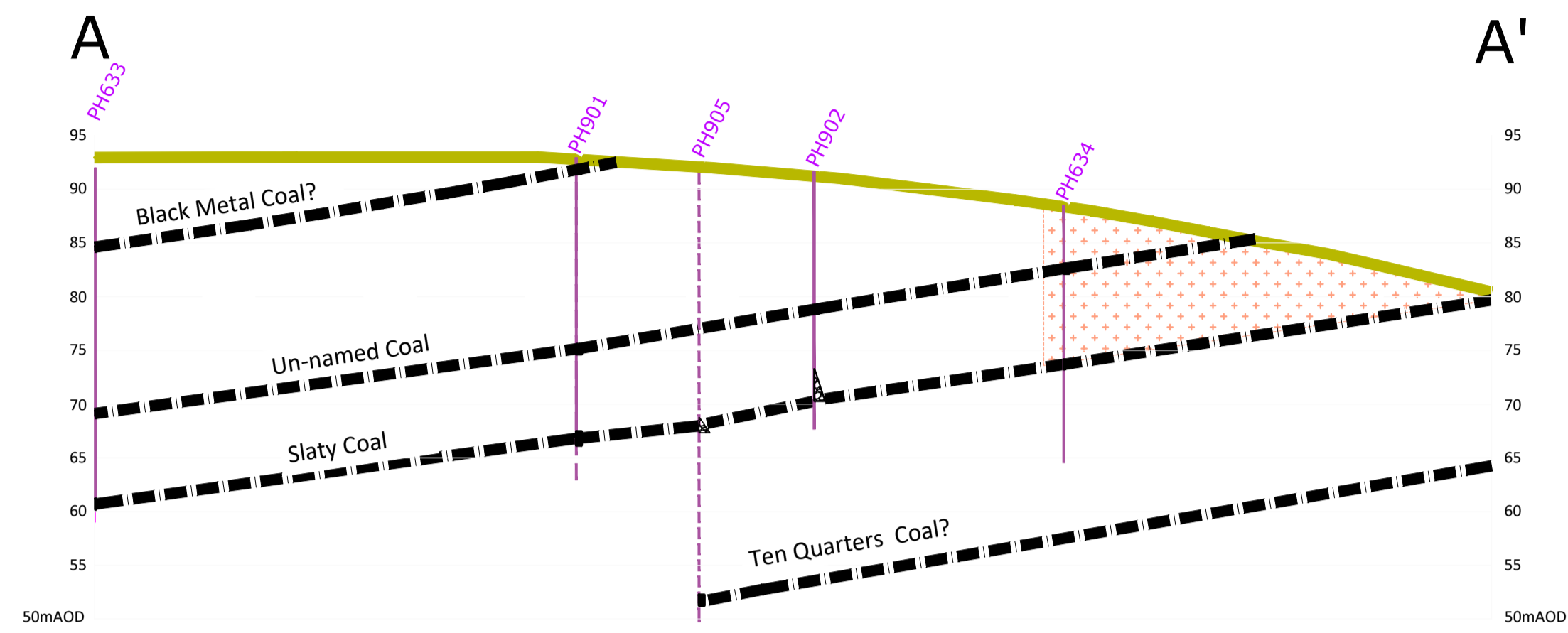
JOB TITLE: **Phase 4 Edgehill Park, Whitehaven**

DRAWING TITLE: **Exploratory Hole Location Plan**

STATUS: **DRAFT**

DRAWN BY: NW	SIGNATURE:	DATE: 3-10-20
APPROVED: BRB	SIGNATURE:	DATE: 5-10-20
SCALE: 1:500@A1	DWG NO.: 4046-G-D040	

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KEY

- Inferred Coal Seam
- Probable Shallow Coal Workings
- IDG Probehole 2020
- IDG Probehole 2021
- Shallow Mining Surface Influence Zone

A-A' Line of Section
(Drawing No. 4046-G-D040)

Revision	Description	Date
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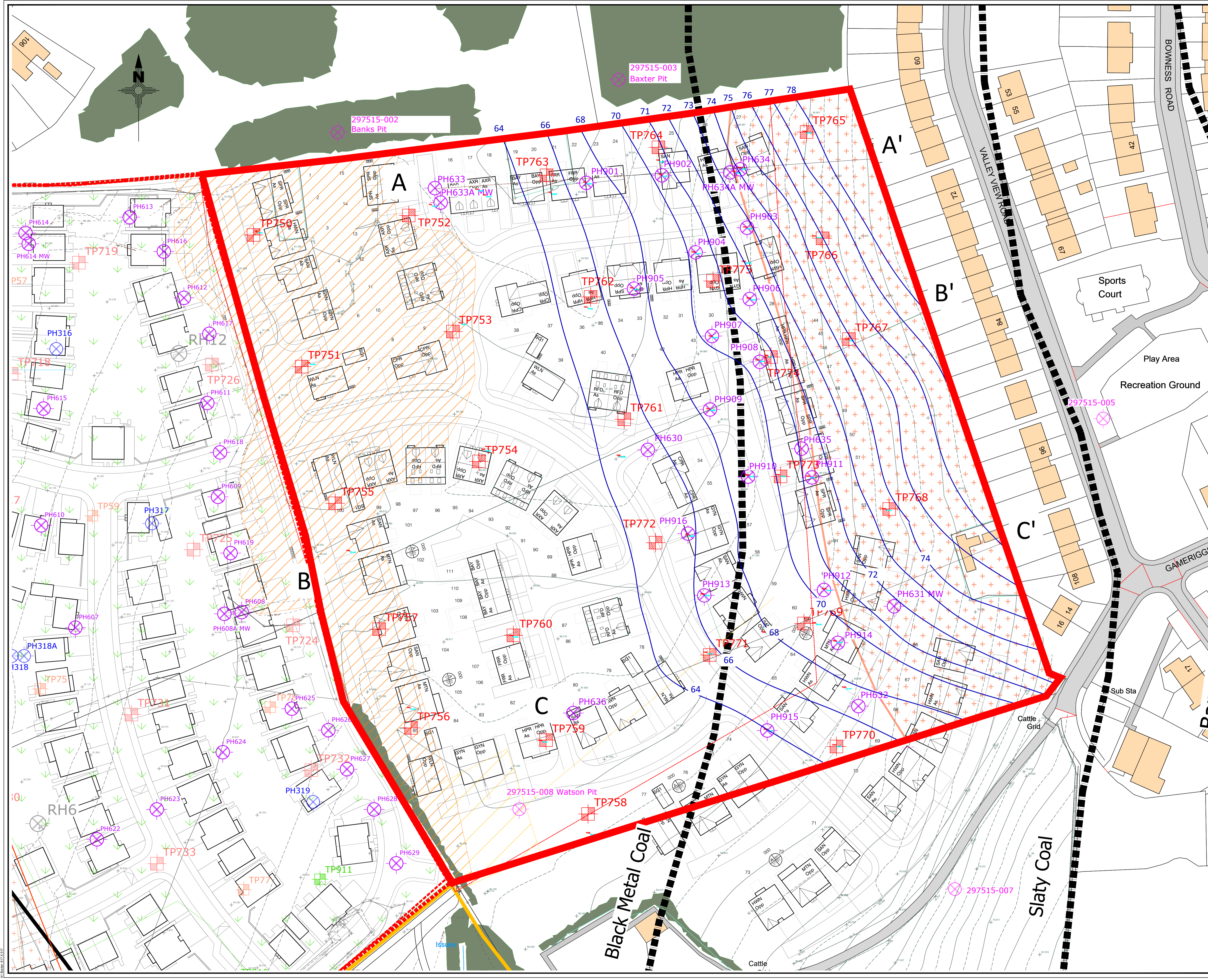
CLIENT
Story Homes

JOB TITLE
Edgehill Park Phase 3

DRAWING TITLE
Geological Cross Sections

STATUS		
DRAWN BY NW	SIGNATURE	DATE 23-11-21
APPROVED BRB	SIGNATURE	DATE 14-12-21
SCALE 1:500@A1	DRG No. 4046-G-D054	

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- KEY**
- Phase 4 CA Permit Boundary
 - - - Proposed Development Area 2021
 - ⊗ PH900 IDG Probehole 2021
 - ⊗ PH600 IDG Probehole 2020
 - ⊗ TP750- IDG Trial Pit 2021
 - ⊗ PH300 IDG Probehole Dec 2016
 - 72 Base of Coal Contour (m AOD)
 - ▨ Evidence of Surface Excavation
 - + Worked Coal <14m of Surface
 - BGS Inferred Coal Seam Outcrop
 - ⊗ 297515-001 CA Recorded Mine Shaft

Revision	Description	Date

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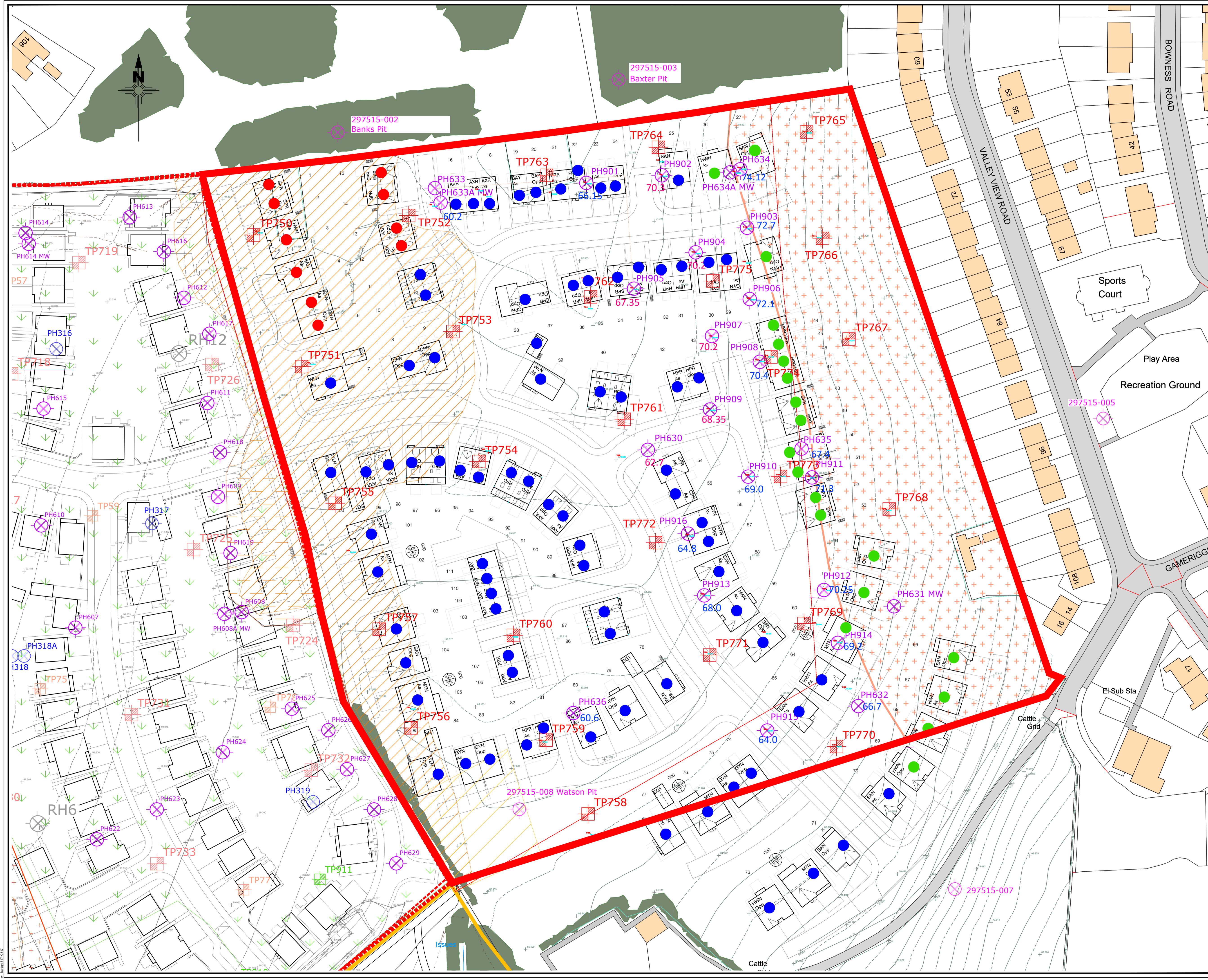
CLIENT
Story Homes

JOB TITLE
Phase 4 Edgehill Park, Whitehaven

DRAWING TITLE
Mining Influence Plan

STATUS Final		
DRAWN BY NW	SIGNATURE	DATE 26-10-21
APPROVED BRB	SIGNATURE	DATE 15-12-21
SCALE 1:500@A1	DRG No. 4046-G-D055	

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- KEY**
- Phase 4 CA Permit Boundary
 - - - Proposed Development Area 2021
 - ⊗ PH900 IDG Probehole 2021
 - ⊗ PH600 IDG Probehole 2020
 - ⊕ TP750- IDG Trial Pit 2021
 - ⊗ PH500 Area B & C Exploratory Probehole Aug 2018
- Potential Foundation Solutions**
- Raft Foundations
 - Strip/Trenchfill Foundations
 - Piled Foundations
- Foundation Recommendations are subject to final development levels, layout & the recommendations of the Structural Engineer
- ▨ Evidence of Surface Excavation
 - ++ Worked Coal <14m of Surface
 - ⊗ 296515-001 CA Recorded Mine Shaft

Revision	Description	Date

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CLIENT
Story Homes

JOB TITLE
Phase 4 Edgehill Park, Whitehaven

DRAWING TITLE
Foundation Zoning Plan

STATUS FINAL		
DRAWN BY NW	SIGNATURE	DATE 26-10-21
APPROVED BY BRB	SIGNATURE	DATE 15-12-21
SCALE 1:500@A1	DRG No. 4046-G-D056	



NOTES
 Do not scale from this drawing. Only figured dimensions are to be taken from this drawing.
 The contractor must verify all dimensions on site before commencing any work or shop drawings.
 The contractor must report any discrepancies to design by pod Ltd before commencing work. If this drawing exceeds the quantities taken in any way, design by pod Ltd is to be informed before the work is started.
 Ordnance Survey information is used on design by pod Ltd drawings, design by pod Ltd is not responsible for the accuracy of dimensions relating to any Ordnance Survey data, or beyond the boundary of the nearest topographic survey data.
 Work within The Construction (Design and Management) Regulations 2015 is not to start until a Health and Safety Plan has been produced.
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Edgehill Park PH4 - 112

02/11/21

64D-STO-500D

SCHEDULE OF ACCOMMODATION - BALANCE

Ref	House Name/Type No.	House Type	Sq.Ft	Garage/Parking	RSL. No.	INT. No.	OPEN No.	Total Sq.Ft.
AFFORDABLE UNITS								
BAY	BAYLEY	2 bed terraced	691	Front / Side Parking	8			5528
FRR	FRASER	3 bed terraced (3 block)	816	Front / Side Parking	4			3264
OPEN MARKET UNITS								
HPR	HARPER	2 bed semi	855	Front / Side Parking			14	11970
SPR	SPENCER	3 bed semi	960	Front / Side Parking			10	9600
CPR	COOPER	3 bed semi	1031	Front / Side Parking			8	8248
AVR	ALEXANDER	3 bed semi	1114	Front / Side Parking			11	12254
GYN	GRAYSON	4 bed semi	1207	Front / Side Parking			12	14484
RFD	RUSHFORD	4 bed townhouse	1428	Front / Side Parking			10	14280
SNH	SANDERSON	4 bed detached	1412	Integ. Garage			13	18356
WLN	WILSON	4 bed detached	1425	Single Det Garage			6	8550
HWN	HEWSON	4 bed detached	1561	Integ. Garage			11	17171
MTN	MASTERTON	5 bed detached	1803	Integ. Garage			5	9015
Total Number of Units and Square Foot					12	0	100	132720

Gross Site Area in Metres	52034.9221
Gross Site Area in Acres	12.86
Strategic Public open Space in M	16383.8211
Strategic Public open Space in Ac	4.54
Net Site Area in Metres	33651.101
Net Site Area in Acres	8.32
Net Site Area in Hectares	3.37
Density (Sq. Ft per Acre)	15952
Density (Units Per Acre)	13
Density (Units Per Hectare)	33.26

Revision Notes:



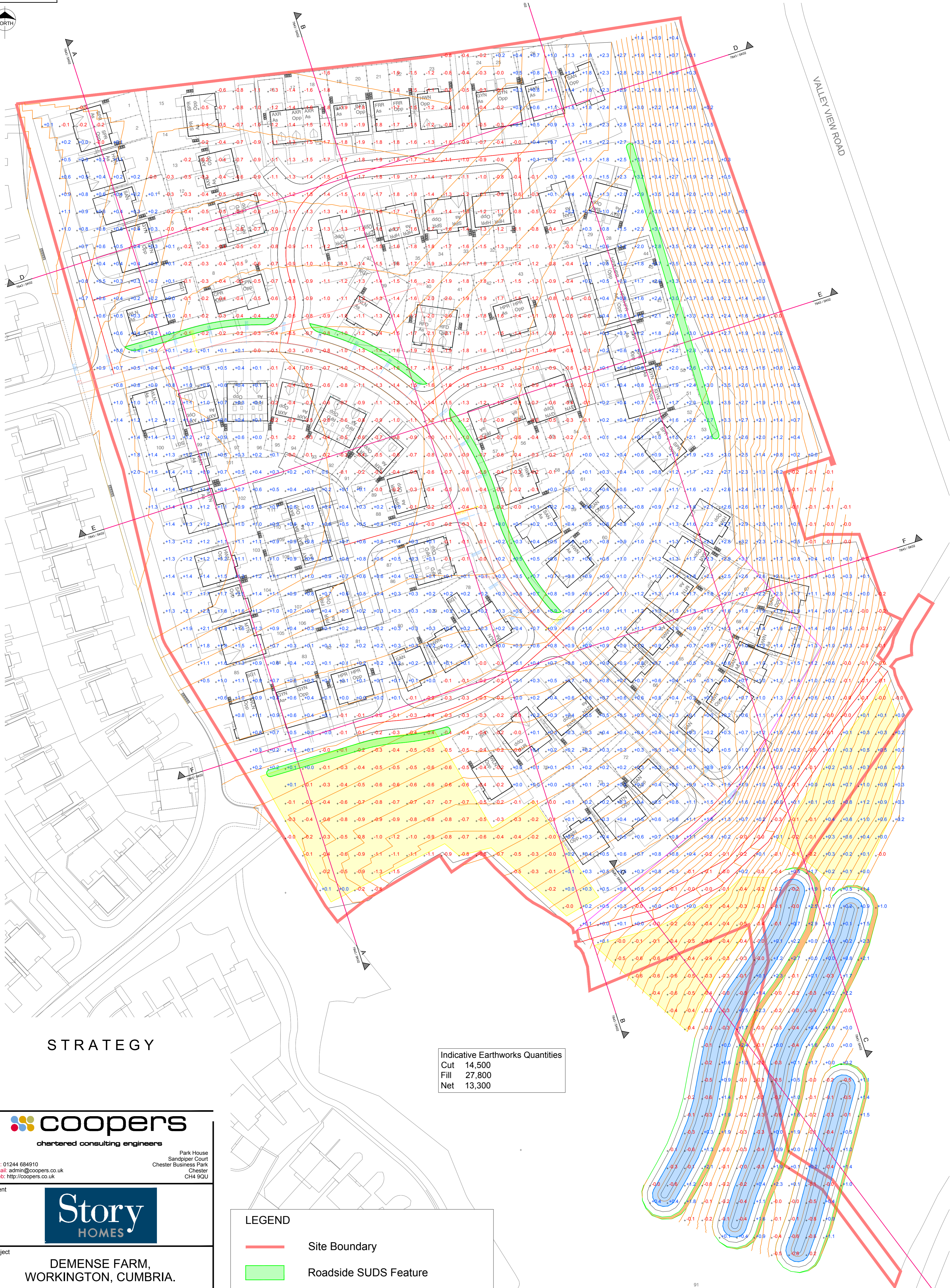
99 gaigate/barnard castle/
 county durham/d112 8es
 e: andy@designbypod.co.uk
 tel: 01833 696 600
 web: www.designbypod.co.uk

PROJECT:
Edgehill Park - Phase 4

DRAWING TITLE:
Block Plan

CLIENT: Story Homes	DATE: 09/21
STATUS: PLANNING	DWN BY: JG
SCALE: 1:1000	CKD BY: AD
PROJECT NO: 66D-STO	SHEET SIZE: A2
DRAWING NO: 005	REVISION: D

DO NOT SCALE



STRATEGY

Indicative Earthworks Quantities
 Cut 14,500
 Fill 27,800
 Net 13,300

coopers
 chartered consulting engineers

Park House
 Sandpiper Court
 Chester Business Park
 Chester
 CH4 9QU

Tel: 01244 684910
 Email: admin@coopers.co.uk
 Web: http://coopers.co.uk

Client

Story HOMES

Project

**DEMENSE FARM,
 WORKINGTON, CUMBRIA.**

Title

Levels and SUDS Strategy

DRAWING NUMBER	SCALE at A1	1:500'
7843 / SK01	DATE	22.10.21
	DRAWN	PJN
	CHECKED	AJ
	REVISION	-

LEGEND

- Site Boundary
- Roadside SUDS Feature
- Swale Attenuation
- Areas potentially to be used for raising to use surplus material

APPENDIX B



Project Title: Rhodia, Whitehaven

PH630

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 90.50

N Coord: 515681

E Coord: 297372

Date: 10/09/2020

Method:

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						89.00		1.50	Turf over brown silty sandy gravelly CLAY. (MIDDLE COAL MEASURES)		
						88.70		1.80	Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						88.50		2.00			
						88.00		2.50	COAL. (MIDDLE COAL MEASURES)		
									Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
									Yellow-brown SILTSTONE with grey MUDSTONE laminations (MIDDLE COAL MEASURES)		
						84.00		6.50	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						75.70		14.80	Black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
						74.70		15.80			
									Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH630

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 90.50

N Coord: 515681

E Coord: 297372

Date: 10/09/2020

Method:

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						72.70		17.80	Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						72.30		18.20	COAL. (MIDDLE COAL MEASURES)		
						72.00		18.50	Black MUDSTONE. (MIDDLE COAL MEASURES)		
						71.50		19.00	COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE and SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						64.00		26.50			
						63.90		26.60	COAL. (MIDDLE COAL MEASURES)		
						62.70		27.80	BROKEN GROUND - NO RETURNS - PROBABLE COAL WORKINGS. (MIDDLE COAL MEASURES)		
						61.70		28.80	SOLID DRILLING - NO RETURNS. (MIDDLE COAL MEASURES)		
									End Of Borehole At 28.80 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH631

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 83.00

N Coord: 515756

E Coord: 297444

Date: 10/09/2020

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						82.50		0.50	Turf over brown silty sandy gravelly CLAY. (MIDDLE COAL MEASURES)		
						80.60		2.40	Yellow-brown SILTSTONE and MUDSTONE laminations. (MIDDLE COAL MEASURES)		
						79.40		3.60	Grey MUDSTONE and SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						78.60		4.40	Black organic MUDSTONE with coal traces. (MIDDLE COAL MEASURES)		
						78.50		4.50	Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
									End Of Borehole At 4.50 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH632

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 83.70

N Coord: 515726

E Coord: 297434

Date: 10/09/2020

Method:

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						82.90		0.80	Turf over brown silty sandy gravelly CLAY. (GLACIAL TILL)		
						81.90		1.80	Yellow-brown weathered silty MUDSTONE. (MIDDLE COAL MEASURES)		
						79.90		3.80	Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						79.00		4.70	Black organic MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
						76.70		7.00	Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						76.40		7.30	COAL. (MIDDLE COAL MEASURES)		
						76.10		7.60	Black organic MUDSTONE. (MIDDLE COAL MEASURES)		
						75.70		8.00	COAL. (MIDDLE COAL MEASURES)		
									Black organic MUDSTONE. (MIDDLE COAL MEASURES)		
									COAL. (MIDDLE COAL MEASURES)		
									Grey SILTSTONE and MUDSTONE laminations. (MIDDLE COAL MEASURES)		
						67.70		16.00	Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH632

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 83.70

N Coord: 515726

E Coord: 297434

Date: 10/09/2020

Method:

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						66.70		17.00	COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE and SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						53.70		30.00	End Of Borehole At 30.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH633

Project Number: 4046

Client: Story Homes

Sheet 1 Of 3

GL (mAOD): 92.00

N Coord: 515879

E Coord: 297309

Date: 11/09/2020

Method: Casagrande C6

Driller:

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						91.20		0.80	Turf over brown silty sandy gravelly CLAY. (MIDDLE COAL MEASURES)		
						89.00		3.00	Yellow-brown weathered silty MUDSTONE. (MIDDLE COAL MEASURES)		
						85.20		6.80	Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						84.70		7.30	Black organic MUDSTONE. (MIDDLE COAL MEASURES)		
						84.30		7.70	COAL. (MIDDLE COAL MEASURES)		
									Grey silty MUDSTONE and SILTSTONE laminations. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- ∇ - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks
11/09/2020	13.5				Slight
11/09/2020	19				Moderate

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH633

Project Number: 4046

Client: Story Homes

Sheet 2 Of 3

GL (mAOD): 92.00

N Coord: 515879

E Coord: 297309

Date: 11/09/2020

Method: Casagrande C6

Driller:

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						70.50		21.50	Grey silty MUDSTONE and SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						69.40		22.60	Black MUDSTONE. (MIDDLE COAL MEASURES)		
						68.90		23.10	COAL (MIDDLE COAL MEASURES)		
									Grey silty MUDSTONE and SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						61.20		30.80			
						60.20		31.80	COAL. (MIDDLE COAL MEASURES)		
									Grey silty MUDSTONE and SILTSTONE laminations. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- ∇ - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks
11/09/2020	13.5				Slight
11/09/2020	19				Moderate

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH633

Project Number: 4046

Client: Story Homes

Sheet 3 Of 3

GL (mAOD): 92.00

N Coord: 515879

E Coord: 297309

Date: 11/09/2020

Method: Casagrande C6

Driller:

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						59.00		33.00	Grey silty MUDSTONE and SILTSTONE laminations. (MIDDLE COAL MEASURES) End Of Borehole At 33.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks
11/09/2020	13.5				Slight
11/09/2020	19				Moderate

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH634

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 88.52

N Coord: 515890

E Coord: 297403

Date: 11/09/2020

Method: Casagrande C6

Driller:

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						87.52		1.00	Turf over brown silty sandy gravelly CLAY. (GLACIAL TILL)		
						86.02		2.50	Yellow-brown weathered silty MUDSTONE. (MIDDLE COAL MEASURES)		
						83.02		5.50	Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						82.62		5.90	COAL. (MIDDLE COAL MEASURES)		
						82.42		6.10	Black organic MUDSTONE. (MIDDLE COAL MEASURES)		
						82.12		6.40	COAL. (MIDDLE COAL MEASURES)		
									Grey silty MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						74.12		14.40	COAL. (MIDDLE COAL MEASURES)		
						73.22		15.30	Grey silty MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks
15/09/2020	0				

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH634

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 88.52

N Coord: 515890

E Coord: 297403

Date: 11/09/2020

Method: Casagrande C6

Driller:

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						64.52		24.00	Grey silty MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
									End Of Borehole At 24.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks
15/09/2020	0				

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH635

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 86.90

N Coord: 515803

E Coord: 297418

Date: 11/09/2020

Method:

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						85.90		1.00	Turf over brown silty sandy gravelly CLAY. (MIDDLE COAL MEASURES)		
						83.90		3.00	Yellow-brown weathered silty MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						77.70		9.20	COAL. (MIDDLE COAL MEASURES)		
						77.40		9.50			
						77.30		9.60			
						76.90		10.00	COAL. (MIDDLE COAL MEASURES)		
						76.30		10.60	Black organic MUDSTONE. (MIDDLE COAL MEASURES)		
						76.00		10.90	COAL. (MIDDLE COAL MEASURES)		
									Black organic MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
									COAL (MIDDLE COAL MEASURES)		
									Grey silty MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH635

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 86.90

N Coord: 515803

E Coord: 297418

Date: 11/09/2020

Method:

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						68.40		18.50	Grey silty MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						67.40		19.50	COAL. (MIDDLE COAL MEASURES)		
						65.90		21.00	Grey silty MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
									End Of Borehole At 21.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH636

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 87.80

N Coord: 515724

E Coord: 297350

Date: 11/09/2020

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						86.80		1.00	Turf over brown silty sandy gravelly CLAY. (MIDDLE COAL MEASURES)		
						84.80		3.00	Yellow-brown weathered silty MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						78.60		9.20	COAL. (MIDDLE COAL MEASURES)		
						78.30		9.50	Black organic MUDSTONE. (MIDDLE COAL MEASURES)		
						78.20		9.60	COAL. (MIDDLE COAL MEASURES)		
						77.70		10.10	Grey silty MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks
11/09/2020	24				Moderate

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH636

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 87.80

N Coord: 515724

E Coord: 297350

Date: 11/09/2020

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						65.70		22.10	Grey silty MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						64.70		23.10	Black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
						63.80		24.00	Grey silty MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)	▼	
									Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						61.10		26.70			
						60.60		27.20	COAL with black Mudstone laminations. (MIDDLE COAL MEASURES)		
									Grey silty MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						57.80		30.00			
									End Of Borehole At 30.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- ∇ - Hand Shear Vane kPa
- ▼ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks
11/09/2020	24				Moderate

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH901

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 92.95

N Coord: 515681

E Coord: 297372

Date: 01/09/2021

Method:

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						92.65	•	0.30	Turf over brown silty sandy LOAM. (MIDDLE COAL MEASURES)		
						91.95		1.00	Yellow-brown clay interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
						91.45	■	1.50	COAL. (MIDDLE COAL MEASURES)		
						89.95	×	3.00	Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						86.95	×	6.00	Yellow-brown SILTSTONE with grey MUDSTONE laminations (MIDDLE COAL MEASURES)		
						78.95		14.00	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey-black MUDSTONE recovered as fine to medium shale. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH901

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 92.95

N Coord: 515681

E Coord: 297372

Date: 01/09/2021

Method:

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						75.95		17.00	Grey-black MUDSTONE recovered as fine to medium shale. (MIDDLE COAL MEASURES)		
						74.95		18.00	Black MUDSTONE with coal traces. (MIDDLE COAL MEASURES)		
						74.65	■	18.30	COAL. (MIDDLE COAL MEASURES)		
									Grey-black MUDSTONE. (MIDDLE COAL MEASURES)		
						71.95		21.00	Grey MUDSTONE and SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						67.45	■	25.50	COAL. (MIDDLE COAL MEASURES)		
						66.15	■	26.80			
						65.45		27.50	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
							⊗		Hard grey SILTSTONE with MUDSTONE (MIDDLE COAL MEASURES)		
						64.15	⊗	28.80			
							⊗		End Of Borehole At 28.80 m		
						62.95	⊗	30.00			

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH902

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 91.67

N Coord: 515889

E Coord: 297379

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						91.37		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						90.37		1.30	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
						79.27		12.40	COAL. (MIDDLE COAL MEASURES)		
						79.17		12.50	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						78.67		13.00	COAL. (MIDDLE COAL MEASURES)		
						78.57		13.10	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH902

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 91.67

N Coord: 515889

E Coord: 297379

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						73.27		18.40	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						70.27		21.40	Broken Ground & loss of flush - Probable mineworkings (PROBABLE WORKINGS)		
						67.67		24.00	Solid drilling with no returns. (MIDDLE COAL MEASURES)		
									End Of Borehole At 24.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH903

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 88.20

N Coord: 515872

E Coord: 297407

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						87.90		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						86.90		1.30	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
						81.70		6.50	COAL. (MIDDLE COAL MEASURES)		
						81.60		6.60	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						73.20		15.00	COAL. (MIDDLE COAL MEASURES)		
						72.70		15.50	Grey SILTSTONE with mudstone laminations. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH903

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 88.20

N Coord: 515872

E Coord: 297407

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						64.20		24.00	Grey SILTSTONE with mudstone laminations. (MIDDLE COAL MEASURES)		
									End Of Borehole At 24.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH904

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 90.00

N Coord: 515862

E Coord: 297389

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						89.70		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						88.70		1.30	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
						78.50		11.50	Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
					78.40		11.60				
					77.90		12.10				
					77.80		12.20				
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH904

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 90.00

N Coord: 515862

E Coord: 297389

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						71.50		18.50	Grey MUDSTONE. (MIDDLE COAL MEASURES) Broken Ground & loss of flush - Probable mineworkings (PROBABLE WORKINGS) Partial returns comprising COAL. Driller reported very little resistance to drilling progress. (MIDDLE COAL MEASURES) Partial Returns comprising grey MUDSTONE with coal traces. (MIDDLE COAL MEASURES) End Of Borehole At 21.00 m		
						71.00		19.00			
						70.20		19.80			
						69.00		21.00			

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH905

Project Number: 4046

Client: Story Homes

Sheet 1 Of 3

GL (mAOD): 91.75

N Coord: 515845

E Coord: 297367

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						91.45		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						90.75		1.00	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
						79.25		12.50	Dark grey-black MUDSTONE. (MIDDLE COAL MEASURES)		
						76.75		15.00	Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH905

Project Number: 4046

Client: Story Homes

Sheet 2 Of 3

GL (mAOD): 91.75

N Coord: 515845

E Coord: 297367

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						74.75		17.00	Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE (MIDDLE COAL MEASURES)		
						68.75		23.00	Broken Ground - loss of flush - Probable Mineworkings. (PROBABLE WORKINGS)		
						67.35		24.40	Solid drilling accompanied by slow recovery of up to 50% returns comprising grey MUDSTONE. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH905

Project Number: 4046

Client: Story Homes

Sheet 3 Of 3

GL (mAOD): 91.75

N Coord: 515845

E Coord: 297367

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
									Solid drilling accompanied by slow recovery of up to 50% returns comprising grey MUDSTONE. (MIDDLE COAL MEASURES)		
						52.25		39.50	COAL. Partial returns. (MIDDLE COAL MEASURES)		
						51.25		40.50	Grey MUDSTONE. Partial returns. (MIDDLE COAL MEASURES)		
						49.75		42.00	End Of Borehole At 42.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH906

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 88.24

N Coord: 515847

E Coord: 297409

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						87.94		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						86.74		1.50	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
						81.74		6.50	Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
						81.64		6.60			
						80.84		7.40	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						80.74		7.50			
									COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						72.74		15.50	COAL. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH906

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 88.24

N Coord: 515847

E Coord: 297409

Date: 01/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						72.14		16.10	COAL. (MIDDLE COAL MEASURES) Grey MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						64.24		24.00			
						64.24		24.00	End Of Borehole At 24.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH907

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 89.67

N Coord: 515847

E Coord: 297388

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						89.37		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						88.17		1.50	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
						86.17		3.50	Grey silty MUDSTONE. (MIDDLE COAL MEASURES) Dark grey-black MUDSTONE. (MIDDLE COAL MEASURES)		
						79.67		10.00	Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
						79.47		10.20			
						78.87		10.80	Grey MUDSTONE (MIDDLE COAL MEASURES) COAL. (MIDDLE COAL MEASURES) Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						78.77		10.90			
Borehole Continues											

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH907

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 89.67

N Coord: 515847

E Coord: 297388

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						71.37		18.30	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						70.17		19.50	Broken ground accompanied by loss of returns - probable mineworkings. (PROBABLE WORKINGS)		
						68.67		21.00	Solid drilling - no returns. (MIDDLE COAL MEASURES)		
									End Of Borehole At 21.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH908

Project Number: 4046

Client: Story Homes

Sheet 1 Of 3

GL (mAOD): 87.00

N Coord: 515821

E Coord: 297414

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						86.70		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						85.20		1.80	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
						82.00		5.00	Dark grey-black MUDSTONE. (MIDDLE COAL MEASURES)		
						79.80		7.20	Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
						79.70		7.30			
						79.00		8.00	Grey MUDSTONE (MIDDLE COAL MEASURES)		
						78.90		8.10			
									COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						71.00		16.00	Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH908

Project Number: 4046

Client: Story Homes

Sheet 2 Of 3

GL (mAOD): 87.00

N Coord: 515821

E Coord: 297414

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						70.40		16.60	COAL (MIDDLE COAL MEASURES) Grey MUDSTONE with SILTSTONE laminations (MIDDLE COAL MEASURES)		
						55.90		31.10	COAL. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH908

Project Number: 4046

Client: Story Homes

Sheet 3 Of 3

GL (mAOD): 87.00

N Coord: 515821

E Coord: 297414

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						54.10		32.90	COAL. (MIDDLE COAL MEASURES)		
						53.00		34.00	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									End Of Borehole At 34.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH909

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 89.85

N Coord: 515810

E Coord: 297393

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						89.55		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						88.35		1.50	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
						86.35		3.50	Grey silty MUDSTONE. (MIDDLE COAL MEASURES)		
									Dark grey-black MUDSTONE. (MIDDLE COAL MEASURES)		
						77.85		12.00	Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
					77.75		12.10	Grey MUDSTONE (MIDDLE COAL MEASURES)			
					77.25		12.60	COAL. (MIDDLE COAL MEASURES)			
					77.15		12.70	Grey MUDSTONE. (MIDDLE COAL MEASURES)			
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH909

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 89.85

N Coord: 515810

E Coord: 297393

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						69.85		20.00	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						68.35		21.50	Broken/soft ground accompanied by partial loss of returns comprising mudstone with coal traces - probable backfilled mineworkings. (PROBABLE WORKINGS)		
						65.85		24.00	Solid drilling - partial returns comprising grey mudstone with coal traces (PROBABLE WORKINGS)		
									End Of Borehole At 24.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH910

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 88.30

N Coord: 515821

E Coord: 297394

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						88.00		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						86.80		1.50	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
						78.60		9.70	Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
						78.50		9.80			
						77.80		10.50	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						77.70		10.60			
									COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH910

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 88.30

N Coord: 515821

E Coord: 297394

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						69.80		18.50	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						69.00		19.30	COAL. (MIDDLE COAL MEASURES)		
						67.30		21.00	Grey MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
									End Of Borehole At 21.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH911

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 86.72

N Coord: 515780

E Coord: 297414

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						86.42		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						85.72		1.00	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
						83.22		3.50	Yellow-brown muddy SANDSTONE (MIDDLE COAL MEASURES)		
						80.82		5.90	Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
					80.72		6.00				
					80.22		6.50				
					80.12		6.60				
									Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						72.02		14.70	COAL. (MIDDLE COAL MEASURES)		
						71.32		15.40			
									Grey MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH911

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 86.72

N Coord: 515780

E Coord: 297414

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						68.72		18.00	Grey MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
									End Of Borehole At 18.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH912

Project Number: 4046

Client: Story Homes

Sheet 1 Of 3

GL (mAOD): 86.15

N Coord: 515759

E Coord: 297410

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						85.85		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						85.15		1.00	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
						79.65		6.50	Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
					79.55		6.60				
					79.05		7.10				
					78.95		7.20				
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						70.85		15.30	COAL (MIDDLE COAL MEASURES)		
						70.25		15.90			
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH912

Project Number: 4046

Client: Story Homes

Sheet 2 Of 3

GL (mAOD): 86.15

N Coord: 515759

E Coord: 297410

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						55.85		30.30	COAL. (MIDDLE COAL MEASURES)		
						54.15		32.00	Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH912

Project Number: 4046

Client: Story Homes

Sheet 3 Of 3

GL (mAOD): 86.15

N Coord: 515759

E Coord: 297410

Date: 02/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						53.15		33.00	Grey MUDSTONE. (MIDDLE COAL MEASURES) End Of Borehole At 33.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH913

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 88.30

N Coord: 515749

E Coord: 297387

Date: 03/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						88.00		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						87.30		1.00	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Yellow-brown muddy SANDSTONE (MIDDLE COAL MEASURES)		
						81.80		6.50	Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
						77.60		10.70	Dark grey-black MUDSTONE with COAL traces. (MIDDLE COAL MEASURES)		
						77.40		10.90		Grey MUDSTONE. (MIDDLE COAL MEASURES)	
						76.50		11.80	COAL. (MIDDLE COAL MEASURES)		
						76.40		11.90		Grey MUDSTONE. (MIDDLE COAL MEASURES)	
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH913

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 88.30

N Coord: 515749

E Coord: 297387

Date: 03/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						68.80		19.50	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						68.00		20.30	COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						64.30		24.00	End Of Borehole At 24.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH914

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 85.20

N Coord: 515739

E Coord: 297417

Date: 04/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						84.90		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						84.20		1.00	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
						78.70		6.50	COAL. (MIDDLE COAL MEASURES)		
						78.60		6.60	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						78.10		7.10	COAL. (MIDDLE COAL MEASURES)		
						77.90		7.30	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						70.00		15.20	COAL. (MIDDLE COAL MEASURES)		
						69.20		16.00	COAL. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH914

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 85.20

N Coord: 515739

E Coord: 297417

Date: 04/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						67.20		18.00	Grey MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES) End Of Borehole At 18.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths

Flushing Medium

Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH915

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 85.50

N Coord: 515718

E Coord: 297382

Date: 04/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						85.20		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						84.20		1.30	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
						73.50		12.00	COAL. (MIDDLE COAL MEASURES)		
						73.40		12.10	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						72.90		12.60	COAL. (MIDDLE COAL MEASURES)		
						72.70		12.80	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
									Borehole Continues		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH915

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 85.50

N Coord: 515718

E Coord: 297382

Date: 04/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						64.70		20.80	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						64.00		21.50	COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						61.50		24.00	End Of Borehole At 24.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH916

Project Number: 4046

Client: Story Homes

Sheet 1 Of 2

GL (mAOD): 89.25

N Coord: 515770

E Coord: 297370

Date: 04/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
						88.95		0.30	TOPSOIL : Turf over brown silty sandy LOAM. (TOPSOIL)		
						87.95		1.30	Yellow-brown silty CLAY. Interpreted to be weathered MUDSTONE. (MIDDLE COAL MEASURES)		
									Grey and dark grey bands of silty MUDSTONE. (MIDDLE COAL MEASURES)		
									COAL with Mudstone. (MIDDLE COAL MEASURES)		
						74.45		14.80	Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						74.35		14.90			
						73.75		15.50	COAL. (MIDDLE COAL MEASURES)		
						73.55		15.70	Grey MUDSTONE. (MIDDLE COAL MEASURES)		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level

REMARKS

No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes

Borehole Continues					
Date	Strike	Level	Minutes	Casing	Remarks
Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type



Project Title: Rhodia, Whitehaven

PH916

Project Number: 4046

Client: Story Homes

Sheet 2 Of 2

GL (mAOD): 89.25

N Coord: 515770

E Coord: 297370

Date: 04/09/2021

Method: Casagrande C6

Driller: GDC

Logged By: NW

Core/Samples	TCR	SCR	RQD	FI	ISPT	Level	Legend	Depth (m)	Description	Water	Standpipe
									Grey MUDSTONE. (MIDDLE COAL MEASURES)		
						65.65		23.60			
						64.85		24.40	COAL. (MIDDLE COAL MEASURES)		
									Grey MUDSTONE with SILTSTONE laminations. (MIDDLE COAL MEASURES)		
						62.25		27.00			
									End Of Borehole At 27.00 m		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed
- W - Water Sample
- S - Standard Penetration Test
- C - Cone Penetration Test
- N - Penetration Test 'N' Value
- V - Hand Shear Vane kPa
- ▽ - Groundwater Strike
- ▼ - Groundwater Level

REMARKS









No Groundwater Encountered
Air Mist

Scale: 1:100

Water Strikes



Date	Strike	Level	Minutes	Casing	Remarks

Daily Log Of Depths			Flushing Medium		
Date	Casing	Water	From	To	Type

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		90.90		0.20	MADE GROUND: Rough grass over brown, slightly gravelly sandy clayey topsoil. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone, quartzite, rare brick. Single whole brick. (MADE GROUND TOPSOIL)	
0.40	ES		90.60		0.50	MADE GROUND: Brown, slightly sandy slightly gravelly clay with thin band of sand and gravel of mudstone and pocket of clayey sand. (COHESIVE MADE GROUND)	
0.75	ES	V=117kPa				Stiff, blue-grey, slightly gravelly CLAY. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90 0.90	D J		90.10		1.00		
1.00	SV	V=117kPa	90.00		1.10		
						Blue-grey and orange, MUDSTONE. Interpreted as weathered (distinctly). Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			89.10		2.00	End Of Trial Pit At 2.00 m	
			88.10		3.00		

KEY






D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

 - Groundwater Strike
 - Groundwater Level





REMARKS

No Groundwater Encountered
Slight groundwater trickle at 1.7m bgl. Pit sides stable.

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		90.45		0.15	<p>MADE GROUND: Rough grass over brown, slightly gravelly sandy clayey topsoil. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone, quartzite, rare brick. Single fragment of ceramic sewer. (MADE GROUND TOPSOIL)</p> <p>Stiff, brown, slightly gravelly fine to coarse sandy CLAY with occasional pockets of orange fine to medium sand. Gravel is rounded fine to coarse of sandstone and quartzite. (GLACIAL TILL)</p>	
0.75 0.75	D J		89.60		1.00	Dark grey, MUDSTONE. Interpreted as weathered (distinctly). Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
1.10	J		89.40		1.20	Black COAL. Interpreted as weathered (partially). Recovered as gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			88.90		1.70	Grey, SILTSTONE. Interpreted as weathered (partially). Recovered as gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			88.70		1.90	End Of Trial Pit At 1.90 m	
			88.60		2.00		
					3.00		
			87.60				

























KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa
-  - Groundwater Strike
-  - Groundwater Level





REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.05	ES		90.20		0.10	<p>MADE GROUND: Rough grass over brown, silty gravelly sandy topsoil. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone, quartzite, rare brick. (MADE GROUND TOPSOIL)</p> <p>MADE GROUND: Orange, sand and gravel of brick with occasional half/whole brick. (GRANULAR MADE GROUND)</p> <p>MADE GROUND: Dark grey, sandy gravel. Sand is fine to coarse. Gravel is subrounded fine to coarse of coal and sandstone. (GRANULAR MADE GROUND)</p> <p>MADE GROUND: Brown, sandy gravelly clay. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of brick, coal and ceramics. (COHESIVE MADE GROUND)</p> <p>Grey and brown, SILTSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES)</p> <p>0.40 - 1.00 Interpreted as weathered (distinctly). Recovered as silty sandy gravel with low cobble content.</p> <p>1.00 - 1.20 Interpreted as weathered (partially). Recovered as silty sandy gravel with low cobble and low boulder content.</p> <p>End Of Trial Pit At 1.20 m</p>	
0.25	ES		90.10		0.20		
			90.00		0.30		
			89.90		0.40		
							
1.00	J		89.30		1.00		
							
			89.10		1.20		
							
							
			88.30		2.00		
							
							
							
							
							
							
							
							
							
							
							
							
			87.30		3.00		

KEY

D - Disturbed Sample
 B - Bulk Sample
 W - Water Sample
 V - Hand Shear Vane kPa

 - Groundwater Strike
 - Groundwater Level



REMARKS

No Groundwater Encountered
 Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP753

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 90.80

N Coord: 515837

E Coord: 297314

Date: 01/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.05	ES		90.70		0.10	<p>MADE GROUND: Rough marsh grass over brown, silty gravelly sandy topsoil. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone and quartzite. (MADE GROUND TOPSOIL)</p> <p>MADE GROUND: Orange and brown, silty sand and gravel of brick with high (>20%) cobble content of bricks, concrete and single masonry up to 0.4m in maximum dimension. (GRANULAR MADE GROUND)</p> <p>Grey and orange-brown, SILTSTONE. Interpreted as weathered (distinctly). Recovered as silty sandy gravel sized particles with medium (5-20%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)</p>	
0.20	ES		90.50		0.30		
			89.80		1.00		
			89.30		1.50	End Of Trial Pit At 1.50 m	
			88.80		2.00		
			87.80		3.00		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa

- Groundwater Strike
- Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP754

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 90.20

N Coord: 515798

E Coord: 297322

Date: 01/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		90.00		0.20	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone and quartzite. (TOPSOIL)	
0.75	SV	V=127kPa				Stiff, light brown mottled grey-orange and brown, slightly sandy slightly gravelly CLAY with rare sandstone cobble. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone, mudstone and coal. (GLACIAL TILL)	
0.90	SV	V=135kPa					
1.00 1.00	D J		89.20		1.00		
1.15	SV	V=122kPa	89.00		1.20		
			88.30		1.90	Grey and brown, SILTSTONE and fine SANDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 1.20 - 1.60 Interpreted as weathered (residual/destructured). Recovered as clayey very gravel sand sized particles. 1.60 - 1.90 Interpreted as weathered (distinctly). Recovered as slightly sandy gravel sand sized particles with medium (5-20%) cobble content.	
			88.20		2.00	End Of Trial Pit At 1.90 m	
			87.20		3.00		

KEY

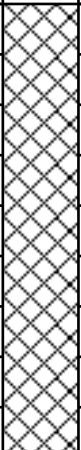


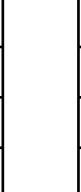
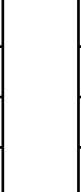

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

- Groundwater Strike
 - Groundwater Level





REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES					<p>MADE GROUND: Rough marsh grass over very soft, brown, slightly fine to medium sandy silty clay. Many metal items (e.g. rods, pipes, wire) and occasional whole bricks and rubber tubes. Strong stagnant water odour. (COHESIVE MADE GROUND)</p> <p>0.70 - 0.80 Land drain encountered with no water flow; broken during excavation.</p>	
1.00	J		88.20		0.90	<p>Grey and orange-brown, SILTSTONE. Interpreted as weathered (distinctly). (WEATHERED PENNINE MIDDLE COAL MEASURES)</p> <p>0.90 - 1.20 Recovered as silty sand and gravel sized particles.</p> <p>1.20 - 1.70 Recovered as silty sand and gravel sized particles and high (>20%) cobble content.</p>	
			88.10		1.00		
			87.40		1.70	<p>Grey and brown, MUDSTONE. Interpreted as weathered (partially). Recovered as sandy gravel sized particles and high (>20%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)</p>	
			87.10		2.00		
			87.00		2.10	End Of Trial Pit At 2.10 m	
			86.10		3.00		

KEY

D - Disturbed Sample
 B - Bulk Sample
 W - Water Sample
 V - Hand Shear Vane kPa

 - Groundwater Strike
 - Groundwater Level



REMARKS

No Groundwater Encountered
 Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven		TP756	
Project Number: 4046	Client: Story Homes		Sheet 1 Of 1
GL (mAOD): 87.10	N Coord: 515720	E Coord: 297302	
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.05	ES						
			86.90		0.20	Rough marsh grass over dark brown, slightly gravelly silty sandy clayey TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone and mudstone. (TOPSOIL)	
			86.70		0.40	Brown, silty clayey SAND. Sand is fine to medium. (GLACIAL TILL)	
						0.20 - 1.00 Historic drain running N-S in the centre of the pit, 1m in width. Backfill material contains dark grey, clayey sand and gravel with cobbles of mudstone and sandstone over thick red tiles. No water flow within the drain.	
						Firm, light brown, slightly sandy CLAY. (GLACIAL TILL)	
			86.10		1.00		
						Light brown, MUDSTONE. Interpreted as weathered (distinctly/destructured). Recovered as silty sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
						1.20 - 1.30 Slow flow of water (only) underneath the location of the historic drain.	
			85.10		2.00		
						End Of Trial Pit At 2.00 m	
			84.10		3.00		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level



REMARKS

Slow flow of water (only) underneath the location of the historic drain at 1.2m bgl. Pit sides stable. Pit terminated due to difficulty excavating. No Shear Vane Tests taken due to initial concern over the historic drain.



Project Title: Rhodia, Whitehaven

TP757

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 88.90

N Coord: 515749

E Coord: 297292

Date: 01/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			88.70		0.20	Rough marsh grass over dark brown, silty sandy clayey TOPSOIL. Sand is fine to coarse. (TOPSOIL)	
0.75	SV	V=31kPa				Soft locally firm, grey-brown, slightly silty slightly sandy CLAY. Sand is fine to medium. (GLACIAL TILL)	
0.90	SV	V=36kPa	87.90		1.00		
1.30	SV	V=22kPa	87.50		1.40	0.50 - 1.10 Historic drain running N-S in the centre of the pit, 0.5m in width. Backfill material contains dark grey, clayey sand and gravel with cobbles of mudstone and sandstone over thick red tiles. No water flow within the drain.	
							2.00
			86.90			Light brown and grey, MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
						1.40 - 1.70 Interpreted as weathered (distinctly/destructured). Recovered as silty sand and gravel sized particles.	
						1.70 - 2.00 Becoming grey. Interpreted as weathered (distinctly). Recovered as sandy gravel sized particles.	
						End Of Trial Pit At 2.00 m	
			85.90		3.00		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa

- Groundwater Strike
- Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP758

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 86.50

N Coord: 515695

E Coord: 297354

Date: 01/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES					Rough grass over dark brown, silty sandy clayey TOPSOIL. Sand is fine to coarse. (TOPSOIL)	
0.60 0.60	D J		86.10		0.40	Firm, orange-brown mottled grey-brown, slightly sandy CLAY. Sand is fine to medium. Interpreted as weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.80	SV	V=82kPa	85.50		1.00	Brown and grey and orange-brown, MUDSTONE. Interpreted as weathered (distinctly) mudstone. Recovered as clayey silty sandy gravel sized particles with medium (5-20%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			85.00		1.50	End Of Trial Pit At 1.50 m	
			84.50		2.00		
			83.50		3.00		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa

- Groundwater Strike
- Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP759

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 87.90

N Coord: 515726

E Coord: 297344

Date: 01/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			87.65		0.25	Rough grass over brown, gravelly clayey sandy silty TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. (TOPSOIL)	
0.75	SV	V=135kPa				Stiff, orange-brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal, quartzite and sandstone. (GLACIAL TILL)	
0.80	D						
0.90	SV	V=135kPa				Grey and orange-brown, fine SANDSTONE. Interpreted as weathered (distinctly) mudstone. Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			86.90		1.00		
			86.70		1.20		
			86.30		1.60	End Of Trial Pit At 1.60 m	
			85.90		2.00		
			84.90		3.00		

KEY




D - Disturbed Sample
 B - Bulk Sample
 W - Water Sample
 V - Hand Shear Vane kPa

- Groundwater Strike
 - Groundwater Level





REMARKS

No Groundwater Encountered
 Pit sides stable. Pit terminated due to difficulty excavating.

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			88.55		0.25	Rough grass over dark brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. (TOPSOIL)	
0.75	SV	V=123kPa				Stiff, orange-brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal, quartzite and sandstone. (GLACIAL TILL)	
0.95	SV	V=*	87.80		1.00		
1.10	SV	V=133kPa	87.60		1.20		
			87.10		1.70	Brown and grey and orange-brown, fine SANDSTONE. Interpreted as weathered (distinctly/destructured) mudstone. Recovered as clayey very sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			86.80		2.00	End Of Trial Pit At 1.70 m	
			85.80		3.00		

KEY

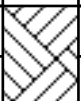









D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

 - Groundwater Strike
 - Groundwater Level





REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating. *Hand Shear Vane Test not possible due to gravel content.

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.05	ES		90.60		0.20	Rough grass over dark brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. (TOPSOIL)	
0.75	SV	V=123kPa				Stiff, orange-brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal, quartzite and sandstone. (GLACIAL TILL)	
0.80	D		89.90		0.90	0.80 - 0.90 Land drain encountered with no water flow; broken during excavation.	
0.80	J						
0.95	SV	V=113kPa	89.80		1.00	Stiff, grey and brown, silty CLAY. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
1.15	SV	V=113kPa					
			89.20		1.60	Black, COAL with shale laminations. Interpreted as weathered (partially). Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			88.80		2.00		
			88.70		2.10	Grey, MUDSTONE. Interpreted as weathered (partially). Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			88.50		2.30		
						End Of Trial Pit At 2.30 m	
			87.80		3.00		

KEY






D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

 - Groundwater Strike
 - Groundwater Level





REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			91.90		0.20	MADE GROUND: Rough grass over dark brown, slightly gravelly clayey silty sandy topsoil. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. (MADE GROUND TOPSOIL)	
			91.40		0.70	Stiff, orange-brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal, quartzite and sandstone. (GLACIAL TILL)	
			91.10		1.00	Brown, MUDSTONE. Interpreted as weathered (distinctly/destructured). Recovered as clayey sand and gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			90.50		1.60	Brown, MUDSTONE and laminations of organic shale. Interpreted as weathered (distinctly). Recovered as clayey sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			90.20		1.90	End Of Trial Pit At 1.90 m	
			90.10		2.00		
			89.10		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

 - Groundwater Strike
 - Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP763

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 93.00

N Coord: 515882

E Coord: 297342

Date: 01/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		92.70		0.30	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. Much gravel is suspected colliery spoil. (TOPSOIL)	
0.60 0.60	D J		92.30		0.70	Stiff, orange-brown mottled grey, slightly sandy slightly gravelly CLAY with low cobble sandstone. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal, quartzite and sandstone. Cobbles are tabular of sandstone and mudstone. (GLACIAL TILL)	
			92.00		1.00	Brown, MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 0.70 - 1.30 Interpreted as weathered (distinctly). Recovered as clayey sand and gravel sized particles.	
			91.40		1.60	1.30 - 1.60 Interpreted as weathered (partially). Recovered as sandy gravel sized particles with low cobble content.	
			91.00		2.00	End Of Trial Pit At 1.60 m	
			90.00		3.00		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa

- Groundwater Strike
- Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP764

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 91.20

N Coord: 515892

E Coord: 297379

Date: 02/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		91.00		0.20	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. (TOPSOIL)	
0.75	SV	V=73kPa				Stiff locally firm, orange-brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse of siltstone. Interpreted to be weathered (residual) siltstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.80	D						
0.80	J						
0.90	SV	V=115kPa	90.20		1.00		
						Grey, MUDSTONE. Interpreted as weathered (distinctly). Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			89.20		2.00		
			89.10		2.10		
						End Of Trial Pit At 2.10 m	
			88.20		3.00		

KEY

D - Disturbed Sample

B - Bulk Sample

W - Water Sample

V - Hand Shear Vane kPa

- Groundwater Strike

- Groundwater Level



REMARKS

No Groundwater Encountered

Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven		TP765	
Project Number: 4046	Client: Story Homes		Sheet 1 Of 1
GL (mAOD): 84.60	N Coord: 515893	E Coord: 297421	
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			84.35		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. Rare gravel of coal and brick. (TOPSOIL)	
0.75	SV	V=56kPa				Firm becoming stiff, orange-brown and grey, slightly sandy silty CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=75kPa					
1.05	SV	V=123kPa	83.60		1.00		
			83.10		1.50	Grey, MUDSTONE. Interpreted as weathered (distinctly). Recovered as silty sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES) 1.50 - 2.00 Recovered materials becoming stiff, silty sandy gravelly clay.	
			82.60		2.00		
			82.10		2.50	End Of Trial Pit At 2.50 m	
			81.60		3.00		

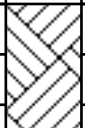




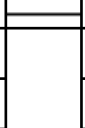
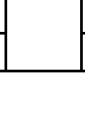
KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level





REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		83.75		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=67kPa				Firm becoming stiff, orange-brown and grey, slightly sandy silty CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=89kPa				0.80 - 1.00 Becoming stiff.	
1.05	SV	V=135kPa	83.00		1.00	Orange-brown and grey, MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 1.00 - 2.00 Interpreted as weathered (destructured). Recovered as clayey very silty gravelly sand sized particles.	
			82.00		2.00	2.00 - 2.50 Interpreted as weathered (distinctly). Recovered as clayey very silty very sandy gravel sized particles.	
			81.50		2.50	End Of Trial Pit At 2.50 m	
			81.00		3.00		

KEY



















D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

 - Groundwater Strike
 - Groundwater Level





REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			84.00		0.20	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=103kPa				Stiff, orange-brown and grey, slightly silty slightly sandy CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=135kPa					
1.05	SV	V=135kPa	83.20		1.00		
			83.00		1.20		
						Orange-brown and grey, MUDSTONE. Interpreted to be weathered (distinctly/destructured) mudstone. Recovered as silty very sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			82.20		2.00		
			82.10		2.10		
							
							
							
							
							
							
							
							
							
			81.20		3.00		
						End Of Trial Pit At 2.10 m	

KEY






D - Disturbed Sample
 B - Bulk Sample
 W - Water Sample
 V - Hand Shear Vane kPa

 - Groundwater Strike
 - Groundwater Level





REMARKS

No Groundwater Encountered
 Pit sides stable. Pit terminated due to difficulty excavating.

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			83.80		0.20	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=76kPa				Stiff, orange-brown and grey, slightly silty slightly sandy CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES) 0.40 - 0.45 Bed of weathered coal.	
0.90	SV	V=87kPa					
1.05	SV	V=89kPa					
			83.00		1.00		
			82.90		1.10		
						Orange-brown and grey, MUDSTONE. Interpreted to be weathered (distinctly) mudstone. Recovered as silty sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			82.00		2.00		
			81.80		2.20		
						End Of Trial Pit At 2.20 m	
			81.00		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

 - Groundwater Strike
 - Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP769

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 86.10

N Coord: 515751

E Coord: 297417

Date: 02/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			85.85		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=93kPa				Stiff, orange-brown and grey, silty sandy CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone with occasional sandstone bed. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=135kPa					
1.05	SV	V=135kPa	85.10		1.00		
			84.90		1.20	Orange-brown and grey, MUDSTONE and occasional sandstone bed. Interpreted to be weathered (distinctly). Recovered as silty very sandy gravel sized particles with low (<5%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			84.20		1.90		
			84.10		2.00		
						End Of Trial Pit At 1.90 m	
			83.10		3.00		

KEY






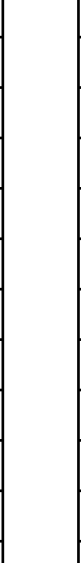

D - Disturbed Sample
 B - Bulk Sample
 W - Water Sample
 V - Hand Shear Vane kPa

- Groundwater Strike
 - Groundwater Level





REMARKS

No Groundwater Encountered
 Pit sides stable. Pit terminated due to difficulty excavating.

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			83.25		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=114kPa				Stiff, orange-brown and grey, silty sandy CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=135kPa					
			82.50		1.00	Orange-brown and grey, MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 0.95 - 1.30 Interpreted to be weathered (distinctly). Recovered as clayey silty sand and gravel sized particles. 1.30 - 1.80 Interpreted to be weathered (partially/distinctly). Recovered as sandy gravel sized particles.	
			81.70		1.80	End Of Trial Pit At 1.80 m	
			81.50		2.00		
			80.50		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

 - Groundwater Strike
 - Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP771

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 87.50

N Coord: 515737

E Coord: 297383

Date: 02/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.05	ES					Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.25 - 0.75	B		87.25		0.25	Stiff locally firm, orange-brown and grey, silty sandy CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.75	SV	V=95kPa					
0.90	SV	V=74kPa					
1.00	SV	V=67kPa	86.50		1.00	0.90 - 1.20 Locally firm.	
			86.30		1.20	Orange-brown and grey, MUDSTONE. Interpreted to be weathered (distinctly). Recovered as slightly clayey sandy gravel sized particles with low (<5%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			85.60		1.90		
2.00	J		85.50		2.00	Grey, fine SANDSTONE. Interpreted to be weathered (partially). Recovered as sandy gravel sized particles with low (<5%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			85.40		2.10	End Of Trial Pit At 2.10 m	
			84.50		3.00		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa

- Groundwater Strike
- Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven		TP772	
Project Number: 4046	Client: Story Homes		Sheet 1 Of 1
GL (mAOD): 89.30	N Coord: 515774	E Coord: 297374	
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES						
0.20 - 0.70	B		89.10		0.20	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
			88.30		1.00	Orange-brown and grey, MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 0.20 - 0.90 Interpreted to be weathered (destructured). Recovered as very clayey very silty fine sand sized particles.	
			87.80		1.50	0.90 - 1.50 Interpreted to be weathered (distinctly). Recovered as clayey silty sand and gravel sized particles.	
			87.30		2.00	Grey, SILTSTONE. Interpreted to be weathered (distinctly). Recovered as silty sandy gravel sized particles with low (<5%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
						End Of Trial Pit At 2.00 m	
			86.30		3.00		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa
- Groundwater Strike
- Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP773

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 87.50

N Coord: 515787

E Coord: 297410

Date: 02/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.15 0.20 - 0.70	ES B		87.30		0.20	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.50	J					Orange-brown and grey MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 0.20 - 0.90 Interpreted to be weathered (distinctly) recovered as clayey very silty fine sand particles.	
0.75	SV	V=119kPa					
0.90	SV	V=135kPa					
			86.50		1.00	0.90 - 1.50 Interpreted to be weathered (destructured) recovered as clayey silty sand & gravel particles.	
			86.20		1.30		
			85.60		1.90	Brown, fine sandy SILTSTONE. Interpreted to be weathered (distinctly/destructured). Recovered as silty very sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			85.50		2.00	End Of Trial Pit At 1.90 m	
			84.50		3.00		

KEY

D - Disturbed Sample
 B - Bulk Sample
 W - Water Sample
 V - Hand Shear Vane kPa

- Groundwater Strike
 - Groundwater Level



REMARKS

No Groundwater Encountered
 Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP774

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 88.30

N Coord: 515823

E Coord: 297402

Date: 02/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.20	ES		88.05		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=95kPa				Stiff locally firm, orange-brown and grey, slightly sandy silty CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=120kPa					
			87.30		1.00	Brown, silty fine SANDSTONE. Interpreted to be weathered (partially). Recovered as silty sandy gravel sized particles with medium (5-20%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			86.60		1.70	End Of Trial Pit At 1.70 m	
			86.30		2.00		
			85.30		3.00		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa

- Groundwater Strike
- Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.



Project Title: Rhodia, Whitehaven

TP775

Project Number: 4046

Client: Story Homes

Sheet 1 Of 1

GL (mAOD): 89.30

N Coord: 515851

E Coord: 297391

Date: 02/09/2021

Method: Tracked Excavator

Logged By: SD

Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		89.05		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=68kPa				Firm becoming stiff, orange-brown and grey, slightly sandy silty CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90 0.95 0.95	SV D J	V=80kPa	88.30		1.00	0.85 - 1.40 Becoming stiff.	
			87.90		1.40		
			87.70		1.60	Orange-brown and grey, MUDSTONE. Interpreted to be weathered (distinctly). Recovered as silty sand and gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			87.50		1.80	Orange-brown, very fine SANDSTONE. Interpreted to be weathered (partially). Recovered as cobble and boulder (0.4m, maximum dimension) sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			87.30		2.00	Weathered, grey-brown, SILTSTONE. Interpreted to be weathered (distinctly). Recovered as silty very sandy gravel sized particles and low (<5%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			87.20		2.10	End Of Trial Pit At 2.10 m	
			86.30		3.00		

KEY

- D - Disturbed Sample
- B - Bulk Sample
- W - Water Sample
- V - Hand Shear Vane kPa

- Groundwater Strike
- Groundwater Level



REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

APPENDIX C

Hole ID	Depth (m)	Material	Table 1 Inorganic Determinands: Concentrations in mg/kg unless otherwise stated. Critical Concentrations (GAC) are shown below														
			TOC	SOM	pH	As	Cd	Cr (III)	Cr (VI)	Cu	Pb	Hg	Ni	Se	Zn	SO ₄ (g/l)	Asbestos
S4UL Residential with homegrown produce			%	%		37	11	910	6	2400	200*	40	130	250	3700		
TP750	0.10	Made Ground Topsoil	4.3	7.5	5.5	4	1	22	<1	27	43	<0.17	26	<1	43		NAD
TP750	0.40	Cohesive Made Ground	4.4	7.6	6.1	4	1	20	<1	30	32	<0.17	65	<1	32		NAD
TP750	0.90	Weathered Bedrock		0.0	6.6												
TP751	0.10	Made Ground Topsoil	4.7	8.1	5.4	5	1	31	<1	24	49	<0.17	29	<1	57		NAD
TP751	0.75	Glacial Till		0.0	5.8											0.050	
TP751	1.10	Weathered Bedrock		0.0	6.3												
TP752	0.05	Made Ground Topsoil	9.2	15.8	5.8	9	1	43	<1	44	98	<0.17	41	<1	88		NAD
TP752	0.25	Granular Made Ground	5.8	10.1	5.7	6	1	27	<1	44	100	<0.17	43	<1	50		NAD
TP752	1.00	Weathered Bedrock		0.0	5.5												
TP753	0.20	Granular Made Ground	3.8	6.5	5.8	4	1	29	<1	27	29	<0.17	28	<1	63		NAD
TP754	1.00	Glacial Till		0.0	6.3											0.020	
TP755	0.10	Cohesive Made Ground	8.1	14.0	5.2	8	2	25	<1	54	68	<0.17	37	<1	348		NAD
TP755	1.00	Weathered Bedrock		0.0	5.5												
TP758	0.10	Topsoil	10.1	17.4	5.5	10	1	35	<1	37	87	<0.17	29	<1	77		NAD
TP758	0.60	Clay/Residual Bedrock		0.0	5.6												
TP761	0.05	Topsoil	4.5	7.8	5.3	5	1	47	<1	39	66	<0.17	26	<1	61		NAD
TP761	0.80	Glacial Till		0.0	6.1												
TP763	0.10	Topsoil	3.9	6.7	5.6	4	2	42	<1	33	44	<0.17	30	<1	83		NAD
TP763	0.60	Glacial Till		0.0	5.1											0.010	
TP764	0.10	Topsoil	4.6	8.0	5.5	5	1	37	<1	42	68	<0.17	34	<1	64		NAD
TP764	0.80	Clay/Residual Bedrock	0.2	0.4	6.2	0	<0.5	14	<1	5	3	<0.17	9	<1	8		NAD
TP771	0.05	Topsoil	5.2	9.0	5.6	5	1	36	<1	30	58	<0.17	19	<1	54		NAD
TP771	2.00	Weathered Bedrock		0.0	6.4											0.020	
TP773	0.50	Clay/Residual Bedrock		0.0	6.6												
TP775	0.95	Clay/Residual Bedrock		0.0	6.3												

Key		Source of Critical Concentration	
BOLD	Determinand in excess of critical concentration	For source of Generic Assessment Criteria refer to Generic Notes 4 "Contamination Assessment" * C4SL	
-	Determinand not tested for		
<	Determinand concentration is below indicated "method" level of detection		
AND	Asbestos not detected		
		§	EA Contaminated Land Exposure Assessment (CLEA) 2009
		§§	SP1010: Development of C4SLs for Assessment of Land Affected by Contamination-Policy Companion Document, March 2014

Hole ID	Depth (m)	Material	Table 1 Inorganic Determinands: Concentrations in mg/kg unless otherwise stated. Critical Concentrations (GAC) are shown below														
			TOC	SOM	pH	As	Cd	Cr (III)	Cr (VI)	Cu	Pb	Hg	Ni	Se	Zn	SO ₄ (g/l)	Asbestos
							x		Land Quality Management (Rev. 2009)								
#							∫		CL:AIRE Generic Assessment Criteria 2009 based on a soil organic matter content of 2.5%. (see Generic Notes in Appendix A).								
							*		Tier 1 assessment criteria for chromium assumes Chromium III to be the Determinand								
							*		Chromium VI LQM. If land history indicates present otherwise Chromium III (3000)								

Hole ID	Depth (m)	Material	Table 2 Speciated Polycyclic Aromatic Hydrocarbons: Concentrations in mg/kg unless otherwise stated. Critical Concentrations (GAC) are shown below																	
			TOC	SOM	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
S4UL Residential with homegrown produce (1% SOM)			%	%	210	170	2400	7.2	2.2	2.6	320	77	15	0.24	280	170	27	2.3	95	620
S4UL Residential with homegrown produce (6% SOM)			%	%	1100	920	11000	13	3	3.7	350	100	27	0.3	890	860	41	13	440	2000
TP750	0.10	Made Ground Topsoil	4.3	7.5	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07
TP750	0.40	Cohesive Made Ground	4.4	7.6	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	0.1	<0.07
TP751	0.10	Made Ground Topsoil	4.7	8.1	<0.01	<0.01	<0.02	0.1	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	0.1	<0.01	<0.03	<0.03	0.1	0.1
TP752	0.05	Made Ground Topsoil	9.2	15.8	<0.01	<0.01	<0.02	0.2	0.2	0.2	0.1	<0.07	0.2	<0.04	0.3	<0.01	0.11	<0.03	0.2	0.2
TP752	0.25	Granular Made Ground	5.8	10.1	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07
TP753	0.20	Granular Made Ground	3.8	6.5	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07
TP755	0.10	Cohesive Made Ground	8.1	14.0	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	0.02	<0.03	<0.03	0.1	<0.07
TP758	0.10	Topsoil	10.1	17.4	<0.01	<0.01	<0.02	0.1	0.1	0.1	<0.05	<0.07	0.1	<0.04	0.2	<0.01	0.05	<0.03	0.2	0.1
TP761	0.05	Topsoil	4.5	7.8	<0.01	<0.01	<0.02	0.1	0.1	0.1	<0.05	<0.07	0.1	<0.04	0.1	<0.01	0.05	<0.03	0.1	0.1
TP763	0.10	Topsoil	3.9	6.7	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07
TP764	0.10	Topsoil	4.6	8.0	<0.01	<0.01	<0.02	0.1	0.1	0.1	<0.05	<0.07	0.1	<0.04	0.1	<0.01	<0.03	<0.03	0.1	<0.07
TP764	0.80	Clay/Residual Bedrock	0.2	0.4	<0.01	<0.01	<0.02	<0.04	<0.04	<0.05	<0.05	<0.07	<0.06	<0.04	<0.08	<0.01	<0.03	<0.03	<0.03	<0.07
TP771	0.05	Topsoil	5.2	9.0	<0.01	<0.01	<0.02	0.1	0.1	0.1	<0.05	<0.07	0.1	<0.04	0.1	<0.01	0.04	<0.03	0.1	0.1

Key		Source of Critical Concentration
BOLD	Determinand in excess of critical concentration	For source of Generic Assessment Criteria refer to Generic Notes 4 "Contamination Assessment"
-	Determinand not tested for	
<	Determinand concentration is below indicated "method" level of detection	

Hole ID	Depth (m)	Material	Table 3 Phytotoxic Assessment: Concentrations in mg/kg unless otherwise stated. Critical Concentrations are dependant on pH value of the material.												
			pH	Cu [§]				Ni [§]				Zn [§]			
				5.0-5.5	5.5-6.0	6.0-7.0	7.0+	5.0-5.5	5.5-6.0	6.0-7.0	7.0+	5.0-5.5	5.5-6.0	6.0-7.0	7.0+
			-	80	100	135	200	50	60	75	110	200	200	200	300
TP750	0.10	Made Ground Topsoil	5.5		27				26				43		
TP750	0.40	Cohesive Made Ground	6.1			30				65			32		
TP751	0.10	Made Ground Topsoil	5.4	24				29				57			
TP752	0.05	Made Ground Topsoil	5.8		44				41				88		
TP752	0.25	Granular Made Ground	5.7		44				43				50		
TP753	0.20	Granular Made Ground	5.8		27				28				63		
TP755	0.10	Cohesive Made Ground	5.2	54				37				348			
TP758	0.10	Topsoil	5.5		37				29				77		
TP761	0.05	Topsoil	5.3	39				26				61			
TP763	0.10	Topsoil	5.6		33				30				83		
TP764	0.10	Topsoil	5.5		42				34				64		
TP764	0.80	Clay/Residual Bedrock	6.2			5				9				8	
TP771	0.05	Topsoil	5.6		30				19				54		

Key		Source of Critical Concentration	
BOLD	Determinand in excess of critical concentration	§	Department of Environment Code of Practice for Agricultural use of Sewage Sludge Revised 2006
-	Determinand not tested for		
<	Determinand concentration is below indicated "method" level of detection		

Hole ID	Depth (m)	Material	Table 4 Soil Inorganic Leachability Assessment: Concentrations in ug/l unless otherwise stated. Results are quoted to 2 significant figures. Critical Concentrations are shown below											
			TOC	pH	As	Cd	Cr (III)	Cr(VI)	Cu	Pb	Hg	Ni	Se	Zn
		GW (Surface Water impact) 2015	%	-	25.8 [#]	0.054 [#]	1.75 [#]	-	0.516 [#]	0.619 [#]	0.026 [#]	2.06 [#]	-	7.02
		GW General Quality 2015	%	-	7.5 [^]	-	-	-	1500 [^]	7.5 [^]	-	15 [^]	-	-
TP753	0.20	Granular Made Ground	3.8	5.8	3	<1	<0.05	<0.05	2	2	<0.1	14	<1	357
TP755	0.10	Cohesive Made Ground	8.1	5.2	4	<1	<0.05	<0.05	<1	<1	<0.1	14	<1	280

Key		Source of Critical Concentration	
BOLD	Determinand in excess of critical concentration	∞	Annual Average EQS for Priority Substances & other Pollutants - Inland Surface Waters, Table 1, Schedule 3, Part 3 – Water Framework Directive (England and Wales) Directions 2015
-	Determinand not tested for	#	Threshold Values for Groundwater - Table 1, Schedule 5, Groundwater Impacts on: Surface Waters, Water Framework Directive (England and Wales) Directions 2015
<	Determinand concentration is below indicated “method” level of detection	\$	Threshold Values for Groundwater - Table 1, Schedule 5, GW Drinking Water Protected Areas, Water Framework Directive (England and Wales) Directions 2015
*	EQS for Specific Pollutants - Table 1, Schedule 3, Part 2, Water Framework Directive (England and Wales) Directions 2015	^	Threshold Values for Groundwater - Table 1, Schedule 5, General Quality of GW Body, Water Framework Directive (England and Wales) Directions 2015
		j	The Water Supply (Water Quality) Regulations 2016

Hole ID	Depth (m)	Material	Table 5 Soil Organic Leachability Assessment: Concentrations in ug/l unless otherwise stated. Results are quoted to 2 significant figures. Critical Concentrations are shown below															
			TOC	SOM	pH	Benzene	Toluene	Ethylbenzene	Xylene	Phenols	Dissolved TPH	PAH	Benzol(a)pyrene	Anthracene	Flouranthene	Benzo(b)flouranthene	Benzo(g,h,i)perylene & Indeno(1,2,3-cd)pyrene	Naphthalene
		GW (Surface Water impact) 2015	%	%	-	5.16 [#]	38.2 [#]	-	15.5 [#]	4.08 [#]	-	-	0.000089 [#]	0.052 [#]	0.0033 [#]	0.016 [#]	-	1.03 [#]
		GW General Quality 2015	%	%		0.75 [^]	-	-	-	-	-	-	-	-	0.075 [^]	-	-	0.075 [^]
TP753	0.20	Granular Made Ground	3.8	6.5	5.8	-	-	-	-	-	-	<0.08	<0.02	<0.02	<0.02	<0.02	<0.02	<0.08
TP755	0.10	Cohesive Made Ground	8.1	14.0	5.2	-	-	-	-	-	-	<0.08	<0.02	<0.02	<0.02	<0.02	<0.02	<0.08

Key		Source of Critical Concentration	
BOLD	Determinand in excess of critical concentration	∞	Annual Average EQS for Priority Substances & other Pollutants - Inland Surface Waters, Table 1, Schedule 3, Part 3 – Water Framework Directive (England and Wales) Directions 2015
-	Determinand not tested for	#	Threshold Values for Groundwater - Table 1, Schedule 5, Groundwater Impacts on: Surface Waters, Water Framework Directive (England and Wales) Directions 2015
<	Determinand concentration is below indicated "method" level of detection	#	Threshold Values for Groundwater - Table 1, Schedule 5, GW Drinking Water Protected Areas, Water Framework Directive (England and Wales) Directions 2015
*	EQS for Specific Pollutants - Table 1, Schedule 3, Part 2, Water Framework Directive (England and Wales) Directions 2015	^	Threshold Values for Groundwater - Table 1, Schedule 5, General Quality of GW Body, Water Framework Directive (England and Wales) Directions 2015

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 21/09719
Issue Number: 1
Date: 17 September, 2021

Client: iD GeoEnvironmental Ltd (Knutsford)
Caledonian House
Tatton Street
Knutsford
WA16 6AG

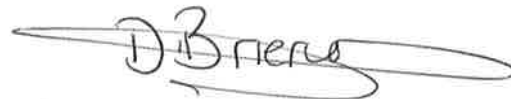
Project Manager: Steve Drew
Project Name: Edgehill, Whitehaven
Project Ref: 4046
Order No: N/A
Date Samples Received: 06/09/21
Date Instructions Received: 08/09/21
Date Analysis Completed: 17/09/21

Prepared by:



Richard Wong
Client Manager

Approved by:



Danielle Brierley
Client Manager

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/1	21/09719/2	21/09719/3	21/09719/4	21/09719/5	21/09719/6	21/09719/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP750	TP750	TP750	TP751	TP751	TP751	TP752			
Depth to Top	0.10	0.40	0.90	0.10	0.75	1.10	0.05			
Depth To Bottom										
Date Sampled	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	6AE	6A	5A	6AE	5A	6A	6AE			
% Stones >10mm _A	2.7	<0.1	<0.1	<0.1	<0.1	<0.1	1.0	% w/w	0.1	A-T-044
pH _D ^{M#}	5.49	6.10	6.61	5.43	5.79	6.31	5.79	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	-	-	-	-	0.05	-	-	g/l	0.01	A-T-026s
Total Organic Carbon _D ^{M#}	4.33	4.41	-	4.69	-	-	9.19	% w/w	0.03	A-T-032s
Arsenic _D ^{M#}	17	26	-	13	-	-	17	mg/kg	1	A-T-024s
Cadmium _D ^{M#}	1.3	1.4	-	0.9	-	-	1.1	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	27	30	-	24	-	-	44	mg/kg	1	A-T-024s
Chromium _D ^{M#}	22	20	-	31	-	-	43	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	-	<1	-	-	<1	mg/kg	1	A-T-040s
Chromium (trivalent)	22	20	-	31	-	-	43	mg/kg	1	Calc
Lead _D ^{M#}	43	32	-	49	-	-	98	mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	-	<0.17	-	-	<0.17	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	26	65	-	29	-	-	41	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	-	<1	-	-	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	43	32	-	57	-	-	88	mg/kg	5	A-T-024s

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/1	21/09719/2	21/09719/3	21/09719/4	21/09719/5	21/09719/6	21/09719/7	Units	Limit of Detection	Method ref			
Client Sample No													
Client Sample ID	TP750	TP750	TP750	TP751	TP751	TP751	TP752						
Depth to Top	0.10	0.40	0.90	0.10	0.75	1.10	0.05						
Depth To Bottom													
Date Sampled	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Sample Matrix Code	6AE	6A	5A	6AE	5A	6A	6AE						
Asbestos in Soil (inc. matrix)													
Asbestos in soil [#]	NAD	NAD	-	NAD	-	-	NAD			A-T-045			
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	-	N/A	-	-	N/A			A-T-045			

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/1	21/09719/2	21/09719/3	21/09719/4	21/09719/5	21/09719/6	21/09719/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP750	TP750	TP750	TP751	TP751	TP751	TP752			
Depth to Top	0.10	0.40	0.90	0.10	0.75	1.10	0.05			
Depth To Bottom										
Date Sampled	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	6AE	6A	5A	6AE	5A	6A	6AE			
PAH-16MS										
Acenaphthene _A ^{M#}	<0.01	<0.01	-	<0.01	-	-	<0.01	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	-	<0.01	-	-	<0.01	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	-	<0.02	-	-	<0.02	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	-	0.06	-	-	0.15	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	-	<0.04	-	-	0.15	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	-	<0.05	-	-	0.20	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	-	<0.05	-	-	0.08	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	-	<0.07	-	-	<0.07	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	-	<0.06	-	-	0.18	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	-	<0.04	-	-	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	-	0.11	-	-	0.29	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	-	<0.01	-	-	<0.01	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	-	<0.03	-	-	0.11	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03	-	<0.03	-	-	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	<0.03	0.13	-	0.09	-	-	0.15	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	-	0.09	-	-	0.24	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	<0.08	0.13	-	0.35	-	-	1.55	mg/kg	0.01	A-T-019s

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/8	21/09719/9	21/09719/10	21/09719/11	21/09719/12	21/09719/13	21/09719/14	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP752	TP752	TP753	TP753	TP754	TP754	TP755			
Depth to Top	0.25	1.00	0.05	0.20	0.10	1.00	0.10			
Depth To Bottom										
Date Sampled	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	6AE	6A	6AE	6ABE	6AE	6A	6AE			
% Stones >10mm _A	2.8	24.8	<0.1	2.7	<0.1	<0.1	<0.1			
pH _D ^{M#}	5.68	5.49	5.44	5.75	5.36	6.31	5.22	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	-	-	-	-	-	0.02	-	g/l	0.01	A-T-026s
Total Organic Carbon _D ^{M#}	5.84	-	-	3.78	-	-	8.13	% w/w	0.03	A-T-032s
Arsenic _D ^{M#}	17	-	-	11	-	-	16	mg/kg	1	A-T-024s
Cadmium _D ^{M#}	1.3	-	-	1.2	-	-	1.8	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	44	-	-	27	-	-	54	mg/kg	1	A-T-024s
Chromium _D ^{M#}	27	-	-	29	-	-	25	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	-	-	<1	-	-	<1	mg/kg	1	A-T-040s
Chromium (trivalent)	27	-	-	29	-	-	25	mg/kg	1	Calc
Lead _D ^{M#}	100	-	-	29	-	-	68	mg/kg	1	A-T-024s
Mercury _D	<0.17	-	-	<0.17	-	-	<0.17	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	43	-	-	28	-	-	37	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	-	-	<1	-	-	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	50	-	-	63	-	-	348	mg/kg	5	A-T-024s
Leachate Prep NRA (10:1) _A	-	-	-	*	-	-	*			A-T-001
Arsenic (leachable) _A [#]	-	-	-	3	-	-	4	µg/l	1	A-T-025w
Cadmium (leachable) _A [#]	-	-	-	<1	-	-	<1	µg/l	1	A-T-025w
Copper (leachable) _A [#]	-	-	-	2	-	-	<1	µg/l	1	A-T-025w
Chromium (leachable) _A [#]	-	-	-	<1	-	-	<1	µg/l	1	A-T-025w
Chromium (hexavalent) (leachable) _A	-	-	-	<0.05	-	-	<0.05	mg/l	0.05	A-T-040w
Chromium (trivalent) (10:1 leachable)	-	-	-	<0.05	-	-	<0.05	mg/l	0.05	Calc
Lead (leachable) _A [#]	-	-	-	2	-	-	<1	µg/l	1	A-T-025w
Mercury (leachable) _A [#]	-	-	-	<0.1	-	-	<0.1	µg/l	0.1	A-T-025w
Nickel (leachable) _A [#]	-	-	-	14	-	-	14	µg/l	1	A-T-025w
Selenium (leachable) _A [#]	-	-	-	<1	-	-	<1	µg/l	1	A-T-025w
Zinc (leachable) _A [#]	-	-	-	357	-	-	280	µg/l	1	A-T-025w

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/8	21/09719/9	21/09719/10	21/09719/11	21/09719/12	21/09719/13	21/09719/14	Units	Limit of Detection	Method ref			
Client Sample No													
Client Sample ID	TP752	TP752	TP753	TP753	TP754	TP754	TP755						
Depth to Top	0.25	1.00	0.05	0.20	0.10	1.00	0.10						
Depth To Bottom													
Date Sampled	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Sample Matrix Code	6AE	6A	6AE	6ABE	6AE	6A	6AE						
Asbestos in Soil (inc. matrix)													
Asbestos in soil [#]	NAD	-	-	NAD	-	-	NAD			A-T-045			
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	-	-	N/A	-	-	N/A			A-T-045			

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/8	21/09719/9	21/09719/10	21/09719/11	21/09719/12	21/09719/13	21/09719/14	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP752	TP752	TP753	TP753	TP754	TP754	TP755			
Depth to Top	0.25	1.00	0.05	0.20	0.10	1.00	0.10			
Depth To Bottom										
Date Sampled	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	6AE	6A	6AE	6ABE	6AE	6A	6AE			
PAH-16MS										
Acenaphthene _A ^{M#}	<0.01	-	-	<0.01	-	-	<0.01	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	-	-	<0.01	-	-	<0.01	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	<0.02	-	-	<0.02	-	-	<0.02	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	-	-	<0.05	-	-	<0.05	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	-	-	<0.05	-	-	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	-	-	<0.07	-	-	<0.07	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	<0.06	-	-	<0.06	-	-	<0.06	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	<0.08	-	-	<0.08	-	-	<0.08	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	<0.01	-	-	<0.01	-	-	0.02	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	-	-	<0.03	-	-	<0.03	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	-	-	<0.03	-	-	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	<0.03	-	-	<0.03	-	-	0.09	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	<0.07	-	-	<0.07	-	-	<0.07	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	<0.08	-	-	<0.08	-	-	0.11	mg/kg	0.01	A-T-019s

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/8	21/09719/9	21/09719/10	21/09719/11	21/09719/12	21/09719/13	21/09719/14	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP752	TP752	TP753	TP753	TP754	TP754	TP755			
Depth to Top	0.25	1.00	0.05	0.20	0.10	1.00	0.10			
Depth To Bottom										
Date Sampled	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	6AE	6A	6AE	6ABE	6AE	6A	6AE			
PAH 16MS (leachable)										
Acenaphthene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Acenaphthylene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Anthracene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Benzo(a)anthracene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Benzo(a)pyrene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Benzo(b)fluoranthene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Benzo(ghi)perylene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Benzo(k)fluoranthene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Chrysene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Dibenzo(ah)anthracene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Fluoranthene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Fluorene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Indeno(123-cd)pyrene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Naphthalene (leachable) _A	-	-	-	<0.08	-	-	<0.08	µg/l	0.02	A-T-019w
Phenanthrene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Pyrene (leachable) _A	-	-	-	<0.02	-	-	<0.02	µg/l	0.02	A-T-019w
Total PAH 16MS (leachable) _A	-	-	-	<0.08	-	-	<0.08	µg/l	0.02	A-T-019w

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/15	21/09719/16	21/09719/17	21/09719/18	21/09719/19	21/09719/20	21/09719/21	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP755	TP756	TP758	TP758	TP761	TP761	TP763			
Depth to Top	1.00	0.05	0.10	0.60	0.05	0.80	0.10			
Depth To Bottom										
Date Sampled	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	4A	6AE	6AE	5AE	6AE	5A	6AE			
% Stones >10mm _A	<0.1	<0.1	0.2	<0.1	0.5	<0.1	2.4			
pH _D ^{M#}	5.46	6.69	5.50	5.62	5.32	6.13	5.59	pH	0.01	A-T-031s
Total Organic Carbon _D ^{M#}	-	-	10.1	-	4.52	-	3.89	% w/w	0.03	A-T-032s
Arsenic _D ^{M#}	-	-	35	-	17	-	8	mg/kg	1	A-T-024s
Cadmium _D ^{M#}	-	-	1.2	-	1.2	-	1.6	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	-	-	37	-	39	-	33	mg/kg	1	A-T-024s
Chromium _D ^{M#}	-	-	35	-	47	-	42	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	-	-	<1	-	<1	-	<1	mg/kg	1	A-T-040s
Chromium (trivalent)	-	-	35	-	47	-	42	mg/kg	1	Calc
Lead _D ^{M#}	-	-	87	-	66	-	44	mg/kg	1	A-T-024s
Mercury _D	-	-	<0.17	-	<0.17	-	<0.17	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	-	-	29	-	26	-	30	mg/kg	1	A-T-024s
Selenium _D ^{M#}	-	-	<1	-	<1	-	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	-	-	77	-	61	-	83	mg/kg	5	A-T-024s

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Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/15	21/09719/16	21/09719/17	21/09719/18	21/09719/19	21/09719/20	21/09719/21	Units	Limit of Detection	Method ref			
Client Sample No													
Client Sample ID	TP755	TP756	TP758	TP758	TP761	TP761	TP763						
Depth to Top	1.00	0.05	0.10	0.60	0.05	0.80	0.10						
Depth To Bottom													
Date Sampled	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Sample Matrix Code	4A	6AE	6AE	5AE	6AE	5A	6AE						
Asbestos in Soil (inc. matrix)													
Asbestos in soil [#]	-	-	NAD	-	NAD	-	NAD			A-T-045			
Asbestos ACM - Suitable for Water Absorption Test? _D	-	-	N/A	-	N/A	-	N/A			A-T-045			

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/15	21/09719/16	21/09719/17	21/09719/18	21/09719/19	21/09719/20	21/09719/21	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP755	TP756	TP758	TP758	TP761	TP761	TP763			
Depth to Top	1.00	0.05	0.10	0.60	0.05	0.80	0.10			
Depth To Bottom										
Date Sampled	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21	01-Sep-21			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	4A	6AE	6AE	5AE	6AE	5A	6AE			
PAH-16MS										
Acenaphthene _A ^{M#}	-	-	<0.01	-	<0.01	-	<0.01	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	-	-	<0.01	-	<0.01	-	<0.01	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	-	-	<0.02	-	<0.02	-	<0.02	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	-	-	0.09	-	0.07	-	<0.04	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	-	-	0.08	-	0.07	-	<0.04	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	-	-	0.11	-	0.10	-	<0.05	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	-	-	<0.05	-	<0.05	-	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	-	-	<0.07	-	<0.07	-	<0.07	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	-	-	0.13	-	0.08	-	<0.06	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	-	-	<0.04	-	<0.04	-	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	-	-	0.16	-	0.13	-	<0.08	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	-	-	<0.01	-	<0.01	-	<0.01	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	-	-	0.05	-	0.05	-	<0.03	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	-	-	<0.03	-	<0.03	-	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	-	-	0.18	-	0.07	-	<0.03	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	-	-	0.13	-	0.11	-	<0.07	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	-	-	0.93	-	0.68	-	<0.08	mg/kg	0.01	A-T-019s

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/22	21/09719/23	21/09719/24	21/09719/25	21/09719/26	21/09719/27	21/09719/28	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP763	TP764	TP764	TP766	TP771	TP771	TP772			
Depth to Top	0.60	0.10	0.80	0.10	0.05	2.00	0.10			
Depth To Bottom										
Date Sampled	01-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	5A	6AE	6A	6AE	6AE	6A	6AE			
% Stones >10mm _A	<0.1	<0.1	<0.1	<0.1	2.8	24.0	0.7			
pH _D ^{M#}	5.14	5.54	6.20	5.61	5.64	6.43	5.33	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.01	-	-	-	-	0.02	-	g/l	0.01	A-T-026s
Total Organic Carbon _D ^{M#}	-	4.62	0.21	-	5.24	-	-	% w/w	0.03	A-T-032s
Arsenic _D ^{M#}	-	13	<1	-	13	-	-	mg/kg	1	A-T-024s
Cadmium _D ^{M#}	-	1.3	<0.5	-	0.9	-	-	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	-	42	5	-	30	-	-	mg/kg	1	A-T-024s
Chromium _D ^{M#}	-	37	14	-	36	-	-	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	-	<1	<1	-	<1	-	-	mg/kg	1	A-T-040s
Chromium (trivalent)	-	37	14	-	36	-	-	mg/kg	1	Calc
Lead _D ^{M#}	-	68	3	-	58	-	-	mg/kg	1	A-T-024s
Mercury _D	-	<0.17	<0.17	-	<0.17	-	-	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	-	34	9	-	19	-	-	mg/kg	1	A-T-024s
Selenium _D ^{M#}	-	<1	<1	-	<1	-	-	mg/kg	1	A-T-024s
Zinc _D ^{M#}	-	64	8	-	54	-	-	mg/kg	5	A-T-024s

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Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/22	21/09719/23	21/09719/24	21/09719/25	21/09719/26	21/09719/27	21/09719/28	Units	Limit of Detection	Method ref			
Client Sample No													
Client Sample ID	TP763	TP764	TP764	TP766	TP771	TP771	TP772						
Depth to Top	0.60	0.10	0.80	0.10	0.05	2.00	0.10						
Depth To Bottom													
Date Sampled	01-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Sample Matrix Code	5A	6AE	6A	6AE	6AE	6A	6AE						
Asbestos in Soil (inc. matrix)													
Asbestos in soil [#]	-	NAD	NAD	-	NAD	-	-			A-T-045			
Asbestos ACM - Suitable for Water Absorption Test? _D	-	N/A	N/A	-	N/A	-	-			A-T-045			

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/22	21/09719/23	21/09719/24	21/09719/25	21/09719/26	21/09719/27	21/09719/28	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP763	TP764	TP764	TP766	TP771	TP771	TP772			
Depth to Top	0.60	0.10	0.80	0.10	0.05	2.00	0.10			
Depth To Bottom										
Date Sampled	01-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	5A	6AE	6A	6AE	6AE	6A	6AE			
PAH-16MS										
Acenaphthene _A ^{M#}	-	<0.01	<0.01	-	<0.01	-	-	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	-	<0.01	<0.01	-	<0.01	-	-	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	-	<0.02	<0.02	-	<0.02	-	-	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	-	0.05	<0.04	-	0.07	-	-	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	-	0.05	<0.04	-	0.06	-	-	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	-	0.08	<0.05	-	0.08	-	-	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	-	<0.05	<0.05	-	<0.05	-	-	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	-	<0.07	<0.07	-	<0.07	-	-	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	-	0.08	<0.06	-	0.08	-	-	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	-	<0.04	<0.04	-	<0.04	-	-	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	-	0.11	<0.08	-	0.12	-	-	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	-	<0.01	<0.01	-	<0.01	-	-	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	-	<0.03	<0.03	-	0.04	-	-	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	-	<0.03	<0.03	-	<0.03	-	-	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	-	0.09	<0.03	-	0.07	-	-	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	-	<0.07	<0.07	-	0.10	-	-	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	-	0.46	<0.08	-	0.62	-	-	mg/kg	0.01	A-T-019s

Envirolab Job Number: 21/09719

Client Project Name: Edgehill, Whitehaven

Client Project Ref: 4046

Lab Sample ID	21/09719/29	21/09719/30	21/09719/31	21/09719/32	21/09719/33			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP773	TP773	TP774	TP775	TP775					
Depth to Top	0.15	0.50	0.20	0.10	0.95					
Depth To Bottom										
Date Sampled	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21	02-Sep-21					
Sample Type	Soil	Soil	Soil	Soil	Soil					
Sample Matrix Code	6AE	5A	6AE	6AE	5AE					
% Stones >10mm _A	4.5	<0.1	<0.1	<0.1	<0.1			% w/w	0.1	A-T-044
pH _D ^{M#}	5.64	6.60	5.38	5.67	6.32			pH	0.01	A-T-031s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: iD GeoEnvironmental Ltd (Knutsford), Caledonian House, Tatton Street,
Knutsford, WA16 6AG

Project: Edgehill, Whitehaven

Clients Project No: 4046

Project No: 21/09719

Date Received: 08/09/2021 (am)

Cool Box Temperatures (°C): 20.8 - 21.1

NO DEVIATIONS IDENTIFIED with respect to sampling dates or containers received.

Note: If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3 (for water samples $5 \pm 3^\circ\text{C}$), ISO 18400-105:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	21/09719/1	21/09719/2	21/09719/3	21/09719/4	21/09719/5	21/09719/6	21/09719/7	21/09719/8	21/09719/9	21/09719/10	21/09719/11	21/09719/12
Client Sample No												
Client Sample ID/Depth	TP750 0.10m	TP750 0.40m	TP750 0.90m	TP751 0.10m	TP751 0.75m	TP751 1.10m	TP752 0.05m	TP752 0.25m	TP752 1.00m	TP753 0.05m	TP753 0.20m	TP754 0.10m
Date Sampled	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21
A-T-019s	14/09/2021	14/09/2021		14/09/2021			14/09/2021	14/09/2021			14/09/2021	
A-T-019w											15/09/2021	
A-T-024s	17/09/2021	17/09/2021		17/09/2021			17/09/2021	17/09/2021			17/09/2021	
A-T-025w											15/09/2021	
A-T-026s					14/09/2021							
A-T-031s	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
A-T-032s	14/09/2021	14/09/2021		14/09/2021			14/09/2021	14/09/2021			14/09/2021	
A-T-040s	14/09/2021	14/09/2021		14/09/2021			14/09/2021	14/09/2021			14/09/2021	
A-T-040w											15/09/2021	
A-T-044	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
A-T-045	09/09/2021	09/09/2021		09/09/2021			09/09/2021	09/09/2021			09/09/2021	
Calc	17/09/2021	17/09/2021		17/09/2021			17/09/2021	17/09/2021			17/09/2021	

Lab Sample ID	21/09719/13	21/09719/14	21/09719/15	21/09719/16	21/09719/17	21/09719/18	21/09719/19	21/09719/20	21/09719/21	21/09719/22	21/09719/23	21/09719/24
Client Sample No												
Client Sample ID/Depth	TP754 1.00m	TP755 0.10m	TP755 1.00m	TP756 0.05m	TP758 0.10m	TP758 0.60m	TP761 0.05m	TP761 0.80m	TP763 0.10m	TP763 0.60m	TP764 0.10m	TP764 0.80m
Date Sampled	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	01/09/21	02/09/21	02/09/21
A-T-019s		14/09/2021			14/09/2021		14/09/2021		14/09/2021		14/09/2021	14/09/2021
A-T-019w		15/09/2021										
A-T-024s		17/09/2021			17/09/2021		17/09/2021		17/09/2021		17/09/2021	17/09/2021
A-T-025w		15/09/2021										
A-T-026s	15/09/2021									15/09/2021		
A-T-031s	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
A-T-032s		14/09/2021			14/09/2021		14/09/2021		14/09/2021		14/09/2021	14/09/2021
A-T-040s		14/09/2021			14/09/2021		15/09/2021		14/09/2021		14/09/2021	14/09/2021
A-T-040w		15/09/2021										
A-T-044	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
A-T-045		09/09/2021			09/09/2021		09/09/2021		09/09/2021		09/09/2021	09/09/2021
Calc		17/09/2021			17/09/2021		17/09/2021		17/09/2021		17/09/2021	17/09/2021

Lab Sample ID	21/09719/25	21/09719/26	21/09719/27	21/09719/28	21/09719/29	21/09719/30	21/09719/31	21/09719/32	21/09719/33
Client Sample No									
Client Sample ID/Depth	TP766 0.10m	TP771 0.05m	TP771 2.00m	TP772 0.10m	TP773 0.15m	TP773 0.50m	TP774 0.20m	TP775 0.10m	TP775 0.95m
Date Sampled	02/09/21	02/09/21	02/09/21	02/09/21	02/09/21	02/09/21	02/09/21	02/09/21	02/09/21
A-T-019s		14/09/2021							
A-T-019w									
A-T-024s		17/09/2021							
A-T-025w									
A-T-026s			15/09/2021						
A-T-031s	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
A-T-032s		14/09/2021							
A-T-040s		14/09/2021							
A-T-040w									
A-T-044	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
A-T-045		09/09/2021							
Calc		17/09/2021							

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

APPENDIX D



LABORATORY REPORT



4043

Contract Number: PSL21/7197

Report Date: 30 September 2021

Client's Reference: 4046

Client Name: ID Geoenvironmental
Caledonian House
Tatton Street
Knutsford
Cheshire
WA16 6AG

For the attention of: Steve Drew

Contract Title: Edgehill, Whitehaven

Date Received: 7/9/2021

Date Commenced: 7/9/2021

Date Completed: 30/9/2021

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:


A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Senior Technician)

S Eyre
(Senior Technician)

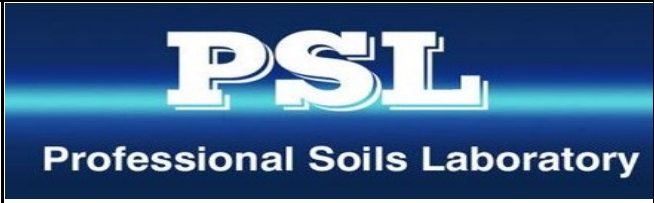

T Watkins
(Senior Technician)

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

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP750			0.90		Brown mottled grey sandy CLAY.
TP754			1.00		Brown mottled grey slightly gravelly sandy CLAY.
TP758			0.60		Brown mottled grey CLAY.
TP764			0.80		Brown mottled grey sandy CLAY.
TP773			0.20	0.70	Brown mottled grey CLAY.
TP772			0.20	0.70	Brown mottled grey CLAY.



Edgehill, Whitehaven

Contract No:
PSL21/7197
Client Ref:
4046


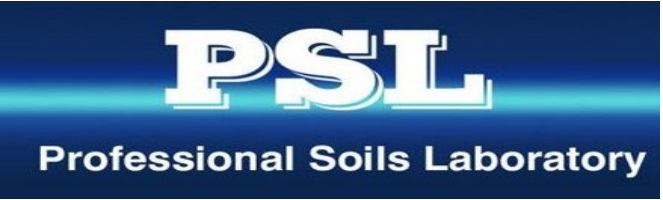
SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

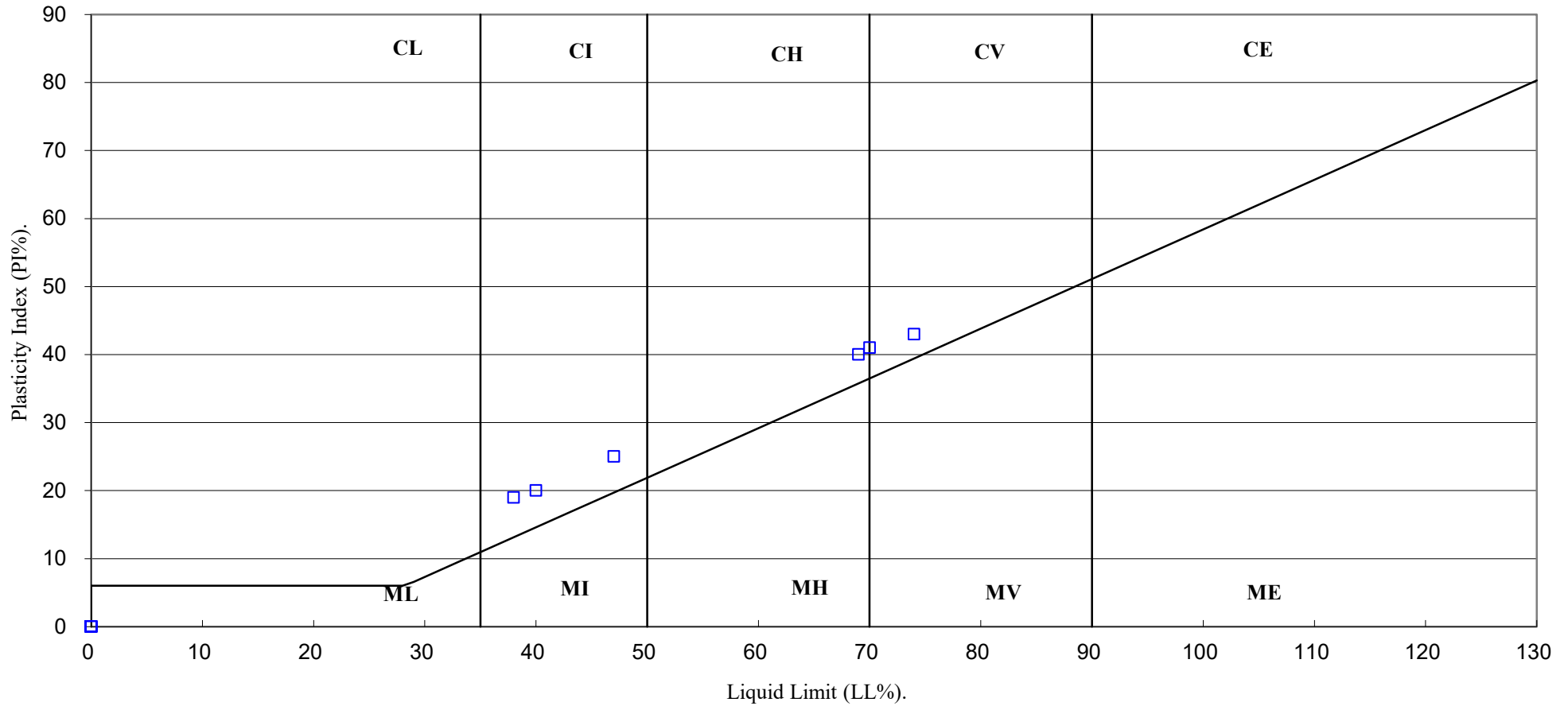
Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % <small>Clause 3.2</small>	Linear Shrinkage % <small>Clause 6.5</small>	Particle Density Mg/m ³ <small>Clause 8.2</small>	Liquid Limit % <small>Clause 4.3/4</small>	Plastic Limit % <small>Clause 5.3</small>	Plasticity Index % <small>Clause 5.4</small>	Passing .425mm %	Remarks
TP750			0.90		16			38	19	19	100	Intermediate Plasticity CI
TP754			1.00		18			40	20	20	93	Intermediate Plasticity CI
TP758			0.60		35			74	31	43	100	Very High Plasticity CV
TP764			0.80		20			47	22	25	100	Intermediate Plasticity CI
TP773			0.20	0.70	29		2.67	70	29	41	100	Very High Plasticity CV
TP772			0.20	0.70	26		2.68	69	29	40	100	High Plasticity CH

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.

 4043		Edgehill, Whitehaven	Contract No:
			PSL21/7197
			Client Ref:
			4046

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL
Professional Soils Laboratory

Edgehill, Whitehaven

Contract No:

PSL21/7197

Client Ref:

4046

PARTICLE SIZE DISTRIBUTION TEST

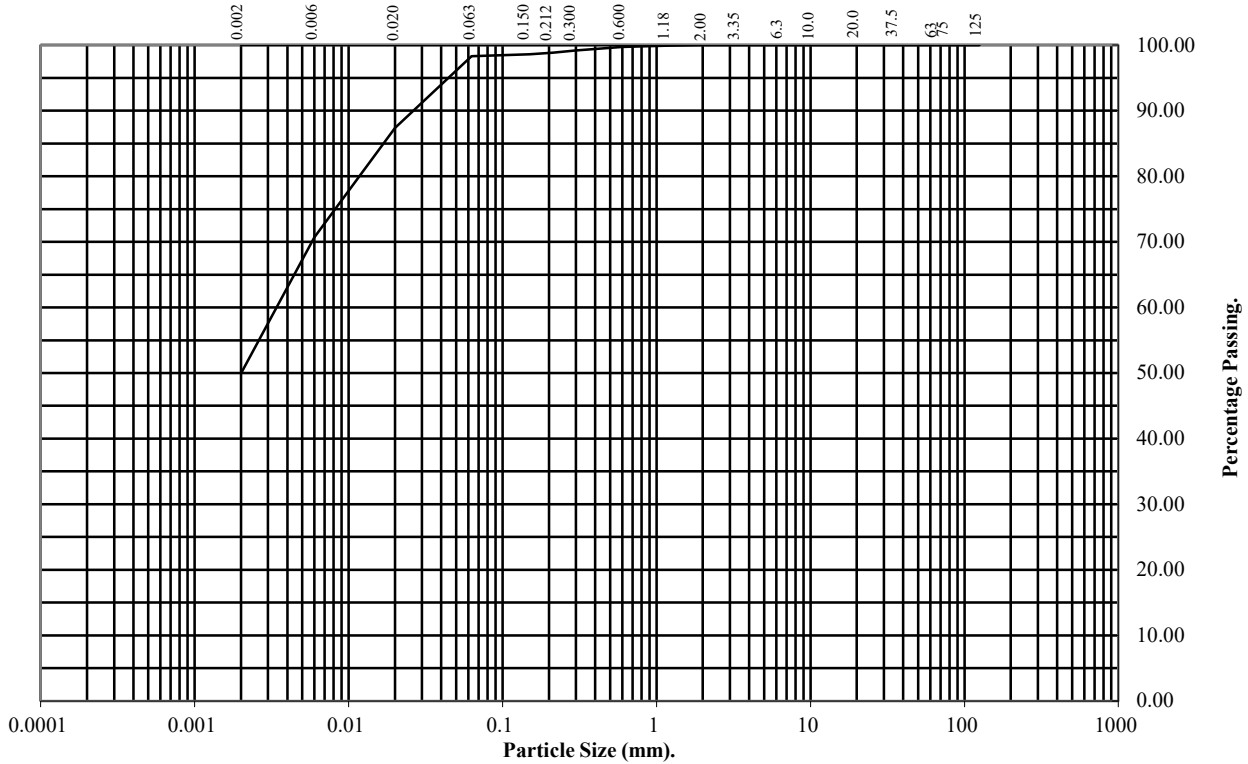
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP772 Top Depth (m): 0.20

Sample Number: Base Depth(m): 0.70

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	100
0.3	99
0.212	99
0.15	99
0.063	98

Particle Diameter	Percentage Passing
0.02	87
0.006	71
0.002	50

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	2
Silt	48
Clay	50

Remarks:
See Summary of Soil Descriptions



Edgehill, Whitehaven

Contract No:
PSL21/7197
Client Ref:
4046

PARTICLE SIZE DISTRIBUTION TEST

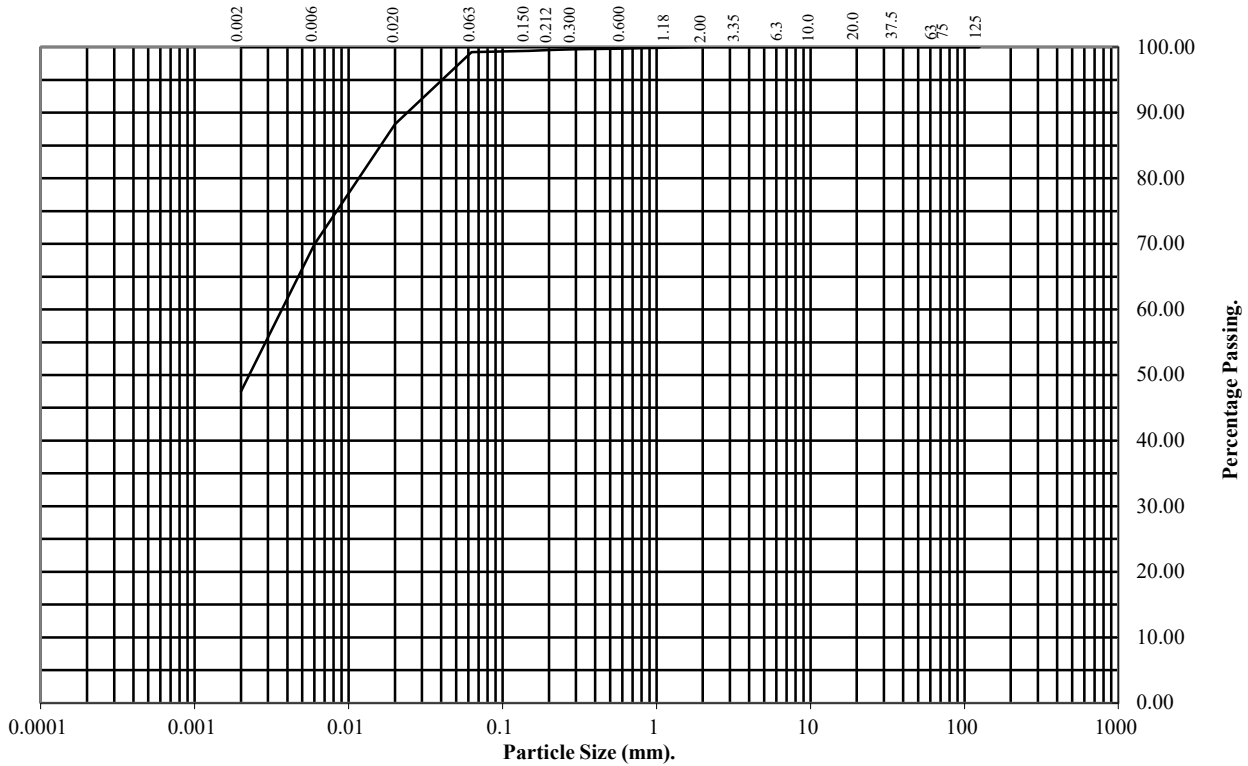
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP773 Top Depth (m): 0.20

Sample Number: Base Depth(m): 0.70

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	100
0.3	100
0.212	100
0.15	99
0.063	99

Particle Diameter	Percentage Passing
0.02	88
0.006	70
0.002	48

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	1
Silt	51
Clay	48

Remarks:
See Summary of Soil Descriptions



Edgehill, Whitehaven

Contract No:
PSL21/7197
Client Ref:
4046

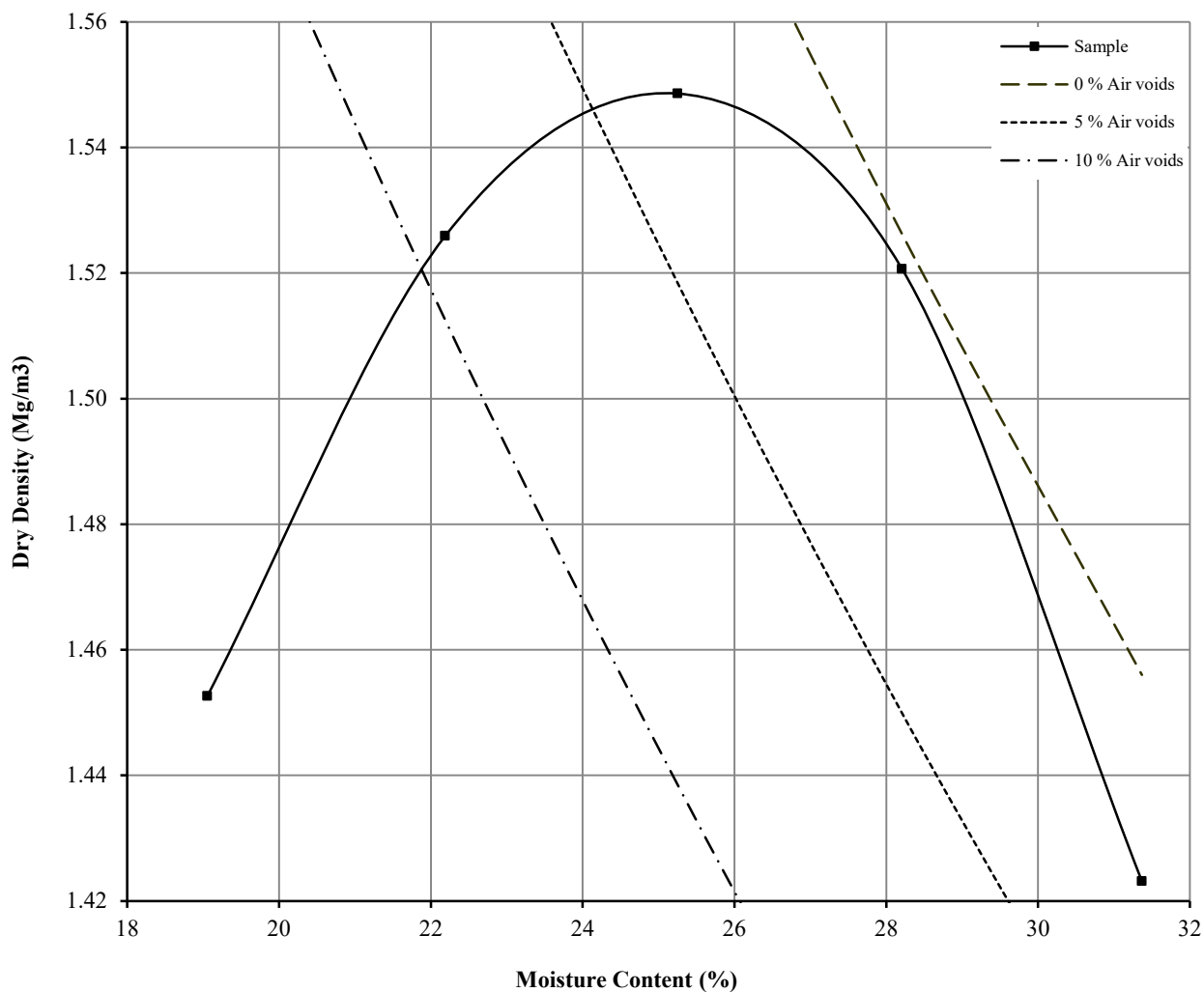
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

Hole Number: TP772 Top Depth (m) : 0.20

Sample Number: Base Depth (m) : 0.70

Sample Type:



Initial Moisture Content:	28	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.68	Measured	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.55	Material Retained on 20.0 mm Test Sieve (%):	0	
Optimum Moisture Content (%):	25			
Remarks See summary of soil descriptions				



Edgehill, Whitehaven

Contract
PSL21/7197
Client Ref
4046

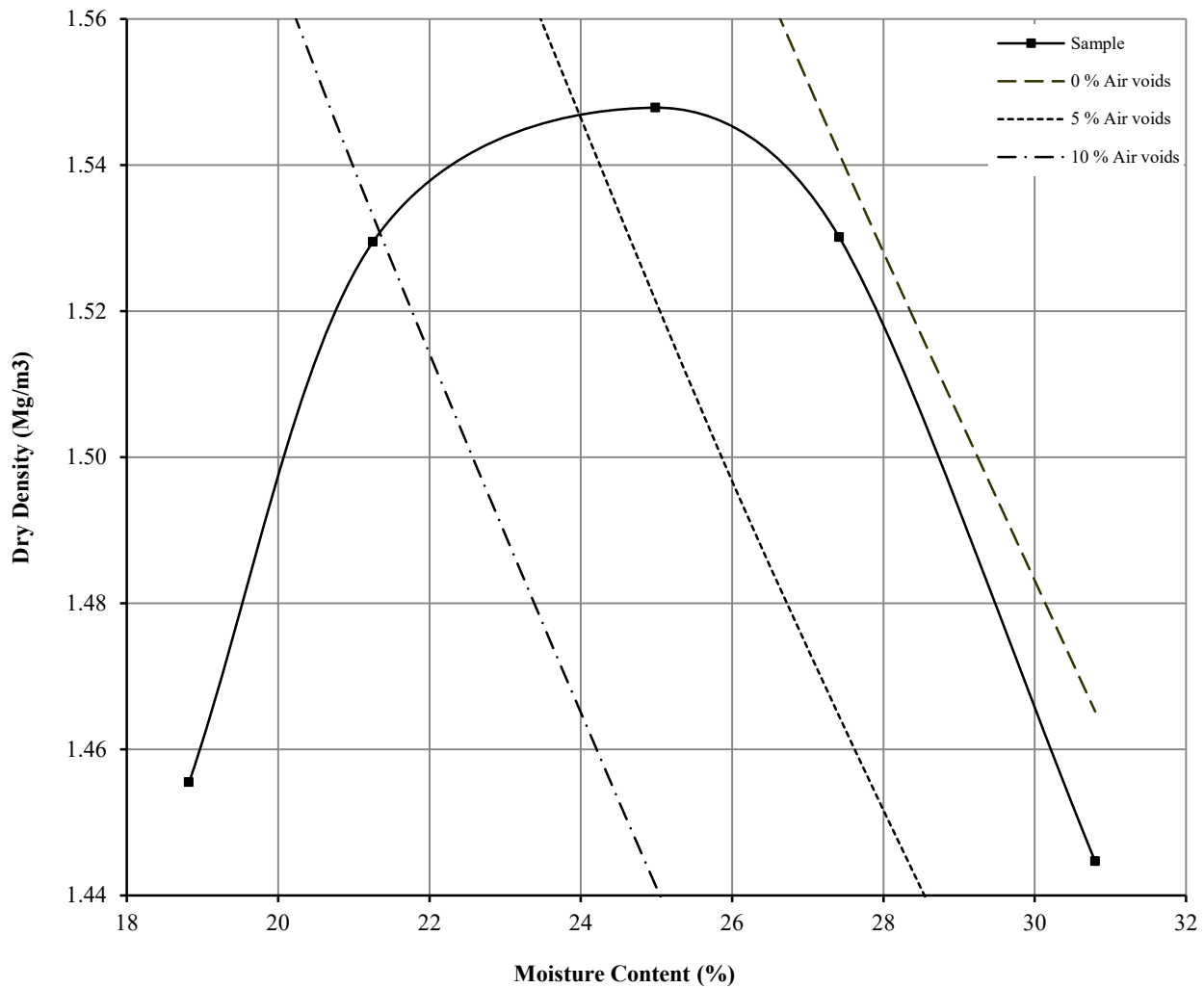
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

Hole Number: TP773 Top Depth (m) : 0.20

Sample Number: Base Depth (m) : 0.70

Sample Type:



Initial Moisture Content:	27	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.67	Measured	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.55	Material Retained on 20.0 mm Test Sieve (%):	0	
Optimum Moisture Content (%):	25			
Remarks See summary of soil descriptions				



Edgehill, Whitehaven

Contract
PSL21/7197
Client Ref
4046

APPENDIX E

Visit	Borehole Reference	Monitoring Date	Observations	AOD	Top of Install Zone (m)	Base of Install Zone (m)	Measured Base of Standpipe (m)	Groundwater Level (m)	Response Zone Flooded	Response Zone Material	Atmospheric Pressure - Start (mb)	Atmospheric Pressure - Finish (mb)	Barometric Pressure Trend	CH ₄ Peak %V/V	CH ₄ Steady %V/V	CO ₂ Peak %V/V	CO ₂ Steady %V/V	O ₂ %V/V	CO ppm	H ₂ S ppm	Flow Peak l/hr	Flow Steady l/hr	Q _{HG} CH ₄ l/hr	Implied CS	Q _{HG} CO ₂ l/hr	Implied CS	Max Q _{HG} CH ₄ l/hr	Implied CS	Max Q _{HG} CO ₂ l/hr	Implied CS				
1	PH631	15/10/2020		83.0	2.50	4.00	3.69	DRY	-	Siltstone & mudstone (Middle Coal Measures)	1016	1015	Falling	ND	ND	1.1	1.1	18.9	2	2	ND	ND	0.0001	CS1	0.0011	CS1	0.0001	CS1	0.0032	CS1				
2		20/10/2020		83.0	2.50	4.00	3.69	DRY	-		980	978	Falling	ND	ND	1.7	1.7	17.2	2	ND	ND	ND	ND	0.0001	CS1	0.0017	CS1							
3		13/11/2020		83.0	2.50	4.00	3.69	DRY	-		993	992	Falling	ND	ND	2.2	2.2	17.9	2	2	ND	ND	ND	ND	0.0001	CS1	0.0022	CS1						
4		27/11/2020		83.0	2.50	4.00	3.69	DRY	-		1006	1004	Falling	ND	ND	2.2	2.2	18.2	1	1	ND	ND	ND	ND	0.0001	CS1	0.0022	CS1						
5		01/12/2021	Very windy	83.0	2.50	4.00	3.69	DRY	-		991	0	Steady	ND	ND	3.9	3.2	11.4	0	ND	ND	ND	ND	0.0001	CS1	0.0032	CS1							
6		07/12/2021	Very windy	83.0	3.00	4.50	3.86	DRY	-		967	965	Falling	ND	ND	3.1	2.9	12.2	0	1	ND	ND	ND	ND	0.0001	CS1	0.0029	CS1						
7				83.0	3.00	4.50			-																									
1	PH633A	15/10/2020	Vandalised - no cover/bung.	92.0	1.00	2.00	1.72	1.70	-	Mudstone (Middle Coal Measures)	1016	1015	Falling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0002	CS1	0.0046	CS1
2		20/10/2020	Well repaired, gas valve replaced.	92.0	1.00	2.00	1.72	DRY	-		980	978	Falling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
3		13/11/2020	Flow at 1.5 for only 15 secs.	92.0	1.00	2.00	1.72	DRY	-		993	992	Falling	ND	ND	1.0	1.0	18.6	2	2	1.5	ND	ND	0.0001	CS1	0.001	CS1							
4		27/11/2020	Flow at 5.0 for only 5secs.	92.0	1.00	2.00	1.72	DRY	-		1006	1004	Falling	ND	ND	ND	ND	18.8	3	1	5.0	ND	ND	0.0001	CS1	0.0001	CS1							
5		01/12/2021		92.0	1.00	2.00	1.72	0.4	FLOODED		991	991	Steady	ND	ND	2.3	2.3	19.1	ND	ND	0.1	0.1	0.0001	CS1	0	-								
6		07/12/2021	Flow at +0.2 (l/hr) for 10 mins. Water in clear pipe after 1min.	92.0	1.00	3.00	1.68	0.05	FLOODED		967	965	Falling	ND	ND	2.3	2.3	17.3	ND	ND	0.2	0.2	0.0002	CS1	0.0046	CS1								
7				92.0	1.00	3.00			-																									
1	PH634A	15/10/2020	Flow took 3mins to equilibrate.	88.0	1.00	3.00	2.69	1.69	-	Siltstone & mudstone (Middle Coal Measures)	1016	1015	Falling	ND	ND	0.4	0.4	14.9	4	2	8.5	ND	ND	0.0001	CS1	0.0004	CS1	0.0001	CS1	0.0009	CS1			
2		20/10/2020		88.0	1.00	3.00	2.69	1.70	-		980	978	Falling	ND	ND	0.6	0.6	14.5	3	3	ND	ND	ND	ND	0.0001	CS1	0.0006	CS1						
3		13/11/2020	Flow at 1.5 for only 15 secs.	88.0	1.00	3.00	2.69	1.60	-		993	992	Falling	ND	ND	0.8	0.8	9.9	3	2	1.5	0.1	0.0001	CS1	0.0008	CS1								
4		27/11/2020	Flow at 4.8 for only 2secs.	88.0	1.00	3.00	2.69	1.66	-		1006	1004	Falling	ND	ND	0.8	0.8	10.1	2	1	4.8	ND	ND	0.0001	CS1	0.0008	CS1							
5		01/12/2021		88.0	1.00	3.00	2.69	DRY	-		991	991	Steady	ND	ND	0.9	0.9	17.2	ND	ND	ND	ND	ND	0.0001	CS1	0.0009	CS1							
6		07/12/2021		88.0	1.00	3.00	2.88	DRY	-		967	965	Falling	ND	ND	1.2	0.2	19.9	ND	ND	ND	ND	ND	0.0001	CS1	0.0002	CS1							
7				88.0	1.00	3.00			-																									
1	PH902	01/12/2021		91.67	18.40	21.00	21.70	DRY	-		991	991	Steady	0.3	0.3	6.4	6.4	0.2	0	0	18.9	18.6	0.0558	CS1	1.1904	CS3	0.0744	CS2	1.1904	CS3				
2		07/12/2021	Gas flow +7.5 (l/hr) after 10 mins.	91.67	18.40	21.00	21.7	DRY	-		967	965	Falling	0.4	0.4	5.9	5.9	0.1	0	0	7.8	7.5	0.03	CS1	0.4425	CS2								
3									-																									
4									-																									
5									-																									
6									-																									
7									-																									
1	PH907	01/12/2021		89.67	18.30	19.50	19.45	DRY	-		991	991	Steady	1.5	1.2	6.0	6.0	2.6	ND	ND	9.7	8.7	0.1305	CS2	0.522	CS2	0.1305	CS2	0.5307	CS2				
2		07/12/2021	Gas flow +7.4 (l/hr) after 10 mins.	89.67	18.30	19.50	19.53	DRY	-		967	965	Falling	1.4	1.4	6.1	6.1	0	0	3	8	7.4	0.1036	CS2	0.4514	CS2								
3									-																									
4									-																									
5									-																									
6									-																									
7									-																									

>>>= outside the range of +100 to -60 l/hr

APPENDIX F

Our Reference: 4046-G-P014

Date: 30th March 2021

Mr Craig Kerr
Story Homes
Story House
Lords Way
Kingmoor Business Park
Carlisle
CA6 4SL



North West & Midlands

Caledonian House, Tatton Street,
Knutsford, Cheshire, WA16 6AG
t: 01565 755557

North East & Yorkshire

The Stables, Aske Hall, Aske,
Richmond
North Yorkshire, DL10 5HG
t: 01748 889010
www.id-geo.co.uk

Dear Mr Kerr,

Edgehill Phase 4 – Supplementary Intrusive Geoenvironmental & Shallow Mining Investigation

Further to your request we are pleased to present cost proposals for supplementary geoenvironmental investigation within proposed Phase 4 at Edgehill Park, Whitehaven.

IDG have issued the following report which relates to the Phase 4 site:

- Preliminary Geoenvironmental Investigation & Coal Mining Risk Assessment of Phase 4, Edgehill Park, Whitehaven, Cumbria for Story Homes Ltd, reference 4046-G-R015 dated October 2020.

As part of the Coal Mining Risk Assessment presented within the above report, IDG carried out an exploratory intrusive shallow mining investigation and brief programme of ground gas monitoring to provide an initial assessment of the sites ground gas regime. The findings of a brief programme of ground gas monitoring are presented in IDG correspondence reference 4046-G-LR014 dated 21st December 2020.

The above reports concluded that the following geoenvironmental factors were likely to influence the site:

- Probable shallow coal mine workings are indicated to be within influencing distance of the site surface in the east of the site which require further investigation to delineate/confirm extent of influence indicated by the preliminary intrusive investigation
- One untreated mine shaft of up to 80m depth is present in the southwest of the site
- Two untreated off-site shafts are recorded within or within 20m of the site's northern boundary
- Surface workings for clay and potentially shallow coal are visible in the west of the site
- Ground gas monitoring to date has not identified a significant risk, however, further assessment based upon the findings of the supplementary investigation may be required.

Our proposal is based on the above and allows for the following works:

- Two days of trial pitting to undertake in-situ geotechnical tests, obtain representative topsoil samples to demonstrate suitability for re-use to obtain bulk soil samples for geotechnical testing and enable provision of foundation recommendations
- Allowance for the drilling of up to sixteen rotary probeholes within the zone of likely influence of workings within the Black metal and Slaty Coal seams (estimated 4-5 days drilling programme dependent upon ground conditions).
- Provisional costs for installation of gas wells within four boreholes (to supplement the existing three monitoring wells) and four additional gas monitoring visits (in the event that the intrusive shallow mining investigation indicates a previously unidentified risk of ground gas and/or migration pathways associated with abandoned mineworkings).

- Laboratory Geotechnical Testing comprising 5 No. pH, soluble sulphates moisture content, & Atterberg limits tests and 2 No. PSD, Particle Density & 2.5kg Compaction tests.
- Proportionate chemical testing of 14 samples of topsoil (i.e. 1/ha) for metals, asbestos and speciated PAH to demonstrate suitability for re-use
- Provisional budget for limited chemical screening of Made Ground within zone of historical excavation to include total petroleum hydrocarbons, solvents and volatile organics, leachable metals & PAH analysis
- Undertaking a generic quantitative contamination risk assessment (GQRA) and preparing a revised conceptual model for the site
- Preparation of a Geoenvironmental Appraisal Report
- Issue of an electronic pdf copy of the report.

Costs are shown in the table shown overleaf, together with costs for provisional items.

We will issue a concise **overview** report within 3 days of fieldwork completion. Our comprehensive report will be issued within 4 weeks of fieldwork completion. If required, a revised Final Report will be issued on completion of any supplementary ground gas monitoring programme.

Assumptions and Additional Notes

We have assumed the following:

- Copies of all service plans must be provided to us *five days* before intrusive works commence. IDG could obtain statutory services information on your behalf however this will be subject to an additional fee and we will require a minimum of three weeks' notice.
- The proposed development will include traditional 2 and 3 storey domestic dwellings with associated gardens, POS, adoptable roads and sewers.
- Access is available for a tracked excavator.
- Reinstatement of the hardstanding or soft landscaping is not required, other than compacted arisings swept over each trial pit using the excavator to leave low mounds of spoil about 3m long by 1m wide, and unsuitable for trafficking.
- Soakaway testing is not required.
- IDG can provide costs for surveying however, it is assumed that collar heights of the exploratory holes will be surveyed by a representative from Story Contracting unless otherwise instructed.
- At this stage asbestos testing comprises laboratory screening only. Quantification tests (at a cost of £XX each) may be required should asbestos be detected.

The following should also be noted:

The above scope of works should enable us to assess abnormal development issues, associated with investigable ground conditions. However, the nature of site investigation is such that it is not always possible to foresee all the potential issues and it is sometimes necessary to recommend additional work. Should this occur, we will inform you immediately, provide costs, and seek your further instruction.

Depending on the rotary investigation findings, additional probe holes may be required to determine the risks associated with shallow mining and delineate the extent of workings in order to obtain fixed price quotations for the necessary consolidation works.

Programme

We anticipate commencement of the intrusive investigation within two weeks of your instruction to proceed, subject to site access & surface conditions and availability of drilling contractors. Fieldwork is scheduled to take up to five days.

PROPOSAL DELETED

Reporting

On completion of the works a comprehensive factual and interpretative report will be issued containing engineering records, laboratory test results, copies of all relevant correspondence and drawings of the site. The report will include qualitative risk assessment with respect to both controlled waters and human health and will provide technically feasible options for redevelopment of the site with housing, including consideration of foundation types and treatment/removal of contamination. Copies of the final report will be issued to the relevant regulatory authorities on receipt of written instruction from yourselves.

Terms & Conditions

The scope of work outlined in this proposal will be undertaken in accordance with our Standard Terms and Conditions, a copy of which are enclosed. Your attention is drawn to the Sections 8 and 9 of the terms and conditions which relate to provision of Professional Indemnity Insurance and Limitation of Liability respectively. We will be pleased to accept your instruction to proceed as acceptance of this proposal and agreement of our Terms and Conditions.

We understand that our report is solely for the benefit of Story Homes. If, however, at a later date, a third party wishes also to rely on the benefit of our report then we will consider any such request. Whether or not we enter into a warranty with a third party will be at our discretion, and subject to payment of a fee to cover our legal and incidental costs. We will also require approval from our insurers should more than one beneficiary require a warranty, or should the proposed warranty not be in our approved standard form.

Invoicing

The attached proposal provides a breakdown of the costs associated with this project. Variation will only occur in the event that a given item is not undertaken or that substantial additional works are recommended, in which case we will inform you immediately, provide costs for the required works, and seek your prior consent.

Our proposal allows for submission of the report to the Local Authority and NHBC, and for submission of a single piece of subsequent correspondence with each regulator to address any queries they may have. Any further meetings, correspondence etc, are chargeable at our hourly rates.

We will submit invoices for this project at the milestones defined below:

- 1st milestone invoice (Items C, E, H, (I) L & M) within 5 days of fieldwork completion, with exploratory logs and an interim letter report outlining our initial findings.
- 2nd milestone invoice (Item Q) on issue of the Final report, which will be issued on or before the date agreed on receipt of your written instruction to proceed.
- Invoice (Item P) upon completion of any gas monitoring programme and issue of a revised Final Report should a ground gas risk assessment be deemed necessary

It is hoped the above is sufficient for your present needs. However, should you require any further information, please contact the undersigned.

Yours sincerely,



Nick Ward BSc (Hons), FGS
for and on behalf of
iD GEOENVIRONMENTAL LIMITED

Encl: Proposed Exploratory Probeholes Drawing No. 4046-G-D034

1 DEFINITIONS AND INTERPRETATION

- 1.1 In this Agreement, unless the context otherwise requires, the following words and expressions have the following meanings:
- "IDG" shall mean ID Geoenvironmental Limited whose registered offices are at Caledonian House, Tatton Street, Knutsford, Cheshire, WA16 6AG.
- "Agreement" shall mean these Terms (entitled "Terms and Conditions for the Appointment of ID Geoenvironmental Limited"), the Proposal, any document recording the Client's unequivocal acceptance of the Proposal and any other documents or parts of other documents expressly referred to in any of the foregoing;
- "Client" shall mean the party for whom the Services are being provided by IDG;
- "Documents" shall mean all documents of any kind and includes plans, drawings, reports, programmes, specifications, Bills of Quantities, calculations, letters, e-mails, faxes, memoranda, films and photographs (including negatives), or any other form of record prepared or provided or received by, or on behalf of IDG, and whether in paper form or stored electronically or on disk, or otherwise;
- "Intellectual Property" includes all rights to, and any interests in, any patents, designs, trade marks, copyright, know-how, trade secrets and any other proprietary rights or forms of intellectual property (protectable by registration or not) in respect of any technology, concept, idea, data, programme or other software (including source and object codes), specification, plan, drawing, schedule, minutes, correspondence, scheme, formula, programme, design, system, process logo, mark, style, or other matter or thing, existing or conceived, used, developed or produced by any person;
- "Parties" shall mean the Client and IDG;
- "Project" shall mean the project described in the Proposal and any enquiry from the Client on which IDG has based its Proposal;
- "Proposal" means the offer document prepared by IDG in response to an enquiry or otherwise, in connection with the proposed provision of the Services;
- "Services" means the work and services relating to the Project to be provided by IDG pursuant to the Agreement and as set out in the Proposal and shall include any additions or amendments thereto made in accordance with these Terms;
- "Terms" means these terms entitled "Terms and Conditions for the Appointment of IDG";
- 1.2 Words importing the singular only shall also include the plural and vice versa, where the context requires.
- 1.3 Words importing persons or parties shall include firms, corporations and any organisation having legal capacity and vice versa, where the context requires; and words importing a particular gender include all genders.
- 1.4 The sub-headings to the clauses of these Terms are for convenience only and shall not affect the construction of the Agreement.
- 1.5 A reference to legislation includes that legislation as from time to time amended, re-enacted or substituted and any Orders in Council, orders, rules, regulations, schemes, warrants, by-laws, directives or codes of practice issued under any such legislation.
- 1.6 In the event of conflict between the documents forming part of the Agreement, the Proposal shall prevail, followed by the Terms.

2 APPOINTMENT & OBLIGATIONS OF IDG

- 2.1 The Client agrees to engage IDG and IDG agrees to provide the Services in accordance with the provisions of the Agreement.
- 2.2 IDG shall perform the Services using the reasonable standard of skill and care normally exercised by similar professional consultancy firms in performing similar services under similar conditions and shall use all reasonable endeavours to perform the Services in accordance with all relevant environmental and safety legislation.

3 OBLIGATIONS OF THE CLIENT

- 3.1 Throughout the period of this Agreement the Client shall afford to IDG or procure the affording to IDG of access to any site where access is required for the performance of the Services. In doing so, the Client accepts responsibility for ensuring that IDG is notified in writing of all special site and/or plant conditions, including without prejudice to the generality of the foregoing, the existence and precise location of all underground services, cables, pipes, drains or underground buildings, constructions or any hazards known or suspected by the Client, which the Client shall clearly mark on the ground or identify on accurate location plans supplied to IDG prior to the commencement of the Services. The Client shall also inform IDG in writing of any relevant operating procedures including any site safe operating procedures and any other regulations relevant to the carrying out of the Services. The Client shall indemnify IDG against all costs, claims, demands and expenses arising as a result of any non-disclosure in this respect, including but not limited to indemnification against any action brought by the owner of the land or otherwise. Whilst IDG will scan all potential exploratory locations with a Cable Avoidance Tool, IDG shall not be liable for any damage to underground services, cables, pipes, drains or underground buildings, constructions and the like which were either not marked on site or for which accurate plans were not provided.
- 3.2 If the Client discovers any conflict, defect or other fault in the information or designs provided by IDG pursuant to the Agreement, he will advise IDG in writing of such defect, conflict or other fault and IDG shall have the right to rectify the same or where necessary, to design the solution for rectification of any works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs.

4 INTELLECTUAL PROPERTY

- 4.1 The copyright in all Intellectual Property prepared by or on behalf of IDG shall remain vested in IDG. The Client shall have a non-exclusive licence to copy and use such Intellectual Property for purposes directly related to the Project. Such licence shall enable the Client to copy and use the Intellectual Property but solely for its own purposes in connection with the Project and such use shall not include any licence to reproduce any conceptual designs or professional opinions contained therein nor shall it include any licence to amend any drawing, design or other Intellectual Property produced by IDG.
- 4.2 Should the Client wish to use such Intellectual Property in connection with any other works or for any other purpose not directly related to the Project or wish to pass any Intellectual Property to any third party, it must obtain the prior written consent of IDG. The giving of such consent shall be at the discretion of IDG and shall be upon such terms as may be required by IDG. IDG shall not be liable for the use by any person of such Intellectual Property for any purpose other than that for which the same were prepared by or on behalf of IDG.
- 4.3 Ownership of any proposals submitted to the Client that are not subsequently confirmed as part of the Services to be provided for the Client remain with IDG and such proposals must not be used as the basis for any future work undertaken by the Client or a third party and no liability can be accepted howsoever arising from such proposals.
- 4.4 In the event of the Client being in default of payment of any fees or other amounts due, IDG may suspend further use of the licence on giving 2 days' notice of the intention to do so. Use of the licence may be resumed on receipt of the outstanding amounts.

5 TITLE

- 6.1 IDG shall transfer only such title or rights in respect of the Documents as it has, and if any part is purchased from a third party IDG shall transfer only such title or rights as that party had and has transferred to IDG.
- 6.2 Title in the Documents shall remain with and shall not pass to the Client until the amount due under the invoice(s) (including interest and costs) has been paid in full.

6 CONFIDENTIALITY

- 6.1 IDG undertakes not to divulge or disclose to any third party without the written consent of the Client information which is designated confidential by the Client or which can reasonably be considered to be confidential and arises during the performance of the Services unless required to do so by law or necessary in the proper performance of its duties in relation to the Project, or in order to make full frank and proper disclosure to its insurers or intended insurers, or to obtain legal or accounting advice. Subject

to this IDG shall be permitted to use information related to the Services it provides in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

7 THIRD PARTIES

- 7.1 The Agreement or any part thereof or any benefit or interest there-under may not be assigned by the Client without the prior written consent of IDG. The giving of such consent shall be at the discretion of IDG and IDG will only agree to an assignment on its terms and in return for payment of a fee by the Client to IDG to cover IDG's legal and other costs associated with any assignment. IDG will consider and may consent to any request from the Client for IDG to enter a collateral warranty with a third party with regard to the Services provided under the Agreement. The giving of such consent shall be at the discretion of IDG and IDG will only enter a collateral warranty on its terms and in return for payment of a fee by the Client to IDG to cover IDG's legal and other costs associated with any collateral warranty.
- 7.2 The Agreement shall not confer and shall not purport to confer on any third party any benefit or any right to enforce any term of this Agreement for the purposes of the Contracts (Rights of Third Parties) Act 1999 or otherwise.

8 INSURANCE

- 8.1 IDG warrants to the Client that there is in force a policy of Professional Indemnity insurance covering its liabilities for negligence under this Agreement, with a limit of indemnity of £2,000,000 (TWO MILLION POUNDS) but subject to separate annual aggregate limits of indemnity in respect of pollution/contamination claims of £2,000,000 and asbestos (£1,000,000). This policy is annually renewable and IDG agrees to use reasonable endeavours to maintain such insurance at all times until six years from the date of the completion (or termination) of the Services under the Agreement, provided such insurance is available at commercially reasonable rates having regard, inter alia, to premiums required and policy terms obtainable. If for any period such insurance is not available at commercially reasonable rates, IDG shall forthwith inform the Client and shall obtain in respect of such period such reduced level of Professional Indemnity insurance as is available and as would be fair and reasonable in the circumstances for IDG to obtain.

9 LIMITATIONS ON LIABILITY

- 9.1 Unless otherwise agreed in writing, IDG's liability under or in connection with the Agreement whether in contract, tort, negligence, breach of statutory duty or otherwise (other than in respect of personal injury or death) shall be limited to and shall not exceed the lesser of either two million pounds or 20 times the total value of invoices issued to the Client for consultancy work instructed under the Agreement. IDG's liability in connection with any claim relating to asbestos shall not exceed £1,000,000. No action or proceedings under or in respect of the Agreement whether in contract, tort, negligence, under statute or otherwise shall be commenced against IDG after the expiry of a period of six years from the date of the completion (or termination) of the Services under the Agreement.
- 9.2 IDG shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by IDG or for the cost of designing a solution for and rectifying any subsequent works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs, unless IDG has been advised in writing of the same by the Client and has been given the opportunity to rectify the same or where necessary, to design the solution for rectification of any subsequent works carried out by others pursuant to the same.

10 PAYMENT

- 10.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal. The due date for payment is the date of the invoice and the final date for payment is 14 days from the date of the invoice. If the Client disputes the amount included for payment in an invoice a written notice must be served on IDG by the Client not later than 7 days before the final date for payment. If no notice is given the amount due shall be the amount stated in the invoice. If the Client shall fail to pay in full any sum due under the terms of the Agreement by the final payment date for that sum and no effective notice of intention to withhold payment has been issued, IDG may serve written notice on the Client demanding payment within 14 days of such notice. If the Client shall fail to comply with such notice, IDG shall be entitled to terminate its employment under the Agreement forthwith.
- 10.2 In the event of failure on the part of the Client to pay any monies in accordance with the foregoing payment provisions, IDG will be entitled to charge interest on any monies owed to it by the Client, such interest to be at a rate of 8% above the base rate of a clearing bank from time to time calculated from the final date for payment to the date of actual payment on a compound basis. IDG will also be entitled to claim any additional costs in collecting the debt plus compensation for time spent.

11 DELAY

- 11.1 IDG will comply with any timescale agreed for completion of the Services unless delayed or prevented by circumstances beyond its reasonable control and in the event of any such circumstances arising IDG undertakes to complete the Services within a reasonable period, but will not be liable to the Client for any delay as a result.

12 TERMINATION

- 12.1 The Agreement may be determined by either party in the event of the other making a composition or arrangement with its creditors, becoming bankrupt, or being a company, making a proposal for a voluntary arrangement for a composition of debts, or has a provisional liquidator appointed, or has a winding-up order made, or passes a resolution for voluntary winding-up (except for the purposes of a bona fide scheme of amalgamation or reconstruction), or has an administrator or an administrative receiver appointed to the whole or any part of its assets. Notice of determination must be given to the party which is insolvent by the other party.
- 12.2 If for any reason the performance of the Services by IDG is suspended for a period in excess of three calendar months then IDG shall be entitled to determine its appointment in respect of the Services by seven days written notice to the Client.
- 12.3 Any determination of the appointment of IDG howsoever caused shall be without prejudice to the right of IDG to require payment for all services performed up to the date of such determination including but not limited to payment of a fair and reasonable proportion of any figure identified in the Proposal or otherwise for fees in respect of a particular service which IDG has started, but not completed.

13 NOTICES

- 13.1 Any notice provided for in the Agreement shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post to the address of the relevant party as may have been notified by each party to the other or, in the absence of notification, to the address of IDG set out above or to the registered address of the Client. Such notice shall be deemed to have been received on the day of delivery if delivered by hand or on the second working day after the day of posting if sent by first class post.

14 ENTIRE AGREEMENT

- 14.1 The Agreement constitutes the complete and entire agreement between the Client and IDG with respect to the Services and supersedes any prior oral and/or written warranties, terms, conditions, communications and representations, whether express or implied and any claim against IDG in respect of the Services can only be made in contract under the provisions of the Agreement and not otherwise under the law or tort or otherwise. IDG will not be bound by any standard or printed terms or conditions furnished by the Client in any of its documents unless IDG specifically states in writing separately from such documents that it intends such terms and conditions to apply.
- 14.2 No amendments, modifications or variation of the Agreement shall be valid unless made in writing and agreed to by both the Client and IDG; such agreement must be recorded in writing by at least one of the Parties.

15 DISPUTES AND GOVERNING LAW

- 15.1 The Agreement shall be governed by and construed in accordance with English law and the Parties irrevocably and unconditionally submit to the jurisdiction of the English Courts.
- 15.2 Where the Housing Grants, Construction and Regeneration Act 1996 applies, any dispute between the Parties may be referred to adjudication in accordance with The Scheme for Construction Contracts Regulations 1998 or any amendment or modification thereof being in force at the time of the dispute, as applicable to England, Wales, Scotland and Northern Ireland.

Appendix G

Generic Notes – ID Geoenvironmental Investigations

Environmental Setting

General

Third party information obtained from the British Geological Survey (BGS), the Coal Authority and the Local Authority etc is presented in the Correspondence Appendix of this Geoenvironmental Report.

Geology, Mining & Quarrying

In order to establish the geological setting of a site, ID Geoenvironmental refer to BGS maps for the area, and the relevant geological memoir.

A coal mining report is obtained from the Coal Authority. Further information is sourced from the Local Authority and by reference to current and historical OS plans.

Landfills and other Historical Land Uses

ID Geoenvironmental obtain data from the Landmark Information Group, the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Historical maps dating from the middle of the nineteenth century are also studied for evidence of historical land uses (i.e. gas works, foundries, chemical works) which may represent potential sources of contamination or ground instability.

Radon

Radon is a colourless, odourless gas, which is radioactive. It is formed in strata that contain uranium and radium (most notably granite), and can move through fissures eventually discharging to atmosphere, or the spaces under and within buildings. Where radon occurs in high concentrations, it can pose a risk to health.

In order to assess potential risks associated with radon gas, ID Geoenvironmental refer to BRE Report BR211, 2007: "*Radon: guidance on protective measures for new buildings*".

The level of protection needed is site-specific and is determined by reference to the maps contained in Annex A of BR211. These maps are derived from the Radon Atlas of England and Wales (2007), and indicate the highest radon potential within each 1km grid square.

If the site falls within a light grey square on the relevant map in Annex A then basic radon protection should be installed in new buildings; if the site falls within a dark grey square then full radon protection should be installed. **If the site is in an un-shaded square then no radon protection is needed.**

BR211 provides a preliminary indication of the measures required for a particular site, but it is also often beneficial to request a BR211 Radon Report from the BGS. The Annex A maps indicate the highest geological radon potential within each 1km grid square, but in many cases the radon potential varies considerably within the grid square. The BR211 Radon Report gives definitive guidance on the requirement for radon protective measures, and therefore may allow the adoption of a lower level of protection than that indicated in the Annex A maps.

ID Geoenvironmental typically obtain a BR211 Radon Report for all sites that fall within a shaded square on the relevant Annex A map.

When requesting a BR211 Radon Report from the BGS ID Geoenvironmental select the search radius carefully, since too large a search radius may result in the inclusion of areas of higher geological radon potential, and therefore in the recommendation of too high a level of protection.

Further details of the protective measures required, if appropriate, are provided in the Hazardous Gas section of this Geoenvironmental Report.

Hydrogeology

ID Geoenvironmental obtain information from the Environment Agency (EA) and the Landmark Information Group with respect to:

- groundwater quality
- recorded pollution incidents
- licensed groundwater abstractions

From 1 April 2010 the Environment Agency's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The aquifer designation data is based on geological mapping provided by the British Geological Survey.

These maps are split into two differing aquifer designations:

- **Superficial (Drift)** – permeable unconsolidated (loose) deposits such as sands and gravels.
- **Bedrock** – solid permeable formations such as sandstone, chalk or limestone.

The maps display the following aquifer designations:

- **Principal aquifers:** *"These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer".*
- **Secondary A** – *"permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers";*

- **Secondary B** - *predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers*
- **Unproductive Strata**: *These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. However groundwater flow through such rocks, although imperceptible, does take place and needs to be considered in assessing the risk associated with persistent pollutants. Some non-aquifers can yield water in sufficient quantities for domestic use”.*

Groundwater vulnerability is determined by 4 variables:

1. The presence and nature of overlying soil (the weathered zone affected by living organisms; soil in the UK can extend up to 2m in depth). Physical properties of the soil affect the downward passage of water and it's ability to attenuate pollutants. The EA make reference to a three-fold classification of soil types:-
 - Soils of **low** leaching potential are defined as *"soils in which the pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants”.*
 - Soils of **intermediate** leaching potential are defined as *"soils which have a moderate ability to attenuate diffuse source pollutants or in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soil layer”.*
 - Soils of **high** leaching potential are defined as *"soils with little ability to attenuate diffuse source pollutants and in which non-adsorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater”.*

In urban areas and restored mineral workings the soil information is based on fewer observations than elsewhere. A worst-case vulnerability (H) is therefore assumed for these areas and for current mineral workings by the EA. All are given a designation of **HU** unless proved otherwise.
2. The presence and nature of Drift, which often overlies bedrock. Where Drift is of substantial thickness and low permeability, it can provide an effective barrier to surface pollutant migration. Permeable Drift is classified as a Minor Aquifer except where it is in probable hydraulic continuity with a Major Aquifer, where it is regarded as part of the Major Aquifer unless proven otherwise by site investigation.
3. The nature of the geological strata (bedrock). Rocks that contain groundwater in exploitable quantities are called aquifers.
4. The depth of the unsaturated zone; i.e. that part of the aquifer which lies above the water table

The EA have also designated Source Protection Zones, which are based on proximity to a groundwater source (springs, wells and abstraction boreholes). The size of a Source Protection Zone is a function of the aquifer, volume of groundwater abstracted and the effective rainfall, and may vary from tens to several thousand hectares.

Hydrology

ID Geoenvironmental obtain information from the Environment Agency and the Landmark Information Group with respect to:

- surface water quality
- recorded pollution incidents
- licensed abstractions (groundwater & surface waters)
- licensed discharge consents
- site susceptibility to flooding

The EA have set **water quality** targets for all rivers. These targets are known as River Quality Objectives (RQO's). The water quality classification scheme used to set RQO planning targets is known as the River Ecosystem scheme. The scheme comprises five classes (RE1 to RE5) which reflect the chemical quality requirements of communities of plants and animals occurring in our rivers.

General Quality Assessment (GQA) grades reflect actual water quality. They are based on the most recent analytical testing undertaken by the EA. There are six GQA grades (denoted A to F) defined by the concentrations of biochemical oxygen demand, total ammonia and dissolved oxygen.

The susceptibility of a site to **flooding** is assessed by reference to a Flood Map on the Environment Agency's website. These maps provide show natural floodplains - areas potentially at risk of flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas.

There are two different kinds of area shown on the Flood Map:

1. Dark blue areas could be flooded by the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or by a river by a flood that has a 1% (1 in 100) or greater chance of happening each year
2. Light blue areas show the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements

The maps also show all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

The Agency's assessment of the likelihood of flooding from rivers and the sea at any location is based on the presence and effect of all flood defences, predicted flood levels, and ground levels.

It should also be noted that as the floodplain shown is the 1 in 100 year (or 1 in 200 year as appropriate), areas outside this may be flooded by more extreme floods (e.g. the 1 in 1000 year

flood). Also, parts of the areas shown at risk of flooding will be flooded by lesser floods (e.g. the 1 in 5 year flood). In some places due to the shape of the river valley, the smaller floods will flood a very similar extent to larger floods but to a lesser depth.

If a site falls within a floodplain, it is recommended that a flood survey be undertaken by a specialist consultant who can advise on appropriate mitigating measures; ie raising slab levels, provision of storage etc.

Furthermore, as discussed in Planning Policy Statement 25 (PPS25) a consequence of amendment 8 to Article 10 of The Town and Country Planning (General Development Procedure) Order 1995 ("the GDPO"), on 1st October 2006, LPAs are required to consult the Environment Agency on all applications for development in flood risk areas (except minor development), including those in areas with critical drainage problems and for any development on land exceeding 1 hectare outside flood risk areas.

COMAH & Explosive Sites

ID Geoenvironmental obtain information from the Landmark Information Group with respect to COMAH or explosive sites within 1km of the proposed development site. MMi's report refers to any that are present, and recommends that the Client seeks further advice from the HSE.

Areas around COMAH sites (chemical plants etc) are zoned with respect to the implementation of emergency plans. The HSE are a statutory consultee to the local planning authority for all COMAH sites. The COMAH site may have to revise it's emergency action plan if development occurs. This might be quite straightforward or could entail significant expenditure. Consequently, the COMAH site may object to a proposed development (although it is the Local Authority who have final say, and they are likely to place more weight on advice from the HSE).

Preliminary Conceptual Ground Model

The site's environmental setting (and proposed end use) is used by ID Geoenvironmental to assess the significance of any contamination encountered during the subsequent ground investigation

Assessment of contaminated land is based on an evaluation of pollutant linkages (source-pathway-receptor). Contaminants within the near surface strata represent a potential source of pollution. The environment (most notably groundwater), site workers and end users are potential targets.

Potential pollutant linkages are shown on a preliminary conceptual site model, presented as a Drawing in an Appendix to this Geoenvironmental Report. The preliminary model is revised in light of data arising from the subsequent ground investigation.

Generic Notes 2. Ground Investigation Fieldwork

General

IDG Ground Investigations are undertaken in accordance with current UK guidance including:

- *BS EN 1997-1:2004+A1:2013 Eurocode 7: Geotechnical design — Part 1: General rules*
- *BS EN 1997-2:2007 Eurocode 7: Geotechnical design —Part 2: Ground investigation and testing*
- *NA to BS EN 1997-2:2007 UK National Annex to Eurocode 7. Geotechnical design. Ground investigation and testing*
- *BS 5930:2015 Code of practice for site investigations.*
- *BS 10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of practice.*
- *BS EN ISO 14688-1:2018 Geotechnical investigation and testing. Identification and classification of soil. Identification and description.*
- *BS EN ISO 14688-2:2018 Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification.*
- *BS EN ISO 14689:2018 Geotechnical investigation and testing. Identification and classification of rock. Identification and description.*
- *“Guidance on the protection of housing on contaminated land” – NHBC & EA R&D Publication 66 (2000, 2008) updated 3rd June 2014*
- *“Technical Aspects of Site Investigation” – EA R&D Technical Report P5-065/TR (2000)*
- *“Development of appropriate soil sampling strategies for land contamination” – EA R&D Technical Report P5-066/TR (2001)*
- *“AGS Guide: The selection of Geotechnical Soil Laboratory Testing” AGS: 2018*

Exploratory hole logs are presented in Appendices to this Geoenvironmental Report. These logs include details of the:

- Investigation technique adopted
- Descriptions of the solid strata, and any groundwater encountered.
- Samples taken
- Results of any in-situ testing
- Any gas\groundwater monitoring well installed

Exploratory Hole Locations

Exploratory hole locations are selected by IDG, prior to commencement of fieldwork, to provide a representative view of the strata beneath the site and to target potential contaminant sources identified

during the preliminary investigation (desk study). Additional exploratory locations are often determined by the site engineer in light of the ground conditions actually encountered; this enables better delineation of the depth and lateral extent of organic contamination, poor ground, relict structures etc.

Investigation Techniques

Ground conditions can be investigated by a number of techniques. Techniques most commonly used by IDG include:

- Machine excavated trial pits, usually equipped with a backactor and a 0.6m wide bucket.
- Cable percussive (Shell & Auger) boreholes, typically using 150mm diameter tools and casing. Cable Percussive drilling is employed to advance boreholes in superficial (made ground and Drift strata).
- Window or Windowless Sampling boreholes. Constraints associated with existing buildings, operations and underground service runs can render some sites partly or wholly inaccessible to a mechanical excavator. In such circumstances, window sampling is often the most appropriate technique. A window sampling drilling rig can be manoeuvred in areas of restricted access and results in minimal disturbance of the ground (a 150mm) diameter tarmac/concrete core can be lifted and put to one side). However, it should be noted that window sampling allows only a limited inspection of the ground (especially made ground with a significant proportion of coarse material) and cannot be used in solid strata.
- Rotary percussive open-hole probeholes are typically drilled using a tricone rock roller bit with water or air as the flushing medium. Rotary probeholes are generally lined through made ground with temporary steel casing to prevent hole collapse. Rotary boreholes are used to enable progress in solid strata (rockhead) and are commonly drilled to identify the presence of shallow mineworkings or to install deep groundwater monitoring boreholes in the solid strata.

Hazardous ground gas and groundwater monitoring boreholes may be installed in cable percussive boreholes, window sample probeholes and rotary boreholes. Where installed, gas\groundwater monitoring wells typically comprise a lower slotted section, surrounded by a filter pack of 10 mm diameter non-calcareous gravel and an upper plain section surrounded in part by a bentonite seal and in part by gravel or arisings. The top of the plain pipe is cut off below ground level and the monitoring well protected by a circular or square, stopcock type manhole cover set in concrete, or the plain pipe is cut off just above ground level and the well protected by 100mm diameter raised steel helmet set in concrete, which stands approximately 300mm proud of ground level.

Monitoring well details, including the location of the response zone and bentonite seal are presented on the relevant exploratory hole logs.

In-situ Testing

Where relative densities of granular materials given on the trial pit and window sample logs are based on visual inspection only, they do not relate to any specific bearing capacities.

BS EN ISO 22476-3:2005+A1:2011 Geotechnical investigation and testing. Field testing. Standard penetration test

The relative densities of granular materials encountered in cable percussive boreholes are based on Standard Penetration Test (SPT) results. SPTs are carried out boreholes, in accordance with BS EN ISO 22476-3:2005. The sampler is penetrated over an initial seating drive of 150mm. The sampler is then driven for a test drive of 300mm in four increments of 75mm. The total number of blow required to drive the sampler 300mm is recorded as the penetration resistance or N-value. Where full penetration (450mm) is not possible the test is continued up to a maximum of 50 blows and the depth of penetration is recorded in millimetres.

The strength of cohesive deposits is determined using a hand shear vane in general accordance with BS1377-7-1990.

Shear strength test results reported on trial pit logs are considered to be more reliable than those reported on window sample logs. Significant sample disturbance occurs during window sampling and consequently shear strength results on disturbed window samples are generally lower than results obtained during trial pitting, in-situ or in large excavated blocks.

Sampling

Representative soil/fill samples are taken at regular intervals from the exploratory holes to assist in description of the ground and to allow selected laboratory testing to be performed. The type of sample taken is dependent on the nature of the stratum and the purpose of the analysis.

Where the soils encountered contain a significant proportion of coarse grained material, truly representative samples are not typically obtained and only the finer fraction is placed in sample containers. However, a visual estimate of the amount of coarse material is made on site. Note: Coarse constituents not sampled are defined as: coarse gravel, cobble and boulder. (i.e. any 'particles' with an average diameter greater than 20mm).

Occasionally, unrepresentative 'spot' samples are also taken from some exploratory locations for contaminant analysis, typically where unusual, localised pockets of materials are encountered.

Samples of soil for chemical testing are placed into appropriate containers (see below) prior to delivery to the selected laboratory. Samples of water are taken in one litre, brown glass bottles and stored in cool boxes, at a temperature of approximately 4°C, until delivery to the selected laboratory. Soil/fill samples for organic analysis are also stored in cool boxes.

Sample Containers (for geotechnical analysis). The majority of samples are only scheduled for PI and sulphate testing, for which 500g of sample is required (a full 0.5-litre plastic tub). However, bulk bags are taken where scheduling of compaction or grading tests are required.

Containers (for contaminant analysis). In order to comply with MCERTS requirements, labs have to provide a sample description and consequently require sufficient soil sample, and the use of wide-necked containers. For any sample requiring both inorganic & organic analysis, it is necessary to submit both a 1-litre glass jar and a 1 kg plastic tub.

Where scheduling for VOC (including GRO) testing is anticipated, a glass vial is also required. In summary (for contaminant analysis):

Anticipated testing	Container(s)	Remarks
pH & metals only	1 kg plastic tub	
organics (TPH, PAH) etc only	1 litre wide-necked glass jar	Vial required if TPH is to include GRO as well as DRO & LRO, or speciated PAH
VOCs (incl. naphthalene and/or GRO) only	glass vial & 1kg plastic tub	
pH & metals, and organics	1 litre wide-necked glass jar 1kg plastic tub	
pH & metals, and organics (incl. VOCs or GRO)	glass vial 1 litre wide-necked glass jar 1kg plastic tub	

Groundwater

Where encountered during fieldwork, groundwater is recorded on exploratory hole logs. If monitoring wells are installed, groundwater levels are also recorded on one or more occasions after completion of the fieldwork.

It should be borne in mind that the rapid excavation rates used during a ground investigation may not allow the establishment of equilibrium water levels. Water levels are likely to fluctuate with season/rainfall and could be substantially higher at wetter times of the year than those found during the ground investigation.

Long-term monitoring of standpipes or piezometers is always recommended if water levels are likely to have a significant effect on earthworks or foundation design.

Description of Strata

Soils encountered during an IDG investigation are described (logged) in general accordance with EN ISO 14688-1. The descriptions and depth of deposits encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section of the report within the main body of text.

Rocks encountered during an IDG investigation are described (logged) in general accordance with EN ISO 14689-1. The descriptions and depth of strata encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section of the report within the main body of text.

The materials encountered in the trial pits are logged, samples taken, and tests performed on the in-situ materials in the excavation faces, to depths of up to 1.2m; below this depth these operations are conducted at the surface on disturbed samples recovered from the excavation.

Key to Exploratory Hole Logs

Keys to logs are presented in the Appendix(ces) containing the logs. There are two Keys – Symbols & Legends and Terms & Definitions.

Generic Notes – ID Geoenvironmental Investigations

3. Geotechnical Laboratory Tests

General

Soil samples are delivered to the laboratory for testing along with a schedule of testing drawn up by IDG. All tests are carried out in accordance with BS 1377:1990.

The test results are presented as received in an Appendix to this Geoenvironmental Report.

The following laboratory testing are routinely carried out on a selection of samples:

- Atterberg limits & moisture contents
- Soluble sulphate & pH

The additional tests are typically only scheduled where significant earthworks regrade is anticipated:

- Grading.
- Compaction tests
- Particle density.

Atterberg Limits & Moisture Content

The Liquid and Plastic Limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average Plasticity Index (PI) for each "type" of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth. IDG typically only consider a soil to be shrinkable if the proportion finer than 63µm is >35%.

PI results are compared against guidance given in the NHBC Standards, Chapter 4.2 (revised April 2003), which advocates the use of modified Plasticity Index (I'_p), defined as:

$$I'_p = I_p * (\% < 425\mu\text{m} / 100)$$

ie if PI is 30%, but the soil contains 80% < 425µm, then: $I'_p = 30 * 80/100 = 24\%$.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425µm sieve is routinely reported by testing labs.

IDG apply engineering judgment where PI results are spread over a range of classifications. Consideration is given to:

- the average values for each particular soil type (ie differentiate between residual soil and alluvium),
- the number of results in each class and
- the actual values.

Unless the judgment strongly indicates otherwise, IDG typically adopt a conservative approach and recommend assumption of the higher classification.

Soluble Sulphate and pH

Sulphates in soil and groundwater are the chemical agents most likely to attack sub-surface concrete, resulting in expansion and softening of the concrete to a mush. Another common cause of concrete deterioration is groundwater acidity.

The rate of chemical attack depends on the concentration of aggressive ions and their replenishment at the reaction surface. The rate of replenishment is related to the presence and mobility of groundwater.

IDG refer to BRE Special Digest 1 (SD1) "Concrete in aggressive ground. Part 1: Assessing the aggressive chemical environment" (2005). SD 1 provides definitions of:

- the nature of the site (greenfield, brownfield or pyritic)
- the groundwater regime (static, mobile or highly mobile)
- the Design Sulphate Class (DC Class) and
- the Aggressive Chemical Environment for Concrete (ACEC Class)

IDG reports clearly state each of the above for the site being considered.

The concentrations of sulphate in aqueous soil/fill extracts are determined in the laboratory using the gravimetric method. The results are expressed in terms of SO_4 for direct comparison with BS 5328:1997. The pH value of each sample was determined by the electrometric method.

SD1 also discusses determination of "representative" sulphate concentration from a number of tests. Essentially if <10 samples of a given soil-type have been tested, the highest measured sulphate concentration should be taken. If >10 samples have been tested, the mean of the highest 20% of the sulphate test results can be taken. With respect to groundwater, the highest sulphate concentration should always be taken.

With respect to pH (soil & groundwater) the value used is the lowest value if <10 samples have been tested and the mean of the lowest 20% if >10 samples have been tested.

Generic Notes – ID Geoenvironmental Investigations

4 Contamination Laboratory Analysis & Interpretation (including WAC)

Current UK Guidance

The UK approach to contaminated land is set out in Contaminated Land Report No. 11 (2004) “Model Procedures for the Management of Land Contamination”. The approach is based upon risk assessment, where risk is defined as the combination of the probability of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

In the context of land contamination, there are three essential elements to any risk: (1) a contaminant source, (2) a receptor (eg controlled water or people exposed to the contaminants) and (3) a pathway linking (1) and (2). Risk can only exist where all three elements combine to create a pollutant linkage. Risk assessment requires the formulation of a conceptual model which supports the identification and assessment of pollutant linkages.

As recommended by CLR11, IDG adopt a tiered approach to risk assessment, consistent with UK guidance and best practice. In general this comprises the following elements of work:

- A Preliminary Risk Assessment (PRA)
- A Generic Quantitative Risk Assessment (GQRA)
- A Detailed Quantitative Risk Assessment (DQRA)

Preliminary Risk Assessment

A preliminary risk assessment is generally undertaken as part of a “Desk Study” investigation. This investigation collates readily available information including historical land uses, the geological, hydrogeological and hydrological setting of the site, and the proposed end-use which is presented as a “Preliminary Conceptual Model”. Potential pollutant linkages are defined and a preliminary assessment of the risks posed to receptors is stated.

Further information regarding the development of a conceptual model for the site is presented in Generic Notes 1 – Environmental Setting and Preliminary Risk Assessment.

Generic Quantitative Risk Assessment

Where potential pollutant linkages are identified in the preliminary conceptual model a generic quantitative risk assessment (GQRA) generally forms part of an intrusive phase of site investigation, allowing for the sampling of both soil and groundwater. The intrusive investigation should target pollutant linkages identified in the Preliminary Conceptual Model, but should also investigate previously unidentified sources and contaminant pathways encountered during the site investigation works.

Human Health

Detailed guidance on human health risk assessment is available in the following:

- Evaluation of models for predicting plant uptake of chemicals from soil - Science Report – SC050021/SR
- Human health toxicological assessment of contaminants in soil - Science Report: SC050021/SR2
- Updated technical background to the CLEA model - Science Report: SC050021/SR3
- CLEA Software (Version 1.05) Handbook Science report: SC050021/SR4
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7
- Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008

Generic Assessment Criteria represent “screening concentrations” devised for a number of standard land-use scenarios. They are based conservative receptor and exposure parameters and provide a useful method of screening out sites where contaminants pose a negligible risk. GACs are available from a number of sources for the following land-use scenarios. These scenarios include:

- Residential end-use with consumption of homegrown produce.
- Residential end-use without consumption of homegrown produce.
- Residential Public Open Space (Landscaped Areas)
- Public Open Space (Parks)
- Allotments
- Commercial Development

The initial step of such a generic quantitative risk assessment is to compare site chemical data with appropriate UK generic assessment criteria. These following GACs are currently appropriate.

- Soil Guideline Values (SGVs) (Environment Agency 2009) are based on CLEA “default settings and therefore represent screening criteria based on minimal risk to human health. SGVs are available for arsenic, cadmium, mercury, nickel, selenium, BTEX, phenols and dioxins, furans and dioxin-like PCB substances for residential, allotments and commercial land-uses based on a sandy loam soil and a 6% soil organic matter (SOM) content.
- Soil Generic Assessment Criteria for Human Health Risk Assessment (EIC/AGS/CL:AIRE 2009) adopted CLEA default settings and therefore represent screening criteria based on minimal risk to human health. GACs were derived for 3 metals and 32 organic contaminants for four standard land uses at 1%, 2% and 6% SOM content.
- Suitable for Use Levels (S4ULs) (LQM/CIEH, Nathanail 2015) represent generic assessment criteria for each of the above standard land-uses, based on updated toxicological assessments and modified exposure parameters. They therefore represent screening criteria based on minimal risk to human health. S4ULs for organic compounds are available for 1%, 2% and 6% SOM. (*S4ULs Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3061. All rights Reserved.*)
- Category 4 Screening Levels (Defra March 2014) are primarily intended to be used to assist the classification of land under the revised Part 2A Statutory Guidance issued in 2012. The revised guidance introduced the concept of four categories of contaminated land (Category 1 (significant/high risk) – Category 4 (low risk). C4SLs are low risk levels which are not representative of significant possibility of significant harm (SPoSH) and, whilst not intended to mark the top of Category 4, should the C4SLs not be exceeded, land can be demonstrated as being in Category 4 and cannot be determined as contaminated land.

The GAC selected to form the basis of a Generic Risk Assessment are dependent on the existing or proposed land use as defined in the Conceptual Model (which identifies the critical receptor and exposure parameters) and other factors such as the SOM content of the near surface soils at the site.

Soil organic matter (SOM) is the fraction of soil composed of organic matter. It consists principally of decomposed plant remains. The presence of SOM is important in determining the fate and behaviour of a number of organic contaminants. Generally, the greater the SOM content of soil, the greater the sorptive capacity of the soil and the lower the mobility of certain contaminant phases. (Note: $TOC = SOM \times 0.58$; and $FOC = TOC/100$).

Generic Assessment Criteria adopted by IDG available, by regulators, upon request.

The CLEA model assumes a simple linear partitioning between the sorbed, dissolved and vapour phases. The theoretical upper boundaries to this behaviour are represented by the maximum aqueous solubility

and pure saturated vapour concentration of the chemical. The CLEA model uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous or vapour based saturation limit (the lower saturation limit). Assessment criteria which exceed the lower of the two saturation limits and where the vapour pathway is an important contributor to exposure are highlighted in red in the CLEA model. These values are depicted as shaded values in the IDG GAC Tables. In such cases the exposure from the vapour phase will be over predicted and where the vapour pathway is the only exposure route being considered the risk is likely to be negligible.

IDG Reports will therefore state the applicable land-use scenario, and the SOM content adopted for the assessment. In general, the initial assessment **assumes a low soil organic matter content (1% SOM)** to ensure that the assessment is appropriately conservative. Where contaminant concentrations exceed the adopted GAC, site-specific assessment (for example applying measured SOM contents of soils or development site-specific exposure parameters) will be undertaken to further evaluate the risk. It should be noted that exceedance of GAC does not necessarily mean that remediation will be required.

Interpretation of Results

Prior to undertaking any comparison of soil contamination data, the issue of the averaging area requires further consideration. IDG consider that contamination across the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, IDG gather and analyse sample results by “soil type”, or by former use in a given sub-area of the site, before undertaking statistical analysis; ie the averaging area is associated with the extent of a particular fill type, or an area affected by spillage\leakage rather than from within a specified depth below the site surface.

In terms of brownfield redevelopment, this is considered an appropriate methodology which provides a representative sample population for statistical analysis which allows for the necessary relocation of soils during site development works.

Should any of the GAC criteria detailed above be exceeded, then three possible courses of action could be considered. (The first is only applicable in terms of human health, but the second and third could also be applied to groundwater or landfill gas).

- Undertake further statistical analysis to determine whether contaminant concentrations of inorganic contaminants within soil\fill actually present a risk (only applicable to assessing the risk to human health).
- Based on a Generic Quantitative Risk Assessment, advocate an appropriate level of remediation to “break” the pollutant linkage - for example the removal/relocation of the contaminated materials or the provision of a clean cover.
- Carry out a more a Detailed Quantitative Risk Assessment in order to further assess the risk.

Controlled Waters Receptors

Where the environmental setting of a site is considered moderately or highly “sensitive” in respect of controlled waters (i.e where a pollutant linkage potentially exists to a controlled waters receptor) a risk assessment will be undertaken. This initially comprises comparison of soil-leachate or groundwater concentrations to the appropriate water quality standard. Depending upon the specific characteristics and environmental setting of the site the appropriate standard is likely to be one of the following:

- Water Supply (Water Quality) Regulations 1989
- Environmental Quality Standards: The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive)(England and Wales) Directions 2010.
- The Surface Waters (Abstraction for Drinking Water) Regulations

It is not possible to derive generic GAC values for controlled waters, because distance to the receptor, ground permeability and hydraulic gradient are key factors in the assessment, and both are extremely site-

specific. As a consequence should groundwater or soil leachate concentrations exceed the adopted water quality standards in a site with moderate or high sensitivity, a detailed quantitative risk assessment may be required.

Phytotoxic Effects

With respect to the assessment of potential **phytotoxic effects** of contaminants, IDG refer to available publications relating to allowable concentrations of heavy metals (copper and zinc) in arable soils which have been set by the Department of Environmentⁱ. These values are detailed in the table below.

Allowable Concentrations of Heavy Metals in Arable Soils

Element	Limit According to pH of soil (mg/kg)			
	5.0 to <5.5	5.5 to <6.0	6.0 to 7.0	>7.0
Copper	80	100	135	200
Nickel	50	60	75	110
Zinc	200	200	200	300

IDG have reviewed the available data on Boron behaviour in soil, plant uptake and the relatively high precipitation rates typical in the UK. In the absence of any definitive value IDG have opted to be relatively conservative and have adopted a Boron Soil Screening Value of 5mg/kg. This value is considered protective of the majority of common landscape plants.

Hazardous Ground Gas

Tier 1 risk assessment of **hazardous gas** is undertaken through reference to the following documents:

- Approved Document C, Building Regulations 2000
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating “traffic lights”. Report Ref. 10627-R01-(02), for NHBC
- CIRIA C665 (2006) – Assessing risks posed by hazardous ground gases to buildings
- BS 8485:2007 – Code of Practice for the characterisation & remediation from ground gas in affected developments

Further information is presented in Generic Notes No. 5 – Hazardous Gas.

Waste Classification & WAC

Waste soils to be disposed off-site should be characterised by a general chemical testing for a broad suite to include pH, TOC, metals, speciated PAH and banded hydrocarbons. WAC testing is not required to characterise the waste. Chemical test result should be provided to the waste haulier and receiving landfill who will confirm the classification of the waste soils.

In the context of waste soils generated by remediation and/or groundwork activities on brownfield sites, the following definitions (from the Landfill Regulations 2002) apply:

- Inert (e.g. uncontaminated ‘natural’ soil, bricks, concrete, tiles & ceramics).
- Non-Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances, but at concentrations below prescribed thresholds).
- Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances at concentrations above prescribed thresholds).

Dangerous substances include compounds containing a variety of determinants commonly found in contaminated soils on brownfield sites, for example arsenic, lead, chromium, benzene etc.

From 16th July 2005, landfill operators require Waste Acceptance Criteria (WAC) laboratory data, should soil waste be classified as **hazardous**, and such waste must have been subjected to pre-treatment. However, subject to WAC testing it may be possible to classify it as stable, non-reactive hazardous waste, which can be placed within a dedicated cell within the non-hazardous landfill.

It should be noted that where non-hazardous waste is accepted at a non-hazardous landfill facility, WAC testing is not required.

Should off-site disposal of soils classified as hazardous waste be undertaken during redevelopment, then WAC analysis should be scheduled at an early stage in the remediation programme.

However, organic compounds (BTEX, TPH, PAH etc) are the most common contaminants that result in soils being classed as hazardous. These contaminants can often be dealt with by alternative technologies (eg by bioremediation or stabilisation) and consequently retention on site is often possible.

Key References

Environment Agency (2008), "Evaluation of models for predicting plant uptake of chemicals from soil" Science Report – SC050021/SR.

Environment Agency (2008), "Human health toxicological assessment of contaminants in soil". Science Report – SR2.

Environment Agency (2009), "Updated Technical Background to the CLEA Model (as amended 2009)". Science Report - SC050021/SR3.

Environment Agency (2009), "CLEA Software (Version 1.05) Handbook". Science Report - SC050021/SR4.

"Guidance on Comparing Soil Contamination Data with a Critical Concentration". CL:AIRE and CIEH (May 2008).

CL:AIRE (2010), "Soil Generic Assessment Criteria for Human Health Risk Assessment".

CL:AIRE (2013), "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. SP1010 Final Project Report.

DEFRA (2014), "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination –. SP1010 Policy Companion Document.

Nathanial (*et. al.*) (2015). The LQM/S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

Department of Environment (1996), "Code of Practice for Agricultural use of Sewage Sludge".

Generic Notes – ID Geoenvironmental Investigations

5. Hazardous Gas

General

Hazardous gas is considered to be any mixture of potentially explosive, toxic or asphyxiating gases, most notably methane, carbon dioxide and oxygen (deficiency).

IDG Investigations are undertaken in accordance with the following Standards and Guidance:

- BS8576:2013 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs).
- BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon-dioxide ground gases for new buildings.
- BS10175:2011 +A2-2017 Investigation of potentially contaminated sites – Code of practice.
- CIRIA C665 (2007) Assessing risks posed by hazardous ground gases to buildings.
- CIRIA C716 Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination.
- CIRIA 735 (2014) Good practice on the testing and verification of protection systems for buildings against hazardous ground gases.

In addition, radon, a naturally occurring radioactive gas is also considered. Further information about radon is included in Notes 1. – Environmental Setting.

At preliminary stage, the assessment of potential risks associated with hazardous gas are based on a review of data obtained from the Landmark Information Group/Groundsure Limited, and the Local Authority. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Sources

Potential sources of hazardous gas include:

- Landfill sites
- Made ground, especially where significant depths are present
- Shallow mineworkings associated with coal extraction
- Geological strata, including peat, organic silts, coal-bearing strata and limestone (reaction with acidic waters), granite (radon)
- Groundwater can sometimes act as a “carrier” for hazardous gas.
- Leakages from pipelines or storage tanks
- Sewers, septic tanks and cess pits

Generation

Wherever biodegradable material is deposited, landfill gas (principally a mixture of methane and carbon dioxide) is likely to be generated by microbial activity. Carbon dioxide is an asphyxiant and toxic; methane is

flammable and a mixture containing between 5% and 15% methane by volume in air is explosive. Landfill gas in the ground is unlikely in itself to pose a significant risk, though it may damage vegetation. However, infiltration of landfill gas into confined spaces (e.g. cellars, services, etc) may give rise to considerable risk.

There is no typical figure for the length of time that landfill gas will be evolved, but at many sites significant gas generation continues for at least 15 years after the last deposit of waste.

Migration

Gas migration from a landfill site may occur in several ways. It may migrate through adjacent strata; the distance of migration being dependent on the pressure gradients, volume of gas and permeability of the strata. Where there are faults, cavities and fissures within the strata, gas may move considerable distances. Other migration pathways for gas include man-made features such as mine shafts, roadways and underground services.

Gas migration is influenced by a number of climatic factors, such as atmospheric pressure variations, water table level variations and the influence of a covering of snow or ice over the surface of the site and surrounding area.

Gas Monitoring Procedure

IDG adopt a standard gas monitoring procedure. This procedure involves the measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration on site immediately prior to and on completion of monitoring.
- Borehole gas emission rate.
- Methane, oxygen and carbon dioxide concentrations using an infra-red gas analyser.
- Standing water level using a dipmeter.

In addition, ground conditions at each sampling location are recorded together with prevailing weather conditions and any other observations such as any vandalism.

Where samples of gas are required for laboratory analysis, Gresham Tubes or Tedlar Bags are used. Gas concentrations in the well are typically recorded immediately before and after retrieval of a sample.

Monitoring Programme

The appropriate length of the monitoring programme is confirmed in accordance with BS8576:2013 (Figure 6).

Site Characterisation

Gas monitoring results are assessed in accordance with BS8485:2015.

Borehole gas flow rates (Q_{hg}) are calculated for each gas at borehole standpipe for each monitoring event. On completion of the monitoring programme a GSV is adopted for the site taking into account the monitoring data, conceptual model, hazardous gas source(s) and nature of pathway. Where the dataset is representative and comprehensive, the GSV should be at the maximum borehole Q_{hg} measured for all the monitoring events.

A worst case check (based on site wide highest flow rate and site wide highest gas concentration) should also be calculated for the site. The worst case Q_{hg} should be compared with the maximum borehole Q_{hg} .

Characteristic gas situation (CS) is determined using the Q_{hg} adopted for the site in accordance with BS8485:2015.

Table 1 – Characteristic Situation BS8485:2015

Characteristic Situation	GSV CH ₄ or CO ₂ (l/hr)	Additional limiting factors	Typical source of generation
1	<0.07	Typically <1% methane concentration and <5% carbon-dioxide concentration (otherwise consider and increase to CS2)	Natural soils with low organic content
2	<0.07 to <0.7	Typical measured flow rate <70 litre/hr)otherwise increase to Characteristic Situation 3)	Natural soil, high peat/organic content
3	0.7 to <3.5	Quantitative Risk Assessment required to evaluate scope of protection measures.	Old landfill, inert waste, mineworking flooded.
4	3.5 to <15		Mineworking – susceptible to flooding, completed landfill, inert waste (WMP 26B criteria)
5	15 to <70		Mineworking unflooded, inactive
6	>70		Recent landfill site

Notes:

Borehole flow rate = volume of gas (regardless of composition) which is escaping from well (l/hr).

Gas Screening Value (litre/hour) = gas concentration (%) / 100 x borehole flow rate (l/hr).

Gas protection measures

A minimum “Gas Protection Score” is allocated for new buildings at the site. This is based on the characteristic situation of the site and the proposed building type. Low rise residential properties are generally classed as “Type A” buildings, whilst managed residential apartments are classed as “Type B buildings”.

The required gas protection measures, taking into account the proposed foundation and floor slab construction methods are selected to meet the required gas protection score. A combination of at least two of the following three types of gas protection measures are required to achieve the minimum gas protection score.

- The structural barrier of the floor slab, or of the basement slab and walls if a basement is present (Gas Protection Score 0-2.5).
- Ventilation measures (Gas Protection Score 0.5-4.0); and,
- Gas resistant membrane (Gas Protection Score 2). It is important to note that there are several requirements (including independent validation) that need to be fulfilled in order to achieve the score of 2.

Generic Notes – Materials Management Plans

Development of a site usually requires either re-use and/or importation of materials such as subsoil, topsoil, general Made Ground fill and crushed brick or concrete (6F5 or similar). Any material excavated from the ground becomes waste at the moment of excavation. If that soil (now a “waste”) is then placed on another part of the development site (or used on another development site) without appropriate waste permits or exemptions being in place, this material will be “illegally deposited waste”.

Changes to landfill tax rules made on 1 April 2018 have significant implications for groundworks on development sites in England and Wales. As a result of the change, HM Revenue & Customs (HMRC) can now recover landfill tax on illegally deposited waste, for which a number of parties involved in the development may be liable. Anyone who deposits the waste or knowingly causes or permits the disposal is jointly and severally liable. Officers of liable companies may also have personal liability. In addition, the developer could now have a tax liability where excavated material or other construction waste is sent off-site for disposal but which is ultimately not disposed of at an appropriately permitted site.

The Contaminated Land: Applications in Real Environments (CL:AIRE) body representing the development industry devised a methodology termed Definition of Waste Code of Practice (DoWCoP), 2011, as an alternative mechanism to complex Environmental Permits and Waste Exemptions, the latter two options typically placing strict limits upon the volumes of waste materials which may be re-used. DoWCoP is recognised by regulatory bodies (i.e. Environment Agency, Local Authorities) as an efficient process which enables the re-use of excavated materials on-site or movement of natural materials between sites by means of a Materials Management Plan (MMP).

The DoWCoP enables:

- The direct transfer and reuse of clean naturally occurring soil materials between sites
- The conditions to support the establishment/operation of fixed soil treatment facilities
- The reuse of both contaminated/uncontaminated materials on their site of origin
- The re-use of Made Ground on other sites within a defined Cluster Project.

DoWCoP can be used by individuals involved in development activities ranging from general earthworks to complex land remediation projects and is applicable to both Greenfield and Brownfield sites.

In practice, prior to any excavation of material, the developer or their Consultant(s) prepares a detailed MMP. The MMP consolidates details of the nature and origin of materials it is proposed to excavate, volumes of excavated and stockpiled and placed materials and contamination test results and risk assessments thereof, together with proposed materials movements during the development. The MMP must also reference the agreed Remediation Strategy, the relevant Planning Permission and regulatory correspondence with the Local Authority and Environment Agency indicating they have no objection to the scheme. The MMP is reviewed by a Suitably Qualified Person, who Declares to the Environment Agency that the MMP is satisfactory. An administrative fee of £40 plus a declaration fee equivalent to £10 for every 1000m³ in excess of 5000m³ is chargeable by CL:AIRE.

The following broadly summarises application of the CL:AIRE DoWCoP, although this summary is by no means exhaustive :

- Subject to qualification by means of an appropriate Desk Study and Site Investigation (i.e. soils description and chemical testing), natural topsoil or subsoil generated by site development which is re-used on the site of origin does not require an MMP or Declaration by a QP, although it is

good practice to prepare one (and probably of economic benefit to the developer as it provides definitive volumes of material to be excavated and moved by the groundworker).

- Natural won topsoil and subsoil surplus to requirements may be moved between sites provided an appropriate Desk Study & adequate site investigation (i.e. soils description and chemical testing) an MMP and QP Declaration is in place for the receiving site. See Table A1 Summary of Direct Transfer process – Minimum Requirements Page 28 of the CL:AIRE DoWCoP.
- Made Ground be re-used on the site of origin provided an appropriate Desk Study and Site Investigation demonstrates its suitable for re-use an agreed Remediation Strategy and Verification Plan is in place and is subject to an MMP and QP Declaration. Low volumes (i.e. 1000T) of uncontaminated Made Ground may be re-used provided a U1 Exemption is in place.
- Made Ground **may not** be moved between sites unless (subject to an agreed Remediation Strategy, Verification Plan an MMP and QP Declaration) it is moved within a Cluster project and is subject to soil treatment (e.g. bioremediation) at a hub site which possesses an appropriate Environmental Permit.
- Demolition derived material can only be moved if an appropriate waste permit is in place or the material meets WRAP protocol (i.e. site won 6F2 demolition material which has been crushed in accordance with an Environmental Permit) and meets chemical and geotechnical acceptance criteria (i.e. no asbestos fibres and suitable gradings).

Further detail concerning the CL:AIRE DoWCoP can be found at <https://www.claire.co.uk/projects-and-initiatives/dow-cop>

Recycled aggregates (i.e. 6F2 derived from crushed concrete) may be produced under the Waste & Resources Action Programme (WRAP) protocol. WRAP sets out steps that must be taken for waste to become a non-waste product or material that can be re-used in industry or supplied to other markets without waste regulation controls.

Further detail concerning WARP can be found at <http://www.wrap.org.uk/content/quality-protocols>

Please contact IDG if you have any questions in respect of the above.