

Land at Woolley Colliery Road, Darton For Homes by Honey, Keith Wike & Brenda Wike, Christopher Wike & Sharon Wike

Report no: 5624/1A
Date: February 2026



SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	5624	Site area/ha	4.16
Client:	Homes by Honey	NGR:	SE 313 104
Site:	Woolley Colliery Road, Darton	Nearest postcode:	S75 5JA

The site is located off Wolley Colliery Road c. 5.1km north of Barnsley town centre and currently comprises three overgrown grassed fields (one large and two smaller fields) with an area of concrete hardstand (former barns/stable, with an underground storage tank immediately north) and tarmac access road in the southeast.

Lithos were commissioned by Honey to provide a geoenvironmental appraisal of the site, which it is understood is to be redeveloped with residential dwellings. Lithos' investigation included a review of 3rd party reports, the site's history and environmental setting, and a ground investigation comprising 23 trial pits and 16 rotary probeholes.

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

Issue	Remarks
Made ground	Made Ground Topsoil and Colliery Spoil were identified across the larger western field to a maximum depth of 0.8m, with an isolated area of Cohesive Made Ground (to 1.0m) in the far south of this field. Concrete and Tarmac hardstand are present in the southeast of the site (former barns/stable and access road). A thin veneer of Ash & Clinker, along with Cohesive and Granular Made Ground to a maximum depth of 1.2m were encountered beneath the concrete hardstand.
Natural ground	Topsoil (across the centre-east, east and southeastern fields), typically 300mm thick overlying Cohesive and Granular Residual Soils to between 1.3m and >3.5m depth. Pennine Middle Coal Measures bedrock was encountered in 6 pits from between 1.2m and 2.5m depth and comprised primarily Siltstone and Sandstone. Bedrock was encountered in the probeholes from between 1.3m and 2.0m depth.
Contamination	No visual/olfactory evidence of hydrocarbon contamination was identified in any of the exploratory holes. Testing suggests that the Topsoil and Made Ground Topsoil is clean and suitable for re-use. Concentrations of arsenic in exceedance of Lithos' screening values were identified in both the Colliery Spoil and Ash & Clinker beneath the site. A clean cover system (600mm) will be required in garden and (450mm) landscaped areas where these materials remain. This material could also be isolated beneath hardstanding. No asbestos fibres were identified in any of the samples screened. Further investigation of the former tank will be required once vegetation clearance has been completed and the footprint can be fully accessed and assessed.
Mining & quarrying	The majority of the site is located within a Coal Mining Development Low Risk Area, with the west of the site within a High Risk Area. A total of 16 probeholes were advanced to check for the presence of underground mine workings. Possible workings within the Top Haigh Moor and Low Haigh Moor coal seam were identified across the site but are only considered to influence surface stability in the southwest where cover ratios are <10. This area will require drilling and grouting.
Hazardous gas	Information from BGS Radon Report indicates that the majority of the site (centre and north) lies in an area where less than 1% of homes are estimated to be above the action level. However, the BGS Radon Report indicates that sections in the south of the site are within an area where 5% to 10% of homes are estimated to be above the action level, and basic radon protection measures are required. Monitoring wells have been installed in 8 shallow probeholes across the site, with monitoring currently underway to confirm the need for any protection measures. A Hazardous Gas Risk Assessment will be issued on completion of monitoring in April 2026.
Preparatory/ Remediation works	Site clearance of surface materials and vegetation, including tree surveying and tree stumps (heights and diameters). Grubbing up of concrete hardstand (and tarmac hardstand if required) and chasing out of any remaining foundations. Provision of 600mm clean cover in garden, reducing to 450mm in landscaped areas where Colliery Spoil is present. Isolation of Ash & Clinker beneath hardstanding (appropriate for Colliery Spoil too, but volumes will need to be considered). Drill & grout of shallow mine workings in the southwest part of the site.

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Issue	Remarks
Foundations	<p>At this stage, it is anticipated that traditional strip/trenchfill footings (deepened due to tree influence) will be the most suitable foundation solution for 2 & 3 storey residential dwellings constructed at this site. Founding stratum will be Cohesive (medium to high strength clays)/Granular (medium dense sands and gravels) Residual Soil.</p> <p>Pennine Middle Coal Measures bedrock is anticipated from shallow depth, if encountered, foundations should be placed entirely on rock.</p> <p>Foundations within 25m of mapped faults will require reinforcement.</p> <p>Where drilling and grouting has been undertaken footings will require thickening and reinforcement.</p>
Groundwater & excavations	<p>Groundwater was encountered at 1.4m in TP106 and within PHs 109, 111 and 112 from between 12.0m and 22.0m depth.</p> <p>Stability of excavations within natural ground was generally good. However, stability within greater thicknesses of Made Ground was noted to be poor, as such any excavations within deeper Made Ground may require shoring.</p>
Flooding & drainage	<p>The entire site lies within Flood Zone 1.</p> <p>Soakaway testing was undertaken in 2 trial pits, with only 1 test undertaken in both. Only 1 location yielded an infiltration rate. However, given ground conditions and site topography (potential for springs) soakaways are not considered a suitable solution for the discharge of surface water run-off.</p>
Highways	<p>Natural Ground is anticipated to provide a CBR value of at least 3%, testing should be undertaken prior to construction to confirm this.</p> <p>Made Ground along the route of proposed highways should be excavated, screened & re-engineered to provide a CBR value of at least 3%.</p>

Significant developer abnormalities relating to geoenvironmental issues at the site are:

- Consolidation via grouting is required in the southwest of the site, associated with shallow mineworkings in the Top Haight Coal seam where cover ratios are <10.
- Provision of 600mm cover in garden and 450mm in landscaped areas underlain by Colliery Spoil.
- Isolation of Ash & Clinker beneath hardstand.

Some further work is required, most notably:

- A simple trial pit investigation will be required in order to remove residual uncertainties with respect to possible contamination associated with the former underground storage tank immediately north of the concrete hardstand in the southeast.
- Preparation of a Remediation Strategy.
- Preparation of a Drill and Grout Specification.

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APPENDICES

Appendix A - General notes

01	Environmental setting
02	Ground investigation fieldwork
03	Geotechnical testing
04	Contamination laboratory analysis & interpretation
05	Hazardous gas
06	Soakaways

Appendix B - Drawings

Drawing	Revision	Title
5624/1	-	Site Location Plan
5624/2	-	Proposed Layout
5624/3	-	Site Features
5624/4	-	Site Photographs
5624/5	-	Preliminary Conceptual Site Model
5624/6	-	Exploratory Hole Locations
5624/7	-	Revised Conceptual Site Model
5624/8	-	Site Geology and Coal (BGS)
5624/9	-	Site Geology and Coal (MRA & Abandonment plans)
5624/10	-	MRA Abandonment Plan – NE978
5624/11	-	MRA Abandonment Plan – NE979
5624/12	-	MRA Abandonment Plan – 16548
5624/13	-	Approximate Area of Drilling & Grouting
5624/14	-	Areas Requiring Foundation Reinforcement

Appendix C - Commission

Appendix D - Historical OS plans[#]

Appendix E - Search responses[#]

From	Date	Content
Landmark	19 th November 2025	Environmental search data
British Geological Survey	19 th November 2025	BGS Radon Report
Mining Remediation Authority	3 rd November 2025	Consultants Coal Mining report
Mining Remediation Authority	19 th November 2025	Mine Entry Data Sheets

Appendix F to G - Exploratory records

Appendix F	SAs 101 & 102 and & TPs 101 to 121
Appendix G	PHs 101 to 116 and PHs 101A, 103A, 106A, 108A 109A, 111A, 113A & 115A

Appendix H - Chemical test results

Appendix I - Geotechnical test results

Appendix J – Soakaway test results

Appendix K - Gas monitoring results

Some of this data is not included within the paper or PDF copies of this report but can be provided on request.

FOREWORD (GEOENVIRONMENTAL APPRAISAL 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 Lithos Consulting Limited (Lithos); 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.

This report has been reviewed by a Competent Person, as defined in the National Planning Policy Framework. Lithos ensure that all projects are managed by individuals with necessary experience, relevant qualifications, and current membership of a relevant professional organisation. Records of engineers, project managers and reviewers involved in this project are maintained by us. Lithos QA/QC procedures for all our work forms an integral part of our ISO9001 accreditation and as such is regularly audited.

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 Lithos prior to significant revision of the development proposals.

The report should be read in its entirety, including all associated drawings and appendices. Lithos cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context. However, it should be noted that in order to keep the number of pages to a minimum, some information (e.g. full copy of the Landmark/Groundsure Report) is not included in the PDF; by request it can be provided.

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 Lithos believes are reliable. Reasonable care and skill has been applied in examining the information obtained. Nevertheless, Lithos cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

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 Lithos, 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.

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

The report represents the findings and opinions of experienced geoenvironmental consultants. Lithos does not provide legal advice and the advice of lawyers may also be required.

Lithos standard terms and conditions apply to the report, a copy of the terms and conditions is available on request or can be found with our proposal in Appendix C.

GEOENVIRONMENTAL APPRAISAL

of land at

WOOLLEY COLLIERY ROAD, DARTON

1 INTRODUCTION

1.1 The commission and brief

- 1.1.1 Lithos Consulting Limited were commissioned by Homes by Honey to carry out a geoenvironmental appraisal of land at Woolley Colliery Road in Darton, Barnsley.
- 1.1.2 This document is a revision of the Geoenvironmental Appraisal (Report 5624/1) issued by Lithos in January 2026; Report 5624/1 is now superseded. This document now includes the additional laboratory testing results, with the only significant revisions to 5624/1 having been made in Section 16.4.
- 1.1.3 Correspondence regarding Lithos' appointment, including the brief for this investigation, is included in Appendix C. The agreed scope of works included:
- A review of third party reports
 - A site walkover and inspection
 - An assessment of the land use history
 - Determination of the site's environmental setting
 - A mining risk assessment in accordance with Mining Remediation Authority¹ guidance.
 - An intrusive ground investigation comprising 23 trial pits and 16 probeholes
 - Assessment of the geotechnical properties of the near surface deposits to enable provision of foundation and highway recommendations
 - A qualitative assessment of contamination risks
 - Recommendations for the necessary site preparatory and remediation works

1.2 The proposed development

- 1.2.1 It is understood that consideration is being given to redevelopment of the site with 2 & 3 storey domestic dwellings, associated gardens, POS, adoptable roads and sewers.
- 1.2.2 No detailed site layout has been provided at this stage, only an indicative road layout (Nett Area Plan: Ref. WIKE – 001, Dated 18.08.2025). This has been reproduced as Drawing 5624/2 in Appendix B.

1.3 Report format and limitations

- 1.3.1 All standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on:
- Assessment of the site's environmental setting
 - Ground investigation fieldwork
 - Geotechnical testing
 - Contamination testing
 - Hazardous gas
 - Soakaways

¹ On 28th November 2024, the Coal Authority changed their name to the Mining Remediation Authority.

1.3.2 General notes and limitations relevant to all Lithos geoenvironmental 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

2.1 General

2.1.1 The site's location is shown on Drawing 5624/1 presented in Appendix B to this report. Site details are summarised in the table below.

Detail	Remarks
Location	5.1 km north of Barnsley town centre
NGR	SE 313 104
Approximate area	4.16 ha (10.3 acres)
Known services	Overhead electric and telecom. Underground telecom, water, sewer and gas.

2.2 Site features

2.2.1 Lithos completed a walkover survey of the site on 20th November 2025.

2.2.2 Existing salient features, at the time of the walkover are presented on Drawing 5624/3 in Appendix B to this report and summarised in the table below.

Feature	Remarks
Current access	Off Woolley Colliery Road to the west.
Topography	Entire site slopes to the south at c. 1:20.
Approximate areas	100m ² Tarmac hardstand. 900m ² Concrete hardstand. 8,200m ² Immature trees. 11,400m ² Mature trees & hedgerows. 21,000m ² Grass & overgrown areas.
Nature of boundaries	Northwest – Metal palisade fencing, mature trees and hedgerows. Northeast, East, South and Southwest – Mature trees and hedgerows. West – Open to footpath along Woolley Colliery Road.
Surrounding land uses	Northwest – Factory building & yard, with residential dwellings beyond. Northeast – Overgrown areas and Bloomhouse Lane, with grassed fields beyond. East – Manor House and overgrown grassland. South – Woolley Colliery Road and Fountain Close, with associated residential dwellings. West – Woolley Colliery Road, with sport pitches and overgrown areas beyond.

2.2.3 A selection of site photographs is included on Drawing 5624/4.

2.2.4 The site is freely accessible off Woolley Colliery Road to the west, and by foot off Bloomhouse Lane to the east and north.

2.2.5 The site comprises three areas of overgrown grassland, one occupies the majority of the site, with two smaller parcels in the east and southeast.

2.2.6 The two smaller parcels are accessible off Bloomhouse Lane and the public footpath which runs along the site route. The parcel in the east has very limited access, with a large proportion of its area covered by immature trees. The parcel in the southeast is less overgrown and has overhead electric and telecom utilities across the north.

- 2.2.7 The largest parcel is split roughly in the centre by a line of mature trees and hedgerows, the eastern half of this larger parcel is again overgrown grassland with sporadic immature trees.
- 2.2.8 Concrete hardstand is present in the southeast, understood to have been occupied by a barn and stable block. Anecdotal evidence also suggests that an air raid shelter is present immediately north of this concrete block, but this area is heavily overgrown.
- 2.2.9 The central and western section of the largest parcel comprises overgrown grassland, but is primarily covered by immature trees.
- 2.2.10 Tracks and informal footpaths were noted across the entire site, but the most prominent ones run across the north of the largest parcel, connecting Woolley Colliery Road from the west and Bloomhouse Lane in the northeast.
- 2.2.11 Monitoring well top hats were noted across the entire site in varying states of disrepair.

3 SITE HISTORY

- 3.1 Site centred extracts from Ordnance Survey (OS) plans dating back to 1854 have been examined. Some of these plans are presented in Appendix D to this report.
- 3.2 The table below provides a summary of the salient points relating to the history of the site. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site. Significant former uses/operations are highlighted in **bold** text for ease of reference.

Date	Site	Surrounding land
1854	Comprises primarily of open arable land, with buildings and a yard (barn and stable block) in the centre-southeast. Bloomhouse Lane crosses the southeast and heads out of the northern boundary.	Open arable land immediately north, east and west. Manor House, associated buildings and a well immediately east. Old quarry (sandstone) immediately southwest. Darton - roads (Bloomhouse Lane/ Woolley Colliery Road) and residential dwellings immediately south. Pye Wood from c. 80m north. Darton Station and railway line from c. 80m southwest. Runs roughly northwest to southeast. River Dearne flows northwest to northeast from c. 170m southwest/south. Woolley Colliery (various buildings, tracks, shafts, reservoirs etc.) shown from c. 400m northwest.
1893	No significant changes.	Old quarry immediately southwest no longer shown. Further buildings shown immediately south (Including Fountain Square, a chapel and Mill House). Three reservoirs, a coal pit, old air shaft and a day hole (mine entrance) located from c. 130m north (north of Pye Wood).
1906	A cistern (below ground water tank) labelled immediately north of the buildings in the centre-southeast	No significant changes.
1918	Cistern now labelled tank .	Pyewood Colliery shown immediately southwest, with buildings, tracks and spoil/slag heaps. Darton Station and railways lines from c. 70m southwest increased in size with further buildings and tracks. Further buildings in Darton from c. 70m south. Coal pit, old air shaft and day hole from c. 130m north no longer shown, reservoirs remain. Darton Main Colliery (buildings, shafts, spoil/slag heaps) shown from c. 500m southwest.
1930	No significant changes.	Miners Welfare Institute building and ground shown immediately northwest (later labelled as a lab, known for testing coal).

Date	Site	Surrounding land
		Road (Woolley Colliery Road) shown along the southern and western boundary. Pyewood Colliery no longer labelled, but increased in size with further spoil/slag heaps. Possible spoil/slag heap shown immediately east. Football ground and associated building shown from c. 60m northwest. Darton Main Colliery greatly increased in size (further buildings, heaps, tracks etc.), spoil/slag heaps and tracks now lie from c. 240m southwest. Woolley Colliery increased in size, track ways now lie from c. 110m north, with spoil/slag heaps from c. 380m northwest. Sewage works shown immediately south of Woolley Colliery from c. 330m north.
1955		Building shown immediately north. Spoil/slag heaps associated with Woolley Colliery increased in size and now lie from c. 220m northwest. Darton Main Colliery from c. 240m southwest now labelled disused with no tracks and fewer buildings shown, spoil/slag heaps remain.
1960	Tank in the centre-east no longer labelled.	Possible spoil/slag heap immediately east increased in size. Buildings immediately north increased in size and now labelled works. Football ground (now sports ground) from c. 60m increased in size and now lies from c. 10m west. Sewage works from c. 330m north increased in size with tanks, beds and buildings shown.
1970	No significant changes.	Spoil/slag heaps associated with Pyewood and Darton Main Collieries no longer shown. Works building immediately north now labelled laboratory. Spoil/slag heaps associated with Woolley Colliery remain labelled, but extents are not shown. Small buildings associated with the sports ground shown from c. 130m northwest. Reservoirs/ponds from c. 130m north no longer shown.
1980	Buildings (barn and stables) and tank in the centre-east no longer shown, concrete remains.	New road (Fountain Close) and residential dwellings shown immediately south.
1993	No significant changes.	Woolley Colliery spoil/slag heap no lies from c. 10m east, south of the sports ground. Pye Wood from c. 80m north no longer shown.
2006		Tracks and areas of woodland shown in the fields immediately north and across the Woolley Colliery Spoil/slag heap from c. 150m west.

3.3 Whilst the tank identified in the centre-southeast of the site was initially identified as a cistern (water tank) it cannot be ruled out that it was not used to contain any other substance whilst it was located on site.

3.4 Anecdotal evidence suggests the buildings in the centre-southeast of the site were a stable block and barn. It was also suggested that an underground air-raid shelter was present in the same location as the tank/cistern mentioned above.

4 ENVIRONMENTAL SETTING

4.1 General

4.1.1 Notes describing how the site's environmental setting has been assessed are included in Appendix A to this report. Reference has been made to publicly available Government held digital data via QGIS (an Open Source Geographic Information System). Extracts from the response received from Landmark, and responses from the Mining Remediation Authority, and the BGS is presented in Appendix E. These responses are summarised below, together with the findings of our own "desk study" investigation.

Issue	Data reviewed	Summary
Geology	1:50,000 BGS map (Sheet 87) 1:10,000 BGS map (Sheet SE31SW) BGS Memoir (Barnsley)	Drift soils – None mapped. Solid (bedrock) – Pennine Middle Coal Measures (Mudstone, Siltstone, Sandstone), with a Sandstone unit (Haigh Moor Rock) at shallow depth. Shallowest coal seam – Top Haigh Moor Coal from relatively shallow depth. See further details in Section 5 below. Strata dip – No dip shown, likely shallow (c. 7°) to the northeast. Faults – Two faults running roughly southwest to northeast. One across the centre-west downthrown to the east, one across the southwest downthrown to the northwest.
Mining	Mining Remediation Authority	The majority of the site is located within a Coal Mining Development Low Risk Area (within the defined coalfield, but no known defined risks have been recorded by the Mining Remediation Authority; there may still be unrecorded issues). However, the west of the site lies within a High Risk Area. Past and present workings – Known underground workings beneath the north and west of the site, with probable unrecorded shallow mineworkings. Opencast – known opencast site located immediately north. Mine entries – None located on site, but the orientation of two adits to the southwest mean they will underly the site at relatively shallow depth. Further details in Section 5 below.
Quarrying	Historical OS plans	Known quarrying immediately southwest of the site.
Landfills	Envirocheck	No known landfills within 250m.
Radon	UK Health Security Agency BGS Radon Report	The majority of the site lies in an area where less than 1% of homes are estimated to be above the radon action level. However, sections of the south of the site lie within an area where 5 - 10% of homes are estimated to be above the radon action level. Further details in Section 15.
Hydrogeology	Environment Agency electronic open data via QGIS	Groundwater Source Protection Zone – None within 250m. Aquifer – Secondary A (Solid). Groundwater abstractions – None within 250m. Groundwater vulnerability – Medium. Pollution incidents – None within 250m.
Hydrology	Defra Catchment data explorer Envirocheck	Nearest watercourse(s) – River Dearne flows southeast c. 290m southwest of the site towards Cawthorne Dike which lies c. 1.4km south. Water quality – Ecological: Moderate. Chemical: Failed due to Mercury, Perfluorooctane sulphonate (PFOS), Polybrominated diphenyl ethers (PBDE) and Cypermethrin (Priority).

Issue	Data reviewed	Summary
		<p>Pollution incidents – 7 incidents (2 significant, 5 minor) between c. 90m and c. 200m south, associated with a variety of pollutants (Oils, Coal solids, sewage etc.) from 1989 to 1990.</p> <p>1 significant incident c. 190m northwest associated with storm overflow sewage from a water company owned location in 1998.</p> <p>7 (4 significant, 3 minor) further incidents from between c. 220m to c. 230m southwest, associated within a variety of pollutants (Top leachate, sewage, coal solids, mining water, rubbish and unknown) from 1989 to 1998.</p> <p>Abstractions – None within 250m.</p> <p>Discharge consents – 7 consents between c. 230m and c. 260m south all associated within Yorkshire Water Services (Unknown, sewers and CSOs) sewerage discharges from 1963 to current (at least 2017, no revocation date supplied).</p>
Flood risk	Environment Agency electronic open data via QGIS	<p>The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low.</p> <p>In accordance with Chapter 14 of the National Planning Policy Framework, a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency).</p>
UXO	Zetica website	Entire site classified as low risk.

5 COAL AND MINING

5.1 British Geological Survey (BGS)

- 5.1.1 The BGS map two faults on site, splitting the site into three fault blocks; western, central, and southeastern. Both faults roughly run southwest to northeast.
- 5.1.2 Geological maps suggest that the following coal seams underlie the site at shallow depth. These are detailed below:

Seam name	Approximate thickness /m	Approximate depth below Top Haigh Moor /m	Remarks
Top Haigh Moor Coal (TH)	c. 1.2m	-	Outcrops c. 60m to c. 70m southwest of the site in the western and southeastern fault blocks. The seam is not shown in the central fault block, but the outcrop should lie from c. 160m southwest.
Low Haigh Moor Coal (LH)	c. 0.8	8	Outcrops c. 200m to c. 210m southwest of the site in the western and southeastern fault block. Again, this seam is not shown in the central fault block, but the outcrop would lie from c. 300m southwest.
Coal	c. 0.3	18	Thin coal seam.
Lidget Coal	c. 0.8	28	No suitable outcrops are shown due to faulting.

- 5.1.3 Given dip and topography, these seams are expected to underlie entire site from varying depths.
- 5.1.4 Areas of made ground (includes spoil/slag heaps) and worked ground (road and railway cuttings) are shown on BGS mapping in close proximity to the site. In addition, an area of infilled ground (backfilled opencast) is shown from c. 80m northeast, associated with opencast workings in the Barnsley and Barnsley Rider Seams.
- 5.1.5 Approximate outcrops, fault lines and areas of worked, made and infilled land recorded by the BGS are shown on Drawing 5624/8.
- 5.1.6 It should be noted that seam outcrops and approximate line of faults plotted on geological maps have been known to be inaccurate by distances in excess of 100m.

5.2 Mining Remediation Authority (MRA)

- 5.2.1 In July 2011 the Mining Remediation Authority (MRA)² formalised their requirements in relation to planning applications and introduced some new terminology relating to coal mining development areas. This Section (and Sections 11.8 & 17.2) provides the necessary mining risk assessment required by the proposed planning application.
- 5.2.2 The majority of the site (c. 80%) is located within a Coal Mining Development **Low Risk Area** - within the defined coalfield, but no known defined risks have been recorded by the Mining Remediation Authority; there may still be unrecorded issues.
- 5.2.3 However, an area in the west of the site (c. 20% of the sites total area) is located within a Coal Mining Development **High Risk Area** - an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc).

² On 28th November 2024, the Coal Authority changed their name to the Mining Remediation Authority.

5.2.4 An MRA Consultants Coal Mining Report states that there is:

- Known underground mining in 5 seams beneath the site, with the shallowest at c. 21m depth.
- Probable unrecorded shallow mineworkings.
- Are spine roadways at shallow depth.
- 4 mine entries (3 adits and 1 shaft) within 100m.
- 8 abandoned mine plan catalogue numbers that intersect the site boundary.
- No outcrops recorded.
- 2 geological faults which cross the site, no fissure or breaklines.
- An area of opencast immediately north.
- No MRA managed tips within 500m.
- Previous site investigations on site.
- No remediated sites within 50m.
- No coal mining related subsidence within 50m.
- No mine gas or mine water treatment schemes.
- No future underground mining, coal mining licensing, court orders, or section 46 notices.

Mine Entries

5.2.5 Mine entry data sheets for the three closest and most relevant of the four known mine entries within 100m have been obtained. Locations of the three mine entries are shown on Drawing 5624/9 and entry details from the MRA mining report and data sheets are summarised in the table below:

Type	Shaft Ref.	Grid reference	Location, treatment & remarks
Adit	431410-001	431167E 410356N	Name – Pyewood Colliery Adit. Source – Abandonment Plans (NE979, NE978, M1095, 7368/1/2). Location – c. 40m southwest, adit azimuth 53 – orientated heading under the site. Treatment – Treated to an unknown specification by SYMAS in 1988.
Adit	431410-002	431184N 410347E	Name – Pyewood Colliery Adit. Source – Abandonment Plans (NE979, NE978, M1095, 7368/1/2). Location – c. 30m southwest, adit azimuth 53 – orientated heading under the site. Treatment – Treated to an unknown specification by SYMAS in 1988.
Shaft	431410-042	431284E 410281N	Name – Possible well. Source – Measured on site. Depth – 6.5m. Diameter – 1.4m. Location – c. 25m south. Treatment – Excavated to base and filled to surface with concrete by British Coal in May 1987.

5.2.6 Given the distance to the shaft (431410-042) and the treatment details provided by the Mining Remediation Authority, this is not to pose a risk to this site or any development on this site.

Mineworkings

5.2.7 It should be noted that it did not become statutory requirement to maintain and preserve plans of abandoned mines until the Mine (Coal) Regulations Act of 1872 and consequently there may be mineworkings beneath the site for which the MRA have no records.

5.2.8 The MRA have records of workings in the seams detailed in the table below.

Seam name	Depth /mbgl	Thickness /m	Last year mined
Top Haigh Moor	21	1.07	1913
Low Haigh Moor	50	0.61	1915
Fenton	157	2.05	1956
Middleton Main	205	1.45	1977
Wheatley	236	0.91	1943

5.2.9 Of the known workings, only the Top Haigh Moor and Low Haigh Moor coal seams are considered significant.

5.3 Abandonment Plans

5.3.1 Abandonment plans have been obtained for underground mineworkings in the Top Haigh Moor and Low Haigh Moor coal seams beneath the site and opencast within the Barnsley and Barnsley Rider coal seams immediately north of the site.

Plan ref: NE978

5.3.2 This abandonment plan (Ref: NE978) shows mineworkings in the **Top Haigh Moor Coal** and has been reproduced as Drawing 5624/10.

5.3.3 Coal was extracted via both pillar and stall workings and panels between 1910 and 1922 in the west and across the north of the site (c. 8,600m² – c. 20% of the total site area). The workings were accessed via two adits (431410-001 & 002) which surface southwest of the site and dip beneath the west.

5.3.4 Several spot heights (in feet) are provided on the plan along the length of one of the adits and into the workings. Staple shafts between the Top and Low Haigh Moor coal seams are shown on the plan, in addition to areas of workings in the Low Haigh Moor coal where it was worked.

5.3.5 An outcrop for the Top Haigh Moor coal seam is shown on this plan from c. 85m southwest.

5.3.6 Further panel mineworkings in the Top Haigh Moor coal seam are shown from December 1962 to November 1968 on this plan to the north and northeast of the site. This area has further spot heights and details of coal thickness along its length.

5.3.7 Information from various shafts (levels for coal seams etc.) in the area is provided along with a seam section which suggest the coal is overlain by grey sandstone (Haigh Moor Rock), a coal thickness of c. 1.0m (including a c. 0.15m thick dirt separation), underlain by Clay.

Plan ref: NE979

5.3.8 This abandonment plan (Ref: NE979) shows mineworkings in the **Low Haigh Moor Coal** and has been reproduced as Drawing 5624/11.

5.3.9 Coal was extracted via both pillar and stall workings and panels between 1915 and 1922 in the west and across the north of the site (c. 3,400m² – c. 10% of the total site area). The workings were accessed via the same two adits as the workings in the Top Haigh Moor and then through the staple shafts shown on the two plans (NE978 & NE979).

5.3.10 Several spot heights (in m AOD) are provided on the plan at the foot of one of the adits and into the workings. Again, the staple shafts between the Top and Low Haigh Moor coal seams are shown on the plan, in addition to areas of workings in the Top Haigh Moor coal.

5.3.11 Further panel mineworkings in the Top Haigh Moor coal seam are shown from December 1962 to November 1968 on this plan to the north and northeast of the site. This area has further spot heights and details of coal thickness along its length.

5.3.12 Information from the Lidgett shaft showing separation between Top & Low Haigh Moor seams and the depth to the Lidgett seam.

5.3.13 A typical seam section is also provided which suggest the coal is overlain by grey gravelly Clays with ironstone, a Coal thickness of c. 0.7m, underlain by Clay.

Plan ref: 16548

5.3.14 This abandonment plan (Ref: 16548) shows opencast workings in the **Barnsley** (Leaf A & C) and **Barnsley Rider** (Leaf D & B) Coal seams and has been reproduced as Drawing 5624/12.

5.3.15 Coal was extracted between 1st November 1990 and 27th July 1991 from c. 90m north.

5.3.16 A plan showing all excavation areas is provided with separate plans for each worked seam. The separate plans provide spot heights (highlights the lowest point of excavation) at the extents of the opencast areas along with the thickness of coal in addition to topographic lines which can the approximate dip of the opencast and coal seams.

5.3.17 A vertical section has been provided which shows seam thicknesses, separation and depths.

5.3.18 The separate plans showing the workings in the Barnsley Rider (Leaf D & Leaf B) indicates an approximate line of a fault, downthrow of 1.6m and 0.8m to the northwest respectively.

Abandonment Plan Summary

5.3.19 The three abandonment plans obtained are fairly detailed and provide useful information regarding the coal beneath the site. Using the spot heights provided on NE978 & NE979, it is anticipated that the following coal seams will underlie the site at the following depth in the centre and west of the site (western fault block).

- **Top Haigh Moor Coal** will underlie the site from c. 14m in the southwest and from c. 45m in the north.
- **Low Haigh Moor Coal** will underlie the site from c. 21m in the southwest and from c. 50m in the north. Expected to lie c. 6m beneath the Top Haigh Moor Coal.

5.3.20 The known underground mineworkings are only shown across the west and northwest of the site, no further known underground workings are present across the remainder of the site.

5.4 Summary of Coal Mining Risks

5.4.1 The table below summarises the potential risks associated with coal mining legacy issues at this site.

Coal mining issue	Yes	No	Remarks
Underground coal mining (recorded at shallow depths)	✓	-	Recorded underground mineworkings in the High Haigh Moor and Low Haigh Moor Coal seams within 50mbgl.
Underground coal mining (probable at shallow depths)	✓	-	The MRA suggest that further unrecorded shallow mineworkings are likely to be present beneath the site. An intrusive mining investigation will be required.
Mine entries (shafts and adits)	✓	-	Two adits and one mineshaft within 50m. A third adit is known within 100m, but the distance and orientation suggest it does not underly or influence this site. The possibility of unrecorded entries cannot be entirely discounted at this stage.
Coal mining geology (faults, fissures)	✓	-	Two faults located on site.
Record of past mine gas emissions or potential	✓	-	No incidences recorded by the MRA. However, a period of gas monitoring across the site will be required given the proposed development.

Coal mining issue	Yes	No	Remarks
Recorded coal mining surface hazard	-	✓	No damage notices or claims recorded on site or within 50m.
Surface mining (opencast workings)	-	✓	No opencast workings recorded on site.

5.4.2 For those issues identified as “yes” in the above table, a more detailed discussion and assessment of the risks, both individually and cumulatively, to the application site and the proposed development is provided below.

5.4.3 Risks include:

- Mines gas
- Recorded, and unrecorded, mine entries
- Collapse of shallow mineworkings, with consequent subsidence affecting surface stability

5.4.4 Current UK guidance, CIRIA C758D³, provides information and guidance for engineers and geologists with respect to the design of: mining investigations; foundations; and remedial measures.

Mining risks – gas

5.4.5 Given the presence known mine workings and the proposed residential development gas monitoring and a hazardous gas risk assessment will be required (see Section 7).

Mining risks – mine entries

5.4.6 The Mining Remediation Authority hold records of 3 known mine entries (1 shaft and 2 adits); all three are known to be treated, but the two adits are treated to an unknown specification.

5.4.7 The known mine shaft is considered to be too far from site to pose any risk. However, if any suspected mine entries are encountered during the construction phase, further advice should be sought from a suitably qualified geotechnical consultant such as Lithos.

5.4.8 If any are located, each shaft should be accurately located by grid co-ordinates, proved to its base, pressure grouted and then be capped off at rockhead level. A shaft cap is generally required to be twice the shaft diameter and designed to support the depth of fill above plus any surcharge loads. Detailed cap design is beyond the scope of this report but should also include gas venting measures.

5.4.9 There are also two recorded **adits**, both of which are said to have been treated (although to an unknown specification) given the estimated dip and distance of the entrance to these adits from site they are likely to be too deep to be treated by excavation and grouting will likely be required where the cover ratio is <10.

Mining risks – shallow underground mineworkings

5.4.10 Mineworkings which could affect surface stability are mostly present beneath the south and west of the site in the Top Haigh Moor and Low Haigh Moor Coal seams.

5.4.11 Coal is likely to have been extracted by pillar & stall methods.

5.4.12 In addition, there may also have been earlier, **unrecorded** mineworkings via bell pits (considered unlikely given the anticipated depth to coal on site) and/or pillar and stall methods, indeed several CA abandonment plans record the presence of ‘old workings’.

³ CIRIA C758D:2019. Abandoned mine workings manual

and if present these could result in unpredictable subsidence.

- 5.4.13 Individual pillars may collapse at any time, leading to settlement in the overlying strata. As the mine roof degrades and collapse the void migrates upwards, sometimes causing a surface collapse or crown hole.
- 5.4.14 The vertical distance through which a void can migrate is difficult to assess. Made ground and superficial deposits are considered to have no inherent strength and the assumption is generally made that if a void reaches the base of these formations, it will reach the surface.
- 5.4.15 CIRIA C758D⁴ notes that given the limited evidence of structural damage caused by pillar failure, compared with that resulting from roof collapses, engineering assessment of the potential for surface instability has focused on the latter. Failure of roof strata results in the progressive transmission of the void upwards through overlying rock. The extent of 'void migration' can be influenced by factors such as: strata dip; bulking characteristics of the collapsed rock or soil; capability for arching of the collapsed zone; groundwater flow and the presence of strong and intact rock layers with the ability to span that may attenuate the upward movement.
- 5.4.16 The limit height on the void migration, where no appreciable surface subsidence results, is often termed 'acceptable cover', with its determination based upon a criterion reflecting the worked thickness of the seam and the rock cover. The acceptable cover criterion is generally represented as ht , where 'h' is the thickness of rock above the workings expressed as a multiple of t , the worked thickness. This has been a popular approach because the two elements can be reasonably well determined via conventional ground investigation.
- 5.4.17 Most evaluations of required bedrock cover come from the examination of Coal Measures mines. In these, it has been observed that the height of migration in bedrock might, exceptionally, extend to 10 times the height of the original extraction. Consequently, the $10t$ criterion has, for over 30 years, been adopted by the industry as providing reasonable assurance against surface subsidence resultant from roof collapse in old, room and pillar mines. However, collapses might attenuate within a lesser cover and there will be circumstances where using the $10t$ criterion could be considered overly conservative.
- 5.4.18 That said, a Coal Authority Technical Guidance Note⁵ which describes a subsidence event that affected a number of properties on a housing estate in north-east England in 2016, concluded that the 10 times rock cover guidance is only a 'rule of thumb' for crown hole collapses. Other subsidence mechanisms can occur, such as pillar failure, for which the 10 times rock cover rule of thumb is not an appropriate guide.
- 5.4.19 Mitigation of the risks posed by the shallow mineworkings will be required, and this could be achieved in one of two ways:
- Extraction of the remaining coal
 - Consolidation, via drilling & grouting

5.5 Mineral safeguarded areas

- 5.5.1 The site is underlain by **Pennine Middle Coal Measures** and might therefore be considered by the Local Authority to lie within a Mineral Safeguarding Area (MSA).
- 5.5.2 Review of the Barnsley Metropolitan Borough Council Local Map Plan interactive viewing suggests that the site does not lie within a 'safeguarding area'.

⁴ CIRIA C758D:2019. *Abandoned mine workings manual*

⁵ Coal Authority, TGN01/2019. *Findings from a large subsidence event on a residential estate.*

- 5.5.3 However, the site is underlain by **coal** and might therefore be considered to be within a Mineral Safeguarding Area (MSA).
- 5.5.4 MSAs are areas of known mineral resources that are of sufficient economic or conservation value to warrant protection for generations to come. The purpose of MSAs is not to preclude automatically other forms of development, but to make sure that mineral resources are adequately and effectively considered in land-use planning decisions.
- 5.5.5 Specialist guidance on Mineral Safeguarding "A Guide to Mineral Safeguarding in England" has been produced by The Mining Remediation Authority and the British Geological Survey.
- 5.5.6 Chapter 17 of the National Planning Policy Framework (NPPF) requires Local Authorities to facilitate the sustainable use of minerals, and planning policies should:
- Safeguard mineral resources by defining Mineral Safeguarding Areas and Mineral Consultation Areas; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked).
 - Set out policies to encourage the prior extraction of minerals, where practicable and environmentally feasible, if it is necessary for non-mineral development to take place.
- 5.5.7 NPPF Chapter 17 notes that when determining planning applications, local planning authorities should give great weight to the benefits of the mineral extraction.
- 5.5.8 NPPF Chapter 17 states that planning permission should not be granted for the extraction of coal unless:
- a) the proposal is environmentally acceptable, or can be made so by planning conditions or obligations; or
 - b) if it is not environmentally acceptable, then it provides national, local or community benefits which clearly outweigh its likely impacts (taking all relevant matters into account, including any residual environmental impacts).
- 5.5.9 Surface extraction of any resources at this site is considered **very unlikely** to be viable based on the size of the site, and its proximity to adjacent residential properties. Prior extraction of minerals would have the potential to cause unacceptable impacts on neighbouring properties and infrastructure, including noise, air quality, traffic impacts and land stability. However, it would be prudent to seek further advice from a Minerals Surveyor.

5.6 Agriculture

- 5.6.1 Historical plans show that the site has been occupied by arable farmland. Generally farming is not considered likely to have caused significant ground contamination. However, activities such as slurry spreading, the discharge of chemicals to ground, and unregulated burial are known to have occurred on farmland. Potential contaminants associated with farming activity could include any of the following.

Agricultural activity	Potential contaminant
Slurry pits, manure heaps, slurry spreading	Methane, metals, nitrates, oxygen depletion
Plant & animal protection	Pesticides & herbicides
Soil conditioners	Metals, sulphates, PAH
Naturally occurring contaminants	Arsenic, metals

- 5.6.2 Whilst it is likely that pesticides have been applied during arable use of the land, these are not likely to include the persistent organochloride pesticides such as Dieldrin, Aldrin, DDT etc. Pesticides routinely used on arable crops the UK (Phenoxy Acetic acid herbicide or PAAH) rapidly degrade in soils or leach via rainwater infiltration to groundwater. It is highly unlikely these would be detected by soil sampling and therefore it is not proposed to undertake analysis of these.
- 5.6.3 The generation of ground gas in quantities with the potential to impact upon the proposed development would only occur with the presence of significant quantities of organic matter. Ground gas monitoring is not considered necessary unless significant quantities of organic matter are identified during the ground investigation.

6 PREVIOUS INVESTIGATION FINDINGS

6.1 General

- 6.1.1 Honey have provided Lithos with a copy of the following report: Land off Bloomhouse Lane, Darton Geo-environmental site assessment and coal mining risk assessment report (Ref. 301645-01 (00)), issued by RSK in March 2016.
- 6.1.2 The report includes a review of data from a Landmark Envirocheck report and historical OS maps dating back to 1890. Sections 1 to 4 of this Lithos Report include similar content to RSK's report, but with further detail.
- 6.1.3 The site boundary included within the above report is a larger site than what is included in this Lithos report.

6.2 Summary of RSK findings

- 6.2.1 RSK's ground investigation works comprised:
- 24 trial pits (TPs 01 to 24) to between 2.1m and 4.95m depth.
 - 6 rotary boreholes (BHs 1 to 6 & BH3A) sunk to between 9.1m to 31m depth.
 - 8 rotary probeholes sunk to between 9m to 30m depth.
 - Monitoring wells were installed in BHs 6, with response zones sealed in Coal Measures bedrock.
 - Geotechnical classification tests (Atterberg Limits, pH, soluble sulphate etc).
 - Chemical laboratory tests (including metals, PAH, asbestos and TPH).
 - Gas monitoring; 2 visits included, with a further 4 planned, with atmospheric pressures in range 996mb to 1018mb. No significant flows were recorded.
- 6.2.2 Ground conditions encountered by exploratory holes within the current site boundary are summarised in the table below.

Summary of RSK exploratory holes on site

Hole	Final depth	Depth to Base of Made Ground	Depth to Base of					Depth to Pennine Middle Coal Measures Bedrock	Penetration	Groundwater	Remarks
			Made Ground			Natural Ground					
			Concrete	Granular Made Ground	Cohesive Made Ground	Coal	Cohesive Residual Soil				
TP01	3.3	0.3	-	-	0.3	2.7	2.0	2.0	1.3	0.8	Thin Coal seam (0.3m), unlikely to be Top Haigh Moor.
TP02	2.9	0.35	-	-	0.35	0.8	1.2	1.2	1.7	-	Thin Coal seam (0.25m), unlikely to be Top Haigh Moor.
TP03	2.8	-	-	-	-	-	2.3	2.3	0.5	-	
TP04	3.7	0.35	-	-	0.35	1.2, 2.7	1.05, 2.45	2.7	1.0	-	Thin Coal seams (0.15m and 0.25m), unlikely to be Top Haigh Moor.
TP05	2.8	0.6	-	-	0.6	-	1.8	1.8	1.0	-	
TP06	2.3	0.15	0.1	-	0.15	-	0.7	0.7	1.6	-	
TP07	3.3	0.6	0.1	0.6	-	-	1.8	1.8	3.3	-	
TP08	2.9	0.55	0.1	-	0.55	-	-	0.55	1.35	-	
TP09	2.3	0.5	-	-	0.5	-	1.3	1.3	1.0	-	
PH1	13.1	-	-	-	-	-	1.5	1.5	11.6	-	
BH1	9.1	-	-	-	-	6.0	1.5	1.5	7.6	-	Thin Coal seam (0.2m), unlikely to be Top Haigh Moor.
BH2	15	-	-	-	-	11.6, 12.3	1.7	1.7	13.3	-	Likely Top Haigh Moor coal seam (1.1m coal with 0.2m mudstone parting).
BH3	18.0	-	-	-	-	5.2	1.6	1.6	16.4	-	Thin Coal seam (0.2m), unlikely to be Top Haigh Moor.
BH3A	12.0	-	-	-	-	5.2	1.6	1.6	10.4	-	Thin Coal seam (0.2m), unlikely to be Top Haigh Moor.

6.3 Lithos comments

- 6.3.1 The information available from logs and associated testing within those pits that lie within the current site boundary is limited. However, at least some samples have been tested from within the site boundary for geotechnical and chemical parameters. Further testing would be considered necessary to fully characterise the site and allow for appropriate recommendations to be made.
- 6.3.2 The probeholes/boreholes advanced by RSK are not considered sufficient to investigate the potential for shallow mine workings beneath the site. The exploratory holes are positioned at the site boundaries which should see workings at their theoretical shallowest (in the south) and deepest (in the north). Nevertheless, the spacing and spread of exploratory holes is not considered suitable, especially in the western field where underground workings are known to be present beneath the site.
- 6.3.3 Trial pit spacing also follows a similar trend and is widely spread across the site. Further trial pitting would be sensible. The RSK trial pits suggest the site is underlain by a veneer of made ground in the largest field.

7 PRELIMINARY CONCEPTUAL SITE MODEL

- 7.1 Assessment of contaminated land is based on an evaluation of pollutant linkages (Source-Pathway-Receptor).
- 7.2 Historical plans show the presence of a buildings (farmyard and stables) along with a cistern/tank in the centre-east. These features should be targeted during the intrusive investigation.
- 7.3 No potentially contaminative industrial land uses have been identified across the majority of the site and consequently there are no obvious Sources. The site is essentially greenfield, although farming activities, and made ground associated with the concrete hardstand and associated underground storage tank in the southeast, may have given rise to some (likely minor) contamination; see Section 5.6.
- 7.4 A preliminary conceptual site model, presented as Drawing 5624/5 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 6.
- 7.5 Potential contaminant linkages are shown on the preliminary conceptual site model.
- 7.6 The conceptual model will likely be subject to modification in light of data arising from the proposed intrusive ground investigation.

8 LAND CONTAMINATION – PART IIA & PLANNING

- 8.1 Local Authorities have responsibilities with respect to land contamination in the context both of Part IIA of the Environmental Protection Act 1990, and Planning.
- 8.2 The contaminated land regime in Part IIA was introduced specifically to address the historical legacy of land contamination. It applies where there is unacceptable risk, assessed on the basis of the **current** use and the relevant circumstances of the land. It is not directed to assessing risks in relation to a future use of the land that would require a specific grant of planning permission. This is primarily a task for the planning system, which aims to control development and land use in the **future**.

Planning

8.3 The National Planning Policy Framework (NPPF), supported by web-based planning practice guidance, includes the following with respect to contamination and site investigation:

“Where a site is affected by contamination or land stability issues, responsibility for securing safe development rests with the developer and/or landowner”.

8.4 Planning policies and decisions should ensure that:

- The site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses, and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation
- After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the environmental protection act 1990
- Adequate site investigation information, prepared by a competent person, is presented'

8.5 Annex 2 of the NPPF states that 'all investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175⁶)'.

This site

8.6 Underlying Pennine Middle Coal Measures bedrock is classified as a Secondary A aquifer. The nearest surface watercourse is the River Dearne, which flows in a southeasterly direction, approximately c. 290m beyond the site's southwest boundary. Therefore, the site's environmental setting is considered to be of moderate sensitivity.

8.7 With respect to human health, the proposed end use (residential) is also sensitive.

8.8 Whilst current use of the site is considered unlikely to have given rise to any significant ground and groundwater contamination, former use as agricultural land may well have.

9 GROUND INVESTIGATION DESIGN

9.1 Anticipated ground conditions & potential issues

9.1.1 Based on the data reviewed in Sections 4 (Environmental Setting), 5 (Coal & Mining) and 6 (Previous Investigation Findings), anticipated ground conditions are expected to comprise:

Anticipated condition	Remarks
Made ground	Isolated to the area of concrete hardstand in the centre-east. Possible thin veneer of Made Ground across the western field.
Natural soils	A veneer of Topsoil over weathered Pennine Middle Coal Measures bedrock (gravelly Clays).
Bedrock	Anticipated at relatively shallow depth (c. 3.0m) beneath the entire site.
Mineworkings	Anticipated beneath the western half of the site from as shallow as c. 10m in the very southwest and getting increasingly deeper further north (due to dip of coal and topography).
Groundwater	Likely shallow perched water within cohesive drift deposits with true groundwater at depth within bedrock.

⁶ BS10175 (2011) - Code of practice for the investigation of potentially contaminated sites

9.1.2 Based on the data above and that in Sections 2 (Site Description) and 3 (History), potential ground-related issues associated with this site are likely to include:

Type of issue	Specific issue	Remarks
Potential on-site contamination sources	<ol style="list-style-type: none"> 1. Reworked topsoil (inorganics, organics). 2. Former buildings. 3. Former underground tank. 4. Underground mineworkings. 	<ol style="list-style-type: none"> 1. Associated with farming. 2. Inorganics, organics, asbestos & \or ACMs. 3. Leaks/spillages (organics). 4. Hazardous gas.
Potential off-site contamination sources	<ol style="list-style-type: none"> 1. Backfilled features, quarries, opencasts and spoil/slag heaps. 2. Underground mineworkings and shafts. 	<ol style="list-style-type: none"> 1. Hazardous gas. 2. Hazardous gas.
Potential geotechnical hazards	<ol style="list-style-type: none"> 1. Relict buried obstructions and deep made ground. 2. Shallow workings. 	<ol style="list-style-type: none"> 1. Associated with former buildings. 2. Grouting.
Other potential constraints	<ol style="list-style-type: none"> 1. Overhead and underground utilities. 2. Topography. 	<ol style="list-style-type: none"> 1. Easement or diversion. 2. Cut and fill earthworks likely required.

9.2 Ground investigation design & strategy

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

Exploratory holes	Purpose
Twenty Trial Pits	<p>To determine the general nature of soils underlying the site, including the:</p> <ul style="list-style-type: none"> • Nature, distribution and thickness of made ground • Nature, degree and extent of contamination • Proportion of undesirable elements e.g. biodegradable matter, foundations etc • Suitability of the ground for founding structures and highways
Soakaway Testing Within Five Pits	Determine whether soakaways could be utilised for storm water drainage
Sixteen Probeholes	To check for the presence of voids or broken ground associated with known underground workings and possible unrecorded shallow mine workings
Within Eight Probeholes	<p>Install monitoring wells across the site in order to:</p> <ul style="list-style-type: none"> • Monitor for hazardous gas • Determine groundwater levels and assess flow direction

9.2.2 Proposed exploratory hole locations were selected to provide a representative view of the strata beneath the site and to target potential areas of interest identified in Section 7 above. A nominal 45m grid spacing was proposed. Additional exploratory locations might be scheduled by the site engineer in light of the ground conditions actually encountered.

9.2.3 The number of representative samples taken will be reflective of the geological complexity actually encountered. However, in general about 3 samples will be taken from most trial pits.

10 FIELDWORK

10.1 Objectives

- 10.1.1 The original investigation strategy is outlined in Section 9.2 above.
- 10.1.2 Three of the five soakaway tests were not undertaken due to the very boggy surface conditions on site preventing the tractor and water bowser from moving around the site.

10.2 Exploratory hole location constraints

- 10.2.1 As mentioned above the sites surface was very boggy during the intrusive investigation and as such some exploratory hole locations were moved to areas of dryer ground which were more accessible. For example, no rotary probehole was advanced in the northwestern corner due to the rutting and boggy ground.
- 10.2.2 Some areas of the site were very overgrown and as such limited or no access was possible for investigation. This is especially relevant in the area of the former underground tank immediately north of the concrete hardstanding in the southeast, a pit was excavated as close to the location of the former tank as possible (TP111).

10.3 Scope of works

- 10.3.1 Fieldwork was supervised by Lithos between 8th and 12th December 2025 and comprised the exploratory holes listed below.

Technique	Exploratory holes	Final depth(s)	Remarks
Trial Pitting (machine dug)	TPs 101 to 121	1.0m to 3.5m	Vane tests undertaken in cohesive soils.
	SAs 101 & 102	2.5m to 2.7m	Vane tests undertaken in cohesive soils. Soakaway testing undertaken.
Rotary Openhole Probeholes	PHs 101 to 116	18.0m to 37.0m	Drilled to determine to presence/extent of mineworkings within the coal seams beneath the site. Locations focussed on areas of recorded workings in the west and where coal is shallowest (south of the site).
	PHs 101A, 103A, 106A, 108A 109A, 111A, 113A & 115A	4.0m	Drilled a 4.0m hole in proximity to corresponding deeper PH location to allow for the installation of monitoring wells.

- 10.3.2 Notes describing ground investigation techniques, in-situ testing and sampling are included in Appendix A to this report.
- 10.3.3 Exploratory hole logs are presented in Appendices F and G to this Report. These logs include details of the:
- Samples taken
 - Descriptions of the solid strata, and any groundwater encountered.
 - Results of the in-situ testing
 - The monitoring wells installed
- 10.3.4 Exploratory hole locations are shown on Drawing 5624/6 presented in Appendix B; exploratory holes were picked-up by a surveyor and co-ordinates/ground levels are included on the logs.

11 GROUND CONDITIONS

11.1 General

- 11.1.1 A complete record of strata encountered beneath the proposed development site is given on the various exploratory hole records, presented in Appendices F and G.
- 11.1.2 Typical ground conditions encountered at the site are described below in Sections 11.2 (made ground) and 11.4 (natural ground), with a summary provided in the table on page 22 to 24.

11.2 Made ground

11.2.1 The made ground on site is a heterogeneous mixture of materials, and it is unlikely, even with a huge amount of sampling, that it could be accurately characterised. Nonetheless, the bulk of the made ground can be categorised as one of 6 broad types in two areas of the site:

11.2.2 Within the larger western field:

- **Made Ground Topsoil:** Encountered in 12 pits with an average thickness of 300mm and comprising slightly sandy, slightly gravelly Clays with frequent rootlets and rare roots. Gravel of mixed lithologies, rare coal plastic, brick, ceramic, glass and metal.
- **Colliery Spoil:** Encountered 11 pits to between 0.4m and 0.8m depth (average 0.6m) underlying Made Ground Topsoil and comprising a dark grey/black slightly sandy slightly gravelly Clay. Gravels of primarily Coal, dark grey Mudstone.

11.2.3 Underlying hardstand:

- **Concrete:** Encountered in TPs 104 & 110 with a thickness of 100mm comprising 60% matrix and 40% aggregate.
- **Ash & Clinker:** Encountered in TP104 beneath concrete hardstand to 0.3m depth and comprising dark brown sandy Gravel of clinker.
- **Granular Made Ground:** Encountered in TP110 beneath concrete to 0.5m depth and comprising a layer of coarse gravels/ cobbles of possible demolition rubble (bricks, mortar etc.) over a sandy clayey gravel of quartz
- **Cohesive Made Ground:** Encountered in TP104 (beneath concrete hardstand) & 106 (south of western field under Made Ground Topsoil) to 1.2m and 1.0m respectively. Typically comprising slightly sandy slightly gravelly Clays with anthropogenic materials (bricks and stone slabs).

11.2.4 The made ground beneath the site appears isolated to the larger western field (maximum observed depth of 1.0m) and beneath the concrete hardstand in the southeast (maximum observed depth of 1.2m).

11.2.5 Whilst not encountered during this investigation, the possibility of 'burial pits', and/or asbestos sheeting (used as shuttering), and/or fragments of asbestos sheeting within the hardcore beneath concrete slabs, and/or limpet asbestos (often sprayed in older buildings to provide fire protection on steel and reinforced concrete beams/columns and on underside of floors) on the hardcore surface beneath concrete slabs, cannot be entirely discounted.

11.2.6 Tarmac hardstand is present in the southeast of the site, but this is currently being used as an access road to residential dwellings immediately east of the site.

11.3 Obstructions

- 11.3.1 It is apparent from a review of historical OS Plans (see Section 3) and the site visit that buildings have been present on the concrete hardstand in the southeast of the site. Drawing 5624/3 shows the area of hardstand and associated former buildings. Historical mapping also suggests an underground tank is present immediately north of this area of concrete hardstanding.
- 11.3.2 A small section of buried brick wall was encountered in the southern end of TP111 from 0.3m to 0.7m depth. TP111 was excavated as close as possible to the location of a former underground storage tank shown on historical OS mapping, it is considered likely that this brick wall is associated with this former tank.

11.4 Natural ground

- 11.4.1 Natural ground was encountered in the majority of the exploratory holes, and typically comprised the following:
- **Topsoil:** Encountered in 12 pits with an average thickness of 300mm and comprising slightly sandy, slightly gravelly Clays with frequent rootlets and rare roots. Gravel of mixed lithologies, rare coal plastic, brick, ceramic, glass and metal.
 - **Cohesive Residual Soil:** Encountered in all pits apart from TP104 underlying Topsoil or Made Ground to between 1.3m and >3.5m depth, typically comprising stiff slightly sandy, slightly gravelly Clays. Gravel of mudstone, siltstone and sandstone, increasing gravel content with depth.
 - **Granular Residual Soil:** Encountered in 16 pits underlying Cohesive Residual Soils to between 2.5m and >3.5m depth, typically comprising a sandy clayey Gravel of Mudstone, Siltstone and Sandstone.
 - **Pennine Middle Coal Measures:** Encountered in 6 pits from between 1.2m and 2.5m depth (average 1.8m) and comprising moderately strong to strong Siltstone and Sandstone. Pennine Middle Coal Measures bedrock was identified in all probeholes from between 1.3m and 2.0m (average 1.6m depth) comprising interbedded Mudstones, Siltstones and Sandstones with occasional banded Coal beds.

Summary of Ground Conditions - Trial Pits

Hole	Final depth (mbgl)	Depth to Base of Made Ground	Depth to Base of (mbgl)								Depth to Pennine Middle Coal Measures Bedrock (mbgl)	Penetration (m)	Groundwater (mbgl)	Remarks
			Made Ground					Natural Soils						
			Made Ground Topsoil	Colliery Spoil	Concrete	Ash & Clinker / Granular Made Ground	Cohesive Made Ground	Topsoil	Cohesive Residual Soil	Granular Residual Soil				
SA101	2.7	0.6	0.3	0.6	-	-	-	-	2.2	2.7	-	-	-	Soakaway test undertaken.
SA102	2.5	0.8	0.3	0.8	-	-	-	-	1.3	2.5	-	-	-	Soakaway test undertaken.
TP101	1.0	0.6	0.3	0.6	-	-	-	-	1.0	-	-	-	-	-
TP102	3.2	-	-	-	-	-	-	0.3	1.4	3.2	-	-	-	-
TP103	3.3	-	-	-	-	-	-	0.3	1.6	3.3	-	-	-	-
TP104	2.1	-	-	-	0.1	0.3	1.2	-	-	-	1.2	2.1	-	Surface water seepages from 0.5m.
TP105	3.2	0.6	0.3	0.6	-	-	-	-	2.3	3.2	-	-	-	Surface water seepages from 0.5m.
TP106	3.3	1.0	0.3	-	-	-	1.0	-	2.6	3.3	-	-	1.4	Groundwater seepages at 1.4m.
TP107	3.3	0.5	0.3	0.5	-	-	-	-	2.9	3.3	-	-	-	Surface water seepages from 0.4m.
TP108	3.2	-	-	-	-	-	-	0.3	1.2	3.2	-	-	-	-
TP109	3.5	-	-	-	-	-	-	0.5	1.9	3.5	-	-	-	-
TP110	2.9	-	-	-	0.1	0.5	-	-	1.8	2.5	2.5	0.4	-	-
TP111	3.1	-	-	-	-	-	-	0.3	1.8	3.1	-	-	-	-
TP112	2.9	-	-	-	-	-	-	0.4	2.9	-	-	-	-	-
TP113	3.2	-	-	-	-	-	-	0.4	1.3	3.2	-	-	-	-
TP114	2.2	-	-	-	-	-	-	0.4	1.8	-	1.8	0.4	-	Surface water seepages from 0.4m.
TP115	3.0	-	-	-	-	-	-	0.3	2.1	-	2.1	0.9	-	-
TP116	3.2	0.4	0.2	0.4	-	-	-	-	1.4	3.2	-	-	-	-
TP117	2.7	0.4	0.2	0.4	-	-	-	-	1.9	2.7	-	-	-	-
TP118	3.0	0.6	0.3	0.6	-	-	-	-	1.9	3.0	-	-	-	-
TP119	2.8	0.6	0.3	0.6	-	-	-	-	1.2	-	1.2	1.6	-	-
TP120	2.9	0.5	0.2	0.5	-	-	-	-	1.7	-	1.7	1.2	-	-
TP121	3.0	0.4	0.2	0.4	-	-	-	-	1.8	3.0	-	-	-	-

Summary of Ground Conditions - Probeholes

Hole	Final depth (mbgl)	Depth to Base of Overburden / Cohesive Residual Soil	Depth to Base of (mbgl)							Possible Mine Workings	Groundwater (mbgl)	Remarks
			Coal (unnamed seam with Mudstone Bands)	Coal (thickness)	Top Haigh Moor Coal	Top Haigh Moor Coal (thickness)	Low Haigh Moor Coal	Low Haigh Moor Coal (thickness)	Pennine Middle Coal Measures			
PH101	30.0	1.5	-	-	15.0	1.0	24.5	1.5	>30	-	-	-
PH102	30.0	2.0	-	-	17.6	1.0	24.0	1.0	>30	-	-	-
PH103	36.0	1.8	4.8	0.6	24.9	0.8	34.0	1.1	>36	-	-	-
PH104	24.0	1.7	-	-	?	?	-	-	>24	16.4m to 21.0m	-	VOIDS 16.4m to 16.6m and 18.5m to 19.0m. Possible packed workings and collapsed ground in the Top Haigh Moor seam.
PH105	30.0	1.6	-	-	19.0	1.1	27.9	0.7	>30	-	-	-
PH106	36.0	1.5	5.8	1.0	24.6	0.8	32.8	1.0	>36	-	-	-
PH107	33.0	1.8	4.2, 13.8	0.4, 0.4	?	?	?	?	>33	22.1m to 24.0m & 28.3m to 29.9m	-	Possible workings in both the Top and Low Haigh Moor seam.
PH108	33.0	1.5	-	-	24.0	1.2	32.6	0.9	>33	-	-	-
PH109	37.0	1.3	12.9, 13.7, 19.9	0.4, 0.2, 0.3	-	-	-	-	>37	-	22.0	-
PH110	33.0	1.4	8.4, 14.3	0.2, 0.3	22.3	1.3	30.5	1.2	>33	?	-	Soft drilling/possible broken ground from 28.8m to 29.3m.
PH111	32.0	1.5	15.2, 16.3, 21.8, 29.4	0.7, 0.3, 0.8, 0.4	-	-	-	-	>32	-	18.0	-
PH112	33.0	1.5	6.2, 17.3, 26	0.2, 0.3, 0.8	?	?	-	-	>33	31.0m to 31.8m	12.0	Possible workings in the Top Haigh Moor seam.
PH113	33.0	1.3	4.7	0.2	-	-	-	-	>33	?	-	Driller noted softer drilling from 28.0m to 29.0m.
PH114	18.0	2.0	3.2	0.2	-	-	-	-	>18	?	-	Soft drilling/possible broken ground from 15.2m to 15.5m. Likely fractured ground from faulting.
PH115	24.0	1.8	-	-	-	-	-	-	>24	?	-	Soft drilling/possible broken ground from 14.0m to 14.4m and 20.0m to 20.8m. Likely fractured ground from faulting.
PH116	30.0	1.8	6.3	0.3	?	?	-	-	>30	27.5m to 28.5m	-	Possible workings in the Top Haigh Moor seam or fractured ground from faulting.

Hole	Final depth (mbgl)	Depth to Base of Overburden / Cohesive Residual Soil	Depth to Base of (mbgl)							Possible Mine Workings	Groundwater (mbgl)	Remarks	
			Coal (unnamed seam with Mudstone Bands)	Coal (thickness)	Top Haigh Moor Coal	Top Haigh Moor Coal (thickness)	Low Haigh Moor Coal	Low Haigh Moor Coal (thickness)	Pennine Middle Coal Measures				
Monitoring wells – drilled and installed to c. 4.0m depth next to the corresponding deeper PH													
PH101A	4.0	1.5	-	-	-	-	-	-	-	4.0	-	-	Monitoring well installed.
PH103A	4.0	1.8	-	-	-	-	-	-	-	4.0	-	-	Monitoring well installed.
PH106A	4.0	1.5	-	-	-	-	-	-	-	4.0	-	-	Monitoring well installed.
PH108A	4.0	1.5	-	-	-	-	-	-	-	4.0	-	-	Monitoring well installed.
PH109A	4.0	1.3	-	-	-	-	-	-	-	4.0	-	-	Monitoring well installed.
PH111A	4.0	1.5	-	-	-	-	-	-	-	4.0	-	-	Monitoring well installed.
PH113A	4.0	1.3	-	-	-	-	-	-	-	4.0	-	-	Monitoring well installed.
PH115A	4.0	1.8	-	-	-	-	-	-	-	4.0	-	-	Monitoring well installed.

11.5 Visual & olfactory evidence of organic contamination

- 11.5.1 No evidence of organic contamination was encountered in any exploratory hole location during the investigation.
- 11.5.2 Samples of Made Ground and Topsoil were scheduled for chemical testing to determine the nature and extent of the identified contamination, and to confirm the suitability of existing Topsoil for re-use; see Section 12.

11.6 Groundwater

- 11.6.1 Groundwater was encountered at 1.4m in TP106 and within PHs 109, 111 and 112 from between 12.0m and 22.0m depth.
- 11.6.2 At the time of writing, one visit has been undertaken. Groundwater levels recorded in the monitoring wells are summarised below.

Hole	Response zone (depth range & strata)	Groundwater body	Typical standing water level	
			m bgl	m AoD#
PH101A	1.0-1.5 (Cohesive Residual Soil) 1.5-4.0 (Pennie Middle Coal Measures)	Shallow perched (Drift)	3.95	73.81
PH103A	2.0 – 4.0 (Pennie Middle Coal Measures)		3.45	78.52
PH106A	2.0 – 4.0 (Pennie Middle Coal Measures)		3.54	76.95
PH108A	2.0 – 4.0 (Pennie Middle Coal Measures)		2.52	72.73
PH109A	2.0 – 4.0 (Pennie Middle Coal Measures)		1.12	84.36
PH111A	2.0 – 4.0 (Pennie Middle Coal Measures)		3.24	83.74
PH113A	2.0 – 4.0 (Pennie Middle Coal Measures)		3.44	79.21
PH115A	2.0 – 4.0 (Pennie Middle Coal Measures)		Dry	Dry

levelled-in by survey to enable groundwater risk assessment

- 11.6.3 Dip data to date suggests a shallow water table. However, a consistent shallow water table was not identified during the excavation of the trial pits. The majority of soils beneath this site are cohesive and of low permeability, therefore, it is considered that the water levels recorded in the monitoring wells are actually surface water run off (i.e. rain water) from the wet weather of the winter months.
- 11.6.4 After an initial dip to record standing water level, PH109A was bailed-out due to the high level of water (1.12mbgl) and to establish an approximate rate of **recharge**. Findings were:

Hole	Vol. removed /litres	Water level lowered by /m	From / to m bgl	Water level recovered to /m bgl	After / mins	Recovery rate
PH109A	12	2.69	1.12 to 3.81	3.68	40	Moderate

Note: In a 50mm diameter well pipe there is approximately 2 litres of water per metre of water column.

- 11.6.5 It is likely that the water levels could be associated with trapped waters associated with surface water runoff, especially where granular soil is not intersected.
- 11.6.6 These results will be required by the foundation designer, drainage designer, and groundworker (especially if/where deep excavation is required).

11.7 Stability

- 11.7.1 Stability of excavations within natural ground was generally good.

11.7.2 However, stability within greater thicknesses of Made Ground was noted to be poor, as such any excavations within deeper Made Ground may require shoring.

11.8 Mining investigation

Shallow workings (rotary probeholes)

11.8.1 It is clear from the desk study that the site is likely to be underlain by shallow mineworkings associated with the Top Haigh Moor and Low Haigh Moor coal seams.

11.8.2 The conjectured coal outcrops and site geology is shown on Drawings 5624/8 & 5624/9 in Appendix B to this report.

11.8.3 Consequently, a mining investigation has been undertaken, comprising the drilling of 16 rotary open-hole probeholes. The investigation identified coal, soft ground, broken ground and voids as summarised in the table on page 23.

11.8.4 The following probeholes were drilled to determine whether the site is underlain by unrecorded shallow mine workings. The strata encountered are summarised below.

Hole	Final depth (m)	Depth to rockhead (m)	Depth to base of Un-named Seam (m) (thickness)	Depth to base of Top Haigh Moor (m) (thickness)	Depth to base of Low Haigh Moor (m) (thickness)
PH101	30.0	1.5	-	15.0 (1.0)	24.5 (1.5)
PH102	30.0	2.0	-	17.6 (1.0)	24.0 (1.0)
PH103	36.0	1.8	4.8 (0.6)	24.9 (0.8)	34.0 (1.1)
PH104	24.0	1.7	-	? (Possible workings 16.4m to 21.0m)	-
PH105	30.0	1.6	-	19.0 (1.1)	27.9 (0.7)
PH106	36.0	1.5	5.8 (1.0)	24.6 (0.8)	32.8 (1.0)
PH107	33.0	1.8	4.2 (0.4), 13.8 (0.4)	? (Possible workings 22.1m to 24.0m)	? (Possible workings 28.3m to 29.9m)
PH108	33.0	1.5	-	24.0 (1.2)	32.6 (0.9)
PH109	37.0	1.3	12.9 (0.4), 13.7 (0.2), 19.9 (0.3)	-	-
PH110	33.0	1.4	8.4 (0.2), 14.3 (0.3)	22.3 (1.3)	30.5 (1.2)
PH111	32.0	1.5	15.2 (0.7), 16.3 (0.3), 21.8 (0.8), 29.4 (0.4)	-	-
PH112	33.0	1.5	6.2 (0.2), 17.3 (0.3), 26 (0.8)	? (Possible workings 31.0m to 31.8m)	-
PH113	33.0	1.3	4.7 (0.2)	-	-
PH114	18.0	2.0	3.2 (0.2)	-	-
PH115	24.0	1.8	-	-	-
PH116	30.0	1.8	6.3 (0.2)	? (Possible workings 27.5m to 28.5m)	-

11.8.5 Analysing the data obtained from the 16 mining investigation probeholes, it is apparent that:

- The Top Haigh Moor coal seam underlies the entire site from as shallow as 15.0m in the southwest and is between 1.3m and 0.8m thick (average 1.0m).
- The Low Haigh Moor coal seam lies from between 6.4m and 9.5m below the Top Haigh Moor (typically c. 8.4m below) and is between 0.7m and 1.5m thick (average 1.1m).
- A total of 4 probeholes (PHs 105, 107, 112 & 116) identified possible workings in one or both of the coal seams.

- A further 4 probeholes (PHs 104, 107, 112 and 116) encountered broken or fractured ground which could indicate workings, but is more likely fracturing related to the faulting at this site.
- The thickness of competent (rock) cover above the Top Haigh Moor Coal seam is only less than 10 times seam thickness in the southwestern corner of the site (area of the two known adits).

11.8.6 Given the number of probeholes drilled across the site and locations of possible mine workings encountered, it is considered likely that further unrecorded mine workings are present across the site. However, the workings are considered too deep to affect surface stability across much of the site, excluding the southwestern corner where some treatment will be required.

11.8.7 A further 8 probeholes were taken to shallow depth (c. 4.0m) alongside the corresponding deeper probehole to enable the installation of gas monitoring wells.

11.9 Revised conceptual ground model (ground conditions)

11.9.1 The Preliminary Conceptual Site Model has been revised in light of data obtained during the ground investigation, most notably with respect to:

- The nature and distribution of made ground, including the presence of significant buried obstructions
- The strength, nature and depth of underlying natural strata
- The presence of coal and shallow workings
- The nature and distribution of contamination (based on visual/olfactory evidence only)

11.9.2 Further refinement of the Conceptual Site Model is presented in Sections 14.3, where the results of laboratory testing for contaminants have been considered.

12 SOAKAWAY TEST RESULTS

12.1 UK guidance

12.1.1 General notes about soakaways, including their location, design, and Lithos' test methodology are presented in Appendix A.

12.1.2 UK guidance does not explicitly state that soakaways cannot be constructed in made ground, but such construction is not generally considered good practice. There may be a risk of settlement caused by wash out of fine soil particles if soakaway waters are allowed to infiltrate into made ground. Furthermore, UK guidance does state that the soakaways should not be built where the presence of contamination could result in pollution of groundwater.

12.1.3 Given topography it is considered possible that springs will appear down-gradient.

12.1.4 CIRIA C753⁷ recommends that soakaways should not be constructed 'in ground where the water table reaches a level within 1m below the base of the soakaway at any time of the year'.

12.1.5 BRE DG365⁸ "Soakaway Design" advises that each soakaway pit should be filled and allowed to drain three times to near empty on the same or consecutive days.

⁷ CIRIA C753. *The SuDS Manual (2015)*.

⁸ BRE DG365. *Soakaway Design (2016)*.

12.2 Field tests

- 12.2.1 Soakaway testing was carried out in two pits (SA101 & 102), in general accordance with BRE DG365 "Soakaway Design". The locations of the soakaways are shown on Drawing 5624/6 presented in Appendix B to this report.
- 12.2.2 Infiltration rates for each soakaway test have been calculated (where possible) in accordance with BRE DG365. This design takes into account time for the water level to fall from 75% to 25% of its effective depth. The effective depth is the difference between the starting water level and the soakaway pit base depth.
- 12.2.3 Where the water level did not fall to 25% effective depth within c. 4 hours, the test was not considered suitable for calculation of an infiltration rate; this was the case for unsuccessful tests in SA101.
- 12.2.4 Where the water level did not quite reach the 25% effective depth, the data has been extrapolated in order to derive a representative infiltration rate; this was the case for the tests in SA102.
- 12.2.5 Relatively slow drainage meant that only one filling cycle was possible in each of the soakaway test pits.
- 12.2.6 Calculated infiltration rates for each successful test are summarised in the table below, and copies of the associated calculations are presented in Appendix J to this report.

Soakaway	Stratum	Infiltration rate (m/s)	Remarks
SA101	Cohesive Residual Soil: 0.6m - 2.2m Granular Residual Soil: 2.2m - 2.7m	Unable to calculate	Still >90% full after c. 4 hours
SA102	Cohesive Residual Soil: 0.8m - 1.3m Granular Residual Soil: 1.3m - 2.5m	1.31x10 ⁻⁵	Results extrapolated to reach 25% effective depth.

12.3 Discussion & conclusions

- 12.3.1 Drainage Engineers could use the infiltration rates reported above to determine the feasibility of soakaways as a solution for the discharge of surface water run-off.
- 12.3.2 Increasing the soakaway effective depth might offer a solution, but consideration should be given to the cost of excavation (especially given the strong nature of the bedrock).
- 12.3.3 It should be noted that soakaway percolation in bedrock is predominately via joints within the rock mass. The relatively small-scale soakaway test pits may not intercept such joints, and this can result in variable test results. It is possible that the larger surface area associated with soakaway construction during development will intercept such joints; although this cannot be guaranteed.
- 12.3.4 Soakaways are generally only considered to provide a satisfactory solution for the disposal of surface water where the vast majority of tests yield reasonable infiltration rates, which is not the case at this site.
- 12.3.5 Consequently, due to the calculated infiltration rates and the topography of the site, soakaways are **unlikely** to provide a suitable drainage solution; and there may be a need for surface water balancing.
- 12.3.6 Drainage solutions are discussed further in Section 17.8.

13 CONTAMINATION (ANALYSIS)

13.1 General

- 13.1.1 The vast majority of the site has not been the subject of a past potentially contaminative industrial land use. However, historical mapping suggests arable farming has been carried out on the site. Sampling of the topsoil has been undertaken to confirm its suitability for re-use.
- 13.1.2 However, concrete hardstand with known former buildings (barns and stables) along with an underground storage tank was located in the southeast. It is not know what was stored in the tank, but an assumed worst case of fuel was stored within it.
- 13.1.3 The site's former usage is likely to have given rise to at least some (minor) ground contamination. Furthermore, thicknesses of Made Ground were encountered in the majority of exploratory locations across the western field and underlying the concrete hardstand in the southeast.
- 13.1.4 An assessment of potential contaminants associated with the former uses has been undertaken; see Section 7.
- 13.1.5 In the context of risks to human health associated with residential redevelopment, the Tier 1 Soil Screening Values referenced in this report have been derived via the CLEA default conceptual site model (CSM) used for generating SGVs, but amended, where appropriate, to be more specific to redevelopment within the planning process.
- 13.1.6 Where available, Category 4 Screening Levels (C4SL) have also been referenced.
- 13.1.7 Generic Note 04 in Appendix A provides further details with respect to current guidance and the interpretation of analytical data.

13.2 Testing scheduled

- 13.2.1 Based on the above assessment, Lithos submitted a test schedule (summarised in the table below) to a UKAS accredited laboratory.

Type of sample	No. of samples	Determinands
Topsoil	6	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Speciated Polycyclic Aromatic Hydrocarbons (PAH)
	3	Clay/sand/silt content and visible contaminants, sharps (glass etc) to check compliance with BS3882:2015
	1 – Area of Former Tank	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Speciated Polycyclic Aromatic Hydrocarbons (PAH) Speciated Total Petroleum Hydrocarbons (TPH)
Cohesive Residual Soil	1	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Speciated Polycyclic Aromatic Hydrocarbons (PAH) Banded Total Petroleum Hydrocarbons (TPH) Water soluble sulphate, chloride, nitrate and magnesium
	1 – Area of Former Tank	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Speciated Polycyclic Aromatic Hydrocarbons (PAH) Speciated Total Petroleum Hydrocarbons (TPH)

Type of sample	No. of samples	Determinands
Made Ground Topsoil	6	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Speciated Polycyclic Aromatic Hydrocarbons (PAH) Banded Total Petroleum Hydrocarbons (TPH)
Colliery Spoil	6	
Ash & Clinker	1	
Granular Made Ground	1	
Cohesive Made Ground	2	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Speciated Polycyclic Aromatic Hydrocarbons (PAH) Banded Total Petroleum Hydrocarbons (TPH) Water soluble sulphate, chloride, nitrate and magnesium

13.2.2 Account was taken of previous uses of the site with samples taken from as close to the former underground tank as possible.

13.3 Soil contamination results

13.3.1 The soil contamination test results are summarised in the tables on pages 31 to 35.

13.3.2 Laboratory test certificates as received from the laboratory are presented in Appendix H to this report.

Summary of degree of soils contamination (inorganics)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens end-use.												
			pH	As ∞	B~	Cd ∞	Cr x	Cu♣\$	Pb ∞	Hg*	Ni	Se	Vn	Zn\$	Asbestos
				37	5	26	4000	100	200	199	109	434	584	200	
TP104	0.2	Ash & Clinker	8	40	0.2	0.2	9.1	73	120	0.07	30	< 0.5	36	41	N.D.
TP104	0.8	Cohesive Made Ground	8.4	7.2	0.3	< 0.1	23	57	25	< 0.05	30	< 0.5	23	120	N.D.
TP106	0.5	Cohesive Made Ground	7.9	13	0.5	0.2	15	30	51	0.07	18	0.7	28	89	N.D.
TP110	0.7	Cohesive Residual Soil - Under Made Ground	7.2	7.1	0.2	< 0.1	17	27	16	< 0.05	26	< 0.5	20	96	N.D.
TP111	0.8	Cohesive Residual Soil – Area of Former Tank	7	7.6	0.2	< 0.1	15	21	13	< 0.05	24	< 0.5	16	66	N.D.
TP111	0.1	Topsoil - Area of Former Tank	6.6	18	0.5	0.9	17	37	72	0.11	18	< 0.5	26	310	N.D.
TP110	0.2	Granular Made Ground	9.2	9.9	0.3	0.1	12	24	25	< 0.05	20	0.7	23	66	N.D.
SA101	0.1	Made Ground Topsoil	7.6	16	0.8	0.5	21	39	54	0.1	32	0.6	37	140	N.D.
TP105	0.1	Made Ground Topsoil	7.7	15	1.3	0.3	17	32	50	0.08	19	0.6	30	84	N.D.
TP106	0.1	Made Ground Topsoil	8	18	0.7	0.3	17	39	62	0.12	21	0.6	32	95	N.D.
TP116	0.1	Made Ground Topsoil	7.1	26	0.8	0.4	20	57	70	0.14	28	0.6	33	140	N.D.
TP118	0.1	Made Ground Topsoil	7.9	19	0.8	0.3	17	37	50	0.15	21	0.7	32	84	N.D.
TP121	0.1	Made Ground Topsoil	5	25	0.4	0.1	16	55	57	0.15	21	0.8	31	77	N.D.
SA101	0.4	Colliery Spoil	3.8	77	0.5	< 0.1	5.1	40	27	0.27	15	1.8	16	34	N.D.
SA102	0.4	Colliery Spoil	5.8	86	0.6	0.1	8.2	45	23	0.24	32	2.9	12	55	N.D.
TP101	0.4	Colliery Spoil	3.4	72	0.6	< 0.1	5.5	32	27	0.16	6.3	1.6	13	17	N.D.
TP105	0.4	Colliery Spoil	8.3	19	0.7	0.2	16	35	43	0.1	21	0.8	30	81	N.D.
TP107	0.4	Colliery Spoil	6.7	37	0.6	< 0.1	17	60	53	0.15	13	1	27	47	N.D.

Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens end-use.												
			pH	As ∞	B~	Cd ∞	Cr x	Cu♣\$	Pb ∞	Hg*	Ni	Se	Vn	Zn\$	Asbestos
				37	5	26	4000	100	200	199	109	434	584	200	
TP118	0.4	Colliery Spoil	6.2	36	0.8	0.2	15	37	47	0.12	20	1.1	26	70	N.D.
TP103	0.1	Topsoil	7.2	17	0.6	0.3	20	36	52	0.09	23	1	38	100	N.D.
TP108	0.1	Topsoil	7.1	25	0.9	0.4	19	41	68	0.1	24	1.5	29	110	N.D.
TP109	0.1	Topsoil	6.2	15	0.6	0.5	22	39	51	0.08	27	2.2	35	120	N.D.
TP113	0.1	Topsoil	5.7	14	0.4	0.2	14	37	88	0.1	19	<0.5	21	74	N.D.
TP114	0.1	Topsoil	6.8	12	0.6	0.2	20	26	41	0.07	17	0.7	27	77	N.D.
TP115	0.1	Topsoil	6	12	0.5	0.3	20	30	48	0.06	24	1.1	29	99	N.D.
Key			Source of Guidance Trigger Level												
36	Parameter tested for and found to be in excess of Tier 1 concentration		With the exception of those annotated with one of the symbols below (∞, \$, ~), all Soil Screening Values in brackets above have been derived using CLEA v1.06. Values assume contaminants located in a sandy loam, with 6% soil organic matter (SOM).												
179	Parameter tested for and found to be > 5 x Tier 1 concentration														
12	Parameter tested for but not found to be in excess of Tier 1 concentration		∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE\Defra)											
-	Parameter not tested for		\$	Ministry of Agriculture, Fisheries & Food. Code of Practice for Agricultural Practice for the Protection of Soil. 1998											
♣	Tier 1 Value is pH dependent		~												
x	Assumes Cr is CrIII. If demonstrated Cr is CrVI screen would be 21mg/kg														
*	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.		N.D.	Not detected, applicable to asbestos I.D. screen only											

Summary of degree of soils contamination (organics)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg.									
			Trigger Level Concentrations are shown in BLUE and assume a residential with gardens and 600mm cover end use									
			% TOC	Benzene ∞	Toluene	Ethyl Benzene	Xylenes	PAH		TPH - C6 to C40		
								B(a)P ∞	Naphthalene	GRO~ C6 to C10	DRO◇ C10 to C21	LRO C21 to C40
	1	2,048	592	590	25	37	23	218	5000			
TP104	0.2	Ash & Clinker	21	-	-	-	-	0.08	< 0.03	< 0.1	<30	<20
TP104	0.8	Cohesive Made Ground	1.3	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
TP106	0.5	Cohesive Made Ground	4.7	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
TP110	0.7	Cohesive Residual Soil - Under Made Ground	< 0.5	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
TP111	0.8	Cohesive Residual Soil - Area of Former Tank	0.6	< 0.01	< 0.01	< 0.01	< 0.01	< 0.03	< 0.03	<0.05	6.89	5.21
TP111	0.1	Topsoil - Area of Former Tank	7	< 0.01	< 0.01	< 0.01	< 0.01	< 0.03	< 0.03	<0.05	6.97	5.3
TP110	0.2	Granular Made Ground	4.3	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
SA101	0.1	Made Ground Topsoil	7.7	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
TP105	0.1	Made Ground Topsoil	6	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
TP106	0.1	Made Ground Topsoil	7.8	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
TP116	0.1	Made Ground Topsoil	7.7	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
TP118	0.1	Made Ground Topsoil	7.3	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
TP121	0.1	Made Ground Topsoil	7.8	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
SA101	0.4	Colliery Spoil	25	-	-	-	-	< 0.03	0.04	< 0.1	<30	<20
SA102	0.4	Colliery Spoil	16	-	-	-	-	< 0.03	0.17	< 0.1	<30	<20
TP101	0.4	Colliery Spoil	31	-	-	-	-	< 0.03	0.05	< 0.1	<30	<20
TP105	0.4	Colliery Spoil	7	-	-	-	-	0.03	< 0.03	< 0.1	<30	<20

Expl Hole	Depth (m)	Material	Concentrations in mg/kg. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens and 600mm cover end use									
			% TOC	Benzene ∞	Toluene	Ethyl Benzene	Xylenes	PAH		TPH - C6 to C40		
								B(a)P ∞	Naphthalene	GRO~ C6 to C10	DRO◇ C10 to C21	LRO C21 to C40
								1	2,048	592	590	25
TP107	0.4	Colliery Spoil	13	-	-	-	-	< 0.03	0.04	< 0.1	<30	<20
TP118	0.4	Colliery Spoil	9.9	-	-	-	-	< 0.03	< 0.03	< 0.1	<30	<20
TP103	0.1	Topsoil	5.2	-	-	-	-	< 0.03	< 0.03	-	-	-
TP108	0.1	Topsoil	7.2	-	-	-	-	< 0.03	< 0.03	-	-	-
TP109	0.1	Topsoil	4	-	-	-	-	< 0.03	< 0.03	-	-	-
TP113	0.1	Topsoil	7.2	-	-	-	-	0.04	< 0.03	-	-	-
TP114	0.1	Topsoil	4.1	-	-	-	-	< 0.03	< 0.03	-	-	-
TP115	0.1	Topsoil	4	-	-	-	-	< 0.03	< 0.03	-	-	-

Key		Source of guidance trigger level	
60	Parameter tested for and in excess of Tier 1 concentration.	All Soil Screening Values in brackets above have been derived using CLEA v1.06. Values assume contaminants located in a sandy loam, with 6% soil organic matter (SOM). Assumes isolation beneath a minimum 600mm thickness of soil cover, see Generic Notes 04 in Appendix A.	
0.3	Parameter tested for but not in excess of Tier 1 concentration.	~	Assumes all GRO is aromatic fraction C7 to C8.
-	Contaminant not tested for.	◇	Assumes all DRO is aliphatic fraction C10 to C12.
		∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra).

TPH 3-step approach HI calculation table (Steps 2 & 3)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens and 600mm cover end use with 6% SOM.													Hazard Index	
			Aliphatic						Aromatic								
			C5-C6	C6-C8	C8-C10	C10-C12	C12-C16	C16-C21	C21-C35	C5-C7	C7-C8	C8-C10	C10-C12	C12-C16	C16-C21		C21-C35
			58	175	44	218	1058	1000000	1000000	80	23	72	402	1500	1000000	1000000	
TP111	0.8	Cohesive Residual Soil - Area of Former Tank	< 0.01	< 0.01	< 0.01	< 1.50	< 1.20	< 1.50	< 3.40	< 0.01	< 0.01	< 0.01	< 0.90	< 0.50	1.29	1.81	0
TP111	0.1	Topsoil - Area of Former Tank	< 0.01	< 0.01	< 0.01	< 1.50	< 1.20	< 1.50	< 3.40	< 0.01	< 0.01	< 0.01	< 0.90	< 0.50	1.37	1.90	0

Inorganic determinands

- 13.3.3 Of the 25 samples of Made Ground and Natural Ground analysed for inorganic parameters, 20 samples can be classified as uncontaminated, with the following samples being classified as contaminated:
- 1 sample of Topsoil (TP111 @ 0.1m, Area of Former Tank) – Zinc.
 - 1 sample of Ash & Clinker (TP104 @ 0.2m) – Arsenic.
 - 3 samples of Colliery Spoil (SA101, SA102, TP101 all @ 0.4m) – Arsenic.
- 13.3.4 The most common contaminant is arsenic, which was above the trigger level in 3 samples, with another 1 sample (TP107 @ 0.4m) on the trigger level.
- 13.3.5 These samples have been classified by comparison with Tier 1 Soil Screening Values for an end use including domestic gardens and any area where plants are to be grown (the most sensitive of proposed end-uses).
- 13.3.6 **Zinc** is a phytotoxic metal; phytotoxicity describes the inhibitive and toxic effect high concentrations of some substances can have on plant growth.
- 13.3.7 Most substances are harmful to human health at lower concentrations than would be detrimental to plant growth. However, there are three notable exceptions - boron, copper and zinc. Plants are the more sensitive receptor to these elements i.e. detrimental effects are seen in plants at concentrations which do not present a risk to human health. Consequently, for zinc, consideration and protection of flora would also be protective of human health.
- 13.3.8 Allowable concentrations of heavy metals in arable soils are set out in Defra's Code of Good Agricultural Practice 2009⁹. The value for zinc is 200mg/kg, and is based on a continued annual application of heavy metal rich fertiliser (sludge); as such it is not representative of activity in a standard UK garden.
- 13.3.9 Lithos have also derived a value for zinc in relation to risks to human health, using the CLEA model, assuming a residential end use with consumption of home grown produce in a sandy loam soil with 6% SOM. The reported value is 2,170mg/kg, ten times greater than the potential phytotoxic concentration.
- 13.3.10 On balance, given the context of a residential development and the relatively low concentrations recorded, zinc is not considered significant and no special remedial measures are considered necessary.
- 13.3.11 The exceedances of **Arsenic** (within 3 samples of Colliery Spoil, with one other at the trigger level) will need further consideration.
- 13.3.12 Current UK guidance regarding the statistical analysis of soil contamination data obtained during a site investigation is provided by CL:AIRE¹⁰, and uses two-way confidence intervals and graphical summaries, to assist assessors when determining whether or not a dataset is adequate to answer the question posed; e.g. "is existing site topsoil suitable for retention & re-use?". To answer such a question, it is necessary to recover and test a large number of samples (a minimum of 10; ideally 20+) in order to undertake meaningful statistical analysis.

⁹ Defra – Protecting our Water, Soil & Air – A Code of Good Agricultural Practice for farmers, growers and land managers. 2009

¹⁰ CL:AIRE, 2020. Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration.

- 13.3.13 However, in the context of site investigation to assess the significance of contamination on brownfield sites which are typically underlain by heterogenous made ground, some remediation is almost always required (placement of soil cover, excavation of gross contamination etc). Consequently, in such circumstances, it is not usually necessary to demonstrate that made ground soils are “clean” and therefore there is no need to test large numbers of samples and undertake statistical analysis. Heterogenous made ground sample results can simply be compared directly with appropriate screening values (e.g. Lithos Tier 1 values).
- 13.3.14 The difference between the old and new approaches, including how Lithos apply the statistical assessment is detailed in Generic Note 04, included as Appendix A to this report.
- 13.3.15 Typically statistical assessment of made ground is not appropriate as Made Ground is considered too heterogenous. However, Lithos can confirm that statistics assessment of Colliery Spoil is appropriate because the sampling is considered to be representative of the ground type and is not targeted around a source location
- 13.3.16 Statistical analysis assumes that a given stratum is reasonably homogenous in terms of composition, the distribution of contaminants and the degree of contamination; the CSM indicates that this is a reasonable assumption at this site.
- 13.3.17 The Dot and Box Plots are presented in Appendix H and the results are summarised below.

Made Ground – Colliery Spoil

Contaminant	Critical concentration	Mean	Upper confidence level (95%)	Lower confidence level (5%)	Range of 'true' mean	Mean lies above critical concentration (Y/N)
Arsenic	37	54.5	83.1	32.69	32.69 – 83.1	Y

All concentrations are in mg/kg

Notes: Values in **bold** indicate that the true mean range exceeds the relevant Tier 1 value.

n/a = none of the samples retrieved from this made ground type yielded a concentration in excess of the relevant Tier 1 value.

- 13.3.18 Statistical analysis indicates that the true mean for Arsenic in the Colliery Spoil is elevated when compared with relevant Lithos tier 1 screening values.
- 13.3.19 As only a limited amount of Ash & Clinker was encountered statistical analysis is not considered appropriate.

Asbestos

- 13.3.20 No visual evidence of asbestos-containing materials (ACMs), such as broken fragments of asbestos-cement sheeting, was noted during the excavation of trial pits.
- 13.3.21 No asbestos fibres were identified in any of the 25 samples screened.

Organic determinands

- 13.3.22 This site is brownfield and underlain by made ground which has yielded elevated concentrations of a number of inorganic determinands. Consequently, for organic compounds, the Tier 1 Soil Screening Values used in this report have been derived with reference to a CSM that assumes a minimum 600mm of clean soil cover will be placed in gardens/landscaped areas (Lithos Scenario B).
- 13.3.23 Lithos have used the CLEA model to derive risk-based screening values for hydrocarbons, in accordance with the methodology detailed by the TPHCWG, and reviewed by a UK workshop of experts with respect to UK adoption of the method.

- 13.3.24 However, these screening values assume a Soil Organic Matter (SOM) of 6% (equivalent to a TOC of 3.5%). Many organic contaminants are more mobile when the SOM is lower, and consequently comparison of soil results with lower screening values may be required.
- 13.3.25 In order to check the validity of Lithos' Tier 1 Soil Screening Values, the average TOC for each common fill type (beyond any areas of obvious hydrocarbon impact) have been determined.

Fill type	Typical TOC (%)	Comparison of soil results with revised screening value necessary?
Ash & Clinker	21	No.
Cohesive Made Ground	3	Yes, but no significant organic contamination was recorded in this soil type. All determinands well below "6%" screening value; most below limit of detection.
Cohesive Residual Soil - Under Made Ground	0.5	
Cohesive Residual Soil - Area of Former Tank	0.6	No.
Topsoil - Area of Former Tank	7	
Granular Made Ground	4.3	
Made Ground Topsoil	7.4	
Colliery Spoil	17	
Topsoil	5.3	

Hydrocarbons (TPH & PAH)

- 13.3.26 Given the previous uses of the majority of the site and absence of visual/olfactory evidence of any hydrocarbon contamination, only a simple banded TPH (cf. full speciation) was initially scheduled on 23 samples.
- 13.3.27 Assessment of TPH associated with a fuel/oil source would normally be undertaken in accordance with a 3-step approach, (outlined in Generic Note 04 in Appendix A) on fully speciated TPH results. However, although only banded TPH analysis has been scheduled here, none of the fractions exceed their respective Tier 1 criteria, even if it is conservatively assumed all of each fraction is either aliphatic or aromatic.
- 13.3.28 Consequently, no significant petroleum hydrocarbon concentrations have been identified across the majority of the site, and there is no risk to human health from these hydrocarbons.
- 13.3.29 However, potential petroleum sources were identified within the preliminary conceptual model. It is understood that TP111 is located in an area that was previously occupied by an underground storage tank.
- 13.3.30 Any potential hydrocarbon contamination encountered here is therefore likely to be due to leakage or spillage of fuel. Such contamination can be mobile and as such may pose a risk to the environment and human health.
- 13.3.31 Consequently, speciated analysis was scheduled on 2 samples from TP111.
- 13.3.32 Assessment of TPH has been undertaken in accordance with a 3-step approach, (outlined in Generic Note 04 in Appendix A). The first two steps involve review of speciated results. The third step assesses cumulative effects.
- 13.3.33 **Step 1 – Consideration of indicator compounds, (BTEX, naphthalene & B(a)P).** None of the Indicator Compounds exceed their respective Tier 1 criteria, therefore the more toxic / prevalent compounds are below their representative screening value and the next step can be undertaken to consider mixtures within the fractions.

Expl Hole	Depth (m)	Material	Concentrations in mg/kg. Results are quoted to 1 decimal place if <10, and whole numbers if >10.					
			Trigger Level Concentrations are shown in BLUE and assume a residential with gardens and no cover or 600mm cover end use with 6% SOM.					
			GRO			DRO	LRO	
			Benzene	Toluene	Ethyl Benzene	Xylenes	Naphthalene	Benzo(a)pyrene
			1	2.048	592	590	25	37
TP111	0.8	Cohesive Residual Soil - Area of Former Tank	0.6	< 0.01	< 0.01	< 0.01	< 0.01	< 0.03
TP111	0.1	Topsoil - Area of Former Tank	7.0	< 0.01	< 0.01	< 0.01	< 0.01	< 0.03

- 13.3.34 **Step 2 – TPH fractions, does any individual fraction exceed Tier 1?** None of the fractions exceed their respective Tier 1 criteria, therefore the anticipated mixture of hydrocarbons within each fraction is not considered to pose a risk at the site.
- 13.3.35 **Step 3 – Assessing cumulative effects.** The third step of the assessment considers the cumulative risk from all of the fractions identified. This is because each TPH fraction comprises a range of different substances, and a number of these can affect the same 'target organ' (i.e. cause skin irritation or affect the liver), resulting in cumulative effects.
- 13.3.36 The cumulative effect, associated with each source material, has been assessed via calculation of a Hazard Index (HI): HI < 1 indicates no cumulative effects; HI > 1, cumulative risk requires further consideration.
- 13.3.37 HI calculation results are presented in the table on page 35.
- 13.3.38 The HI for all samples is < 1, therefore cumulative risks need not be considered further.

Polycyclic Aromatic Hydrocarbons (PAH)

- 13.3.39 There are numerous PAH compounds. The USEPA identified 16 PAHs that are considered to represent the most problematic in terms of toxicology, fate and behaviour. The UK have also focused on these 16 and these are included in the laboratory report where speciated PAH analysis has been scheduled.
- 13.3.40 Speciated PAH analysis has been undertaken in order to determine concentrations of the key "marker" compounds: benzo(a)pyrene (considered the most toxic of the PAHs); and naphthalene (the most mobile and volatile of the PAHs).
- 13.3.41 Speciated analysis has confirmed the absence of significant concentrations of both benzo(a)pyrene and naphthalene in the soils beneath this site.

13.4 Topsoil

- 13.4.1 Topsoil (typically 400mm thick) is present across most of the site, with Made Ground Topsoil (typically 300mm thick) is present across the western field. Testing suggests this material is chemically suitable for re-use.
- 13.4.2 Given the nature of the topsoil present on this site it would be expected to be suitable to support plant growth. However, see also the advice in Section 18.4.

BS3882 Topsoil testing

- 13.4.3 The presence of visible contaminants, sharps (glass etc) was assessed by the Engineer in the field (inspection of initial trial pit arisings, none were identified. BS3882 considers visual contaminants to comprise 'undesirable potentially injurious foreign object(s) visible to the naked eye'.

13.4.4 The clay/sand/silt content of 2 Topsoil (TPs 103 & 109) and 3 Made Ground Topsoil (TPs 106, 117 & 120) samples have been determined to check compliance with BS3882¹¹ requirements.

13.4.5 The results are summarised below:

Parameter	BS3882 Specification	TP103 @ 0.2m	TP109 @ 0.2m	TP106 @ 0.2m	TP117 @ 0.2m	TP120 @ 0.2m
Retained on 2mm Sieve	< 30%	38	37	29	31	34
Retained on 20mm Sieve	< 10%	33	28	19	20	22
Retained on 50mm Sieve	0%	0	0	0	0	0
Clay Content	5 to 35%	32	30	44	36	30
Silt Content	0 to 65%	50	43	46	49	50
Sand Content	0 to 90%	18	27	10	15	20
Visible Contaminants	< 0.5%	-	-	-	-	-
Texture	-	Silty Clay Loam	Clay Loam	Silty Clay	Silty Clay	Silty Clay Loam

Note: Values in **bold** type fail the required specification for multipurpose topsoil

13.4.6 The results indicate that the Topsoil generally complies with the requirements for multipurpose topsoil, with the following exceptions:

- The fine to medium gravel content of both samples tested exceeded the maximum permissible level (38% & 37% cf. upper threshold of 30%).
- The coarse gravel content of both samples tested exceeded the maximum permissible level (33% and 28% cf. upper threshold of 10%).

13.4.7 The results indicate that the Made Ground Topsoil generally complies with the requirements for multipurpose topsoil, with the following exceptions:

- The fine to medium gravel content of 2 samples tested slightly exceeded the maximum permissible level (31% & 34% cf. upper threshold of 30%).
- The coarse gravel content of all 3 samples tested exceeded the maximum permissible level (19% to 22% cf. upper threshold of 10%).
- The Clay content of 2 samples tested exceeded the maximum permissible level (44% and 36% cf. upper threshold of 35%).

13.4.8 The above results suggest that both the Topsoil and Made Ground Topsoil at this site does not fully comply with the standards set out in BS3882. In terms of textural classification, the topsoil falls into the 'clay' class. This is likely associated with the underlying natural clay soils–from which the topsoil has been derived by weathering, and which is likely to have been mixed with the topsoil by ploughing.

13.4.9 Further advice could be sought from an agricultural soils expert, but at this stage it seems likely that if existing topsoil is retained in proposed gardens, it should be blinded with a minimum 100mm of imported topsoil. Alternatively, it might be possible to blend existing topsoil with sand and manure to generate a more suitable material.

13.4.10 Greenfield sites typically generate a surplus of topsoil, and there might be implications here with export of surplus topsoil to other development sites.

¹¹ BS3882:2015. Specification for topsoil. Published by BSI Standards Limited.

14 CONTAMINATION (QUALITATIVE RISK ASSESSMENT & REMEDIATION)

14.1 Topsoil

14.1.1 Topsoil (typically 400mm thick) is present across most of the site, with Made Ground Topsoil (typically 300mm thick) is present across the western field. Testing suggests this material is chemically suitable for re-use.

14.2 Summary of significant contamination

14.2.1 A veneer of Made Ground Topsoil and Colliery Spoil underlies the vast majority of the western half of the site and appears isolated at most the top 1.0m at most, but generally <0.7m.

14.2.2 The Made Ground Topsoil typically 300mm thick and comprises slightly sandy, slightly gravelly Clays, with the underlying Colliery Spoil typically 300mm thick and comprising dark grey/black slightly sandy, slightly gravelly Clays with frequent gravel of coal.

14.2.3 An area of Concrete Hardstand is present in the southeast of the site and is partially underlain by a thin veneer of Ash & Clinker (0.2m thick) and/or Made Ground (maximum 1.2m deep). Testing suggests the vast majority of the Made Ground in this area is clean.

14.2.4 This Colliery Spoil and Ash & Clinker contain elevated concentrations **arsenic** and coarse gravel/clinker, which would generally be considered undesirable as a near-surface material in garden areas.

14.3 Revised conceptual ground model (contamination)

14.3.1 The Preliminary Conceptual Site Model has been amended in light of data obtained during the ground investigation, most notably with respect to the distribution of made ground and contaminants.

14.3.2 A revised Conceptual Site Model is presented as Drawing 5624/7 in Appendix B. The Model includes the contaminants described in Section 14.2 above, and potential contaminant linkages (summarised below in Section 14.5) to receptors.

14.4 Environmental setting & end use

14.4.1 It is apparent from Section 14.2 above, that only limited contamination has been identified to date in the soils beneath this site. However, a supplementary investigation will be required post vegetation clearance in the area of the former underground tank immediately north of the concrete hardstand in the southeast.

14.4.2 As discussed in Section 14.2 above, contamination exists in the Colliery Spoil beneath the western side of this site. In order to assess the significance of this contamination, consideration must be given to the site's environmental setting and the proposed end use.

14.4.3 The underlying Pennine Middle Coal Measures bedrock is classified as a Secondary A aquifer. The nearest surface watercourse is the River Dearne, which flows in a southeasterly direction, approximately 290m beyond the site's southwestern boundary. Therefore, the site's environmental setting is considered to be **moderate sensitivity**.

14.4.4 With respect to human health, the proposed end use (residential) is considered sensitive.

14.4.5 Transient risks to construction workers can be addressed by the adoption of appropriate health and safety measures, see Section 18.7.

14.5 Contaminant linkages

14.5.1 In terms of a proposed redevelopment of this site, plausible contaminant linkages can be summarised as follows.

Contaminants

14.5.2 Contaminants have been summarised in Section 14.2 above.

Pathways

14.5.3 Potential contaminant pathways include:

- Ingestion
- Inhalation of contaminated particulates
- Surface water run-off, including existing drainage infrastructure
- Downward infiltration of leachable/mobile contaminants to groundwater
- Gas migration

Receptors

14.5.4 Potential contaminant receptors include:

- The environment – bedrock aquifer
- End users of the site (residents)

14.5.5 It can be concluded that there are plausible pathways between the soil contaminants summarised in Section 14.2 above and potential receptors. Consequently, some remediation will be required; either treatment/removal of the contaminant, or "breakage" of the pathway.

14.6 Potential remediation options

General

14.6.1 Given the constraints discussed in Section 10.2 (vegetation), a simple post vegetation clearance trial pit investigation will be required before definitive recommendations are provided regarding the underground storage tank. However, at this stage (no visual/olfactory evidence and no significant concentrations identified in samples taken close to the location of the former underground storage tank) it is considered unlikely that anything more than placement of soil cover in garden areas will be required.

14.6.2 Approval of the recommendations given below should be sought from the appropriate regulatory authorities prior to commencement of site redevelopment.

Soil cover

14.6.3 As discussed in more detail below, the presence of **arsenic** will necessitate placement of a **600mm** thick surface cover of "clean" soil in garden/landscaped areas where the Colliery Spoil or Ash & Clinker remains.

14.6.4 In areas covered by hardstand, or floor slabs (buildings) contaminants will be satisfactorily isolated from end users.

14.6.5 New utilities should be laid in trenches reinstated with 'clean' backfill in order to prevent exposure to maintenance workers in the future.

Inorganic contamination

- 14.6.6 The Colliery Spoil in the western half of the site has yielded elevated concentrations of arsenic. Therefore, where residual Colliery Spoil remains beneath garden areas (i.e. not beneath hardstanding) a 600mm thick surface cover of "clean" soil comprising 450mm subsoil and 150mm topsoil is recommended, reducing to 450mm in landscaped areas (300mm subsoil and 150mm topsoil).
- 14.6.7 This cover will break potential contaminant linkages between the contaminated made ground and future end-users.
- 14.6.8 Given the amount of Made Ground and Ash & Clinker encountered beneath the concrete hardstand it is considered suitable and most appropriate for redistribution beneath concrete oversite or areas of hardstanding, where they would be satisfactorily isolated from end users.

Organic contamination

- 14.6.9 No areas of gross organic contamination were encountered during the site works. However, localised areas of more onerous contamination than that identified to date may be present on site.
- 14.6.10 However, given the comments made in Sections 10.2 (fieldwork constraints) and 13 (presence of a former underground storage tank), it would be prudent to allow for the off-site disposal of some grossly contaminated soil. Further advice should be sought from a specialist contractor, with experience of brownfield remediation, regarding an appropriate contingency.

14.7 Summary of potential contaminant linkages & mitigation

- 14.7.1 In terms of the proposed redevelopment plausible contaminant linkages, and feasible remediation options, can be summarised as follows:

Receptors	Pathways	Contaminants	Plausible contaminant linkage? (and remediation options where required)
Human health (Future residents) ◇	Consumption of contaminated vegetables	Arsenic in the Colliery Spoil/ Ash & Clinker	Isolation beneath at least 600mm clean soil cover in gardens reducing to 450mm in landscaped areas/isolation beneath hardstand.
	Ingestion		
Buildings	Migration & accumulation of explosive gas	Methane	To be assessed on completion of monitoring and gas risk assessment.

◇ transient risks to construction workers will be addressed by the adoption of appropriate health and safety measures in accordance with the Health and Safety at Work Act 1974 and regulations made under the Act including for example the COSHH Regulations.

14.8 Waste classification

- 14.8.1 Disposal of the made ground off site is generally not considered appropriate, economically viable, nor in line with current Government philosophy regarding sustainable development. However, some excess arisings may be generated by excavations for foundations, sewers etc. Disposal to landfill (or an appropriate soil / aggregate transfer station) may be the most practical solution, if redistribution and retention on site is not feasible.
- 14.8.2 Following excavation and stockpiling, sampling will be required prior to disposal.

- 14.8.3 As there is no WRAP protocol for soils, the characterisation, sampling and classification of soils arising from brownfield sites has been incorporated within the Environment Agency's Technical Guidance WM3¹². Classification of soils as non-hazardous or hazardous in accordance with WM3 is quite a complex process, although it ultimately results in a simple classification as hazardous or non-hazardous. Note: inert is not a class under WM3; WAC testing is required to determine whether a waste soil can be considered inert.
- 14.8.4 If waste soil is classed as hazardous following classification under WM3, and destined for landfill, waste acceptance criteria (WAC) leachate testing will need to be undertaken. Similarly, if waste soil destined for landfill is classed as non-hazardous under WM3, and suspected to be inert, WAC leachate testing will need to be undertaken. However, non-hazardous soil waste can go to a non-hazardous landfill facility; no further testing (e.g. WAC) is required.
- 14.8.5 WAC analysis is different to the 'routine' laboratory testing (such as that included earlier in this Section) undertaken in order to determine hazardous properties. Lithos typically only include WAC analysis if significant off-site disposal (of soil classified as hazardous waste) is anticipated.
- 14.8.6 It is critical if material is to be exported from site that this is allocated an appropriate waste code, following the steps within WM3. Waste carriers transporting, and sites accepting, this material should have a corresponding code within their permits. It is the responsibility of those generating the waste (i.e. the Developer), to ensure that the waste is handled and disposed of appropriately.
- 14.8.7 Soil treatment facilities (STFs) provide an alternative to landfill. STFs are regulated by the Environment Agency and allow soils to be treated and screened (effectively recycled to be used at other sites). Export to an STF does not require WAC testing and suitability of various soil types will be dependent on material waste codes, which may be allocated after consideration of the data in Section 14 but will often need supplementing with further testing after soils have been stockpiled (see also advice in Section 18.3).
- 14.8.8 Most STFs are permitted to accept soils with waste code 17 05 04 (i.e. soils which do not exhibit hazardous properties). Lithos has a list of permitted STFs and can help identify one local to this development site.
- 14.8.9 As discussed in Section 11.2, tarmac hardstand is present along a private access road in the southeast.
- 14.8.10 This **tarmac** could be recycled and crushed to yield a 6F3 selected granular material, provided the recovered bitumen content is less than 10% (determined in accordance with BS598-1¹³). Crushed tarmac could also be blended with crushed concrete etc to generate 6F2 graded material. 6F2 can contain up to 50% recycled tarmac/asphalt (provided it does not pose a contamination risk to controlled waters and, if the proportion of asphalt is greater than 20%, the recovered bitumen content is less than 2%). Crushed tarmac should not be placed beneath proposed gardens or landscaped areas.
- 14.8.11 However, if off-site disposal is anticipated, tarmac assessment is based on the amount of coal tar present, this will vary depending on the age of the tarmac. The assessment is based on the amount of benzo(a)pyrene and has a concentration limit of 50mg/kg.
- 14.8.12 No sampling or testing of this Tarmac has been undertaken.

¹² Technical Guidance WM3 – Guidance on the classification and assessment of waste. Environment Agency 2015

¹³ BS598 (2003) Sampling and examination of bituminous mixtures for roads and other paved areas.

15 HAZARDOUS GAS

15.1 General

15.1.1 Consideration of the conceptual site model and potential linkages has enabled a preliminary qualitative assessment of risks associated with gas:

Source	Receptors	Hazard	Pathway	Initial risk
On-site made ground	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Low: made ground essentially inert, with little degradable matter
	Buildings	Explosion		
Shallow mineworkings & off site backfilled features	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Low: no significant thickness of low permeability drift or bedrock above workings
	Buildings	Explosion		

15.1.2 Given the above gas monitoring wells have been installed in 8 shallower probeholes across the site. Details of the installations are given on the probehole logs presented in Appendix G to this the report.

15.1.3 The generation potential of the gas source was initially considered to be Low. Consequently, in accordance with CIRIA Report C665¹⁴, given the proposed residential end use, 9 visits have been scheduled over a 6-month period.

15.2 Scope of works

15.2.1 To date, the wells have been monitored on one occasion for groundwater levels and soils-gases, and the results are presented in Appendix K.

15.2.2 A standard procedure was followed, in accordance with CIRIA guidance:

- Ambient oxygen concentration
- Atmospheric temperature & pressure
- Methane, oxygen and carbon dioxide concentrations and flow rates using a Gas Data GFM436 infra-red gas analyser
- Standing water level using a dipmeter
- Ambient oxygen concentration (check for instrument drift)

15.3 Monitoring results

15.3.1 The results of the monitoring completed to date are summarised below.

Well	Response zone (m)	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
PH101A	1.0-1.5 (Cohesive Residual Soil) 1.5-4.0 (Pennie Middle Coal Measures)	ND	1.9	ND
PH103A	2.0 – 4.0 (Pennie Middle Coal Measures)	ND	1.7	ND
PH106A	2.0 – 4.0 (Pennie Middle Coal Measures)	ND	1.7	-18.3

¹⁴ CIRIA C665: Assessing risks posed by hazardous ground gases to buildings (2007).

Well	Response zone (m)	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
PH108A	2.0 – 4.0 (Pennie Middle Coal Measures)	ND	0.9	ND
PH109A	2.0 – 4.0 (Pennie Middle Coal Measures)	ND	2.1	6.8
PH111A	2.0 – 4.0 (Pennie Middle Coal Measures)	ND	ND	ND
PH113A	2.0 – 4.0 (Pennie Middle Coal Measures)	ND	1.0	ND
PH115A	2.0 – 4.0 (Pennie Middle Coal Measures)	ND	2.2	ND

Note: ND – None detected

15.4 Discussion (methane & carbon dioxide)

15.4.1 One round of monitoring has been undertaken and has found the following:

- No recorded methane.
- A maximum CO₂ concentration of 2.2%.

15.4.2 Generic Note 05 in Appendix A outlines how monitoring results are interpreted.

15.4.3 A hazardous gas risk assessment incorporating all of the results will be issued on completion of monitoring in June 2026.

15.5 Radon

15.5.1 Requirements with respect radon measures are set out in Building Regulations Approved Document C. Probability bandings (based on the proportion of properties in a given area that exceed the Action Level; currently 200 Bq.m⁻³) are used to determine whether a property requires no, basic or full measures.

15.5.2 At present Approved Document C advocates basic measures for the probability banding 3% to 10% (full measures if >10%). However, the UK Health Security Agency (HSA) would like to see all new build include basic measures.

15.5.3 In December 2022, the British Geological Survey (BGS), deployed a revised dataset which increased accuracy and also the number of properties falling within radon affected areas. This revised dataset is now referenced by maps on the HSA website.

15.5.4 Information from BGS Radon Report indicates that the majority of the site (**centre and north**) lies in an area where **less than 1%** of homes are estimated to be above the action level.

15.5.5 As such, **no** special precautions against radon are required across the centre and north.

15.5.6 However, the BGS Radon Report indicates that sections in the **south of the site** are within an area where **5% to 10%** of homes are estimated to be above the action level, and **basic** radon protection measures are required in new dwellings.

- 15.5.7 Basic radon measures comprise a radon resistant barrier* (membrane) laid within the floor construction and across the wall cavity in accordance with BRE211:2023¹⁵. The joints between the sheets that form the membrane and cross the cavity **must** be sealed, along with all service penetrations, to make the construction as airtight as possible. A separate cavity tray should be installed in the cavity one brick course above the radon membrane. In order to withstand the installation and follow on construction process membranes should be no less than 400 microns thick.¹⁶
- 15.5.8 BRE211:2023 highlights the importance of good practice and a high standard of workmanship to ensure radon membranes are installed to a high standard.
- 15.5.9 A building site is a harsh environment and barriers can easily become damaged during construction by operatives or equipment moving across or working over a completed section of barrier. As a consequence, where there is a risk of puncturing the membrane, it should be ensured that the membrane is well protected with sand or lean mix concrete before advancing construction.
- 15.5.10 The radon protection system should be subject to inspection and verification by a third party inspector that has a full understanding of all elements of the radon protection system.
- 15.5.11 Verification should be carried out at a minimum frequency of 1 in 10 plots where groundworkers carry out installation, and 1 in 20 plots where accredited installers are used. Plots selected for inspection should be located across the development and not clustered.

¹⁵ BRE Report BR211, 2023: "Radon: guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects)"

* Confirmation of resistance to radon must be obtained from the manufacturer.

¹⁶ BS8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. January 2019.

16 GEOTECHNICAL TESTING

16.1 General

- 16.1.1 A total of 19 samples of Cohesive and Granular Residual Soil (to confirm these deposits are non plastic) were delivered to a suitably accredited laboratory with a schedule of geotechnical testing drawn up by Lithos.
- 16.1.2 The geotechnical laboratory test results are presented in Appendix I to this report.

16.2 Atterberg limits

- 16.2.1 The plasticity indices of the 19 samples of soil have been determined; results are summarised below.

Soil type	No. samples tested	Moisture content range % (average)	Range of Plasticity Indices % * (average)	Shrinkability
Cohesive Residual Soil	16	12.6 – 44.5 (23.3)	18 – 67 (33)	Medium
Granular Residual Soil	3	9.8 – 12.3 (10.8)	-	Non Plastic

* Modified where appropriate in accordance with Chapter 4.2 of the NHBC Standards BRE Digest 240 (Low-rise buildings on shrinkable clay soils).

Note. The term Shrinkability is equivalent to the term Volume Change Potential used in Chapter 4.2.

- 16.2.2 For the purposes of foundation design, it is recommended that all cohesive soils be regarded as being of **Medium** shrinkability.
- 16.2.3 The 3 samples of Granular Residual Soil tested confirm that the granular soils are non shrinkable.

16.3 Particle size distribution

- 16.3.1 The grading of 1 sample of gravelly, very clayey Sand (Granular Residual Soil) was determined by wet sieving and the results are summarised in the table below:

Sample & depth	Field description	% passing 37.5mm sieve	% passing 20mm sieve	% passing 2mm sieve	% fines	Material description (based on grading & plasticity)
TP121 @ 2.6m	Gravelly, very clayey SAND	100	93	81	70	Slightly sandy, slightly gravelly CLAY

- 16.3.2 Fines (silt and clay) were found to comprise 70% of the material sampled. Therefore, where any marginal granular soils (very clayey Sands) encountered on this site can therefore be regarded as shrinkable.

16.4 Soluble sulphate and pH

- 16.4.1 In accordance with BRE SD1¹⁷, this site has been classified as brownfield with a mobile groundwater regime.
- 16.4.2 It is envisaged foundations will extend to depths of about 1m through both Made Ground and Natural Ground, samples taken from this depth range have been submitted for pH and water-soluble sulphate (2:1 soil/water extract).

¹⁷ BRE Special Digest 1 (2005) – Concrete in aggressive ground.

- 16.4.3 The concentrations of sulphate in the aqueous natural soil extracts of 21 samples were determined. In addition, 2 samples of Cohesive Made Ground were tested as part of the contamination suite. The pH value of each sample has also been determined.
- 16.4.4 The highest water-soluble sulphate concentration and the lowest pH value for each soil type analysed are shown in the table below.

Soil type	No. samples tested	Lowest pH values	Highest soluble sulphate concentration (mg/l)
Cohesive Residual Soil	11	4*	1500
Granular Residual Soil	6	5.8	280
Pennine Middle Coal Measures	4	5.6	260
Cohesive Made Ground	2	7.9	120

* Indicates the pH value is lower than 5.5.

Granular Residual Soil, Pennine Middle Coal Measures & Cohesive Made Ground

- 16.4.5 The pH values for Granular Residual Soil, Pennine Middle Coal Measures and Cohesive Made Ground were all above 5.5, therefore concentrations of chloride and nitrate are considered insignificant.
- 16.4.6 In accordance with Tables C1 and C2 of SD1, sub-surface concrete should be Design Sulphate Class **DS-1**, with the site allocated an ACEC Classification of **AC-1**.

Cohesive Residual Soil

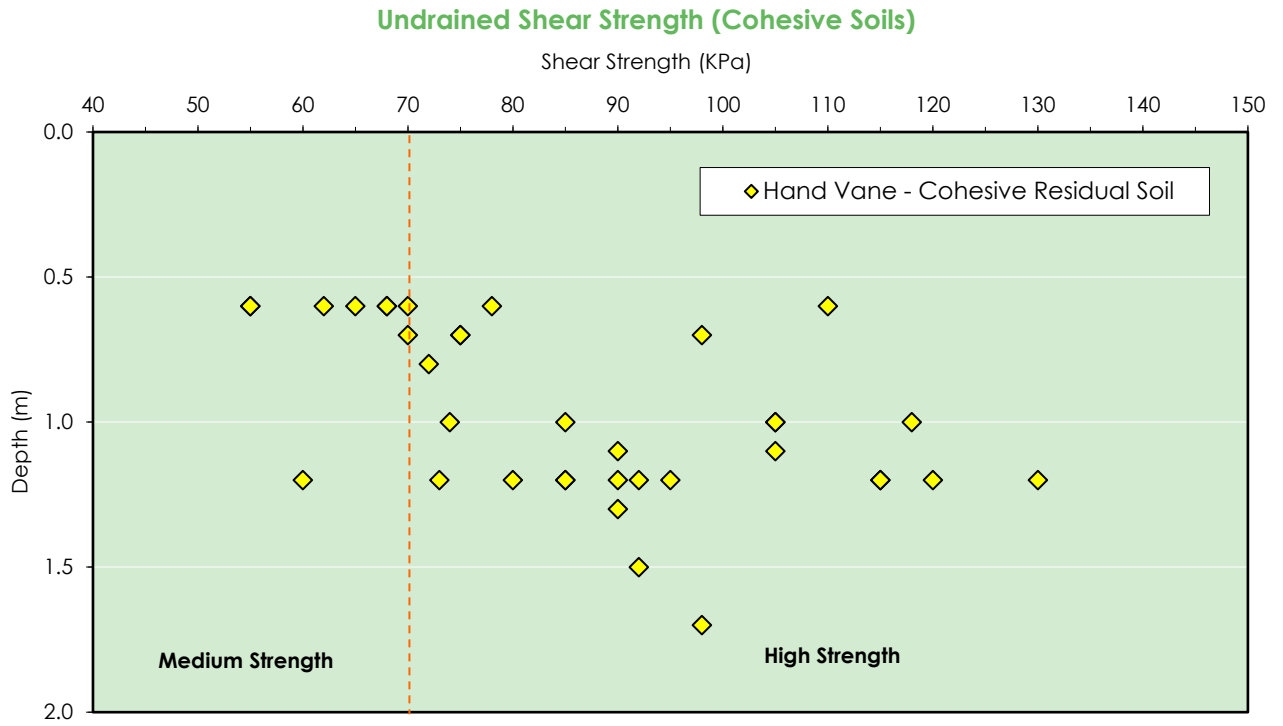
- 16.4.7 In total, 3 out of the 11 Cohesive Residual Soil samples yielded pH values below 5.5, therefore supplementary analysis to determine the concentrations of magnesium, chloride and nitrate has been scheduled.
- 16.4.8 The 3 samples yielded magnesium of less than 100mg/l, with chloride and nitrate results of less than 10mg/l, and consequently the equivalent sulphate concentrations are negligible.
- 16.4.9 In accordance with Tables C1 and C2 of SD1, sub-surface concrete should be Design Sulphate Class **DS-2**, with the site allocated an ACEC Classification of **AC-1** for the Cohesive Residual Soils.

16.5 Undrained shear strength testing

Hand shear vane testing

- 16.5.1 Hand shear vane testing was undertaken within trial pits in-situ to around 1.2m depth and from larger blocks of excavated clay below that depth.
- 16.5.2 The results are summarised within the plot below and illustrate a linear increase in undrained shear strength (S_u) with depth within the Cohesive Residual Soil. Below approximately 0.5m depth S_u is typically greater than 65kPa.

16.5.3 The plot below provides a summary of undrained shear strengths.



17 GEOTECHNICAL ISSUES

17.1 Conceptual site model

- 17.1.1 Underlying natural ground conditions typically comprise medium to high strength Clays (Cohesive Residual Soils) over clayey Gravel (Granular Residual Soils) or directly onto Pennine Middle Coal Measures at relatively shallow depth.
- 17.1.2 A thin veneer of Colliery Spoil and overlying Made Ground Topsoil (c. 300mm thick) is present across the western field to depths of between 0.4m and 0.8m depth (average 0.6m).
- 17.1.3 An area of concrete hardstand is present in the southeast, underlain by Made Ground (Cohesive, Granular and Ash & Clinker) to a maximum depth of 1.0m. A section of tarmac road is present to the south of this hardstand.

17.2 Mining & quarrying

- 17.2.1 The majority of the site is located within a Coal Mining Development Low Risk Area (within the defined coalfield, but no known defined risks have been recorded by the Mining Remediation Authority; there may still be unrecorded issues). However, the west of the site lies within a High Risk Area.
- 17.2.2 There is known underground workings beneath the north and west of the site, with probable unrecorded shallow mineworkings. In addition to an area of known opencast immediately north and two adits oriented as such that they underly the site.

Shallow mineworkings

- 17.2.3 CIRIA SP32¹⁸ suggests voids resulting from mineral extraction are unlikely to migrate more than 10 times the seam thickness through competent bedrock. CIRIA C758D¹⁹ notes that the use of this 10 times 'rule-of-thumb', as the design basis for treatment depth, has been observed to be successful over many years for a wide range of mineworkings and overlying rock/soil strata scenarios. However, consideration must always be given to site specifics such as nature of roof strata, strata dip, groundwater, extraction ratio etc.
- 17.2.4 Mitigation against the risk of subsidence associated with the shallow mineworkings will be required across about 15% of the site's total area, as shown on Drawing 5624/13 in Appendix B. This will likely involve consolidation by drilling and grouting, although consideration could also be given to coal extraction (see Section 18.8).
- 17.2.5 Based on the findings of this investigation and the anticipated nature of the workings, it is considered that the necessary consolidation (grouting) would require drilling holes on a 6m grid with a centre hole (4.25m grid). A viscous grout composed of appropriate proportions of OPC, PFA, sand or pea gravel would then be injected into the workings via these holes.
- 17.2.6 Further holes would need to be drilled in areas of high grout take (to confirm filling of void space), and in areas where several adjacent holes encountered solid coal (to confirm that the local area is underlain by no workings, rather than pillars).
- 17.2.7 Drilling and grouting operations should be carried out with engineering supervision and be undertaken in accordance with a revision of Lithos' "General Specification for the Treatment of Shallow Mineworkings" tailored to the site-specifics.

¹⁸ CIRIA SP32 (1984) - Construction over abandoned mine workings

¹⁹ CIRIA C758D (2019) - Abandoned mine workings manual

17.3 Site regrade and/or ground improvement

- 17.3.1 At the time of writing, proposed finished floor levels (FFL), finished road, or garden & driveway levels and gradients have not been finalised. However, given existing topography (much of the site is sloping, with gradients of up to 1 in 15 in the centre-west and southwest), some site regrade is anticipated, with the need for underbuild and possibly retaining walls.
- 17.3.2 Careful consideration will need to be given to earthworks design, and implications for slope stability, retaining walls, foundations, highway gradients and drainage
- 17.3.3 Any digital terrain modelling undertaken, or commissioned, should consider implications for the foundation recommendations outlined below.
- 17.3.4 Natural ground underlying this site is often clayey, therefore consideration should be given to the implication of undertaking earthworks in poor/wet weather when the ground surface is likely to become difficult to cross with heavy machinery.
- 17.3.5 Wherever possible, Lithos recommend that excavated soils are retained on site. However, if this is not possible the comments in Section 14.8 should apply.

17.4 Excavations

- 17.4.1 Based on the results of the investigation it is considered unlikely that major groundwater flows will be encountered in shallow excavations. Nonetheless, groundwater should be controlled in accordance with CIRIA Report R113²⁰.
- 17.4.2 Excavations should remain stable in the short term but if left open for any significant period of time may require shoring most notably in granular soils and made ground.
- 17.4.3 Bedrock was encountered in several exploratory holes. Based on the exploratory hole logs, excavation greater than 2.0m is likely to prove difficult across areas where bedrock was encountered at shallower depth (southwest and centre-east). Any deep excavations such as those that may be required for drainage etc will encounter hard rock; a breaker may be required.

17.5 Foundation recommendations

General

- 17.5.1 Foundation recommendations assume that development will be of two or three storey construction and that line loads will not exceed 90kN/m run. If this is not the case significant alteration to these recommendations will be required.
- 17.5.2 Further investigation should be commissioned if any apartment blocks with higher line loads (say >120kN/m run) are proposed. Such investigation would include cable percussion boreholes and geotechnical analysis (triaxial and oedometer testing) of recovered, undisturbed samples.
- 17.5.3 Given existing topography some regrade is anticipated. Any digital terrain modelling undertaken, or commissioned, by Honey should consider implications for the foundation recommendations outlined below.
- 17.5.4 Foundation depths (and types) will depend on thicknesses of fill following the anticipated earthworks regrade.

²⁰ CIRIA Report R113 (1986) - Control of Groundwater for Temporary Works.

- 17.5.5 Made Ground is not considered a suitable foundation material and foundations should therefore be taken through these materials into underlying natural strata of adequate bearing capacity.
- 17.5.6 Honey or their groundworker should seek further advice from Lithos if unexpected ground conditions are encountered in foundation or sewer excavations, including any conflict between soft ground associated with a backfilled trial pit excavation and the line of a proposed footing.
- 17.5.7 In accordance with Tables C1 and C2 of SD1, sub-surface concrete should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-1 for Granular Residual Soil, Pennine Middle Coal Measures and Cohesive Made Ground.
- 17.5.8 However, for the Cohesive Residual Soil a sub-surface concrete should be Design Sulphate Class DS-2, with the site allocated an ACEC Classification of AC-1.
- 17.5.9 Even after consolidation, foundations should be “beefed-up” to accommodate any potential time dependant differential settlement.
- 17.5.10 Further advice regarding reinforcement should be sought from the appointed Structural Engineer, but in the meantime, reference should be made to the table below.

Rock cover above grouted seam	Preferred Foundation
<5 x seam thickness ²¹	Raft - designed to span 3m over potential soft spots and cantilever 1.5m at corners. Either stiffened, flat-bottomed rafts a minimum of 300mm thick, on 450mm of compacted Type 1 material, with reinforcement top and bottom. Or, rafts could be of 300mm concrete with a 150mm upstand to allow for wall construction provided that the base of compacted type 1 material lies at a depth of at least 600mm
>5 x seam thickness – 10m	Strip footing OK, but thickened (300mm), and reinforced top and bottom
>10m	Strip footing OK, but needs to be 300mm thick reinforced with one layer of mesh

- 17.5.11 Given the depth to coal in the area of consolidation, it is considered likely that only the >5 – 10m and >10m foundation solutions outlined in the table above will be needed.
- 17.5.12 However, areas in the far southwest could fall into the <5 seam thickness category and could require raft foundations.

Strip/trench fill footings

- 17.5.13 It is considered that shallow strip or deepened trench fill footings will be the most suitable foundation solution for two or three storey houses constructed at the site. Footings will be founded in primarily Cohesive Residual Soil (medium to high strength Clays), with some in Granular Residual Soil or shallow competent rock.
- 17.5.14 Reinforcement, as a precaution against differential settlement, is recommended only where foundation excavations encounter significant lateral and vertical variations in strata. One layer of B385 mesh placed 75mm above the base of the footing is likely to provide suitable reinforcement, but further advice should be sought from the Structural Engineer.
- 17.5.15 Foundations of plots placed over relict foundations (associated with former buildings in southeast, now demolished) should be taken to greater depth than the relict foundations and into natural ground of adequate bearing capacity.

²¹ See s5.6 of *Structural Foundations Manual (M F Atkinson) 2nd Ed.*

- 17.5.16 Foundations will be required to be placed below a line drawn up at 45° from the base of any service or similar excavation.
- 17.5.17 Deepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.3.
- 17.5.18 In order to minimise softening and swelling of cohesive soils or loosening of granular soils, it is recommended that footings are cast as soon as formation level is reached (or alternatively formation could be blinded using concrete with as low a water:cement ratio as possible).

Cohesive Residual Soils (completely weathered bedrock)

- 17.5.19 Atterberg tests suggest that natural cohesive soils at the site are of medium shrinkability. A minimum founding depth of 900mm (not accounting for any existing or proposed vegetation) is therefore required for all soils on the site where strip footings are proposed.
- 17.5.20 In accordance with NHBC Standards, founding depths in cohesive soils should be taken from original or finished ground level, whichever is the lower, to the underside of the footing.
- 17.5.21 Foundations should be deepened near trees in accordance with NHBC Standards Chapter 4.2. It is estimated that up to 70% of the site may be affected by trees.
- 17.5.22 A number of immature (likely self-seeded) trees were noted across much of the site (particularly in the centre of the larger western field and across the easternmost and southernmost fields) during the site walkover, and these will require removal prior to construction. A number of these trees lie within the footprint of proposed plots. In theory, this could result in foundation depths of >2.5m. However, in accordance with NHBC Standards Chapter 4.2, if the trees are <50% of their mature height at the time of removal, a default distance to the proposed foundation of 2m can be applied to foundation depth calculations. This will likely result in few (if any) foundation depths of >2.5m. This should be confirmed by a detailed tree survey prior to vegetation removal, and removal should take place as soon as possible.
- 17.5.23 Whilst no definitive layout has been provided, it is anticipated that some plots will be built on ground from which hedgerows will be removed. Whilst the hedgerows at the site are relatively low (<2.5m height) and appear to have been maintained at that height by trimming, it is often difficult to definitively prove that they have not desiccated soils to significant depth. In theory, if mature Hawthorn is removed from within the footprint of a plot, founding depth (in medium shrinkability clay) would be >2.5m.
- 17.5.24 Trench fill foundations should be designed in accordance with NHBC Standards, Chapter 4.2. Heave precautions (a suitable approved compressible void former) should be used on the internal face of all external walls where the foundation is within the zone of influence of trees and greater than 1.5m deep.
- 17.5.25 Any trench fill foundation deeper than 2.5m will need to be designed by a Chartered Engineer, whose status is accepted by NHBC (NHBC Standards, Technical Requirement R5).
- 17.5.26 It would therefore be prudent to prepare a detailed foundation schedule and seek approval from NHBC in order to determine likely foundation abnormalities.
- 17.5.27 A safe bearing capacity of at least 150kPa, allowing a maximum foundation line load of 90kN/m run, can be assumed if the following are true
- A foundation length of 8m
 - A foundation breadth of 0.6m
 - A foundation thickness of 225mm
 - A foundation depth of 0.9m depth

- An undrained shear strength of 65kPa for the firm clay (typical minimum recorded on site)

17.5.28 Assuming the foundation geometry detailed above, minimal settlements would be anticipated. This is considered likely to be acceptable. However, further advice should be sought from the Structural Engineer responsible for foundation design.

Granular Residual Soils (completely weathered bedrock)

17.5.29 Where **Granular Residual Soils** (sandy, clayey Gravel) at founding depth. It is assumed to have a relative density of at least medium dense (in accordance with BS5930); residual granular soils typically have an angle of shearing resistance (ϕ) of at least 34°.

17.5.30 A safe bearing capacity of at least 150kPa, allowing a maximum foundation line load of 90kN/m run, can be assumed if the following are true:

- A foundation length of 8m
- A foundation breadth of 0.6m
- A foundation thickness of 225mm
- A foundation depth of 0.6m depth
- An angle of shearing resistance of $\phi=34^\circ$ for the granular deposits

17.5.31 Assuming the foundation geometry detailed above, minimal settlements would be anticipated. This is considered likely to be acceptable. However, further advice should be sought from the Structural Engineer responsible for foundation design.

17.5.32 In accordance with NHBC Standards, a minimum founding depth of 450mm (due to potential frost susceptibility) is required in granular soils. This depth should be taken from finished ground level to the underside of the footing. If finished ground level is to be above existing ground level then the foundation excavation simply needs to ensure that there is sufficient depth of excavation to allow casting of the footing entirely within natural ground (not made ground or topsoil).

17.5.33 However, if the excavation is dug from original ground level in cold conditions when freezing is expected, then foundation depth should be taken from the existing, not finished, ground level.

17.5.34 Where ground level is being raised, it would be prudent to proof roll the exposed granular soils after stripping topsoil (to mitigate any near-surface disturbance), and ideally fill should be placed prior to construction (otherwise the Developer will need to consider the potential for movement associated with placement of the fill).

17.5.35 It should also be noted that the footing may require deepening or stepping in order to allow plot drainage to exit the plot footprint (either over or under the footing).

Bedrock

17.5.36 The Pennine Middle Coal Measures is generally considered to have a safe bearing capacity of at least 300kPa and minimal settlements would be anticipated.

17.5.37 Where rock is encountered at shallow depth foundations should be placed **entirely** on rock and not partially on rock and partially on soil. This may, depending on surface gradient, necessitate significant deepening of foundations.

17.5.38 Bedrock is variable (Mudstone, Siltstone and Sandstone) but often comprises mudstone which can be easily excavated using a backhoe excavator and will be recovered as a tabular gravel. Where in-situ mudstone is encountered at founding depth, it will provide a suitable founding stratum for two or three storey dwellings and need only be penetrated by the proposed foundation thickness. Note: any overlying residual soil (typically clay with gravel-sized lithorelicts of mudstone) is likely to be a shrinkable soil; Mudstone is not.

Coal

17.5.39 Given the anticipated earthworks regrade it is possible some excavations for may come into contact with coal. Care should be taken not to unnecessarily over deepen foundations, in order to minimise the chance of encountering coal.

17.5.40 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 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.

17.5.41 By virtue of the provisions of the Coal Industry Act 1994 interests in unworked coal and coal mines previously vested in the British Coal Corporation are now vested in the Mining Remediation Authority. The developer will need to contact the Mining Remediation Authority to dig or carry away such coal as they encounter in connection with redevelopment of the site (this is often referred to as incidental coal).

Geological fault

17.5.42 Drawing 5624/14 shows the approximate line of the faults superimposed the proposed layout. The drawing has been prepared using data from the BGS, abandonment plans and Lithos site investigation data.

17.5.43 It should be noted that the line of a fault on a geological map is often very approximate, and it may be inaccurate by 10m or more. Furthermore, the presence of a fault is usually 'masked' by overlying drift or residual soils; they can only be seen where long trenches are excavated into bedrock.

17.5.44 At this site, no movement associated with past, present or future mining is anticipated, therefore building can take place over the fault, without the need to search for the fault, and without the need to adopt special precautions in the footings of those plots suspected to lie in the vicinity of the fault.

17.5.45 However, NHBC like to see reinforcement of footings with one layer of B385 mesh placed 75mm above the base of the footing. Given the uncertainty regarding the precise line of the fault, it would be prudent to reinforce the footings of all plots within 25m of its assumed line. This area covers approximately 45% of the site.

17.5.46 Further advice should be sought if a significant weak zone is encountered (e.g. ground comprising loose, broken or soft 'gouge' material) during the excavation of footings. If associated with a fault, the weak zone is likely to form a fairly continuous "linear belt", rather than a localised "pocket", and be anything from a few centimetres to a few metres in width.

17.6 Floor slabs

17.6.1 Suspended floor slabs should be utilised where the depth of made ground or engineered stone exceeds 600mm in accordance with NHBC Standards Chapter 5.1 (to negate potential settlement problems).

- 17.6.2 Where shallow foundations are within the influence of existing or proposed trees (and underlain by shrinkable soils), NHBC require a suspended floor slab, with sub-floor void. The floor slab is most commonly a precast block and beam construction, but alternatively could comprise a suspended timber floor, or a slab cast on a suitable compressible void former. Ground-bearing and cast in-situ suspended slabs (other than those cast on a void former) are not acceptable where foundations are within the influence of trees.
- 17.6.3 In accordance with NHBC Standards Chapter 4.2, a minimum void height of 250mm should be adopted for a precast block and beam (or suspended timber) floor; this includes a 150mm ventilation allowance. If a suspended, cast in-situ slab (on a void former) is proposed, a minimum clear void height of 100mm should be adopted; of course, the actual thickness of the void former will be significantly greater.
- 17.6.4 Ventilation should be provided to precast and timber suspended floors in accordance with NHBC Standards Chapter 5.2.
- 17.6.5 Beyond the influence of existing or proposed trees (or where Granular Residual Soils are present at surface after anticipated earthworks regrade), it is considered that the natural ground is generally suitable for the use of ground bearing floors. However, ground bearing slabs should not be cast on topsoil. Where plots are elevated for design reasons, the depth of engineered stone below a ground bearing slab should not exceed 600mm, in accordance with NHBC guidance.
- 17.6.6 The natural ground beneath this site includes cohesive soils and is therefore subject to seasonal variation in moisture content. If ground slabs were constructed on desiccated soil, heave of the slab would occur on re-hydration of the ground. If any significantly desiccated soil is present, a suspended floor slab, with sub-floor void will be required.
- 17.6.7 It should be noted that NHBC have suffered a significant number of claims resulting from the use of ground bearing floor slabs. Consequently, if ground bearing slabs are proposed, care should be taken to ensure correct and careful construction. For example, if fill to the internal face of the foundation excavation is not properly compacted, subsequent settlement can result in cracking of the slab.
- 17.6.8 In the unlikely event that coal is exposed beneath the floor void, it would be prudent to prevent air ingress and the potential for spontaneous combustion by blinding with concrete or removing the coal.
- 17.6.9 Floor slab design should be finalised/take account of the results of the gas monitoring and protection measures required, which will be detailed in Lithos' gas risk assessment, to be issued on completion of monitoring in April 2026.

17.7 Designated concrete mixes

- 17.7.1 Designated mixes are considered in BRE SD1²² and BS 8500²³. However, in addition to soil chemistry (sulphate class), there are a number of other considerations relating to structural design that need to be taken into account when determining an appropriate concrete mix.
- 17.7.2 Consequently, Honey should seek advice from their appointed Structural Engineer.

²² BRE Special Digest 1 (2005) – Concrete in aggressive ground.

²³ BS 8500-1&2:2015+A2:2019. Concrete. Complementary British Standard to BS EN 206. Method of specifying and guidance for the specifier (1) & Specification for constituent materials and concrete (2).

17.8 Drainage

- 17.8.1 Given topography it is considered possible that springs will appear down-gradient. In addition, based on observations made during the investigation, soakaways are very unlikely to provide a suitable drainage solution for surface water run-off at the site. Consequently, it will be necessary to consider alternative sustainable drainage systems (SuDS), and there may be a need for surface water balancing.
- 17.8.2 Alternative SuDS options (see CIRIA C753²⁴ for further details) include:
- Pervious Pavements – provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate into subsurface storage, with subsequent infiltration or controlled discharge. Pavement could be porous (water able to infiltrate across entire surface material; e.g. reinforced grass), or permeable (water infiltrates via joints between concrete blocks).
 - Swales – linear grassed features in which surface water can be stored or conveyed. Where suitable, swales can be designed to allow infiltration.
- 17.8.3 Yorkshire Water have published a guide²⁵ for developers and designers outlining their design requirements for surface water attenuation assets. However, further to changes in drainage policy over recent years, independent water authorities (including IWNL, ICOSA, LEEF etc) now adopt more housing schemes than the traditional authorities such as Yorkshire Water. Consequently, CIRIA C753 has become the more commonly used guidance for the design of SuDS features (including attenuation assets).
- 17.8.4 With respect to detention basins and soakaway tanks, whilst CIRIA C753 does not include explicit guidance on the frequency\duration of groundwater monitoring, it is generally accepted that water table levels should be taken from borehole monitoring wells over 4 consecutive seasons, for at least 3 points in the basin\tank area. The detention basin should be designed to ensure that there is a minimum of 1m of unsaturated soil between the maximum groundwater level and the lowest part of the structure.

17.9 Highways

- 17.9.1 The natural soils present at shallow depth (anticipated formation) are predominantly cohesive. Based on visual inspection of the natural materials and the recorded plasticity indices at the site, published guidance²⁶ and tables²⁷ indicate that the Cohesive Residual Soils would be expected to provide a CBR value of at least 3%. These values should be verified prior to or during construction.
- 17.9.2 Whilst the CBRs estimated above should be achievable, significant deterioration during/after periods of significant rainfall and/or site trafficking is likely. Consequently, it would be prudent to consider flexibility in the groundworks programme to enable highway construction during prolonged dry/warm weather (typically between May and September) when formation will be least vulnerable to deterioration. Alternatively, a minimum 200mm thickness of suitable granular fill (i.e. a “blanket” of 6F2) could be placed along the line of proposed highways to protect formation during the construction phase.

17.10 External works

- 17.10.1 Any digital terrain modelling undertaken, or commissioned, by Honey should be made available to their Engineering Designer prior to issue of an External Works Drawing.

²⁴ CIRIA C753 (2015) – The SuDS Manual.

²⁵ Design Requirements for Surface Water Attenuation Assets, February 2017.

²⁶ CD225 Design for new pavement foundations Revision 1 (Design Manual for Roads and Bridges)

²⁷ The Structural Design of Bituminous Road, TRRL Laboratory Report 1132 (Table C1, page 36)

- 17.10.2 Given the existing topography there could be a need for retaining walls even after earthworks regrade. When designing retaining walls, consideration should be given to Clause 10.2.3 of NHBC standards which states that flexible retaining walls such as gabion and timber structures should not be used to provide support to homes, garages, roads, drives, car parking areas or drainage systems.

18 REDEVELOPMENT ISSUES

18.1 General

- 18.1.1 This report has presented options with respect to foundation solutions, provision of 600mm of clean cover in garden areas (reducing to 450mm in landscaped areas) underlain by Colliery Spoil, isolation of Ash & Clinker beneath hardstand, and re-use of topsoil etc that are considered technically feasible and in line with current good practice. Consequently, Lithos would expect to obtain regulatory approval for whichever option is adopted, although this cannot be guaranteed. Copies of this report should be forwarded to the relevant regulatory authorities (Warranty Provider & Local Authority) for their comment/approval.
- 18.1.2 Even after an appropriate preliminary investigation and ground investigation, with exploratory holes on a closely spaced grid (say trial pits at 30m centres), a geoenvironmental appraisal is typically based on inspection of the ground underlying less than 0.5% of the total site area (and much less at depths in excess of about 3.5m). Consequently, there is always a possibility that unanticipated ground conditions will be encountered during the construction phase.
- 18.1.3 If unexpected ground is encountered during the construction phase, the Contractor should immediately seek further advice from the Engineer.

18.2 Remediation strategy

- 18.2.1 Redevelopment of this site will almost certainly be subject to planning conditions relating to remediation and validation. Once a specific, preferred development strategy has been decided, Lithos could liaise with local Planning Authority and Warranty Provider and prepare a detailed Remediation Strategy document for approval.
- 18.2.2 The Remediation Strategy document would include:
- General background information, including site location, site description and a summary of ground investigation data
 - An overview of existing constraints on development and the aims of the proposed remediation works
 - Specific details of the anticipated site remediation/preparatory works
 - Details of site supervision and verification
 - A summary of implications for redevelopment
- 18.2.3 The Remediation Strategy will describe what is required, but not how it is achieved; the appointed Contractor would normally be expected to undertake an Options Appraisal, and then prepare a Method Statement.
- 18.2.4 The anticipated remediation works are summarised below:
- General site clearance of surface materials and vegetation
 - Break-up of slabs and hardstand
 - Crushing of all suitable artificial hard material (i.e. concrete/brick etc)

- Provision of a minimum 600mm thick cover layer of 'clean' soils in all gardens and 450mm in landscaped areas underlain by Colliery Spoil (and Ash & Clinker if not isolated beneath hardstand)
- Excavation of natural soils from beneath made ground to source 'clean' subsoil for use in gardens and landscaped areas
- Simple post vegetation clearance investigation of the former underground storage tank immediately north of the concrete hardstand in the southeast.

18.2.5 Subsoil excavated during the site preparatory works for subsequent use as cover in gardens and landscaped areas, would be best placed during the construction phase; i.e. it should be left in stockpile(s) on completion of the site preparatory works.

18.2.6 A minimum 200mm thickness of suitable granular fill (i.e. a "blanket" of 6F2) could be placed along the line of proposed haul roads to provide a firm and stable running layer for the subsequent construction works.

18.2.7 It is strongly recommended that any buried structure (under the concrete hardstand) should be chased-out and survey-in the resultant excavations before making them safe by backfilling. At the very least, relevant features should be surveyed-in before "hiding" them beneath a veneer of rubble. Similarly, it would be prudent to complete a drainage survey prior to blading rubble across the site to leave it safe and secure.

18.2.8 The Contractor should make all necessary arrangements to prevent off-site migration of contaminated sediment via surface water run-off, and avoid any pollution of nearby watercourses. This will necessitate the installation of surface water grips, and removal, sealing-off, or diversion of all redundant former site drains (and any land drains).

18.2.9 A Surface Water Management Plan should be prepared by the Contractor, describing the mitigation measures that will be put in place to intercept direct run-off from any disturbed areas, stockpiles etc, thereby preventing any potential impact of adjacent land and nearby watercourses. Surface water run-off will probably require treatment (as a minimum to allow settlement of fines) prior to consented discharge.

18.3 Control of excavation arisings

18.3.1 Excavations into made ground are likely to yield contaminated arisings. The groundworker should carefully segregate (and stockpile separately) made ground arisings from arisings of "clean" natural soils, in order that an excessive volume of unsuitable material is not generated.

18.3.2 The groundworker should appreciate the need for good materials management. Most notably the importance of not mixing different materials within a given stockpile; i.e. there should be separate stockpiles of: topsoil; grubbed-up concrete hardstand; tarmac; Ash & Clinker; any fuel-contaminated soil (none identified during this site investigation); excess clean, natural soil arisings; general construction waste etc.

18.3.3 Further characterisation of stockpiled materials is likely to be required if off-site disposal is proposed.

18.3.4 Made Ground arisings could be:

- Colliery Spoil - Redistributed beneath concrete oversite, or areas of hardstanding, where they would be satisfactorily isolated from end users.
- Ash & Clinker and Colliery Spoil - Isolated beneath the 600mm thick cover layer in garden or landscaped areas.
- Exported from site to a suitably licensed landfill facility.

18.3.5 Natural ground arisings should be suitable for use as subsoil in the proposed soil cover.

18.4 Management of topsoil

- 18.4.1 In order to manage surface water and silt it is recommended that a phased approach is taken to site clearance and construction; prior to construction, topsoil and vegetation form a natural barrier and limit surface water (and silt) run off.
- 18.4.2 This is a large site, and it would be prudent to retain topsoil and vegetation until construction is due to commence in a given sub-area (other than along the line of proposed roads & sewers).
- 18.4.3 NHBC Conditions require garden areas to be provided with topsoil to a thickness of not less than 100mm. Topsoil thicknesses in excess of 400mm should generally be avoided.
- 18.4.4 Prior to placement of topsoil, the underlying subsoil should be loosened by ripping or rotovating. Stones and other objects greater than 50mm should be removed from the prepared surface, and the loosened subsoil should be roughly levelled so that an even depth of topsoil can be achieved.
- 18.4.5 Subsequent trafficking over the loosened subsoil should be minimised.
- 18.4.6 Topsoil should not be placed during or immediately after heavy rain.
- 18.4.7 After spreading, any large, compacted lumps should be broken down to produce a fine filth suitable for planting, turfing and seeding (< 10mm maximum aggregate size).

18.5 Good practice guidance

- 18.5.1 The construction phase groundworker should follow good environmental practice to minimise the risks of spillage, leakage etc with reference, but not limited, to the following documents:
- CIRIA C741²⁸
 - EA Pollution Prevention Guidelines²⁹:
 - PPG6 - Working at construction and demolition sites
 - PPG2 - Above ground oil storage tank
 - PPG7 – The safe operation of refuelling facilities
 - PPG21 – Incident Response Planning
- 18.5.2 Site preparatory works associated with this project are likely to involve the re-use of both natural and made ground soils on site and possibly the import of natural soils from another development site. The Contractor could prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011)³⁰.
- 18.5.3 The MMP would document how all of the materials to be excavated during the proposed site preparatory and remediation earthworks are to be dealt with.

18.6 New utilities

- 18.6.1 It is strongly recommended that all statutory service bodies are consulted at an early stage with respect to the ground conditions within which they will lay services in order to enable them to assess at an early stage any potential abnormal costs.

²⁸ CIRIA C741 (2015) - Environmental Good Practice on Site

²⁹ Whilst this has formally been withdrawn it can still be accessed via the EA archives and provides useful information on managing risks.

³⁰ The Definition of Waste: Development Industry Code of Practice. CL:AIRE, 2011.

- 18.6.2 Drainage and other utilities should not be placed within any coal seam (considered highly unlikely); the seam should either be removed to below the base of the lowest service, or services should be placed in oversize trenches cut into the seam & backfilled with inert material.
- 18.6.3 It is recommended that trenches for services including site drainage and water supply are cut over size in order to isolate pipe materials from potential contaminants and to enable maintenance to be conducted in "clean" material.
- 18.6.4 Water Companies have a statutory duty to supply wholesome water, which could be compromised by the selection of an inappropriate pipe material. For example, compounds such as petroleum hydrocarbons and solvents can permeate commonly used plastics pipes, and/or corrosive chemicals can reduce the service life of metallic pipes. Guidance has been developed for the selection of pipes in brownfield sites and is contained in a UKWIR Report³¹.
- 18.6.5 Due to the Made Ground encountered, this site can be considered brownfield, and therefore consideration of soil contaminant concentrations is required. Samples taken must be representative of the soil conditions in which the water pipes are proposed to be laid; normally water pipes are laid 0.7m to 1.3m below finished ground level.
- 18.6.6 At the time of writing, the proposed route(s), and total length, of water supply pipes were unknown. Consequently, to date laboratory testing of soil samples in line with UKWIR guidance has not been undertaken.
- 18.6.7 In addition, significant earthworks and some remediation is required, and ground currently present along proposed supply pipe routes will almost certainly be redistributed. Consequently, to date laboratory testing of soil samples in line with UKWIR guidance has not been undertaken.
- 18.6.8 However, given the above and the relatively consistent ground conditions reported, it is considered likely that the use of 'standard' polyethylene water supply pipes should be acceptable, although Honey should consult Yorkshire Water at the earliest opportunity to confirm this.

18.7 Health & safety issues - construction workers

- 18.7.1 Access into excavations etc. must be controlled and undertaken in accordance with the CDM Regulations 2015, most notably Regulation 22, to mitigate risk of collapse or asphyxiation.
- 18.7.2 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.
- 18.7.3 The bulk of the made ground will be retained on site. This made ground contains contaminants at concentrations above the guidance threshold values for an end use that includes domestic gardens. Workers involved in excavations for foundations, drainage, utilities etc are likely to come into direct contact with the made ground.
- 18.7.4 Although workers will only be exposed to the contaminated soil for a relatively short time, the contaminants represent a risk, and simple precautionary measures are required, i.e. good personal hygiene and basic personal protective equipment.

³¹ UKWIR Report 10/WM/03/21 – 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'.

18.7.5 Consequently, during the remediation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land".

18.8 Coal extraction

18.8.1 The Top Haigh Moor Coal and Low Haigh Moor Coal both underlie the site; At the shallowest point the Top Haigh Moor is at depths of >10m, with the Low Haigh Moor another c. 8m below. Due to the dip of the seam and topography of the site both seams get deeper at an increased speed as you head further north.

18.8.2 Prior extraction of coal is encouraged by both the Mining Remediation Authority and Planning Authorities, largely because a potential mineral resource will not be sterilised by the development. However, it is worth noting that the UK market for coal is changing (driven by government carbon emission targets) – most notably power stations are no longer burning coal. Consequently, prior extraction of coal has become less attractive in recent times.

18.8.3 There can be financial benefits to extraction, since the extraction contractor would pay the landowner a disturbance allowance for the coal, and there would be a saving because grouting would not be required.

18.8.4 Furthermore, any unrecorded mine entries would also be found and removed. Traffic movements (associated with coal export) are expected to be similar to those associated with grouting (import of PFA and cement).

18.8.5 However, coal extraction is not without drawbacks; these include:

- The creation of 'high-walls' around the margins of the extraction area (essentially the whole of the site's perimeter).
- The time required to ensure significant settlement of the replaced overburden (anticipated residual settlement must be less than 25mm) is typically at least 12 months. However, the actual delay to build programme might be longer, since it is impossible to predict the actual time required for ongoing creep settlements to fall to tolerable levels. Prediction is hampered by uncertainties associated with groundwater rebound and the nature of the excavated material with respect to suitability for compaction.
- Local environmental issues associated with noise and dust.
- Public perception issues.
- Concerns that once an initial excavation has been opened, the coal extraction contractor might decide there is insufficient coal remaining and abort further work, or even run into financial difficulties, leaving Honey with increased foundation abnormalities and no royalties.

18.8.6 Assuming the above factors do not preclude further consideration at the 'first hurdle', the viability of extraction is influenced by physical factors, most notably:

- The presence (or not) of old mineworkings
- Seam thickness (greater the better)
- Seam depth (shallower the better)

18.8.7 As discussed in Section 11.8, old mineworkings exist beneath the site, with known working across the west and north in both of the Top and Low Haigh Moor seams. This suggests that significant extraction has already occurred, reducing the potential yield from further extraction prior to redevelopment.

18.8.8 Furthermore, the presence of faulting and close proximity of the site to existing residential dwellings will likely mean coal extraction is not considered suitable.

18.8.9 Consequently, it is considered **very unlikely** that prior extraction of coal from this site would be economically viable.

18.9 Shallow coal in garden areas

18.9.1 Whilst there is no explicit guidance in NHBC Standards, liaison with NHBC suggests their stance is essentially the same as that they would apply to potentially combustible fills (such as Ash & Clinker). So where significant coal is present at very shallow depth in garden areas (uppermost 1m), it should either be removed, or covered with inert subsoil/topsoil so that it lies at greater than 1m depth.

18.9.2 Whilst shallow coal in gardens is considered unlikely, the anticipated earthworks regrade will change levels across the site and in theory this could lead to shallow coal being encountered. However, this is likely to be very limited and only occur with the thinner unnamed coal seams encountered in the probeholes.

18.9.3 The most pragmatic way of dealing with shallow coal in gardens will be to inspect foundation excavations, and where coal is recorded within the uppermost 1m or so then excavate an inspection pit in the rear garden. Further advice should be sought from Lithos during the construction phase.

18.9.4 As with foundation arisings, the developer will need to contact the Mining Remediation Authority to dig or carry away excavated (incidental) coal.

18.10 Potential development constraints

18.10.1 Topography means almost the entire site will require at least some regrade earthworks.

18.10.2 Significant deterioration of the surface is likely to be caused by trafficking, especially after topsoil has been stripped and during/after periods of significant rainfall. Consequently, it would be prudent to consider placement of a minimum 200mm thickness of suitable granular fill (i.e. a "blanket" of 6F2) along the line of proposed highways and any temporary haul roads to protect formation during the construction phase.

18.10.3 The overhead electric and telecom utilities in the southeast present a potential development constraint unless they can be relocated. Additional enquiries are required to ascertain the feasibility of such diversionary works and the particular easement required by each service undertaker if they remain in-situ.

18.10.4 Utility companies with services in the access road in the southeast may seek to restrict changes in site level if the depth of cover above their services were adversely affected by any development proposals. This aspect requires further clarification.

18.10.5 It is possible that the utility companies will have restrictions with respect to development in the vicinity of their overhead and underground utilities; an easement may be required.

19 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

19.1 General

- 19.1.1 The site is located east of Wolley Colliery Road c. 5.1km north of Barnsley town centre and currently comprises three overgrown grassed fields (one large and two smaller fields) with an area of concrete hardstand (former barns/stable with an underground storage tank immediately north) and tarmac access road in the southeast.
- 19.1.2 It is understood that consideration is being given to redevelopment of the site with 2 & 3 storey domestic dwellings, associated gardens, POS, adoptable roads and sewers. No detailed site layout has been provided at this stage, only an indicative road layout (Nett Area Plan: Ref. WIKE – 001, Dated 18.08.2025). This has been reproduced as Drawing 5624/2 in Appendix B.
- 19.1.3 Ground conditions typically comprise medium to high strength Clays (Cohesive Residual Soils) over clayey Gravel (Granular Residual Soils) or directly onto Pennine Middle Coal Measures at relatively shallow depth. Two coal seams and associated recorded and unrecorded mine workings are present beneath the site, these are briefly summarised below.

19.2 Mining

- 19.2.1 The majority of the site is located within a Coal Mining Development Low Risk Area (within the defined coalfield, but no known defined risks have been recorded by the Mining Remediation Authority; there may still be unrecorded issues). However, the west of the site lies within a High Risk Area.
- 19.2.2 As such, 16 mining investigation probeholes were advanced to check for the presence of underground mine workings. The Top Haigh Moor coal seam underlies the entire site from as shallow as 15.0m in the southwest and is between 1.3m and 0.8m thick (average 1.0m). The Low Haigh Moor coal seam lies from between 6.4m and 9.5m below the Top Haigh Moor (typically c. 8.4m below) and is between 0.7m and 1.5m thick (average 1.1m).
- 19.2.3 A total of 4 probeholes (PHs 105, 107, 112 & 116) identified possible workings in one or both of the coal seams.
- 19.2.4 The mining investigation did find further possible workings across the site outside of the recorded underground mineworkings in the west and north.
- 19.2.5 However, the thickness of competent (rock) cover above the Top Haigh Moor Coal seam is only less than 10 times seam thickness in the southwestern corner of the site (area of the two known adits).
- 19.2.6 Consequently, consolidation of mineworkings (grouting) on a 6m grid with a centre hole (i.e. 4.25m grid) is considered to only be required in the southwest of the site (approximate area shown on Drawing 5624/13).

19.3 Hazardous gas

- 19.3.1 Information from BGS Radon Report indicates that the majority of the site (centre and north) lies in an area where less than 1% of homes are estimated to be above the action level. As such, no special precautions against radon are required across the centre and north.
- 19.3.2 However, the BGS Radon Report indicates that sections in the south of the site are within an area where 5% to 10% of homes are estimated to be above the action level, and basic radon protection measures are required in new dwellings.

- 19.3.3 Gas monitoring is currently underway, and a Hazardous Gas Risk Assessment will be issued on completion of the monitoring in June 2026.

19.4 Contamination & remediation

- 19.4.1 Topsoil or Made Ground Topsoil is present across the vast majority of the site. Testing suggests that this material is chemically suitable for re-use. However, it may require binding based on the gradings showing a high gravel and/or clay content.
- 19.4.2 Samples of Colliery Spoil (across the largest western field) and Ash & Clinker (underlying the concrete hardstand in the southeast) had levels of arsenic in exceedance of Lithos' screening values.
- 19.4.3 The placement of a clean cover system (600mm clean cover) will be required in gardens, reducing to 450mm in landscaped areas. This material could also be isolated beneath hardstand, considered a more suitable option for the Ash & Clinker and not the Colliery Spoil given the anticipated volumes.

19.5 Foundations

- 19.5.1 After anticipated earthworks regrade it is considered that the majority of plots can be built on strip/trenchfill footings within medium to high strength Cohesive Residual Soils at a minimum depth of 0.9m or in or Granular Residual Soils from a minimum depth of 0.6m. Footings will require deepening in areas of significant tree influence (majority of the site).
- 19.5.2 Pennine Middle Coal Measures is anticipated from relatively shallow depth and could be encountered in some foundation excavations. If encountered footings should be placed entirely on rock (i.e. not spanning rock and residual soils).
- 19.5.3 Where plots are within 25m of assumed line of geological faults, reinforcement of footings with one layer of B385 mesh placed 75mm above the base of the footing will be required. Reinforcement and thickening of foundations will also be required where drilling and grouting has been undertaken (southwest). These areas are shown on Drawing 5624/14.

19.6 Flooding

- 19.6.1 The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low.

19.7 Drainage

- 19.7.1 Due to very slow infiltration rates and topography (springs are considered possible), soakaways are very unlikely to provide a suitable drainage solution for surface water run-off at the site. Consequently, it will be necessary to consider alternative sustainable drainage systems (SuDS), and there may be a need for surface water balancing.

19.8 Highways

- 19.8.1 Based on visual inspection of the shallow natural materials and published guidance, the Cohesive and Granular Residual Soils are likely to provide a CBR value of at least 3%. This value should be verified prior to or during construction.
- 19.8.2 However, made ground is present across the majority of the site, typically to depths of around 0.6m, and consultation with the adopting authority, regarding the specification of the highways, is strongly recommended.

19.8.3 Where made ground is present it should be excavated and either replaced with suitable aggregate, or screened, to allow selection of suitable material, before being replaced in engineered layers. Where the made ground is re-engineered it is considered that a CBR value of at least 3% should be achievable. However, this should be verified by field trials.

19.9 Further works

19.9.1 Given the constraints discussed in Section 10.2 (vegetation) a trial pit investigation will be required in order to remove residual uncertainties with respect to possible contamination associated with the former underground storage tank.

19.9.2 If considered necessary, further rotary probeholes across the southwest of the site (where the Top Haigh Moor Coal is shallowest and cover ratios are <10) to better delineate the line of the fault and in turn the required area of drilling and grouting.

19.9.3 Preparation of a Remediation Strategy.

19.9.4 Preparation of a Drill and Grout Specification.

Appendix A

General Notes

General

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

Geology, mining & quarrying

In order to establish the geological setting of a site, Lithos refer to BGS maps for the area, and the relevant geological memoir. Further information is sourced by reference to current and historical OS plans.

In July 2011, the Coal Authority (CA) formalised their requirements in relation to planning applications and introduced some new terminology. The CA, using its extensive records has prepared plans for all coalfield Local Planning Authorities, which effectively refines the defined coalfield areas into High Risk and Low Risk areas. **High Risk** areas are likely to be affected by a range of legacy issues that pose a risk to surface stability, including: mine entries; shallow coal workings; workable coal seam outcrops; mines gas; and previous surface mining sites. **Low Risk** areas comprise the remainder of the defined coalfield, and are areas where no known defined risks have been recorded; although there may still be unrecorded issues. Where a site lies within either a High or Low Risk area, a mining report is obtained from the CA.

Landfills

Reference is made to publicly available Government held digital data via **QGIS** (an Open Source Geographic Information System), data from Landmark or Groundsure, and sometimes the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site.

Historical OS plans are also inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

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, Lithos refer to BRE Report BR211¹, and the UK Health Protection Agency (HPA) website. In December 2022, the British Geological Survey (BGS), deployed a revised dataset which increased accuracy and also the number of properties falling within radon affected areas. This revised dataset is now referenced by maps on the HSA website.

Advice on the limitation of exposure of the population to radon in buildings was originally published in 1990 by the National Radiological Protection Board (NRPB), which joined the HPA in 2005; the HPA updated NRPB advice in July 2010².

The HPA recommended that the NRPB radon Action Level for homes be retained, and a new Target Level for radon in homes be introduced. The values of the Action Level and Target Level, expressed as the annual average radon concentration in the home, are 200 Bqm⁻³ and 100 Bqm⁻³ respectively. The Target Level was to provide an objective for remedial action in existing homes and preventive action in new homes.

The term 'radon Affected Area' is defined as those parts of the country with >1% of homes estimated to be above the Action Levels. The level of protection needed is site-specific and can be determined by reference to this mapping on the Public Health England website, which indicates the highest radon potential within each 1km grid square. Each 1km grid square is classified on the basis of the percentage of existing homes within that grid square estimated to have radon concentrations above the Action Level. There are 6 'bands': <1%; 1 to 3%; 3 to 5%; 5 to 10%; 10 to 30%; and >30%.

The NRPB advised that action should be taken to reduce radon concentrations in existing homes if the radon concentration exceeded the Action Level of 200 Bqm⁻³ in room air averaged over a year; ten times the average UK domestic radon concentration. NRPB advice informed changes in the requirements for radon protection in new buildings.

- **Basic** preventive measures are required in new buildings, extensions, conversions and refurbishments if the probability of exceeding the Action Level is **>3%** in England and Wales, and >1% in Scotland and Northern Ireland.
- Provision for further preventive (**Full**) measures is required in new buildings if the probability of exceeding the Action Level is **>10%**.

At present Building Regulations Approved Document C advocates basic measures for the probability banding 3% to 10%, and full measures if >10%. However, HPA would like to see all new build include basic measures.

Action & Target Levels should also be applied to non-domestic buildings with public occupancy exceeding 2,000 hrs/yr and to all schools.

Hydrogeology

Reference is made to publicly available Government held digital data via QGIS, and Landmark or Groundsure with respect to:

- Groundwater quality
- Recorded pollution incidents
- Licensed groundwater abstractions

From April 2010 the EA'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. The maps are split into two different types of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels
- Bedrock - solid permeable formations e.g. sandstone, chalk and limestone

The maps display the following aquifer designations:

Principal aquifers: These are layers of rock or superficial 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 aquifers: These include a wide range of rock layers or superficial deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into three types:

- **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
- Secondary undifferentiated - In most cases, this is because the rock type in question has previously been designated as both a minor and non-aquifer in different locations due to the variable characteristics.

¹ BRE Report BR211, 2023: "Radon: guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects)".

² Limitation of Human Exposure to Radon, Documents of the Health Protection Agency - Radiation, Chemical and Environmental Hazards, RCE-15. July 2010.

Unproductive strata: These are rock layers or superficial deposits with low permeability that have negligible significance for water supply or river base flow.

The EA maps only display the principal and secondary aquifers as coloured areas. All uncoloured areas on the map will be unproductive strata. However, for uncoloured areas on the superficial (drift) designation map it is not possible to distinguish between areas of unproductive strata and areas where no superficial deposits are present; to do this, it is necessary to consult the published geological survey maps.

For the purposes of the EA's Groundwater Protection Policy the following default position applies, unless there is site specific information to the contrary:

- If no superficial (drift) aquifers are shown, the bedrock designation is adopted
- In areas where the bedrock designation shows unproductive strata (the uncoloured areas) the superficial designation is adopted
- In all other areas, the more sensitive of the two designations is used (e.g. If secondary superficial overlies principal bedrock, an overall designation of principal is assumed)

The EA have also designated groundwater 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

Reference is made to publicly available Government held digital data via QGIS, and Landmark or Groundsure 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 (RQOs). 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 6 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 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 (Flood Zone 3) 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 (Flood Zone 2) 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. Where there is no blue shading (Flood Zone 1), there is less than a 0.1% (1 in 1000) chance of flooding occurring each year.

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, 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 who can advise on appropriate mitigating measures; i.e. raising slab levels, provision of storage etc. In accordance with Chapter 10 of the National Planning Policy Framework, a site-specific flood risk assessment is required for: proposals of 1 hectare or greater in Flood Zone 1, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and any new development in Flood Zones 2 and 3.

COMAH & explosive sites

Lithos obtain information from Landmark or Groundsure with respect to Control of Major Accident Hazards (COMAH) or explosive sites within 1km of the proposed development site. Lithos' 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 its 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 site model

The site's environmental setting (and proposed end use) is used by Lithos 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 receptors.

Potential pollutant linkages are shown on a preliminary conceptual site model (pCSM). A CSM is essentially a cross-section through a site that reflects both the surface topography and underlying geology, and shows surface features of interest. The most significant sources of contamination are then superimposed onto this cross-section together with potential receptors (human health & controlled waters), and plausible pathways between the two. In addition to environmental issues, the CSM should also highlight geotechnical issues.

A pCSM is prepared after consideration of all available "desk study" data, and before design of the ground investigation. Data reviewed should include historical plans (with superimposition on a current-day plan), previous SI reports, geological maps etc. The pCSM, in conjunction with knowledge of site constraints (buildings, services, slopes etc) is used to design the ground investigation.

The revised CSM takes account of data obtained during the ground investigation, including the distribution of made ground, the nature and distribution of contamination etc.

General

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

- BS5930:2015 "Code of practice for site investigation"
- Eurocode 7: BS EN 1997-1:2004. Geotechnical design - Part 1: General rules
- Eurocode 7: BS EN 1997-2:2007. Geotechnical design - Part 2: Ground investigation and testing
- BS10175:2013 "Code of practice for the identification of potentially contaminated sites"
- "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)
- Contaminated Land Reports 1 to 6, most notably CLR Report No. 4 "Sampling strategies for contaminated land"
- "Guidance on the protection of housing on contaminated land" – NHBC & EA R&D Publication 66 (2000)
- AGS: 1996 "Guide to the selection of Geotechnical Soil Laboratory Testing"

Exploratory hole locations

Exploratory hole locations are selected by Lithos, 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; the procedures used are in general accordance with BS5930: 2015 and BS1377: 1990. Techniques most commonly used by Lithos include:

- Machine excavated **trial pits**, usually equipped with a backactor and a 0.6m wide bucket. Allows a thorough inspection of the ground; especially the uppermost 1m or so (but able to reach depths of up to c. 4m), with the recovery of representative, disturbed samples. Also used to conduct soakaway testing.
- **Window or windowless** sampling boreholes (**dynamic sampling**). 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).
- **Cable percussive** (Shell & Auger) boreholes, typically using 150mm diameter tools and casing. Enables the recovery of soil samples and data from greater depth than is possible via trial pitting or a mini-percussive drill rig. Also enables the installation of better/deeper monitoring wells (cf use of a mini-percussive drill rig) due to the utilisation of temporary steel casing during drilling.
- **Rotary percussive** open-hole probeholes are typically drilled using a tri-cone rock roller or polycrystalline diamond compact (PDC) bit with air as the flushing medium. Probeholes are generally lined through made ground with temporary steel casing to prevent hole collapse. Often used to penetrate bedrock to investigate abandoned shallow mineworkings
- **Rotary cored** boreholes. A rock core is cut by a bit, passes up into the inner barrel and, at the end of the coring run, the core barrel assembly is lifted to the surface. Core drilling is relatively expensive, but essential if quality data is required to assess issues associated with deep excavation, rock slope stability etc.

Where installed, gas\groundwater monitoring **wells** typically comprise a lower slotted section, surrounded by a filter pack of 10 mm 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 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 steel borehole helmet set in concrete. Monitoring well details, including the location of the response zone and bentonite seal are presented on the relevant exploratory hole logs.

In-situ testing

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

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 1377 1990, Part 9 Section 3.3. Where full penetration (600mm) is not possible, N values are calculated by linear extrapolation and are shown on the logs as $N^* = x$. The strength of cohesive deposits is determined using a hand shear vane.

Shear strength test results (hand vane readings) 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

Typically Lithos collect at least three soil samples from each exploratory hole, although in practice a greater number are often taken. The collection of a sufficient number of samples provides a sound basis upon which to schedule laboratory analysis, ensuring:

- A sufficient number of samples from each (common) site material are tested
- Horizontal and vertical coverage of the site is adequate, thereby providing a robust data set for use in the conceptual ground model
- Any localised, significant, but non-pervasive conditions are considered

Made ground and natural soils encountered in the field during a ground investigation often contain a significant proportion of coarse grained material (e.g. brick etc). Soil samples obtained during most investigations are often only truly representative of the in-situ soil mass where there is an absence of particles coarser than medium gravel; i.e the entire soil mass would pass a 20mm sieve.

Representative bulk samples of the **soil mass** are retrieved from coarse soils for specific geotechnical tests (most notably grading and compaction); this typically requires the collection of at least 10kg of soil, and occasionally >50kg. However, in the context of assessing land contamination, it is generally accepted that samples should be representative of the **soil matrix** of the stratum from which they are taken. Consequently, truly representative samples of coarse soils for subsequent contaminant analysis are not obtained - only the finer fraction is placed in sample containers. Coarse constituents not sampled would typically comprise any 'particles' with an average diameter greater than about 20mm (i.e. coarse gravel, cobble and boulder).



At present, neither ISO/IEC 17025 nor MCERTS specify sample pre-treatment with respect to stone removal. Unsurprisingly therefore UKAS accredited testing laboratories do not adopt the same approach to stones¹ – some crush and test the “as received” soil, whilst others sieve out stones and analyse only the residual soil (the sieve size used varies depending on the laboratory).

In essence, samples taken from coarser soils for contaminant analysis are “screened” by the geoenvironmental engineer in the field, and often sieved again by the laboratory during sample preparation. Geoenvironmental engineers do not typically re-calculate soil mass contaminant concentrations by taking account of the unsampled coarse fraction. Likewise, laboratories that remove stones typically report contaminant concentrations based on the dry weight of soil passing the sieve. In the context of land contamination and human health risk assessment, this is considered reasonable, because it is the soil matrix which is of greatest concern. Stones are unlikely to:

- Provide a significant source for plant uptake (consumption of vegetables)
- Remain on vegetables after washing (consumption of vegetables)
- Be eaten (accidentally by an adult, or deliberately by a child)
- Be whipped-up by the wind for dust generation (inhalation)
- Stick to the skin for any length of time (dermal contact)
- Yield toxic vapour (inhalation)

Consequently, Lithos instruct labs to remove all stones >10mm, and to report the results as dry-weight based on the mass of matrix tested. However, the laboratory are given site-specific instruction where coarse stones are coated in say oil, or impregnated with mobile contaminants such as diesel. Where the stones are predominantly natural, or inert (e.g. brick, concrete etc), removal will clearly result in higher reported concentrations, than if the stones were crushed and added to the matrix.

Where the stones include a significant proportion of contaminant-rich material (e.g. slag, fragments of galvanised metal etc) an argument could be made for crushing and analysing. However, provided the stones are stable (i.e. unlikely to disintegrate or degrade) they should not pose a significant risk to human health for the reasons stated above.

Sometimes it is necessary to obtain samples that are not representative of the wider soil matrix, for example when investigating localised, significant, but non-pervasive conditions. Any such unrepresentative samples are annotated with the suffix ‘*’ (eg 2D*, or 4G*). Lithos’ site engineer describes both the unrepresentative sample, and the soil mass from which it was taken.

Sample Containers (for contaminant analysis). Samples of soil for contaminant testing are placed into appropriate containers (see below). Soil samples for organic analysis are stored in cool boxes, at a temperature of approximately 4°C, until delivery to the selected laboratory.

Anticipated testing	Container(s)
Asbestos identification	1000ml plastic tub
pH & metals	1000ml plastic tub or 250ml glass jars
non-volatile organics	250ml glass jars
Speciated TPH	250ml & 50ml glass jars
VOCs (incl. naphthalene and/or GRO)	50ml glass jar

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 is proposed.

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. 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.

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 this investigation.

Description of strata

Soils encountered during a Lithos investigation are described (logged) in general accordance with BS 5930:2015. The descriptions and depth of strata encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section 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.

¹ Mark Perrin. Stoned – Sample Preparation for Soils Analysis. Ground Engineering, April 2007.

General

Soil samples are delivered to the laboratory for testing along with a schedule of testing drawn up by Lithos. All tests are carried out in accordance with BS 1377:1990. The following laboratory testing is routinely carried out on a selection of samples:

- Atterberg limits & moisture contents
- Soluble sulphate & pH

Where soft, cohesive soils are encountered, one-dimensional consolidation tests are scheduled in order to assess settlement characteristics, and unconsolidated undrained triaxial compression tests to assess shear strength.

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

- Grading
- Compaction tests
- Particle density

Test results are presented as received in an Appendix to the Geoenvironmental Report.

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. Lithos 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:

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

i.e. 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. Lithos 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, Lithos typically adopts a conservative approach and recommends 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.

Lithos 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 (DS class) and
- The aggressive chemical environment for concrete (ACEC class)

Lithos 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 SO₄ 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.

Oedometer (Consolidation) tests

Oedometer tests measure a soil's consolidation properties, and are performed by applying different loads to a soil sample and measuring the deformation response. Typically the sample is subject to 5 incremental pressures (4 loading & 1 unloading), and the convention is for each subsequent pressure to be double the previous pressure. BS1377 suggests the **initial** pressure should be:

- a) For stiff soils the effective overburden pressure*
- b) For firm soils "somewhat less" than the effective overburden pressure
- c) For soft soils "appreciably less" than the effective overburden pressure, usually 25 kPa or less
- d) For very soft soils very low, typically 5 kPa or 10 kPa

* Effective **overburden pressure** (kNm⁻²) = depth (m) x soil bulk unit weight (kNm⁻³)

Results from these tests are used to predict how a soil in the field will deform in response to a change in effective stress.

Triaxial tests

This test measures the mechanical properties of a soil by placing the sample between two parallel platens which apply stress in one (usually vertical) direction, with fluid used to apply a confining pressure in the perpendicular directions. During the test, the surrounding fluid is pressurized, and then stress on the platens is increased until the material in the cylinder fails.

From triaxial test data, it is possible to extract fundamental material parameters, including its angle of shearing resistance, apparent cohesion, and dilatancy angle. These parameters are then used in computer models to predict how the material will behave in a larger-scale engineering application.

Quick (single stage, Unconsolidated, Undrained tests) are most appropriate for foundation design. This is because load is applied relatively quickly, and shear strength of the clay will be lowest initially; after the applied load causes some consolidation of the ground (after drainage results in dissipation of short-term excess pore water pressure), the in-situ clays will become progressively stronger and hence the factor of safety will increase. Confining pressure is specified as equivalent to overburden pressure (kNm^{-2}).

Foundations on granular soils would use effective shear strength parameters (c' and ϕ') to assess safe bearing capacity, as the soil would fully drain quickly. These effective shear strength parameters could be determined from Consolidated Undrained (or sometimes the more expensive Consolidated Drained) triaxial tests, but often correlations to the SPT are used.

Unconsolidated Undrained triaxial tests are most appropriate for assessment of the stability of fill slopes on clays. Similar to foundations, the application of load gradually increases the strength of the clays and hence the critical case is the short term undrained condition.

Consolidated Undrained (or sometimes **Consolidated Drained**) triaxial tests are most appropriate for assessment of the stability of cut slopes in clays. This is because unloading of the ground leads to short term reduction in pore pressures that approximately balance the unloading, hence the soil strength is largely unchanged. Over time the reduced pore pressures suck water in, which leads in to the progressive increase in pore pressure and loss of strength. The fully drained state is critical, which must be modelled using effective strength parameters and a reasonable estimate of the long term water table conditions.

Slopes formed in granular soils would use effective shear strength parameters (c' and ϕ') to assess safe bearing capacity, as the soil would fully drain quickly. These effective shear strength parameters could be determined from Consolidated Undrained (or sometimes the more expensive Consolidated Drained) triaxial tests, but often correlations to the SPT are used.

Determination of analytical suite

An assessment of potential contaminants associated with the former usages of the site is undertaken with reference to CLR 8 "Potential contaminants for the assessment of land" and the relevant DETR Industry Profile(s).

Common contaminants

Common **Inorganic** Contaminants include:

- Metals, most notably cadmium, copper, chromium, mercury, lead, nickel, and zinc
- Semi-metals, most notably arsenic, selenium, and (water soluble) boron
- Non-metals, most notably sulphur
- Inorganic anions, most notably cyanides (free & complex), sulphates, sulphides, and nitrates

With respect to the terminology used by most analytical laboratories:

Total cyanide = Free cyanide + Complex cyanide

Total cyanide (CN) is determined by acid extraction; whereas free cyanide is the water soluble fraction. Complex cyanide is "bound" in compounds and is hard to breakdown. Laboratory determination of complex CN involves subjecting the sample to UV digestion for determination of both free and total CN.

Thiocyanate (SCN) is a different species combined with sulphur.

Elemental sulphur (S) and free sulphur are the same. Total sulphur is all forms, including that present in sulphates (SO₄), sulphides etc.

There are 2 forms of chromium (Cr), chromium VI and chromium III. Chromium VI is the more toxic of these. In soils, total chromium is determined by a strong aqua regia acid digestion. Chromium VI is an empirical method based on a water extract test.

Common **Organic** Contaminants include hydrocarbons, phenols, and polychlorinated biphenyls.

Petroleum is a mixture of hydrocarbons produced from the distillation of crude oil, and includes aliphatics (alkanes, alkenes and cycloalkanes), aromatics (benzene and derivatives) and hydrocarbon-like compounds containing minor amounts of oxygen, sulphur or nitrogen. Petroleum hydrocarbons can be grouped based on the carbon number range:

- GRO – Gasoline Range Organics (typically C₆ to C₁₀). Also referred to as PRO – Petroleum Range Organics
- DRO – Diesel Range Organics (typically C₁₀ to C₂₈)
- LRO - Lubricating Oil Range Organics (typically C₂₈ to C₄₀)
- MRO – Mineral Oil Range Organics (typically C₁₈ to C₄₄)

However, it should be borne in mind that the terms "GRO" and "DRO" analysis are purely descriptive terms, the exact definition of which varies. Total Petroleum Hydrocarbons (TPH) is also a poorly defined term; some testing laboratories regard TPH as hydrocarbons ranging from C₅-C₄₀, whereas others define TPH as C₁₀-C₃₀.

The composition of a TPH plume migrating through the ground can vary significantly; this is primarily dictated by the nature of the source (e.g. petrol, diesel, engine oil etc). Furthermore, different hydrocarbons are affected differently by weathering processes, and this can result in further variation in the chemical composition of the TPH.

Gasoline contains light aliphatic hydrocarbons (especially within the C₄ to C₅ range) that are volatile. The aromatic hydrocarbons in gasoline are primarily benzene, toluene, ethylbenzene and xylenes, referred to as BTEX. Small amounts of polycyclic aromatic hydrocarbons (PAHs) such as benzo(a)pyrene may also be present. Diesel and light fuel oils have higher molecular weights than gasoline. Consequently, they are less volatile and less water soluble. About 25 to 35% is composed of aromatic hydrocarbons. BTEX concentrations are generally low.

Heavy Fuel Oils are typically dark in colour and considerably more viscous than water. They contain 15 to 40% aromatic hydrocarbons. Polar nitrogen, sulphur and oxygen-containing compounds (NSO) compounds are also present. Lubricating Oils are relatively viscous and insoluble in groundwater. They may contain 10 to 30% aromatics, including the heavier PAHs. NSO compounds are also common.

Polycyclic Aromatic Hydrocarbons (PAHs) have two or more fused benzene rings as a structural characteristic. PAH compounds are present in both petrol and diesel, although in significantly lower concentrations than in coal tars. Certain PAH compounds are carcinogenic (benzo(a)pyrene) and/or mobile in the environment (naphthalene).

Volatile Organic Compounds (VOCs) are organic chemicals, and most are liquids that readily evaporate on exposure to air. Examples include benzene, toluene, xylene, chloroform etc. Semi-Volatile Organic Compounds (sVOCs) include phenol and benzo(a)pyrene, and have relatively low boiling points. Both groups of chemicals are readily absorbed through skin and some, such as benzene, are believed to be linked to tumour growth.

Phenols are compounds that have a hydroxyl group (-OH) attached to an aromatic ring (ie include a benzene ring and an -OH group). Most are colourless solids. A solution of phenol in water is known as carbolic acid, and is a powerful antiseptic. However, phenol vapour is toxic, and skin contact can result in burns.

Polychlorinated Biphenyls (PCBs) were used in pre-1974 transformers as dielectric fluids. PCB's are of increasing toxicity relative to the degree of chlorination. Acute symptoms of PCB poisoning are irritation of the respiratory tract leading to coughing and shortness of breath. Nausea, vomiting and abdominal pain are caused by ingestion of PCB's.

Dioxins and furans (polychlorinated dibenzodioxins and polychlorinated dibenzofurans) are some of the most toxic chemicals known; in the environment, they tend to bio-accumulate in the food chain. Dioxin is a general term that describes a group of hundreds of chemicals that are highly persistent in the environment. The most toxic compound is 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD.

Dioxin is formed by burning chlorine-based chemical compounds with hydrocarbons. The major source of dioxin in the environment comes from waste-burning incinerators and also from backyard burn-barrels. Dioxin pollution is also affiliated with paper mills which use chlorine bleaching in their process and with the production of Polyvinyl Chloride (PVC) plastics and with the production of certain chlorinated chemicals (like many pesticides).

Methods of analysis (organic compounds)

TPH by GC-FID is an analytical technique which only detects hydrocarbons (aliphatic and aromatic) in the range C₁₀ to C₄₀ (volatiles, heavy tars, humic material and sulphur are not detected). The laboratory can provide a broad, 'banded' breakdown of the TPH results into gasoline range organics (GRO), diesel range organics (DRO) and heavier lubricating oil range organics (LRO), or fully speciated results with the reporting of hydrocarbon concentrations in 14 specific carbon bandings based upon behavioural characteristics, e.g. aliphatic C₆ to C₈, aromatic C₁₀ to C₁₂ etc.

Speciated VOC (by GC-MS) analysis quantifies the concentrations of 30 USA-EPA priority compounds. These include chlorinated alkanes and alkenes (in the molecular weight range chloroethane to tetrachloroethane); trimethylbenzenes; dichlorobenzenes; and the 4 BTEX compounds (benzene, ethyl-benzene, toluene & xylene).

Speciated sVOC by (GC-MS) analysis quantifies the concentrations of a variety of organic compounds, including the 16 USA-EPA priority PAHs, phenols, 7 USA EPA priority PCB congeners, herbicides & pesticides.

Note: PAHs are hydrocarbons and consequently (where present) will be picked-up when scheduling TPH by GC-FID.

Note: Risk assessment models require physicochemical properties (solubilities, toxicities etc) of compounds in order to model their behaviour in the environment. These physicochemical properties cannot be derived from a single "TPH", "GRO" or "DRO" value. However, the carbon banded fractions can be used in risk assessment models.

Current UK guidance

The UK approach to contaminated land is set out in Land Contamination Risk Management (2020). 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); 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.

Lithos adopt a tiered approach to risk assessment, consistent with UK guidance and best practice. The initial step of such a risk assessment (or Tier 1) is the comparison of site data with appropriate UK guidance levels. Lithos risk-derived screening values, or remedial targets. It should be noted that exceedance of Tier 1 does not necessarily mean that remedial action will be required.

Soil screening values used by Lithos

In March 2002 DEFRA and the Environment Agency published a series of technical papers (R&D Publications CLR 7, 8, 9 & 10) outlining the UK approach to the assessment of risk to human health from land contamination. In 2008 CLR 7, 9 & 10 and all corresponding SGV and Tox reports were withdrawn and superseded by new guidance including:

- Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008
- 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 Handbook, Science report: SC050021/SR4
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7

In December 2013 Defra published the results of research project SP1010 – Development of Category 4 Screening Levels (C4SLs) for Assessment of Land Affected by Contamination. The objective of this project was to provide technical guidance in support of Defra's revised Statutory Guidance for Part 2A of the Environmental Protection Act 1990 (Part 2A). The revised Statutory Guidance, published in April 2012, introduced a new four-category system for classifying land under Part 2A, where Category 1 includes land where the level of risk is clearly unacceptable, and Category 4 includes land where the level of risk posed is acceptably low. Project SP1010 aimed to deliver:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- Demonstration of the methodology, via derivation of C4SLs for 6 substances – arsenic, cadmium, chromium IV, lead, benzene & benzo(a)pyrene.

The methodology for deriving both the previous Soil Guideline Values and the Category 4 Screening Levels is based on the Environment Agency's Contaminated Land Exposure Assessment (CLEA) methodology. Development of C4SLs has been achieved by modifying the toxicological and/or exposure parameters used within CLEA (while maintaining current exposure parameters).

Part 2A Statutory Guidance was developed on the basis that C4SLs could be used under the planning regime. Defra anticipate that, where they exist, C4SLs will be used as generic screening criteria, and Lithos consider C4SLs to be suitable for use as Tier 1 Screening Values. Lithos have discussed this matter with both NHBC and YALPAG (collection of Yorkshire & Lincolnshire local authorities) and received confirmation that they are satisfied with this approach.

The CLEA conceptual site model assumes a source located in a sandy loam, with 6% soil organic matter (SOM) - equivalent to 3.5% total organic carbon (TOC). However, many organic contaminants are more mobile when the SOM is lower, and consequently comparison of soil results with revised, lower screening values may be required. Other CLEA default characteristics adopted by Lithos are:

Sandy Loam characteristics (source)	Default values adopted
Total porosity (fraction)	0.53
Water filled porosity (fraction)	0.33
Air filled porosity (fraction)	0.2

Lithos have derived Screening Values for five different CSMs (scenarios); these are:

- A - Residential with gardens, but no cover (or only up to 300mm)
- B - Residential with gardens and 600mm 'clean' cover
- C - Residential apartments with landscaping (i.e. no home grown produce)
- D - Commercial/industrial with landscaping
- E – Importation of soil cover

The **exposure** pathways considered for each scenario are detailed in the table below.

Scenario	Land use	Pathways	Justification
A	Residential with garden, but no cover (or only up to 300mm)	<ul style="list-style-type: none"> • Direct ingestion of soil • Dermal contact • Consumption of vegetables & soil attached to vegetables • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust 	Minimal cover – insufficient to break any pathways therefore all exposure pathways are relevant.
B	Residential with garden minimum 600mm cover	<ul style="list-style-type: none"> • Inhalation of indoor vapours • Inhalation of outdoor vapours 	The 600mm cover removes the risk from all pathways other than inhalation.
C	Residential apartments with landscaped areas and minimum 300mm cover	<ul style="list-style-type: none"> • Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust 	All pathways applicable due to possible exposure from landscaped areas. However consumption of home grown produce not included as unlikely to be grown in landscaped areas. Where vegetables are to be grown site specific QRA may be required.

04 - Contamination analysis & interpretation (including WAC)

Generic notes – geoenvironmental investigations



Scenario	Land use	Pathways	Justification
D	Commercial/ industrial with landscaped areas no cover	<ul style="list-style-type: none"> Direct ingestion of soil Dermal contact Inhalation of indoor vapours and dust Inhalation of outdoor vapours and dust 	All pathways applicable due to possible exposure from landscaped areas. Assumed the commercial development consists of offices to provide a conservative assessment.
E	Importation of soil for cover in garden and landscaped areas	<ul style="list-style-type: none"> Direct ingestion of soil Dermal contact Consumption of vegetables & soil attached to vegetables Inhalation of outdoor vapours and dust 	Material used as cover to break existing pathways therefore all direct and indirect pathways relevant; however cover is not placed below plots therefore indoor inhalation is not relevant.

Lithos have assumed the source of contamination is directly below the building foundation; i.e. a depth to source of 0.15m as opposed to the CLEA default of 0.65m. This assumption provides for a more conservative approach than the UK default.

Lithos have derived Tier 1 values for a number of inorganic and organic determinands in the context of the five Scenarios A to E. The Tier 1 values are **not** intended to be used when considering potential risks associated with:

- Existing land uses in the context of Part 2A of the Environment Protection Act 1990;
- End uses such as allotments, sports fields, children's playgrounds, care homes, hospitals etc; or
- Groundwater and surface water

Inorganic Tier 1 values for scenarios A to E

Inorganic contaminant	Tier 1 assessment criteria (mg/kg) for Scenarios A to E							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
As	32	37	37	Use (A) in SI Report for initial "screen" If >5 x A, then consider increase of cover to 1,000mm	40	640	37	C4SL adopted
Cd	10	26	26		149	410	26	C4SL adopted
Cr			4,000		4,000	28,767	4,000	Assumes Cr is CrIII
Pb	450	200	200		314	2,330	200	C4SL adopted
Ni	130		109		123	892	109	Assessment of health risk only
Se	350		434		596	13,018	434	
Hg	170		199		244	3,603	199	Assumes in an inorganic compound
Vn			584		586	4,994	584	
B			5		5	5	5	
Cu			100		100	100	100	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependant)
Zn			200	200	200	200		

Organic Tier 1 values for scenarios A to E

Organic contaminant (all sourced via CLEA)	Tier 1 assessment criteria (mg/kg) for Scenarios A to E							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
Benzene	0.33	0.87	0.7	<1 [^]	<1 [^]	63	<1	<1 based on professional judgement and lower than calculated value.
Toluene	610		836	2,048	1,912	5,000	<1	Scenario D based on professional judgement and lower than calculated value.
Ethyl Benzene	350		379	592	566	5,000	<10	Scenario E based on professional judgement and lower than calculated value.
Xylenes	240		535	590	585	5,000	<10	Scenario E based on professional judgement and lower than calculated value.
Phenol	420		1,434	3,360	2,264	5,000	<10	
PCBs			2	8	2	38	N/A	Based on toxicity of EC7
Benzo(a)pyrene		5	5	25	5	76	5	C4SL adopted. Scenario B 5 times scenario A
Naphthalene			6	6	6	619	<10	Scenario E based on professional judgement and lower than calculated value
Gasoline Range Organics			22	23	23	2178	626	See 3-step assessment of TPH below
Diesel Range Organics			215	218	215	^5,000	1,429	^Based on professional judgement and lower than calculated value
Lubricating Range Org			3,299	5,000	3,829	^5,000	3,299	

* For a residential end use

The significance of PAHs can be determined by considering indicator compounds. In most cases benzo(a)pyrene (BaP) is adopted as an indicator due to the amount of toxicological data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food. A surrogate marker approach can be used to estimate the toxicity of a mixture of PAHs in soil using toxicity data for individual indicator compounds within that mixture. Exposure to the surrogate marker is assumed to represent exposure to all PAHs in that matrix. The surrogate marker approach relies on a number of assumptions:

- Surrogate marker (BaP) must be present in all soil samples
- Profile of the different PAH relative to BaP should be similar in all samples
- PAH profile in the soil samples should be similar to that used in the pivotal toxicity study¹

To assess the PAH profile in a soil sample, the ratio of the seven genotoxic PAHs (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene), relative to BaP, should be calculated. The ratio relative to BaP should lie within an order of magnitude above and below the mean ratio to BaP.

¹ SP1010 Appendix E, Provisional C4SLs for benzo(a)pyrene as a surrogate marker for PAHs, CL:AIRE 2013

Naphthalene should also be considered separately against its generic screen. Whilst classed as a PAH, naphthalene is more volatile and mobile in the environment than most other PAHs. As such the significance of naphthalene cannot be considered within the surrogate marker approach. Similarly, TPH cannot be assessed as a single "total" value, and reference has been made to the Environment Agency's document P5-080/TR3, "The UK approach for evaluating human health risks from petroleum hydrocarbons in soils". This document supports the assumptions and recommendations made by the US Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG). The TPHCWG have broken down "TPH" into representative constituent fractions or "EC Bandings". The TPHCWG have derived a series of physicochemical and toxicological parameters for each of the bandings.

The significance of speciated TPH results can be assessed by following the 3 steps outlined in the tables below.

Step	Result	Action
1. Consider indicator compounds: Are BTEX, naphthalene, benzo(a)pyrene above their respective Tier 1 values?	Yes	Remediation or dQRA required
	No	Proceed to Step 2
2. Consider individual TPH fractions: are they above respective screening values?	Yes	Remediation or dQRA required
	No	Proceed to Step 3
3. Assess Cumulative effects: Is the calculated Hazard Index for each source >1	Yes	Remediation or dQRA required
	No	TPH compounds pose no significant risk

The equation used to assess cumulative effects in step 3 is shown below.

$$HI = \sum_{F_i=1}^{16} HQ F_i = \frac{\text{Measured concentration } F_i \text{ (mg kg}^{-1}\text{)}}{SGV F_i \text{ (mg kg}^{-1}\text{)}}$$

where HI = Hazard Index
 HQ = Hazard Quotient
 F_i = Fraction_i
 SGV = Soil Guideline Value

Statistical Assessment

Current UK guidance is provided by CL:AIRE², and uses two-way confidence intervals and graphical summaries, to assist assessors when determining whether or not a dataset is adequate to answer the question posed; e.g. "is existing site topsoil suitable for retention & re-use?". To answer such a question, it is necessary to recover and test a large number of samples (a minimum of 10; ideally 20+) in order to undertake meaningful statistical analysis.

However, in the context of site investigation to assess the significance of contamination on brownfield sites which are typically underlain by **heterogenous made ground**, some remediation is almost always required (placement of soil cover, excavation of gross contamination etc). Consequently, in such circumstances, it is not necessary to demonstrate that made ground soils are "clean" and therefore there is no need to test large numbers of samples and undertake statistical analysis. Sample results can simply be compared directly with appropriate screening values (e.g. Lithos Tier 1 values).

The CL:AIRE (2020) guidance replaces the withdrawn "Guidance on Comparing Soil Contamination Data with a Critical Concentration" (2008). The old approach to statistical analysis was based on a definitive yes/no answer which required limited consideration of the dataset and Conceptual Site Model. It was widely accepted that this did not allow sites or risk to be adequately assessed. The updated approach requires a comprehensive understanding of the datasets within the context of the Conceptual Site Model.

Current guidance requires that:

- A robust CSM is in place which identifies source areas, averaging areas and averaging zones
- Sampling locations are relatively evenly spread across the site and were selected using simple or stratified random sampling with no targeting being undertaken
- The field data and CSM do not suggest the presence of a hotspot of contamination which should be treated as a separate zone
- The samples are all taken from a similar same depth and within the same material type across the zone being assessed
- A minimum of 10 samples have been taken. It should be appreciated that confidence in a dataset increases as the number of samples obtained and tested from a zone increases.

The statistical analysis assumes a homogenous distribution of strata and contamination and therefore the dataset will be normally distributed (symmetric, log symmetric or fat tailed).

A normally distributed dataset is assessed using a number of statistical tools to generate a Dot and Box Plot which includes summary statistics and confidence intervals. The review of statistical data enables the assessor to make a decision, with an associated level of confidence, where the true mean of the sample population lies in relation to the critical concentration.

It is essential when using statistics to assess sample data that all decisions relate back to the conceptual site model. Statistics cannot indicate if contamination on a site is likely to present a risk to the end user, this is the role of the 'competent person' i.e. Lithos.

However, broadly speaking the following applies:

- Mean and UCL below the critical concentration – no further assessment required.
- Mean below the critical concentration, but UCL above – consider the CSM and likely sources.
- Mean and UCL above the critical concentration – further assessment required, remediation likely depending on the CSM.
- LCL, Mean & UCL above the critical concentration – further assessment required, remediation likely.

² CL:AIRE, 2020. Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration.

Other screening values used by Lithos

Tier 1 risk assessment of **hazardous gas** is undertaken through reference to the following documents (and further information is presented in Generic Note No. 5 – Hazardous Gas):

- 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 (2007) – Assessing risks posed by hazardous ground gases to buildings
- BS 8485:2015 – Code of Practice for the characterisation & remediation from ground gas in affected developments

With respect to the assessment of potential **phytotoxic effects** of contaminants, Lithos refer to The Sewage Sludge in Agriculture: Code of Practice 2018 for copper and zinc (at pH 5.5 to 6.0). The CLEA derived Tier 1 value is adopted for nickel due to its human health effects.

The potential risk to **building materials** is considered through reference to relevant BRE Digests, with particular emphasis on BRE Special Digest 1, ‘Concrete in aggressive ground’, 2005.

With respect to the interpretation of the **calorific values**, at present there are no accepted methods to assess whether a sample is combustible and under what circumstances it might smoulder. Some guidance is given in ICRCCL Note 61/84 “Notes on the fire hazards of contaminated land” which states that: “In general ... it seems likely that materials whose CV’s exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn”.

Tier 1 **groundwater risk assessments** are always site specific and compare leachate or groundwater concentrations with the appropriate water quality standard based on the CSM and consideration of relevant water quality impacts and assessments.

Waste classification & WAC

In the context of waste soils generated by remediation and/or groundworks 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.

Landfill operators require Waste Acceptance Criteria (WAC) laboratory data, if soil waste is classified as **hazardous**. 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.

Lithos typically only include WAC analysis in site investigation proposals and reports, if significant off-site disposal (of soil classified as hazardous waste) is anticipated, for example where redevelopment proposals include basement construction etc. If off-site disposal of soils classified as hazardous waste during redevelopment is anticipated, 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, and these contaminants can often be dealt with by alternative technologies (e.g. by bioremediation or stabilisation) and consequently retention on site is often possible.

It should be noted that **non-hazardous** soil waste can go to a non-hazardous landfill facility; no further testing (e.g. WAC) is required.

Possible action in event of Tier 1 exceedance

Should any of the Tier 1 criteria detailed above be exceeded, then three potential courses of action are available. (The first is only applicable in terms of human health, but the second and third could also be applied to groundwater or landfill gas).

1. Undertake further statistical analysis following the approach set out in Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration, 2020 (see above) in order to determine whether contaminant concentrations of inorganic contaminants within soil\fill actually present a risk (only applicable to assessing the risk to human health).
2. Carry out a more detailed quantitative risk assessment in order to determine whether contamination risks actually exist.
3. Based on a qualitative risk assessment, advocate an appropriate level of remediation to “break” the pollutant linkage - for example the removal of the contaminated materials or the provision of a clean cover.

Prior to undertaking any statistical analysis the issue of the **averaging area** requires further consideration. Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration, 2020 provides some guidance on averaging areas noting that they are the area within which a receptor may be exposed to contamination but leaving the site assessor to determine the appropriate averaging area for their site.

Lithos consider the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, Lithos gather and analyse sample results by fill type, and/or by former use in a given sub-area of the site, before undertaking statistical analysis; i.e. the averaging area is associated with the extent of a particular fill type, or an area affected by spillage\leakage.

In terms of brownfield redevelopment, this is considered a more appropriate methodology which provides a more representative sample population for statistical analysis. As such the entire site is considered in terms of the proposed end use, be this residential with, or without gardens.

Analysis by soil\fill type is appropriate for essentially immobile contaminants associated with a particular fill type, for example arsenic in colliery spoil, metals in ash & clinker, sulphate in plaster-rich demolition rubble etc.

Analysis by former use is appropriate where more mobile contaminants have entered the ground, for example diesel associated with leakage from a former fuel tank, downward migration of leachable metals through granular materials, various soluble contaminants present in a wastewater leaking into the ground via a fractured sewer etc. In these circumstances, it may be appropriate to undertake statistical analysis of sample results from a variety of different soil\fill types. However, consideration would have to be given to factors such as porosity which might influence impregnation of a mobile contaminant into the soil mass, i.e. contamination would normally be more pervasive and significant in granular soils than cohesive soils

General

Hazardous gas is considered to be any mixture of potentially explosive, toxic or asphyxiating gases, most notably methane, carbon dioxide and oxygen (deficiency). In addition, radon, a naturally occurring radioactive gas is also considered. Further information about radon is included in Notes 01 – Environmental Setting.

Assessment of potential risks associated with hazardous gas are based on a review of data obtained from the Landmark Information Group, the Environment Agency and the Local Authority and the British Geological Survey. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Where landfilling has occurred within 250m of the site boundary, the Local Planning Authority may request a landfill gas investigation in accordance with the Town and Country Planning General Development Order, 1988.

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 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

Lithos adopt a standard gas monitoring procedure, in accordance with CIRIA guidance. This procedure involves the measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration
- 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 multi-layer Tedlar / ALTEF sampling bags are used. Gas concentrations in the well are typically recorded immediately before and after retrieval of a sample.

Current guidance

CIRIA Report 151 (1995) identified that there was inadequate guidance on trigger concentrations for ground gases. CIRIA concluded that the most important aspect of a gas regime below or adjacent to a site was the surface emission rate, i.e. how quickly the gas is coming out of the ground. The lower the surface emission rate the lower the risk. CIRIA Report C665 (2007) advocated two methodologies for characterising sites:

A – All developments except low rise housing. The advocated methodology is that proposed by Wilson & Card, 1999

B – Low rise housing. An alternative (traffic light) methodology, derived by Boyle and Witherington, 2006 for NHBC

Both methodologies refer to Gas Screening Values (GSV); previously referred to as limiting borehole gas volume flow. However, the NHBC traffic light guidance will be withdrawn in July 2025, and consequently Lithos typically now only refer to Situation A methodology.

Relevant UK guidance includes:

- BS8485:2015+A1:2019 – Code of Practice for the characterisation & remediation from ground gas in affected developments.
- BS8576:2013 Guidance on investigations for ground gas – permanent gases and volatile organic compounds
- Wilson, Card & Haines (CIEH, 208) The Local Authority Guide to Ground Gas
- CIRIA C665 (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings
- CIRIA C735 (2014) Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases
- CL:AIRE (October 2021) Good Practice for Risk Assessment for Coal Mine Gas Emissions
- CL:AIRE Research Bulletin RB17 (November 2012) A Pragmatic Approach to Ground Gas Risk Assessment
- CL:AIRE Research Bulletin RB13 (February 2011) The Utility of Continuous Monitoring in Detection & Prediction of 'Worst-Case' Ground Gas Concentration
- BRE\Environment Agency Report BR 414 (2001) – "Protective Measures for housing on gas-contaminated land".
- YALPAG (December 2016) - Verification Requirements for Gas Protection Systems - Technical Guidance for Developers, Landowners and Consultants.
- Environment Agency Report LFTGN 03 - Guidance on the management of landfill gas, June 2014
- NHBC Foundation (April 2023) Hazardous Ground Gas – an Essential Guide for Housebuilders (NF94)

Situation A Methodology (All developments)

(Wilson & Card, 1999) revised Table 28 of CIRIA 149 in terms of borehole gas volume flow rate (now GSV) in order to achieve a more consistent design of protection measures. This was done to reflect the importance of recognising the gas surface emission rate. Wilson & Card then developed a method for classifying gassing sites (Table 1 below), which took into account the combined gas concentration and GSV.

Characteristic Situation	Gas Screening Value, CH ₄ or CO ₂ (l/hr)	Additional limiting factors	Typical source of generation
1	<0.07	Methane not to exceed 1% v/v and carbon dioxide not to exceed 5% v/v	Natural soils with low organic content
2	<0.7	Borehole air flow rate not to exceed 70 litre/hr otherwise increase to Characteristic Situation 3	Natural soil, high peat/organic content
3	<3.5		Old landfill, inert waste, mineworkings flooded.
4	<15	Quantitative Risk Assessment required to evaluate scope of protection measures.	Mineworkings – susceptible to flooding, completed landfill, inert waste
5	<70		Mineworkings 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). To facilitate design implementation, the limiting values for both methane and carbon dioxide are identical.

Background

Soakaways have been the traditional way to dispose of stormwater from buildings and paved areas remote from a public sewer or watercourse. In recent years, soakaways have been used within urban, fully-sewered areas to limit the impact on discharge of new upstream building works, and to avoid costs of sewer up-grading outside a development.

Soakaways are increasingly seen as a more widely applicable option alongside other means of stormwater control and disposal. Soakaways must store the immediate stormwater run-off and allow for its efficient infiltration into the adjacent soil. They must discharge their stored water sufficiently quickly to provide the necessary capacity to receive run-off from a subsequent storm. The time taken for discharge depends upon the soakaway shape and size, and the surrounding soil's infiltration characteristics. Soakaways can be constructed in many different forms and from a range of materials.

BRE Digest 365, DG365: 1991 describes design and construction procedures, explains how to calculate rainfall design values and soil infiltration rates, and gives design examples. Further advice is provided in **NHBC Standards Chapter 5.3** (Section 9 & Appendix F), **Building Regulations Section 3** of Approved Document H (Drainage & Waste Disposal), and Chapter 13 of **CIRIA's SUDS Manual (C753:2015)**.

Soakaways should generally be built on land lower than or sloping away from buildings and be sited **at least 5m** from the foundations of a building.

BRE365 states that '**Groundwater should not rise to the level of the base of the soakaway** during annual variations in the water table' this is further reinforced in Chapter 13 of CIRIA C753:2015 which states that: "A *minimum distance of 1m between the base of the infiltration system and the maximum likely groundwater level should always be adopted. This is to minimise the risk of groundwater rising into the infiltration component and reducing the available storage volume, to protect the functionality of the infiltration process by ensuring a sufficient depth of unsaturated material and to protect the groundwater from any contamination in the run-off*". There may be a requirement to install groundwater monitoring wells at a site in order to monitor seasonal variations in groundwater level at least over a wet winter period.

Soakaways should **not be sited on sloping sites**, an assessment should also be made to ensure that infiltrating water will not cause a rise in groundwater levels, waterlogging of downhill areas or springs, and that slopes are not made unstable.

Made ground (and ground within 5m of deep fill) is not generally regarded as suitable for soakaways, due to the potential for inundation settlement and the leaching of contaminants.

Chalk: CIRIA C574:2002 notes that concentrated ingress of water into the chalk can initiate dissolution, particularly in low-density chalk. For this reason, soakaways should be sited well away from foundations for structures, roads or railways:-

- in areas where dissolution features are known to be prevalent, soakaways should be avoided but, if unavoidable, should be sited at least 20m away from foundations etc
- where the chalk is of low density (weak), or where density is not known, soakaways should be sited at least 10m away from foundations
- where the chalk is of medium density, or higher (moderately weak), soakaways should be sited at least 5m away from foundations

Test methodology

Lithos undertake soakaway tests in general accordance with BRE Digest 365 "Soakaway Design". The BRE Digest recommends that each soakaway pit is filled and allowed to drain three times to near empty; the three fillings to be on the same or consecutive days. However, each test can take over 2 hours to complete. Consequently, at site investigation / feasibility stage, testing is usually undertaken in a 'broad sweep', relatively widely spaced; often only 1 or 2 fills. The drainage designer reviews SI data and if soakaways look feasible, commences design with the incorporation of soakaways. Prior to finalising design, the Drainage Engineer will usually recommend further soakaway testing: (a) within 25m of proposed chamber locations; and (b) to include 3 fills.

Whilst in theory 3 fills is fine, in practice it is often not straightforward. Where drainage rates are quick (draining < 1 hour), allowing 3 fills per pit within a day, even larger water bowsers (say 2,300 gallon/10,000 litre) will run out of water after testing in two pits. Re-filling can take 2 to 3 hours depending on available water supplies etc. So, it is typically only possible to do fully compliant BRE 365 testing in 4 pits a day.

Where infiltration is moderate (a fill drains in say 2 to 4 hours), soakaways may be considered feasible, but it will not usually be possible to complete 3 fills in a day. Therefore, it becomes necessary to leave pits open overnight (usually with a consequent need for herras fencing, site security etc, or the use of stone backfill).

Infiltration rates

Infiltration rates for each soakaway test are calculated (where possible) in accordance with BRE Digest 365. This design takes into account the time of emptying the soakaway pit between 25% and 75% of its effective depth. The effective depth is calculated from the starting water level to the soakaway pit base. Where the water level did not fall to 25% effective depth, the data was interpolated in order to obtain a representative infiltration rate.

Soakaway design

Soakaway design should be carried out by a suitably qualified and experienced Drainage Engineer, in accordance with BRE Digest 365 using the infiltration rates calculated from soakaway testing during a ground investigation.

It is generally assumed that soakaways become impracticable on residential developments when:

- A chamber type design requires a square pit with side length in excess of 1.8m, or an effective depth greater than 1.5m.
- A trench type design requires a length greater than about 10m, or an effective depth greater than 1.5m.

Increasing the soakaway effective depth might offer a solution, but consideration should be given to:

- Standing groundwater level
- Depth to base of permeable strata
- Cost of excavation

Soakaway percolation in some rock types is predominately via the vertical joints within the rock mass. The relatively small-scale soakaway test pits may not intercept such joints and this can result in variable test results. However, it is likely that the larger surface area of a completed soakaway within the development will intercept such joints.

The drainage designer submits designs for approval to:

- The Lead Local Flood Authority (LLFA), usually part of the Local Authority (e.g. NYCC). The LLFA are a consultee to the planning authority. They review the full technical design to ensure that proposals (both plots & highways) are satisfactory. The LLFA may also set standards for soakaway design (NYCC have, and these now require 3 fills and soakaway testing within 25m of proposed chamber locations).
- Local Authority Highways Dept. The Highways Authority adopt highways drainage, so review drainage design (via approval of a Section 38 submission). They also visit site to inspect construction.
- Building warranty provider (e.g. NHBC, Premier etc), if soakaways are proposed for roof & driveway waters.

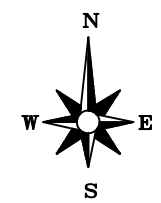
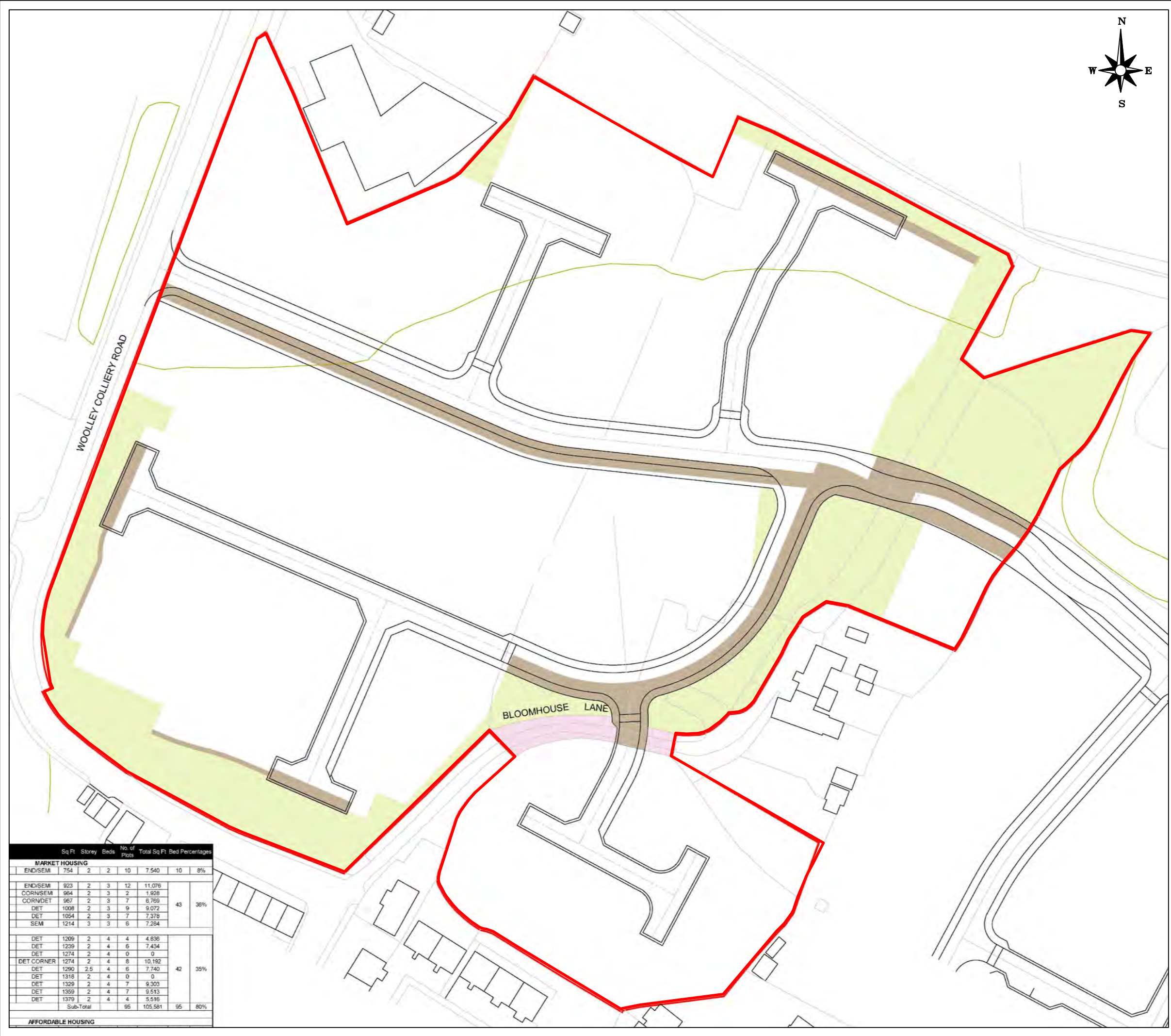
Appendix B
Drawings



**The Site
SE 312 104**

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 info@lithos.co.uk www.lithos.co.uk Tel 01937 545330	CLIENT	JOB TITLE	DRAWING TITLE	DRAWN	DATE		
	HOMES BY HONEY	WOOLLEY COLLIERY ROAD, DARTON	SITE LOCATION PLAN	DP	03 11 2025		
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				1:25,000	A4	5624/1	



NOTES

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM HOMES BY HONEY
DRAWING REFERENCE: NETT AREA PLAN -
WIKE - 001, DATED 18 08 2025

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DARTON

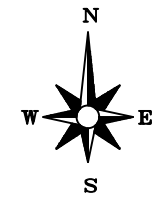
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PROPOSED SITE LAYOUT

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SCALE	1:1000	SHEET	A3	DRAWING NO.	5624/2	REVISION	
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	Sq Ft	Storey	Beds	No of Pkts	Total Sq Ft	Bed Percentages
MARKET HOUSING						
END/SEM	754	2	2	10	7,540	10 8%
END/SEM	923	2	3	12	11,076	
CORN/SEM	964	2	3	2	1,928	
CORN/DET	967	2	3	7	6,769	43 36%
DET	1008	2	3	9	9,072	
DET	1054	2	3	7	7,378	
SEM	1214	3	3	6	7,284	
AFFORDABLE HOUSING						
DET	1209	2	4	4	4,836	
DET	1239	2	4	6	7,434	
DET	1274	2	4	0	0	
DET CORNER	1274	2	4	8	10,192	42 35%
DET	1290	2.5	4	6	7,740	
DET	1316	2	4	0	0	
DET	1329	2	4	7	9,303	
DET	1359	2	4	7	9,513	
DET	1379	2	4	4	5,516	
Sub-Total				95	105,581	95 80%



NOTES

	GRASS & OVERGROWN AREAS
	IMMATURE TREES
	MATURE TREES AND HEDGEROWS
	TARMAC HARDSTAND
	CONCRETE HARDSTAND
	APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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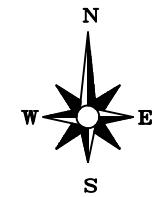
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WOOLLEY COLLIERY ROAD, DARTON








DRAWING TITLE
SITE FEATURES

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CHECKED AG	DATE 21 11 2025	

SCALE 1:1500	SHEET A3	DRAWING NO. 5624/3	REVISION
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- NOTES
-  GRASS & OVERGROWN AREAS
 -  IMMATURE TREES
 -  MATURE TREES AND HEDGEROWS
 -  TARMAC HARDSTAND
 -  CONCRETE HARDSTAND
 -  APPROXIMATE SITE BOUNDARY
 -  LOCATION & ORIENTATION OF PHOTOGRAPH



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JOB TITLE

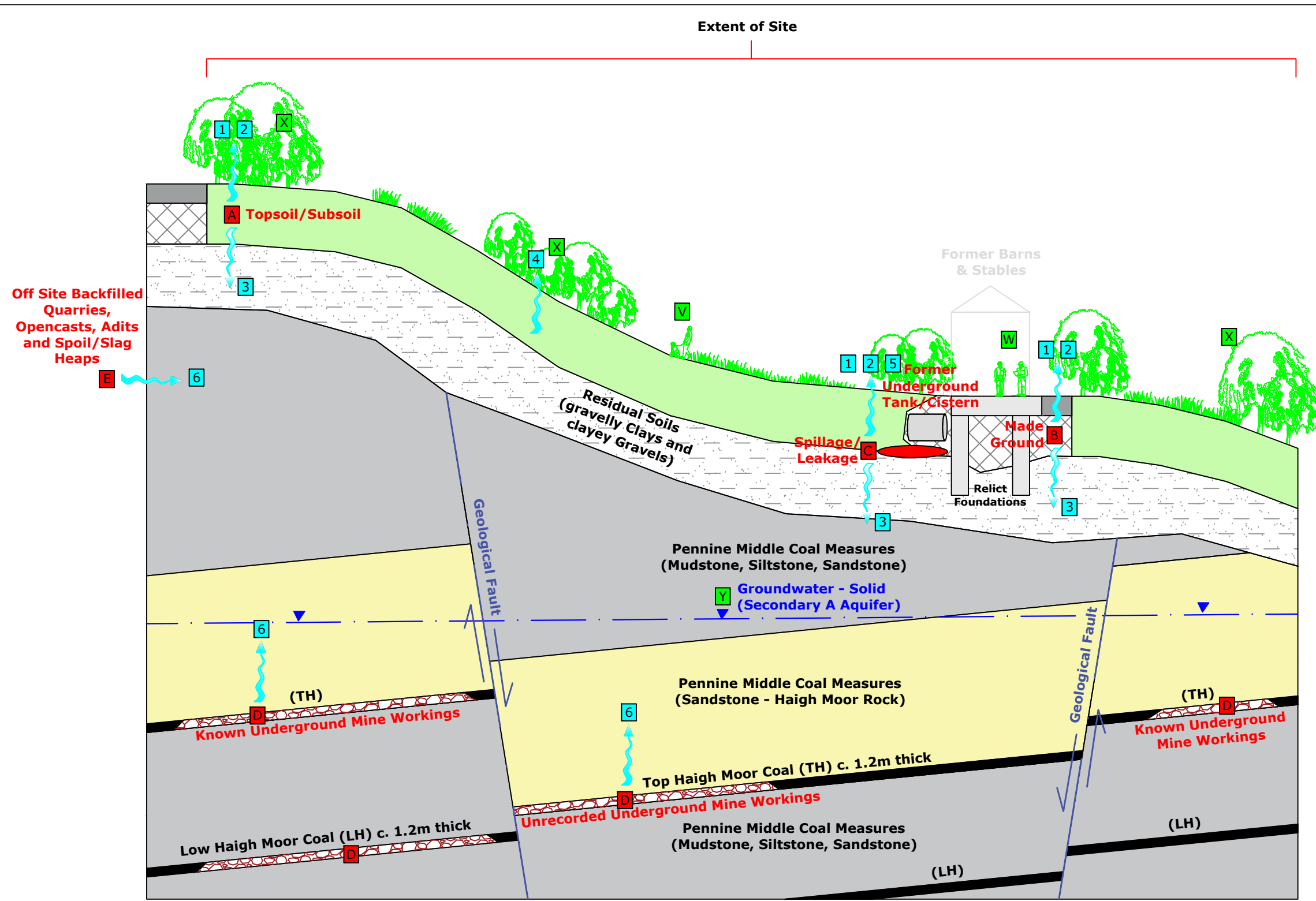
WOOLLEY COLLIERY ROAD, DARTON

DRAWING TITLE

SITE PHOTOGRAPHS

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				FINAL	<input checked="" type="checkbox"/>

SCALE	NOT TO SCALE	SHEET	A3	DRAWING NO.	5624/4	REVISION	
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Off Site Backfilled Quarries, Opencasts, Adits and Spoil/Slag Heaps

SOURCES	
A	TOPSOIL (INORGANICS & ORGANICS)
B	MADE GROUND (INORGANICS, ORGANICS & ASEBESTOS)
C	LEAKAGE/SPILLAGE (ORGANICS)
D	MINEWORKINGS (HAZARDOUS GAS)
E	BACKFILLED FEATURES & MINE WORKINGS (HAZARDOUS GAS)

PATHWAYS	
1	DERMAL CONTACT
2	INGESTION/INHALATION
3	LEACHING OF CONTAMINANTS
4	UPTAKE BY PLANTS
5	VOLATILISATION
6	MIGRATION OF GAS

RECEPTORS	
V	END USERS (RESIDENTS)
W	SITE WORKERS
X	VEGETATION
Y	GROUNDWATER

NOTES		
REV.	DESCRIPTION	DATE



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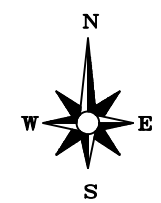
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JOB TITLE
WOOLLEY COLLIERY ROAD, DARTON

DRAWING TITLE
PRELIMINARY CONCEPTUAL SITE MODEL

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SCALE	Not to scale	SHEET	A3	DRAWING NO.	5624/5	REVISION	
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NOTES

RSK 2016 INVESTIGATION

- TRIAL PIT LOCATION
- PROBEHOLE LOCATION

LITHOS 2025 INVESTIGATION

- TRIAL PIT LOCATION
- SOAKAWAY LOCATION
- PROBEHOLE LOCATION
- MONITORING WELL LOCATION
- APPROXIMATE SITE BOUNDARY

EXPLORATORY HOLE LOCATIONS HAVE BEEN SURVEYED IN (COORDINATES & GROUND LEVEL) ON COMPLETION

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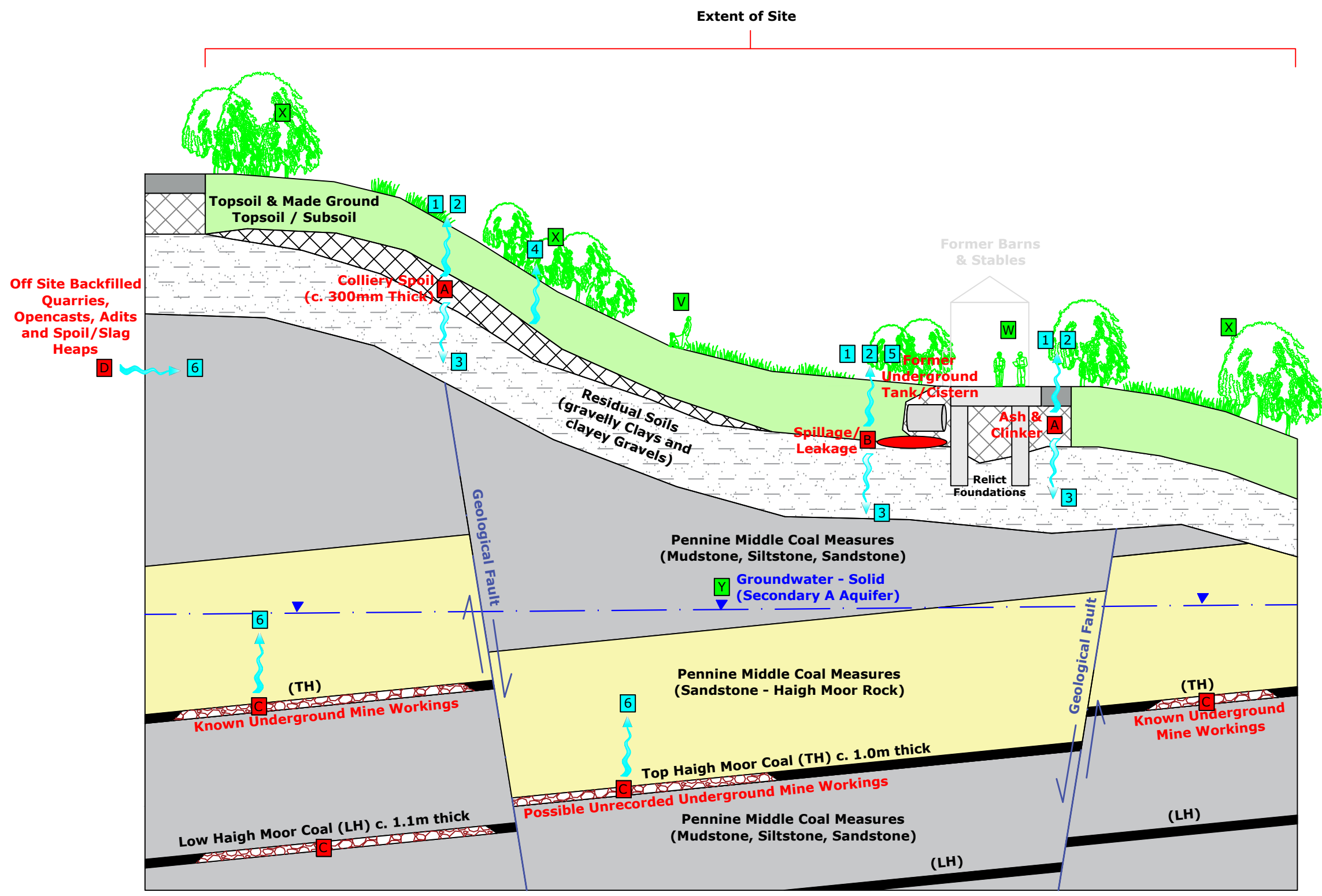
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WOOLLEY COLLIERY ROAD, DARTON

DRAWING TITLE

EXPLORATORY HOLE LOCATIONS

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				REVISION	



SOURCES	
A	MADE GROUND (ARSENIC)
B	LEAKAGE/SPILLAGE (ORGANICS)
C	MINeworkINGS (HAZARDOUS GAS)
D	BACKFILLED FEATURES & MINE WORKINGS (HAZARDOUS GAS)

PATHWAYS	
1	DERMAL CONTACT
2	INGESTION/INHALATION
3	LEACHING OF CONTAMINANTS
4	UPTAKE BY PLANTS
5	VOLATILISATION
6	MIGRATION OF GAS

RECEPTORS	
V	END USERS (RESIDENTS)
W	SITE WORKERS
X	VEGETATION
Y	GROUNDWATER

NOTES		
REV.	DESCRIPTION	DATE

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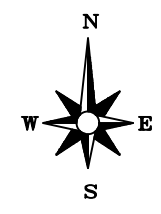
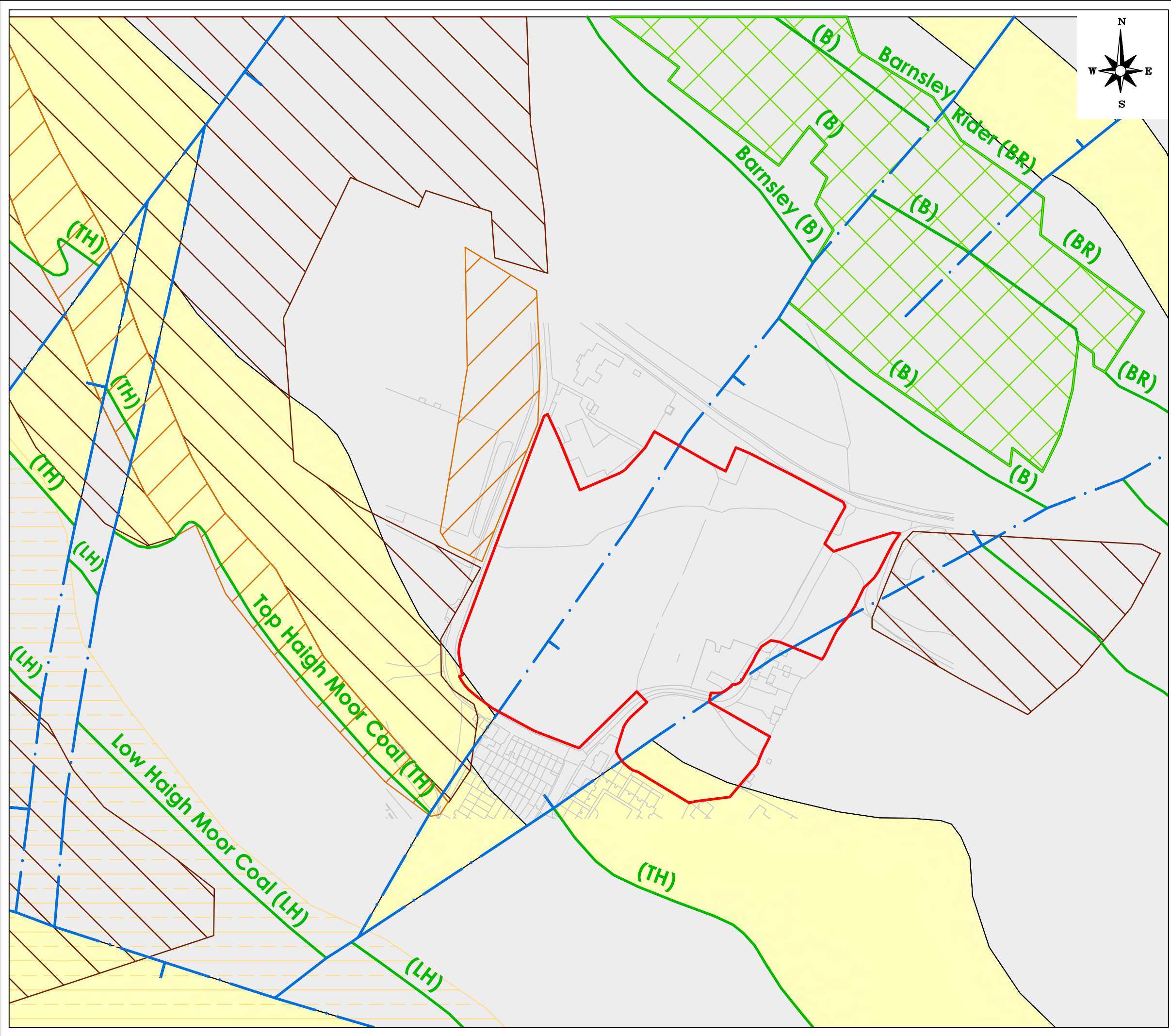
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WOOLLEY COLLIERY ROAD, DARTON

DRAWING TITLE

REVISED CONCEPTUAL SITE MODEL

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				FINAL	<input checked="" type="checkbox"/>
SCALE	Not to scale	SHEET	A3	DRAWING NO.	5624/7
				REVISION	



NOTES

BASED ON BGS INFORMATION

- PENNINE MIDDLE COAL MEASURES (MUDSTONE, SILTSTONE, SANDSTONE)
- PENNINE MIDDLE COAL MEASURES (SANDSTONE incl. HAIGH MOOR ROCK)
- ALLUVIUM
- MADE GROUND (SPOIL/SLAG HEAPS, ROAD, RAILWAY AND CANAL EMBANKMENTS)
- WORKED GROUND (ROAD AND RAILWAY CUTTINGS)
- INFILLED GROUND (BACKFILLED OPENCASTS, PITS AND QUARRIES)
- CONJECTURED COAL OUTCROP
- APPROXIMATE LINE OF GEOLOGICAL FAULT
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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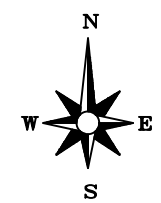
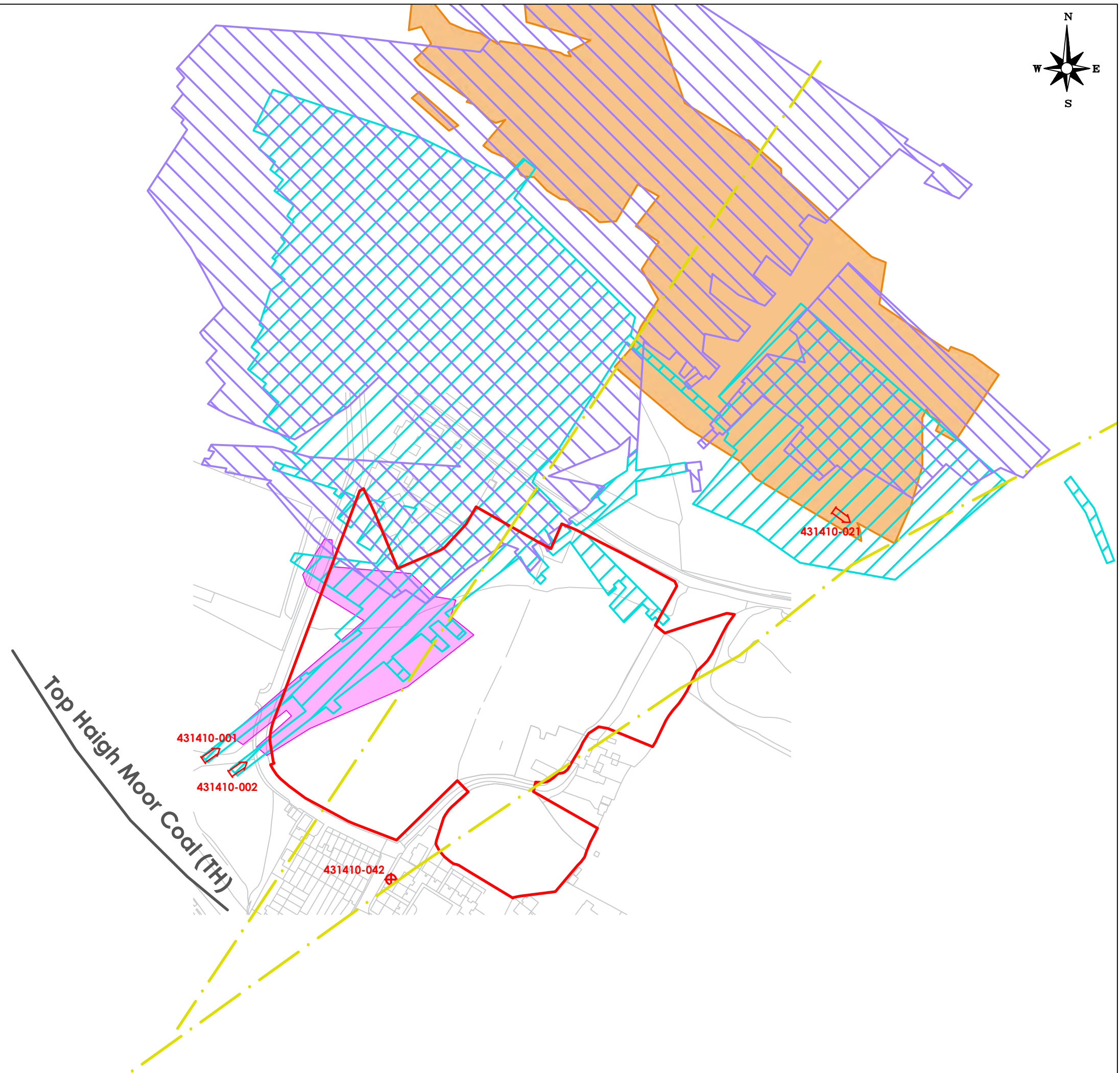
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WOOLLEY COLLIERY ROAD, DARTON

DRAWING TITLE

SITE GEOLOGY & COAL (BGS)

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				FINAL	<input checked="" type="checkbox"/>
SCALE	1:2500	SHEET	A3	DRAWING NO.	5624/8
				REVISION	



NOTES

BASED ON MRA INFORMATION

- MINE SHAFT
- KNOWN ADIT
- MRA HIGH RISK AREA
- APPROXIMATE LINE OF GEOLOGICAL FAULT

ABANDONMENT PLAN REF - NE978

- EXTENT OF WORKINGS SHOWN IN THE TOP HAIGH MOOR COAL SEAM
- CONJECTURED COAL OUTCROP

ABANDONMENT PLAN REF - NE979

- EXTENT OF WORKINGS SHOWN IN THE LOW HAIGH MOOR COAL SEAM

ABANDONMENT PLAN REF - 16548

- EXTENT OF OPENCAST WORKINGS SHOWN IN THE BARNSELY AND BARNSELY RIDER COAL SEAMS
- APPROXIMATE SITE BOUNDARY

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JOB TITLE
WOOLLEY COLLIERY ROAD, DARTON

DRAWING TITLE
SITE GEOLOGY & COAL (MRA & ABANDONMENT PLANS)

DRAWN DP	DATE 27 11 2025	STATUS FOR COMMENT <input type="checkbox"/>
CHECKED AG	DATE 27 11 2025	FOR APPROVAL <input type="checkbox"/>
		DRAFT <input type="checkbox"/>
		FINAL <input checked="" type="checkbox"/>

SCALE 1:2500	SHEET A3	DRAWING NO. 5624/9	REVISION
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NOTES

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM ABANDONMENT PLAN CATALOGUE NUMBER: NE978

REV.	DESCRIPTION	DATE



info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

CLIENT

HOMES BY HONEY

JOB TITLE

WOOLLEY COLLIERY ROAD, DARTON

DRAWING TITLE

ABANDONMENT PLAN NE978

DRAWN	DATE	STATUS
DP	04 12 2025	FOR COMMENT <input type="checkbox"/>
CHECKED	DATE	FOR APPROVAL <input type="checkbox"/>
AG	04 12 2025	DRAFT <input type="checkbox"/>
		FINAL <input checked="" type="checkbox"/>

SCALE	SHEET	DRAWING NO.	REVISION
1:5000	A3	5624/10	

BARNSELY PUMPING SHAFT
44/3309/266787

SURFACE LEVEL [Banking]	10,298.86
[Ref. Pt. for Depths]	
SURFACE LEVEL [Ground]	10,296.69
BARNSELY SEAM INSET LEVEL	9,994.22
BARNSELY SEAM LEVEL	9,979.21
DEPTH OF SHAFT [Sump Bottom]	106.55yds.

THIS SHAFT FILLED IN TO SURFACE - APRIL 1962
RE-EXCAVATED TO BARNSELY INSET - AUGUST 1970

IN COMPLIANCE WITH THE COAL AND OTHER MINES (SURVEYORS AND PLANS) REGULATIONS 1956

WORKINGS IN OTHER SEAMS WITHIN A DISTANCE OF 40 YDS VERTICALLY ARE

LOW HAIGH MOOR SEAM LIDGETT SEAM

NORTH GAWBER COLLIERY

LIDGETT SHAFT 44/3309/169842 [Point of Origin for Underground Surveys]	BARNSELY UPCAST SHAFT 44/3309/196817	BARNSELY DOWNCAST SHAFT 44/3309/225751
SURFACE LEVEL [Ground & Low Deck]	SURFACE LEVEL [Ground & Banking]	SURFACE LEVEL [Ground]
10,306.41	10,300.75	10,296.75
[Ref. Pt. for Depths]	[Ref. Pt. for Depths]	[Ref. Pt. for Depths]
BARNSELY SEAM LEVEL	BARNSELY SEAM LEVEL	BARNSELY SEAM INSET LEVEL
9,997.96	9,995.69	9,991.51
BARNSELY SEAM INSET LEVEL	BARNSELY SEAM INSET LEVEL	BARNSELY SEAM LEVEL
9,997.96	9,995.69	9,988.80
TOP HAIGH MOOR SEAM LEVEL	DEPTH OF SHAFT [Sump Bottom]	DEPTH OF SHAFT [Sump Bottom]
9,794.81	110.69yds.	104.75yds.
[Panel in Shaft Wall]	THIS SHAFT FILLED IN TO SURFACE - AUGUST 1967	
LOW HAIGH MOOR SEAM LEVEL	— OLD DARTON COLLIERY SHAFTS —	
9,774.00	No.1 SHAFT [OLD DOWNCAST] 44/3209/235543	No.2 SHAFT [OLD UPCAST] 44/3209/257566
[Panel in Shaft Wall]	SURFACE LEVEL [Ground]	SURFACE LEVEL [Ground & Banking]
LIDGETT SEAM INSET LEVEL [Low Deck]	10,242.77	10,243.00
9,665.47	[Ref. Pt. for Depths]	[Ref. Pt. for Depths]
LIDGETT SEAM LEVEL	TOP HAIGH MOOR SEAM LEVEL	TOP HAIGH MOOR SEAM LEVEL
9,663.57	10,003.60	9,999.89
DEPTH OF SHAFT [Sump Bottom]	LOW HAIGH MOOR SEAM LEVEL	LOW HAIGH MOOR SEAM LEVEL
222.14yds.	9,977.88	9,975.12
	LOW HAIGH MOOR SEAM INSET LEVEL	LOW HAIGH MOOR SEAM INSET LEVEL
	9,977.14	9,971.96
	LIDGETT SEAM LEVEL	LIDGETT SEAM LEVEL
	9,872.64	9,867.62
	LIDGETT SEAM INSET LEVEL	LIDGETT SEAM INSET LEVEL
	9,872.64	9,866.43
	DEPTH OF SHAFT [Sump Bottom]	DEPTH OF SHAFT [Sump Bottom]
	129.38yds.	131.52yds.
	THIS SHAFT FILLED IN TO SURFACE - AUGUST 1970	

TOP HAIGH MOOR SEAM

GREY SANDSTONE [HAIGH MOOR ROCK]

COAL 1'-3"
DIRT 0'-6"

COAL 1'-7"

FIRECLAY

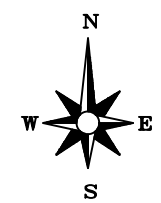
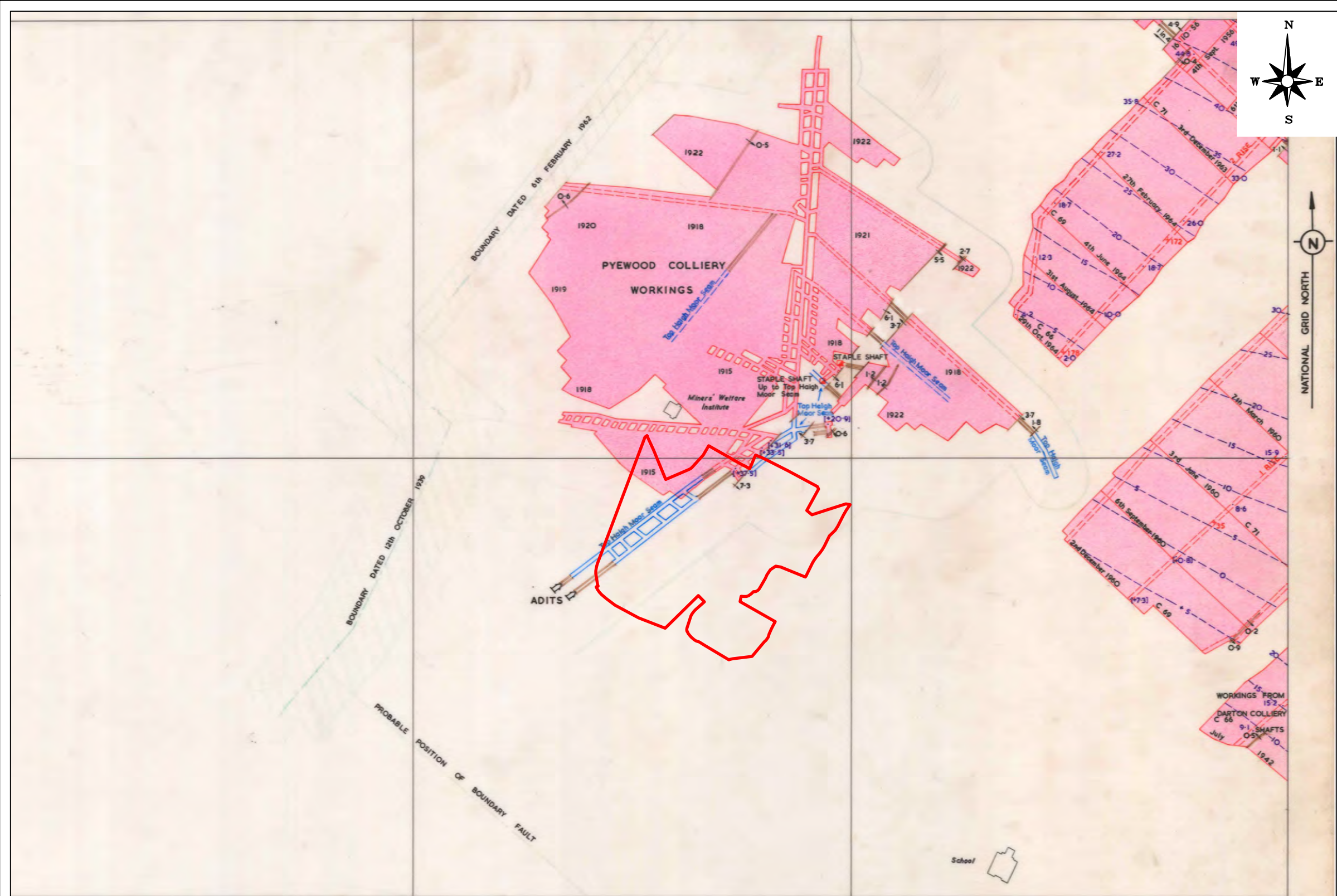
NON METRIC

TOP HAIGH MOOR SEAM

— SCALE:- 1/2500 —

DATUM FOR LEVELS
10,000 feet below ORDNANCE DATUM
[Via O.S. FLUSH BRACKET B.M. No. S.9249 on
S.E. corner of Lidgett Shaft Winding Engine House
VALUE 306.84' A.O.D.]

DATE OF ABANDONMENT 5th MARCH 1986.
DATE OF CONSTRUCTION MAY 1961



NATIONAL GRID NORTH

NOTES
 — APPROXIMATE SITE BOUNDARY
 REPRODUCED FROM ABANDONMENT PLAN CATALOGUE NUMBER: NE979

REV.	DESCRIPTION	DATE



info@lithos.co.uk
 www.lithos.co.uk
 Tel 01937 545330

CLIENT
 HOMES BY HONEY

JOB TITLE
 WOOLLEY COLLIERY ROAD, DARTON

DRAWING TITLE
 ABANDONMENT PLAN NE979

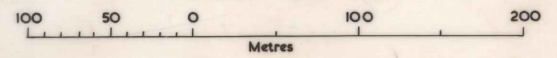
IN COMPLIANCE WITH THE COAL AND OTHER MINES (SURVEYORS AND PLANS) REGULATIONS 1956
 OVERLAY TRACINGS OF WORKINGS IN OTHER SEAMS WITHIN A DISTANCE OF 37 METRES VERTICALLY, WHICH FORM PART OF THIS WORKING PLAN ARE
 TOP HAIGH MOOR SEAM
 LIDGETT SEAM

I hereby certify, enquire, that to the best of my knowledge and belief, it is an accurate plan of the mine.
 Signed: *A.T. Wood*
 Date: 23/6/1986
 Certificate No. 6208

LOW HAIGH MOOR SEAM

[NETHERTON THIN SEAM]

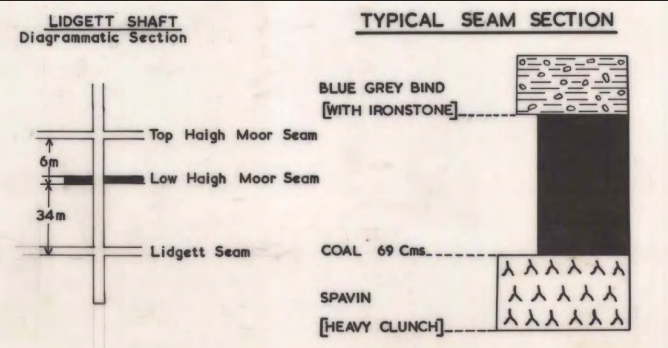
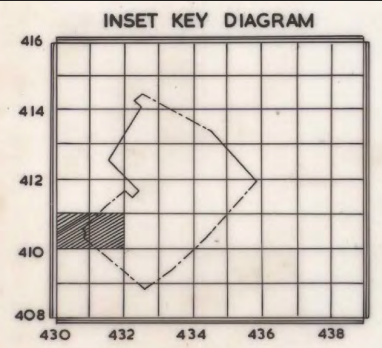
SCALE 1/2500



I hereby certify that no further working has taken place, after the date of abandonment, which would affect the accuracy of this plan.
 Signed: *A.T. Wood* Colliery/Agent/Gen. Manager
 Date: 19.6.86
 Certificate No. 8153 Dated: 10-8-90

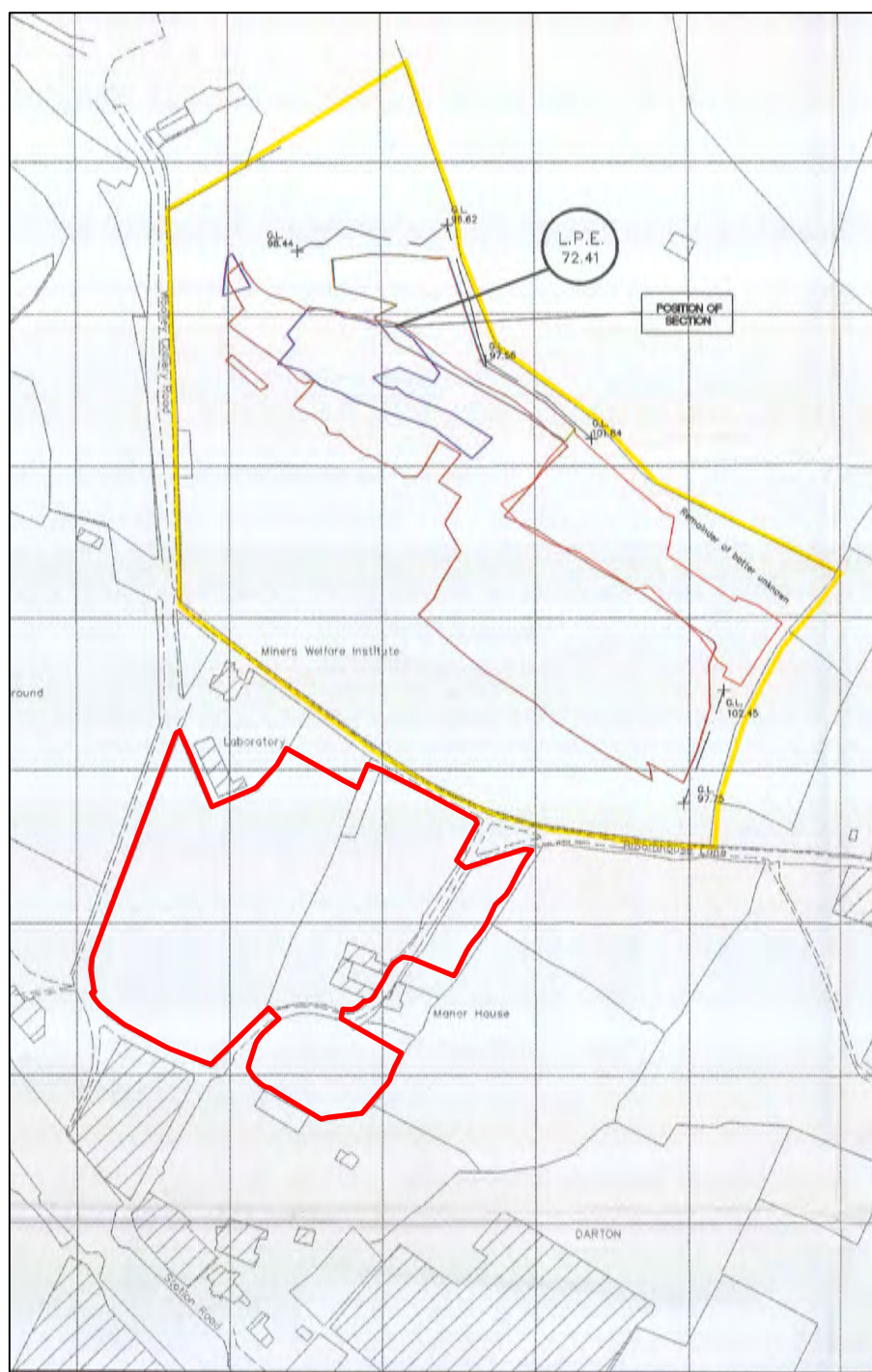
This is the Working Plan of the Mine as completed to MARCH 1986.
 I hereby certify, after thorough examination and enquiry, that to the best of my knowledge and belief, it is an accurate plan of the mine.
 Signed: *A.T. Wood* Colliery Surveyor
 Date: 23/6/1986
 Certificate No. 6208 Dated: 26-11-76

Grid values to ORDNANCE SURVEY NATIONAL GRID Datum for levels: _____ ORDNANCE DATUM
 Via O.S. FLUSH BRACKET B.M. No 5.9249 on SE corner of Lidgett Shaft Winding Engine House. VALUE [+ 93.53]
 Levels ABOVE O.D. shewn _____ [+123.4]
 Levels BELOW O.D. shewn _____ 123.4
 Seam Sections shewn in centimetres
 DATE OF CONSTRUCTION JULY 1942
 DATE OF ABANDONMENT 5th MARCH 1986



DRAWN	DATE	STATUS
DP	04 12 2025	FOR COMMENT <input type="checkbox"/>
AG	04 12 2025	FOR APPROVAL <input type="checkbox"/>
		DRAFT <input type="checkbox"/>
		FINAL <input checked="" type="checkbox"/>

SCALE	SHEET	DRAWING NO.	REVISION
1:5000	A3	5624/11	



- ### Legend
- SITE BOUNDARY (Centre of symbol to be taken as boundary of site)
 - PERIMETER OF BATTER
 - POSITION OF KNOWN OR SUSPECTED SHAFT
Refer to Shaft Register
 - POSITION OF KNOWN OR SUSPECTED ADIT
Refer to Shaft Register
 - FAULT (Throw in Metres)
 - WASHOUT
 - AREA OF NO COAL
 - OLD WORKINGS (Seam Colour)
 - AREA OF COMPACTION (AT SURFACE)
Consulting Engineers :-
 - BOTTOM COAL CONTOUR (Seam Colour)
 - L.P.E.
72.41 LOWEST POINT OF EXCAVATION
 - ORIGINAL GROUND LEVEL (Metres)
 - BOTTOM OF COAL LEVEL WITH THICKNESS (Metres)

Site Bench Mark E N L
NOT KNOWN

ALL LEVELS RELATIVE TO NEWLYN DATUM

- AREA OF SEAM WORKED IN GEOLOGICAL DESCENDING ORDER**
- BARNSELY RIDER (Leaf D)
 - BARNSELY RIDER (Leaf B)
 - BARNSELY (Leaf A)
 - BARNSELY (Leaf C)

NOTES

3E(2)(c) LICENCE - MED CONTRACTING LTD, BARNSELY

LAND TYPE AND USAGE

BEFORE OPERATIONS INFORMATION NOT AVAILABLE

AFTER RESTORATION PROPOSED WETLAND

DETAILS OF OVERBURDEN INFORMATION NOT AVAILABLE

DETAILS OF BACKFILL INFORMATION NOT AVAILABLE

NATURE OF COAL INFORMATION NOT AVAILABLE

OPERATIONAL DATES

LICENCE ISSUED	9 NOVEMBER 1990
COALING COMMENCED	1 NOVEMBER 1990
COALING COMPLETED	27 JULY 1991
PLANS ISSUED	28 OCTOBER 1994

16548

BRITISH COAL OPENCAST
Headquarters, 200 Lichfield Lane
Mansfield, Notts. NG18 4RG

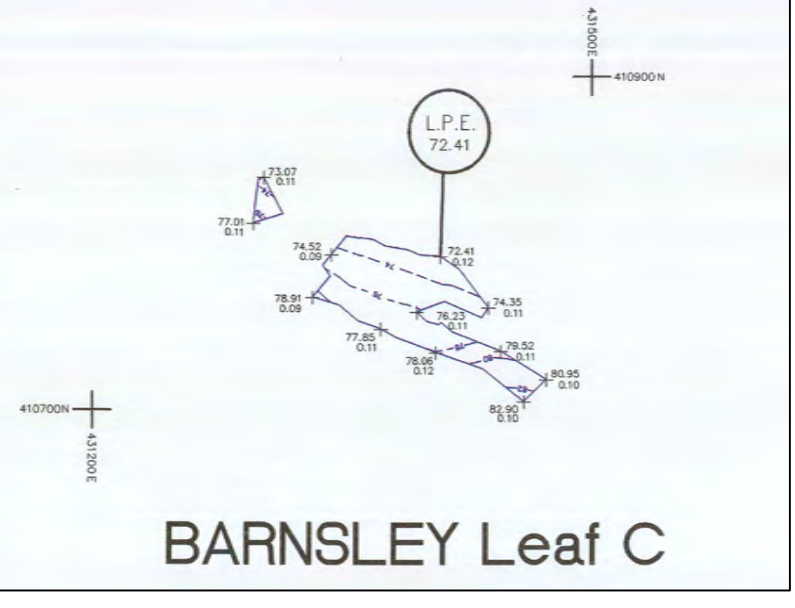
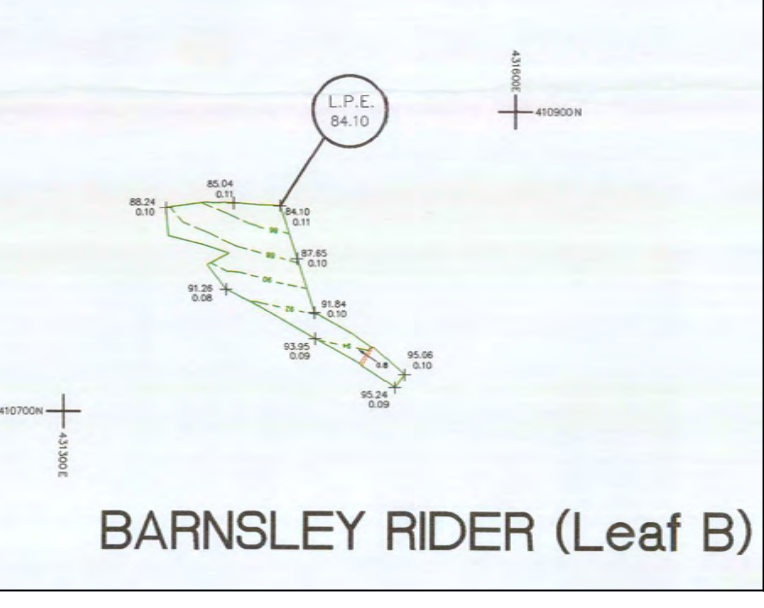
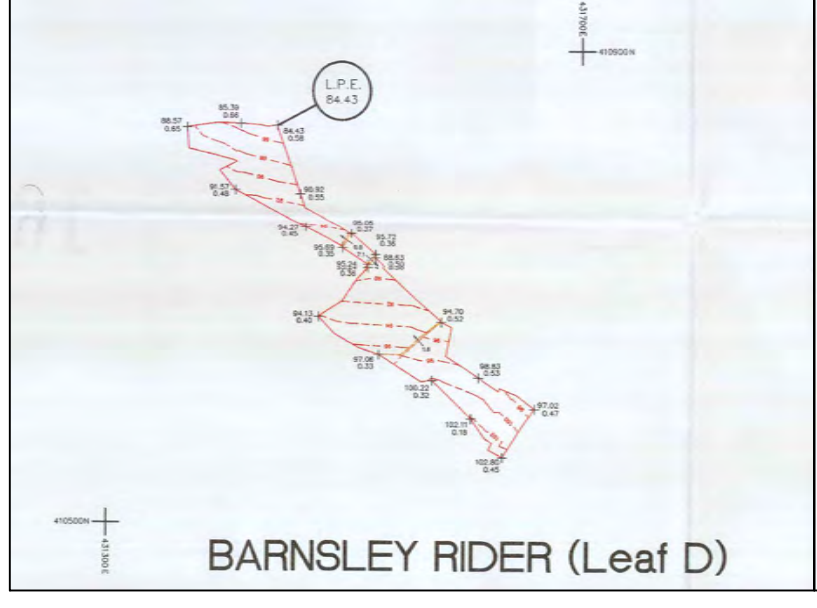
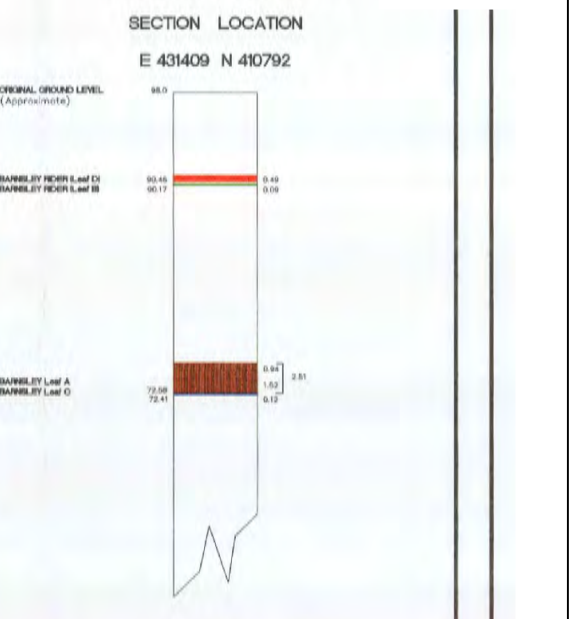
SITE NAME
BLOOMHOUSE LANE + EXTENSION L.O.M.

TITLE
COMPLETION PLAN

County	SOUTH YORKSHIRE	District	BARNSELY BOROUGH	Civil Parish	-
Location	5.5 KILOMETRES NORTH, WEST OF BARNSELY				
O.S. SHEETS USED	Prefix	Based upon Ordnance Survey maps with the sanction of the controller of H.M. Stationery Office. Crown Copyright Reserved. Licence No. NA 273082			
	SE	Drawn by	FHR	Date	23.09.94
		Checked by	C.S.B	Date	OCT.1994
		Scale	1:2500	Sheet	1 of 1
		Drawing No.	CP2687	Completion Plan No.	

Vertical Sections

SEAM NAME LEVEL SEAM THICKNESS
BOTTOM OF COAL



NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM ABANDONMENT PLAN
CATALOGUE NUMBER: 16548

REV.	DESCRIPTION	DATE



info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

CLIENT

HOMES BY HONEY

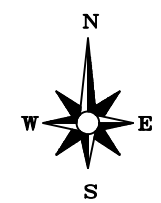
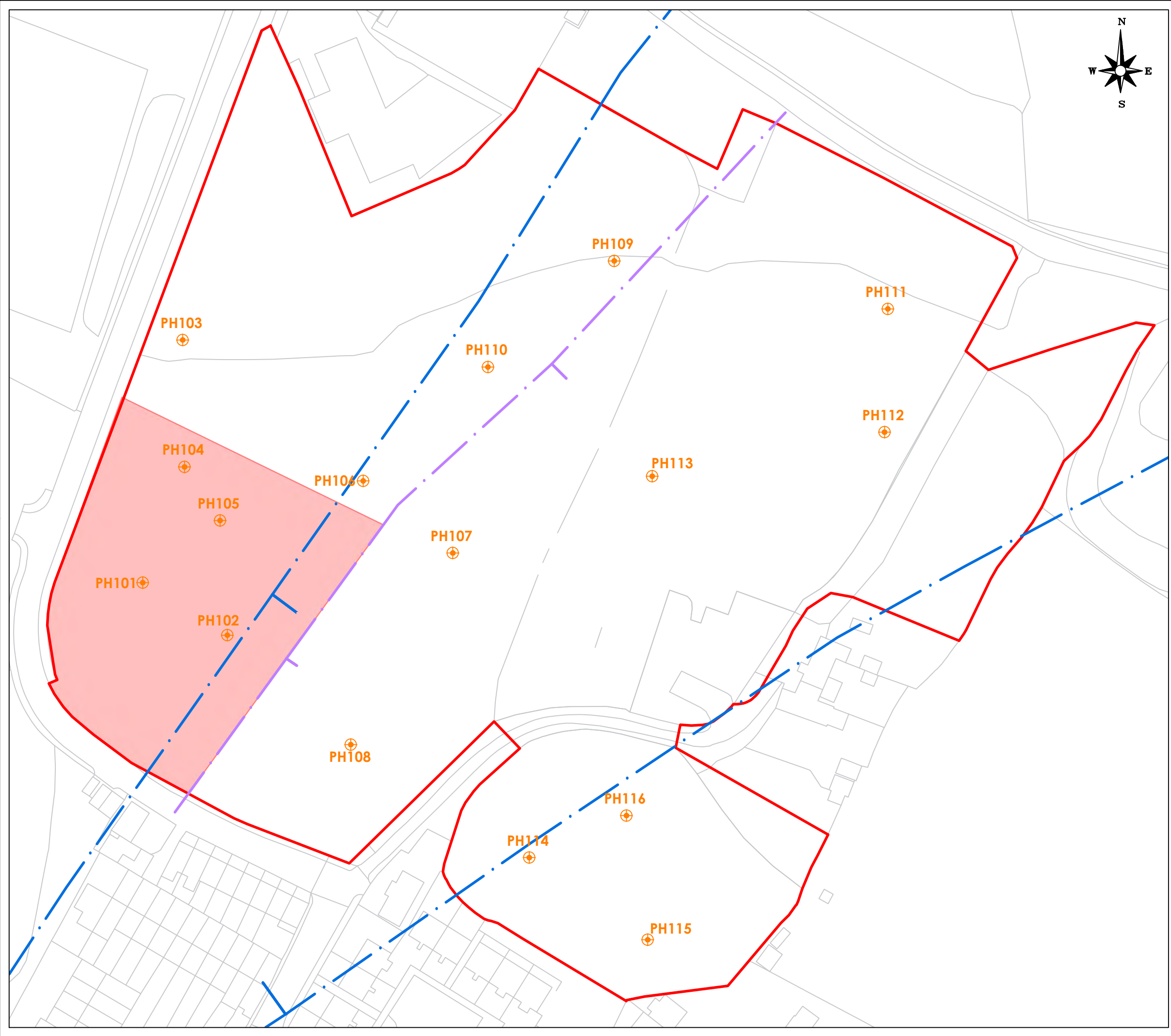
JOB TITLE






WOOLLEY COLLIERY ROAD,
DARTON

DRAWING TITLE

ABANDONMENT PLAN 16548

DRAWN	DP	DATE	04 12 2025	STATUS	FOR COMMENT <input type="checkbox"/>
CHECKED	AG	DATE	04 12 2025		FOR APPROVAL <input type="checkbox"/>
					DRAFT <input type="checkbox"/>
					FINAL <input checked="" type="checkbox"/>
SCALE	1:5000	SHEET	A3	DRAWING NO.	5624/12
				REVISION	



- NOTES
-  PROBEHOLE LOCATION
 -  APPROXIMATE AREA OF DRILLING AND GROUTING (COVER RATIO <10)
 -  APPROXIMATE LINE OF GEOLOGICAL FAULT (LITHOS SI & ABANDONMENT PLANS)
 -  APPROXIMATE LINE OF GEOLOGICAL FAULT (BGS)
 -  APPROXIMATE SITE BOUNDARY

THE EXTENT OF DRILL & GROUT AREA HAS BEEN CALCULATED ASSUMING THE HEIGHT OF THE ADIT COULD BE UP TO C. 2.0m

REV.	DESCRIPTION	DATE



info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

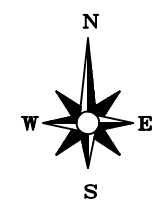
CLIENT
HOMES BY HONEY

JOB TITLE
WOOLLEY COLLIERY ROAD, DARTON

DRAWING TITLE
APPROXIMATE AREA OF DRILLING AND GROUTING

DRAWN DP	DATE 19 12 2025	STATUS FOR COMMENT <input type="checkbox"/> FOR APPROVAL <input type="checkbox"/> DRAFT <input type="checkbox"/> FINAL <input checked="" type="checkbox"/>
CHECKED AG	DATE 19 12 2025	

SCALE 1:1000	SHEET A3	DRAWING NO. 5624/ 13	REVISION
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- NOTES
- PROBEHOLE LOCATION
 - APPROXIMATE AREA OF DRILLING AND GROUTING - LIKELY >5 - 10m OF ROCK COVER - THEREFORE STRIP FOUNDATIONS REQUIRE REINFORCEMENT AND THICKENING
 - WITHIN 25m OF APPROXIMATE LINE OF FAULT
 - APPROXIMATE LINE OF GEOLOGICAL FAULT (LITHOS SI & ABANDONMENT PLANS)
 - APPROXIMATE LINE OF GEOLOGICAL FAULT (BGS)
 - APPROXIMATE SITE BOUNDARY
- REPRODUCED FROM HOMES BY HONEY DRAWING REFERENCE: NETT AREA PLAN - WIKE - 001, DATED 18 08 2025
- | REV. | DESCRIPTION | DATE |
|------|-------------|------|
| | | |



info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

CLIENT
HOMES BY HONEY

JOB TITLE
WOOLLEY COLLIERY ROAD, DARTON

DRAWING TITLE
AREAS REQUIRING FOUNDATION REINFORCEMENT

Sq Ft	Stores	Beds	Total Sq Ft	Est. Generation			
MARKET HOUSING							
END/SEM	754	2	2	10	7,540	10	8%
END/SEM	593	2	3	12	11,076		
CORN/SEM	964	-2	3	2	1,528		
CORN/DET	967	2	3	7	6,739	43	36%
DET	1006	2	3	9	9,072		
DET	1054	2	3	7	7,378		
SEM	1214	3	3	6	7,284		
DET	1209	3	6	4	4,636		
DET	1239	2	4	6	7,434		
DET	1274	2	4	0	0		
DET CORNER	1274	2	4	8	10,192		
DET	1290	2.5	4	6	7,740	42	33%
DET	1313	2	6	0	0		
DET	1329	2	4	7	9,303		
DET	1359	2	4	7	9,513		
DET	1379	2	4	4	5,516		
Sub-Total				95	105,581	95	80%
AFFORDABLE HOUSING							
END/SEM	786	2	2	12	9,468	12	10%

DRAWN	DP	DATE	22 01 2026	STATUS	FOR COMMENT <input type="checkbox"/>
CHECKED	AG	DATE	22 01 2026	FOR APPROVAL	<input type="checkbox"/>
				DRAFT	<input type="checkbox"/>
				FINAL	<input checked="" type="checkbox"/>
SCALE	1:1000	SHEET	A3	DRAWING NO.	5624/14
				REVISION	

Appendix C
Commission

002/5624/AG

22nd October 2025

Mr J Blankley
Homes by honey
Lumina Park
Park Approach
Leeds
LS15 8GB



Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330

www.lithos.co.uk

Dear Joe

Woolley Colliery Road, Darton, Barnsley

Further to your recent invitation, please find attached our proposal for undertaking a site investigation on the above land. We understand that proposed development will include traditional 2 storey domestic dwellings with associated gardens, POS and adoptable roads and sewers; although no layout is available yet.

Review of the information supplied suggests that the site consists of a single parcel of land of (c. 4.1 ha). Review of Google Maps suggests the site is undeveloped rough vegetated land.

Brief review of internet data suggests the site:

- Appears to have remained undeveloped throughout its history;
- Is not located within 250m of a known landfill site;
- Is not within a groundwater source protection zone;
- Is in an area where 5-10% of properties are at or above the radon action level;
- Is in an area where the risk of encountering UXO is considered low; and
- Lies within a Coal Mining Development Low Risk Area, however an area of the site is recorded to be underlain by known shallow workings.
- Two adits located off site, but are orientated such that they will be present beneath the site.

Brief examination of the relevant geological map suggests the site is underlain by Pennine Middel Coal Measures likely completely weathered near surface to a gravelly clay.

The scope of works outlined in this letter should enable us to assess abnormal development issues, associated with the ground. However, the nature of site investigation is such that it is not always possible to foresee all the potential issues. Consequently, it is sometimes necessary to recommend additional work, but where this occurs we will inform you immediately, provide costs, and seek your further instruction. We have reviewed available internet data and our geological maps in order to minimise the likelihood of further work.

Redevelopment of this site will almost certainly be subject to planning conditions relating to ground investigation, remediation and validation. Recent experience suggests that a single phase of ground investigation may not be sufficient to obtain regulatory approval and enable discharge of all relevant planning conditions. Nonetheless, useful data can be obtained at this time and we will certainly aim to resolve as much uncertainty relating to ground as possible.

We will need a Promap or topo survey in CAD format, to provide a base plan for technical drawings etc. If you do not have one, we could obtain for an E\O of £***.



Our site investigation will be undertaken in accordance with UK good practice (as outlined in BS5930, BS10175, LCRM etc). Our Report may not be fully compliant with Eurocode 7 (EC7) and will not purport to be a Ground Investigation Report, nor a Geotechnical Design Report as defined by EC7. Our ground appraisal is intended to assist others as they proceed with design of the proposed development.

This proposal allows for the following works:

Desk study: Environmental search data and historical maps (obtained from Landmark or Groundsure), will be reviewed in order to determine whether past land uses have had any effect on the proposed development. In addition, published geological plans of the area will be examined. Based on the initial radon classification a BGS radon report will be obtained.

We will also visit site to review current operations and undertake a walkover survey.

Given the site's location within a Coal Mining Low Risk Area, a Consultant's mining report will be obtained. Review of the CA's interactive viewer suggests abandonment plans should be available for known shallow mineworkings beneath the site.

Fieldwork: We have allowed for 2 day's trial pitting (or c. 20 no. trial pits) and the drilling of about 15 rotary probeholes to check for the presence of mineworkings. All trial pits and boreholes will be supervised and logged by an experienced geoenvironmental engineer.

This proposal has been put together without a recent site visit. If ground conditions are found to be significantly wet/boggy at the time of the investigation, it may be necessary to hire additional resources (bog mats, tracked excavators, tractors, stone etc) in order for works to continue. We will discuss the requirement for any such items and associated costs with you prior to ordering.

Trial pitting will enable us to determine the:

- Nature of any made ground, including:
 - visual/olfactory evidence of potential contamination and the proportion of undesirable elements e.g. biodegradable matter, relict foundations etc
 - the proportion of "oversize", boulder-sized material
- Nature, distribution and thickness of shallow soils
- Suitability of the ground for soakaways
- Suitability of the ground for founding structures and highways

Given nature of the land and the time of year and anticipated ground we have allowed for pits to be dug using a tracked 360° excavator.

Representative soil samples of natural and man-made ground, including any contaminated samples, will be taken during the works. In-situ shear strengths of any cohesive soils encountered will be determined by the use of a hand-held shear vane.

We will make every effort to compact arisings and 'sweep' them over each trial pit. However, you should be aware that on completion of the investigation, "graves" of spoil (each about 3m long by 1m wide) unsuitable for trafficking, will be left up to 400mm proud at each trial pit location. At this stage, no allowance has been made for any further reinstatement such as removal of excess arisings, replacement of turf etc.

If the pitting encounters significant thicknesses of made ground or very soft/loose deposits (neither considered likely), boreholes may be required to obtain geotechnical data from greater depth. We will advise you of any need for boreholes within 2 days of completion of the pitting.

Soakaway testing will also be carried out in at least 5 pits in order to assess suitability of the ground for plot and highway surface water drainage. This will provide an 'initial sweep' at relatively wide spacings and often with only 1 or 2 fills.

It should be noted that if the initial soakaway tests yield satisfactory results, in order to obtain approvals from the LLFA, Highways etc, the drainage designer is likely to require further testing: (a) within 25m of proposed chamber locations; and (b) to include 3 fills.

The site is underlain by the Top Haigh Moor coal seam, and therefore we have allowed for the drilling of 15 **rotary probeholes** to check whether old mineworkings are present and pose a significant risk to surface stability of the site.

If a potential risk is perceived to exist, further probeholes may be required to delineate the extent of workings in order to obtain fixed price quotations for the necessary consolidation works. Furthermore, we have assumed that it will be possible to advance the 15 probeholes within 4 days but there is a chance that it may take longer in which case we will inform you before leaving site, and seek your further instruction. Each day of additional drilling would cost £**** (inclusive of supervision) provided it were instructed whilst the drilling rig was still on site.

It will be necessary to submit an application (with the associated fee) to the Coal Authority (CA) for 'Permission to enter CA mining interests'; and we have allowed for this. You should note that the CA have updated the application process and as of 4th October 2021, developers (clients) must submit a signed copy of the **CA's T&Cs** (copy enclosed) before the CA will commence work on permit issue which can take up to 4 weeks. Lithos can perform the role of Agent.

Given the absence of coal seams with a history of spontaneous combustion and the site's size / location, we should be able to avoid the need to drill holes within 50m of surrounding residential properties and therefore, in accordance with CA requirements, we should be able to use air as the flushing medium.

Boreholes will also allow the installation of gas wells (50mm ID, HDPE pipework with bentonite seals and a gravel filter pack). Well headworks will comprise a 100mm diameter steel security helmet which will extend about 150mm above ground level (if required, the position of each helmet could be "marked" with a 1.5m high fence post to reduce the likelihood of damage by farm machinery).

At this stage, we have assumed that overnight security will not be required, but this will be reviewed following a site visit. If required, security would be an E\O of £*** per night.

We have allowed for all exploratory holes to be picked-up by a **surveyor** (co-ordinates/ground levels will be included on the logs).

Given the likely presence of shallow mineworkings, we have allowed for the installation of wells in 8 holes and monitoring for hazardous **gas** (and any shallow groundwater).

The generation potential of this gas source is considered likely to be Low. Therefore, in accordance with CIRIA Report C665, we have initially allowed for 9 visits over a 6-month period. A hazardous gas risk assessment will be issued on completion of monitoring.

We strongly recommend that groundwater / gas wells be decommissioned after monitoring has been completed. Decommissioning involves removal of the metal covers, unscrewing the upper 1m to 2 m of pipework and filling the void / remaining well with bentonite.

Decommissioning of monitoring wells removes the potential for groundwater pollution caused by accidental spillages during the construction phase and prevents gas migration into sub-floor voids. Subject to your instruction, we will decommission accessible wells after the last monitoring visit for an E\O price of £***+VAT. We will contact you to seek instruction following issue of our gas risk assessment.

Testing: This will comprise routine **geotechnical** soils analysis, including 15 moisture content & Atterberg limits, and 15 pH & water-soluble sulphate and 5 gradings.

This site is greenfield and therefore we could obtain in-situ CBR values from plate tests on site. However, at this stage, we will simply estimate CBR values from strata descriptions and classification test results.

At this stage, we have no reason to expect wide areas of the site to be underlain by significant thicknesses of made ground. Consequently, we have only allowed for **contaminant** testing of up to 10 made ground samples, plus a further 10 samples of topsoil to confirm its suitability for re-use. The test suite will include heavy metals, speciated PAH, and banded TPH (with supplementary speciation as/where appropriate).

If more significant made ground is encountered, we will inform you immediately and provide costs for the recommended chemical testing.

Within in our proposal we have allowed for the screening (ID) of 20 samples for asbestos. In the event that positive IDs are reported, it is likely that we will need to schedule further analysis (asbestos quantification), in order to determine the significance of the results. Asbestos quantification is currently a relatively expensive test and consequently we have not allowed for it at this stage. We will inform you immediately after receipt of results if we consider asbestos quantification is required.

Visible contaminants, sharps and the clay/sand/silt content of 3 topsoil samples will be determined to check compliance with BS3882 requirements.

Reporting & timescales: In order to provide you with sufficient information to enable assessment of abnormal costs at the earliest opportunity we will issue a concise overview report within 3 days of fieldwork completion.

On completion of the desk study, fieldwork and laboratory testing a comprehensive, factual and interpretative report will be issued. This will contain exploratory hole logs, 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. The report will also include consideration of foundation types.

At the time of writing, fieldwork could be commenced within 4-5 weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within 4 weeks of fieldwork completion. This report will comment on issues associated with hazardous gas, but the gas risk assessment will not be issued until monitoring is completed.

This report will include a **mining risk assessment** in accordance with Coal Authority guidance.

A completed copy of the **HBF** Contaminated Land Assessment Form will be included in an Appendix to our Report. However, this site is greenfield, and therefore consideration of soil contaminant concentrations should not be required (as stated in the UKWIR guidance) and the use of 'standard' polyethylene water supply pipes should be acceptable.

Invoicing: The attached proposal provides a breakdown of the costs associated with this project. This breakdown is for information only and the proposal can be regarded as a lump sum price of **£******* plus VAT. 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. Revision of the costings provided may be required if works are not instructed within **3 months** of the date this proposal was issued.

Our proposal allows for submission of a single piece of correspondence with NHBC and/or the local authority to address any queries they may have. Any further meetings, correspondence etc, would be chargeable.

We will submit invoices for this project on completion of each Item(s) instructed.

Please note if following instruction of the works outlined in this proposal, it is necessary to subsequently **postpone or cancel**, this should be done at least 3 working days before Lithos are due to commence

intrusive investigation on site. We reserve the right to charge a cancellation fee in the event of later notification to cover plant / drill rig costs and abortive consultancy time. The cancellation fee will not exceed £**** plus VAT.

Health, safety & welfare: The works outlined above will be carried out in accordance with Lithos' task- and site- specific Risk Assessments and Method Statements.

Details of welfare will be included within the Method Statements. However, this investigation is expected to last for at least 5 working days and therefore this proposal includes for provision of a Welfare Unit, with the benefit of full canteen facilities, hot water with full size sink, toilet and drying room.

Immediately prior to commencement of fieldwork, a site compound will be established in a location to be agreed with Honey, comprising a storage container, and a welfare cabin for site staff, secured with Heras fencing; equipment and plant will be stored here overnight.

Utility plans are required in order to protect operatives from the hazards associated with striking buried services and avoid potentially substantial disruption\repair costs. We will make every effort not to damage any services (including review of utility plans and use of a CAT detector). However, Lithos cannot accept liability for damage to any underground services that are not accurately marked on plans made available to us prior to commencement of our field investigation, or have not been accurately marked on the ground by a responsible third party (e.g. utility company, site owner).

Most developers have copies of the necessary utility plans (including electricity, gas, water, drainage & telecom), and it would be appreciated if you could forward these prior to the proposed fieldworks. However, if you do not have the necessary plans, Lithos will obtain them direct from each of the utility companies.

Under the **CDM** Regulations 2015, Lithos must be provided with pre-construction information already in your possession, or information that can reasonably be obtained through sensible enquiry. This information must be relevant to the project, have an appropriate level of detail, and be proportionate to the nature of the risks.

If no other designers or contractors have been appointed, Lithos could perform the role of Principal Contractor but only for the duration of the site investigation outlined in this proposal. If you require us to perform the role of Principal Contractor, please make this clear in your instruction. It should be noted that we are not suitably qualified to perform this role where other designers or contractors are also appointed.

Whilst it is anticipated that the site investigation outlined in this proposal will be undertaken several months before any development is commenced, our works may be considered to constitute part of 'the construction works' and consequently you may need to notify the HSE that works which involve breaking ground are being commissioned. It would be appreciated if you could forward a copy of the **F10** prior to commencement of investigation fieldwork.

Further work: In addition to the investigation outlined above, the following further works may ultimately be required:

- If deep infrastructure (e.g. a wet well) is proposed, **boreholes** to provide further information regarding soil and groundwater conditions to inform groundworks design for the required enabling works.
- If the initial **soakaway** tests yield satisfactory results, it may be necessary to:
 - Undertake further testing in order to obtain approvals from the LLFA etc: (a) within 25m of proposed chamber locations; and (b) to include 3 fills.
 - Install groundwater monitoring wells to depths of around 5m in at least 3 boreholes. Given the anticipated depth to bedrock, these boreholes might need to be advanced by rotary probing.

- The wells should then be monitored on at least 7 occasions; monthly for 3 months, and then bi-monthly for a further 8 months.
- If a potential risk from shallow mineworkings is identified, further **proboholes**, to delineate the extent in order to obtain fixed price quotations for the necessary consolidation (drill & grout) works.

Terms & conditions: This work will be undertaken in accordance with our Standard Terms and Conditions, a copy of which are enclosed.

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

Yours sincerely



Adam Gombocz
Director

**for and on behalf of
LITHOS CONSULTING LIMITED**

1 DEFINITIONS AND INTERPRETATION

1.1 In this Agreement, unless the context otherwise requires, the following words and expressions have the following meanings:

"Agreement" means these Terms (entitled "Terms and Conditions for the Appointment of Lithos Consulting"), the Proposal, any document recording your unequivocal acceptance of the Proposal and any other documents or parts of other documents expressly referred to in any of the foregoing;

"Documents" means all documents of any kind and includes plans, drawings, reports, programmes, specifications, Bills of Materials, 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 us, 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, programme, design, system, process logo, mark, style, or other matter or thing, existing or conceived, used, developed or produced by any person;

"Project" means the project described in the Proposal and any enquiry from you on which we have based our Proposal;

"Proposal" means the offer document prepared by us 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 us pursuant to the Agreement and as set out in the Proposal and includes any additions or amendments thereto made in accordance with these Terms;

"Terms" means these terms entitled "Lithos Consulting Terms of Appointment" as amended from time to time.

- 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

2.1 You agree to engage us and we agree to provide the Services in accordance with the provisions of this Agreement.

3 OUR OBLIGATIONS

- 3.1 We shall perform the Services using the reasonable standard of skill and care normally exercised by qualified members of our profession, performing similar services under similar conditions.
- 3.2 We shall use all reasonable endeavours to perform the Services in accordance with relevant environmental and safety legislation.

4 YOUR OBLIGATIONS

- 4.1 Throughout the period of this Agreement you shall afford to us, or procure for our benefit, access to any site where access is required for the performance of the Services.
- 4.2 You accept responsibility for ensuring that we are 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, which you shall clearly mark on the ground or identify on accurate location plans supplied to us prior to the commencement of the Services. You shall also inform us 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. You shall indemnify us against all costs, losses, 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.
- 4.3 If you discover any conflict, defect or other fault in the information or designs provided by us pursuant to the Agreement, you will advise us in writing of such defect, conflict or other fault and we 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.

5 COPYRIGHT

- 5.1 The copyright in all Intellectual Property prepared by or on behalf of us in connection with the Project for delivery to you shall remain vested in us.
- 5.2 You shall have a non-exclusive licence to copy and use such Intellectual Property for purposes directly related to the Project. Such licence shall enable you to copy and use the Intellectual Property but solely for your 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 us.
- 5.3 Should you 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, you must obtain our prior written consent. The giving of such consent shall be at our absolute discretion and shall be upon such terms as we may require. We shall not be liable to you 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 our behalf.
- 5.4 Ownership of any proposals submitted to you that are not subsequently confirmed as part of the Services to be provided for you remain with us and such proposals must not be used as the basis for any future work undertaken by you or a third party and no liability can be accepted howsoever arising from such proposals.
- 5.5 In the event of you being in default of payment of any fees or other amounts due, we may suspend further use of the licence on giving no less than 2 calendar days' notice of the intention to do so. Use of the licence may be resumed on receipt of the outstanding amounts.

6 CONFIDENTIALITY

- 6.1 Neither you nor we shall at any time disclose to any person any confidential information concerning the business, affairs, customers, clients or suppliers of the other party or of any member of the group of companies to which the other party belongs, except as permitted by clauses 6.2 and 6.4.
- 6.2 Each party may disclose the other party's confidential information:
- (a) to its employees, officers, representatives, contractors, sub-contractors or advisers who need to know such information for the purposes of exercising the party's rights or carrying out its obligations under or in connection with this Agreement. Each party shall ensure that its employees, officers, representatives, contractors, sub-contractors or advisers to whom it discloses the other party's confidential information comply with this paragraph 6; and
- (b) as may be required by law, to a court of competent jurisdiction or any governmental or regulatory authority.
- 6.3 Neither you nor we shall use any other party's confidential information for any purpose other than to exercise our rights or perform our respective obligations under or in connection with this Agreement.
- 6.4 Subject to the above and our privacy policy which can be found on www.lithos.co.uk, we shall be permitted to use information related to the Services we provide in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

7 ASSIGNMENT

- 7.1 You may assign the benefit of this Agreement on two occasions with our prior written consent (not to be unreasonably withheld) and any additional assignments shall be with our prior consent.
- 7.2 We may at any time assign, mortgage, charge, subcontract, delegate, declare a trust over or deal in any other manner with any or all of our rights and obligations under this Agreement.

8 INSURANCE

- 8.1 We shall maintain a professional indemnity insurance policy covering our liabilities for negligence under this Agreement, with a limit of indemnity of £5,000,000 (FIVE MILLION POUNDS) any one claim, save for pollution and contamination claims and asbestos claims both of which carry £2,000,000 (TWO MILLION POUNDS) in the aggregate cover. This policy is annually renewable and whilst renewal is not automatic, We shall maintain such insurance at all times until six years from the date of the completion (or termination) of the Services under this Agreement, provided such insurance is available at commercially reasonable rates and terms.
- 8.2 If for any period such insurance is not available at commercially reasonable rates and terms, we shall inform you 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 us to obtain.

9 PAYMENT

- 9.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal.
- 9.2 You shall pay you any VAT properly chargeable on the Services and any amount expressed as payable to us under this Agreement is exclusive of VAT unless stated otherwise.
- 9.3 The due date for payment is the date of the invoice and the final date for payment is 28 days from the date of the invoice.
- 9.4 If you dispute the amount included for payment in an invoice then you must serve a written notice on us no later than 14 calendar days before the final date for payment. If no notice is given within the required timeframe the amount due shall be the amount stated in the invoice.
- 9.5 If you fail to pay any monies in accordance with the foregoing payment provisions, we shall be entitled to charge interest on any monies owed to us, such interest to be at a rate of 4% 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. The parties acknowledge that our liability under this clause 10.5 is a substantial remedy for the purposes of section 9(1) of the Late Payment of Commercial Debts (Interest) Act 1998.

10 LIMITATIONS ON LIABILITY

- 10.1 Unless otherwise agreed in writing, our total liability under or in connection with this 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 the level of insurance cover referred to within clause 8.1 above, or 20 times the total value of invoices issued to you for the Services.
- 10.2 No action or proceedings under or in respect of the Agreement whether in contract, tort, negligence, under statute or otherwise shall be commenced against us after the expiry of a period of six years from the date of the completion (or termination) of the Services under this Agreement.
- 10.3 Whilst we usually scan for potential exploratory locations with a Cable Avoidance Tool, we 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.
- 10.4 We shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by us 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 we have been advised in writing of the same by you and have 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.

11 DELAY

We shall comply with any timescale agreed for completion of the Services unless delayed or prevented by circumstances beyond our reasonable control and in the event of any such circumstances arising we undertake to complete the Services within a reasonable period, but will not be liable to you for any delay as a result.

12 TERMINATION

- 12.1 The Agreement may be terminated by either of us 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 termination must be given to the party which is insolvent by the other party.
- 12.2 If for any reason our Services are suspended for a period in excess of three calendar months then we shall be entitled to terminate our appointment under this Agreement in respect of the Services by no less than seven days written notice to you.
- 12.3 If you fail to pay in full any sum due under the terms of this Agreement by the final date for payment for that sum and no effective pay less notice is issued, we may serve written notice to you demanding payment within 14 days of such notice. If you fail to comply with such notice, we shall be entitled to terminate our employment under this Agreement forthwith.
- 12.4 Any termination of our appointment howsoever caused shall be without prejudice to our rights to require payment for all Services performed up to the date of such termination 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 Lithos has started, but not completed.

13 THIRD PARTY RIGHTS

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.

14 COLLATERAL WARRANTIES & LETTERS OF RELIANCE

We shall consider and may consent to a request from you for us to enter into a collateral warranty or letter of reliance with a third party with regard to the Services provided under this Agreement. The giving of such consent shall be at our absolute discretion and providing we agree to our standard form of collateral warranty or letter of reliance (subject to any reasonable changes to be approved by us at our absolute discretion) and in return for payment of a fee (to be notified at the time of the request).

15 NOTICES

- 15.1 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 pre-paid 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 our respective registered office addresses.
- 15.2 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 pre-paid first class post.

16 ENTIRE AGREEMENT

- 16.1 The Agreement constitutes the complete and entire agreement between us 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 us in respect of the Services can only be made in contract under the provisions of this Agreement and not otherwise under the law or tort or otherwise.
- 16.2 No amendments, modifications or variation of this Agreement shall be valid unless made in writing and agreed to by us; such agreement must be recorded in writing by at least one of us.
- 16.3 We shall not be bound by any standard or printed terms or conditions furnished by you in any of your documents unless we specifically state in writing separately from such documents that we intend such terms and conditions to apply.

17 DISPUTES, JURISDICTION AND GOVERNING LAW

- 17.1 This Agreement shall be governed by and construed in accordance with English law and we irrevocably and unconditionally submit to the jurisdiction of the English Courts.
- 17.2 Where the Housing Grants, Construction and Regeneration Act 1996 applies, any dispute between us 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.

Adam Gombocz
Director
Lithos Consulting Ltd

adam.gombocz@lithos.co.uk
www.lithos.co.uk

Parkhill
Walton Road
Wetherby, LS22 5DZ



M 07951 497021
DD 01937 543353



From: Joe Blankley <Joe.Blankley@homesbyhoney.co.uk>

Sent: 27 October 2025 13:45

To: Adam Gombocz <Adam.Gombocz@lithos.co.uk>

Subject: RE: Darton - Site Investigation quote

Hi Adam

Hope you have had a good weekend mate – don't know quite what I thought of Leeds, but result was much needed!

Noted with regards to the below, I think based on this it is sensible to go with your quote and effectively start again!

We have gone a little bit 0-100 with this site – so time is somewhat critical on here!

We have undertaken a site walkover and there is certainly some scrub to be cleared to allow you to undertake the SI, which we will get removed prior to you starting – but the tree's will stay!

Based on the above/ below – can we look to get the CA permit in to undertake the works and can you advise on timescales to undertake please?

We have got the services records back this morning also – so I have attached these below via a WeTransfer link.

WeTransfer – <https://we.tl/t-IRW8Jjh13s>

Any issues just let me know,

Cheers

Joe

honey

Joe Blankley

Engineering Manager

Mobile: [07495 505674](tel:07495505674)

Email: Joe.Blankley@homesbyhoney.co.uk

www.homesbyhoney.co.uk

Homes by honey, Lumina, Park Approach, Leeds LS15 8GB

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From: Adam Gombocz <Adam.Gombocz@lithos.co.uk>

Sent: 22 October 2025 18:15

To: Joe Blankley <Joe.Blankley@homesbyhoney.co.uk>

Subject: RE: Darton - Site Investigation quote

Hi Joe,

I have had a quick look at the RSK report, unfortunately it doesn't change much, as they carried out very little SI on your parcel, and certainly not enough BHs to confirm the absence of mine workings, coupled with this the report is 9 years old.

The CA record known shallow workings in the west of the site, which RSK did not target.

Therefore, the quote I prepared is attached. As always, this allows for a robust scope of works, including 2 day's pitting, a days soakaway testing, 4 days rotary probing & gas monitoring which should allow you to submit a bid that is unconditional with respect to ground and discharge ground-related planning conditions.

In addition, I have also allowed for appropriate chemical and geotechnical lab testing.

The cost is relatively high, which is dictated by the need for a mining investigation and gas monitoring.

I am out of the office most of tomorrow morning, but I will give you a call tomorrow afternoon to discuss.

Thanks,

Adam Gombocz
Director
Lithos Consulting Ltd

adam.gombocz@lithos.co.uk
www.lithos.co.uk

Parkhill
Walton Road
Wetherby, LS22 5DZ



M 07951 497021
DD 01937 543353



From: Joe Blankley <Joe.Blankley@homesbyhoney.co.uk>

Sent: 22 October 2025 17:19

To: Adam Gombocz <Adam.Gombocz@lithos.co.uk>

Subject: Darton - Site Investigation

Hi Adam

Apologies for the confusion (100% from me!)

There has been an SI undertaken for Jones Homes back in 2016 – which I have attached via WeTransfer as it's massive!

WeTransfer - <https://we.tl/t-uaDPeG1lxK>

I would be interested to see how this affects your quote as discussed and also if you would have a review and see if you think anything further is needed!
It's for the wider allocation – so not all the data is on our site – but it seems to suggest we are not required to carry out any D&G works etc.

Let me know your thought mate!

Cheers

Joe

honey

Joe Blankley

Engineering Manager

Mobile: 07495 505674

Email: Joe.Blankley@homesbyhoney.co.uk

www.homesbyhoney.co.uk

Homes by honey, Lumina, Park Approach, Leeds LS15 8GB

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From: Joe Blankley

Sent: 16 October 2025 10:15

To: Adam Gombocz <adam.gombocz@lithos.co.uk>

Subject: Darton - Site Investigation

Hi Adam

Thanks for you time yesterday on Bessacarr – massively helpful as always!
As we discussed, we have also got another new site we are looking at that needs an SI undertaking.

We have nothing at all on the development yet in terms of information (we are topo'ing the development this week) – so this will soon be available.

We will also go out for existing service records so we can provide these ahead of your visit!

Looking at the MRA mapping for the area (and at the end of the day it's Darton) it looks like it's affected by shallow mine workings.

Appreciate you will need to do some sort of Phase 1 etc to prep for the SI, but can we

have a look at pencilling this in and starting the CA permit now as this one is going to be all systems go.

We haven't even got as far as a layout yet, but I have attached our block plan to at least give you a feel for where we are going.

The site address is Woolley Colliery Road, Darton, Barnsley S75 5JA

Any issues as always just let me know,

Cheers

Joe

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This message has been scanned by Mailsafe

Appendix D
Historical OS Plans



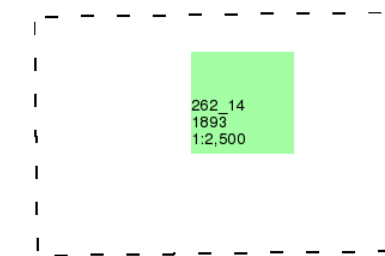
Yorkshire

Published 1893

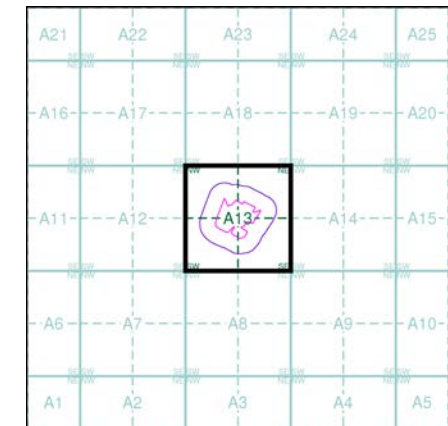
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

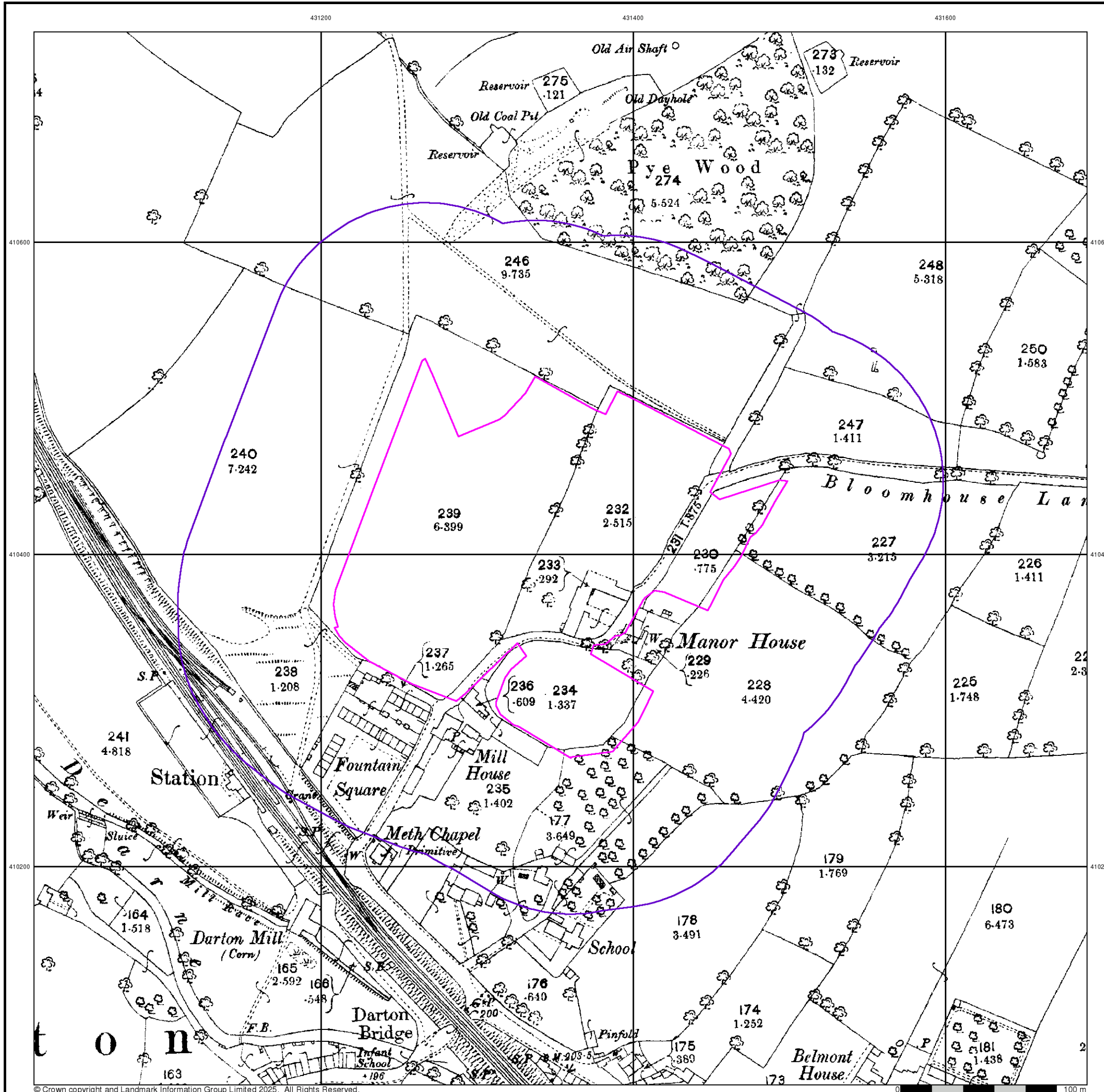
Order Number: 390461214_1_1
Customer Ref: 5624
National Grid Reference: 431350, 410400
Slice: A
Site Area (Ha): 4.17
Search Buffer (m): 100

Site Details

Woolley Colliery Road, Darton, BARNSELY, S75 5JA



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk





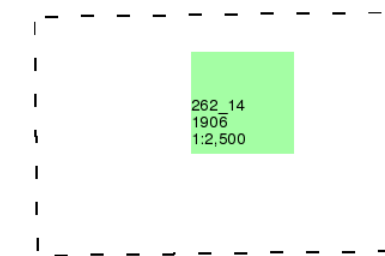
Yorkshire

Published 1906

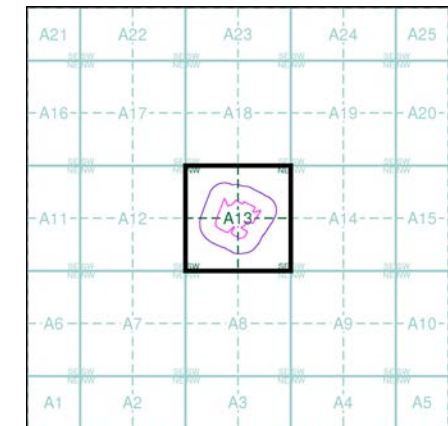
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

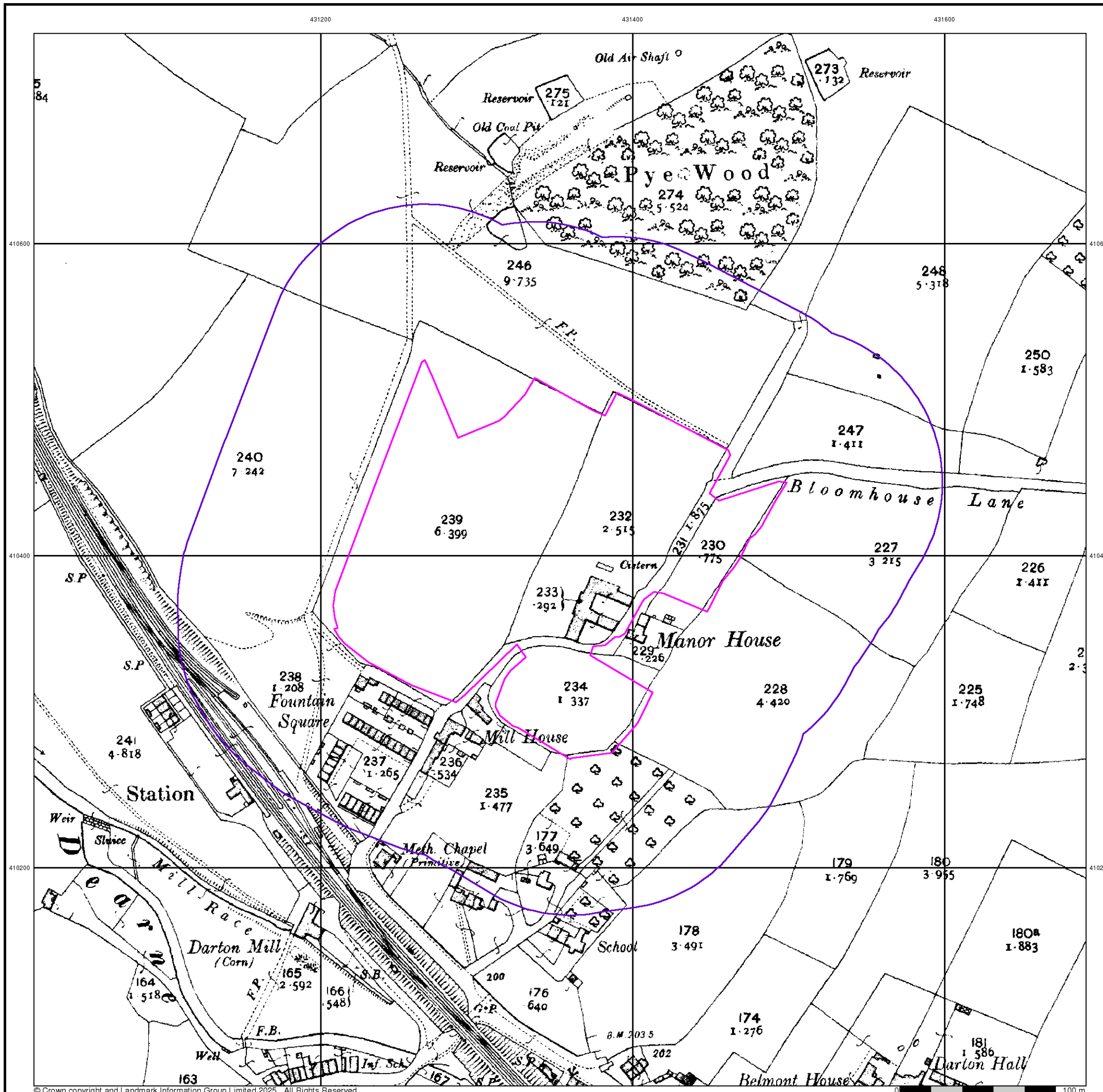
Order Number: 390461214_1_1
Customer Ref: 5624
National Grid Reference: 431350, 410400
Slice: A
Site Area (Ha): 4.17
Search Buffer (m): 100

Site Details

Woolley Colliery Road, Darton, BARNSELY, S75 5JA



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk





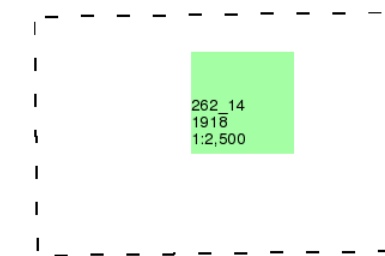
Yorkshire

Published 1918

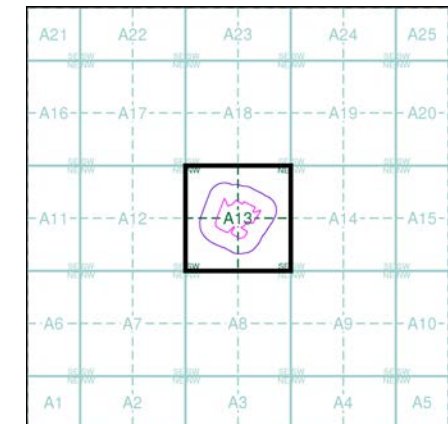
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

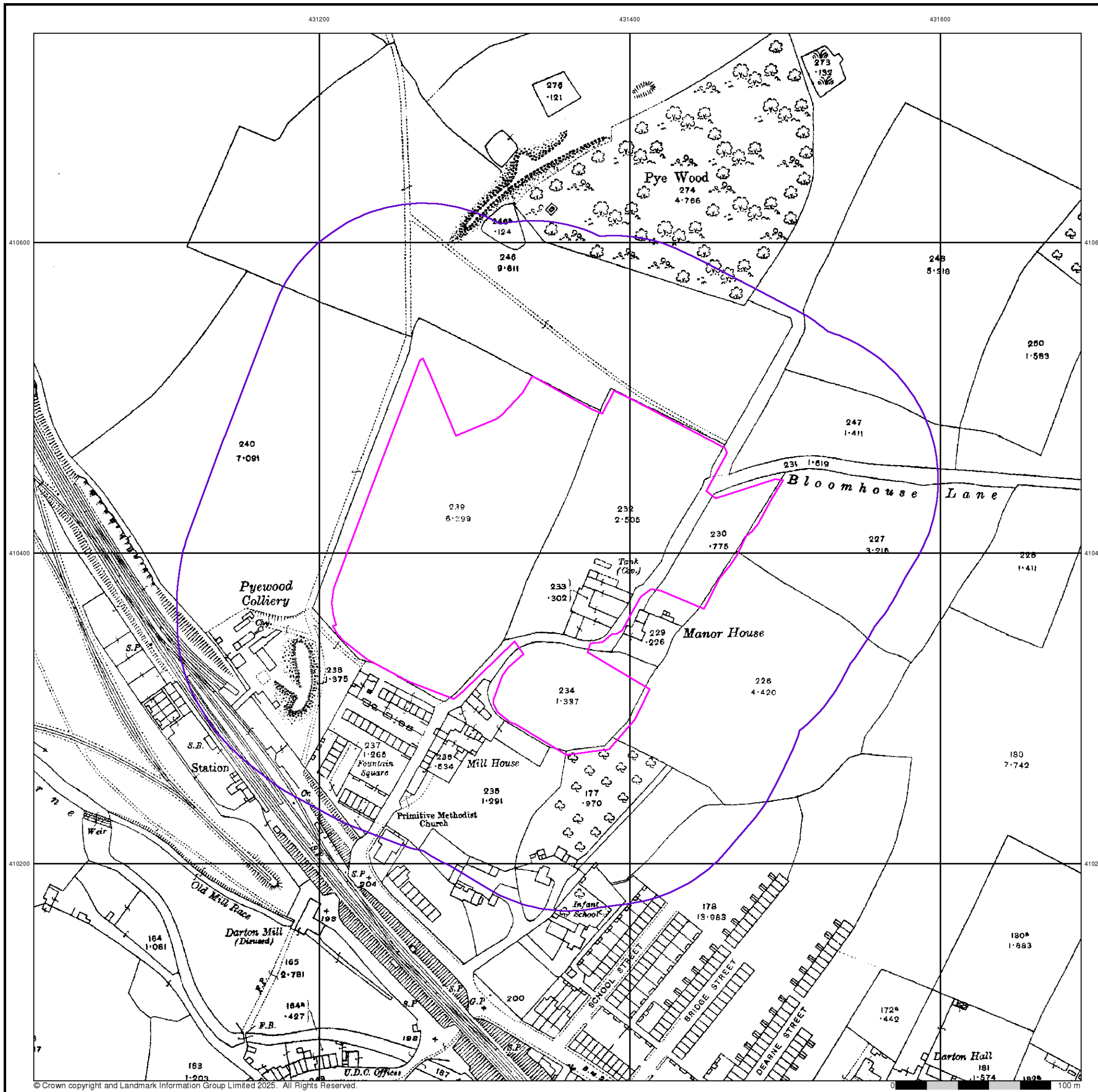
Order Number: 390461214_1_1
Customer Ref: 5624
National Grid Reference: 431350, 410400
Slice: A
Site Area (Ha): 4.17
Search Buffer (m): 100

Site Details

Woolley Colliery Road, Darton, BARNSELY, S75 5JA



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk





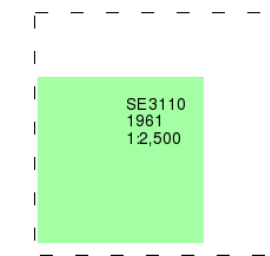
Ordnance Survey Plan

Published 1961

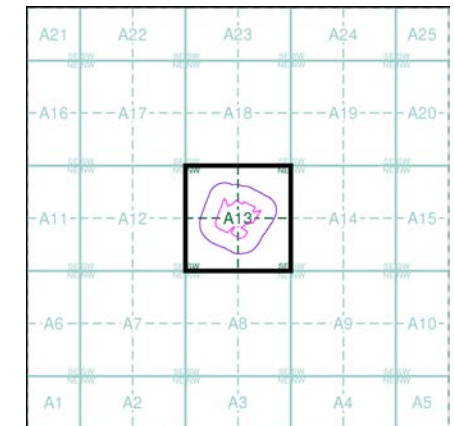
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

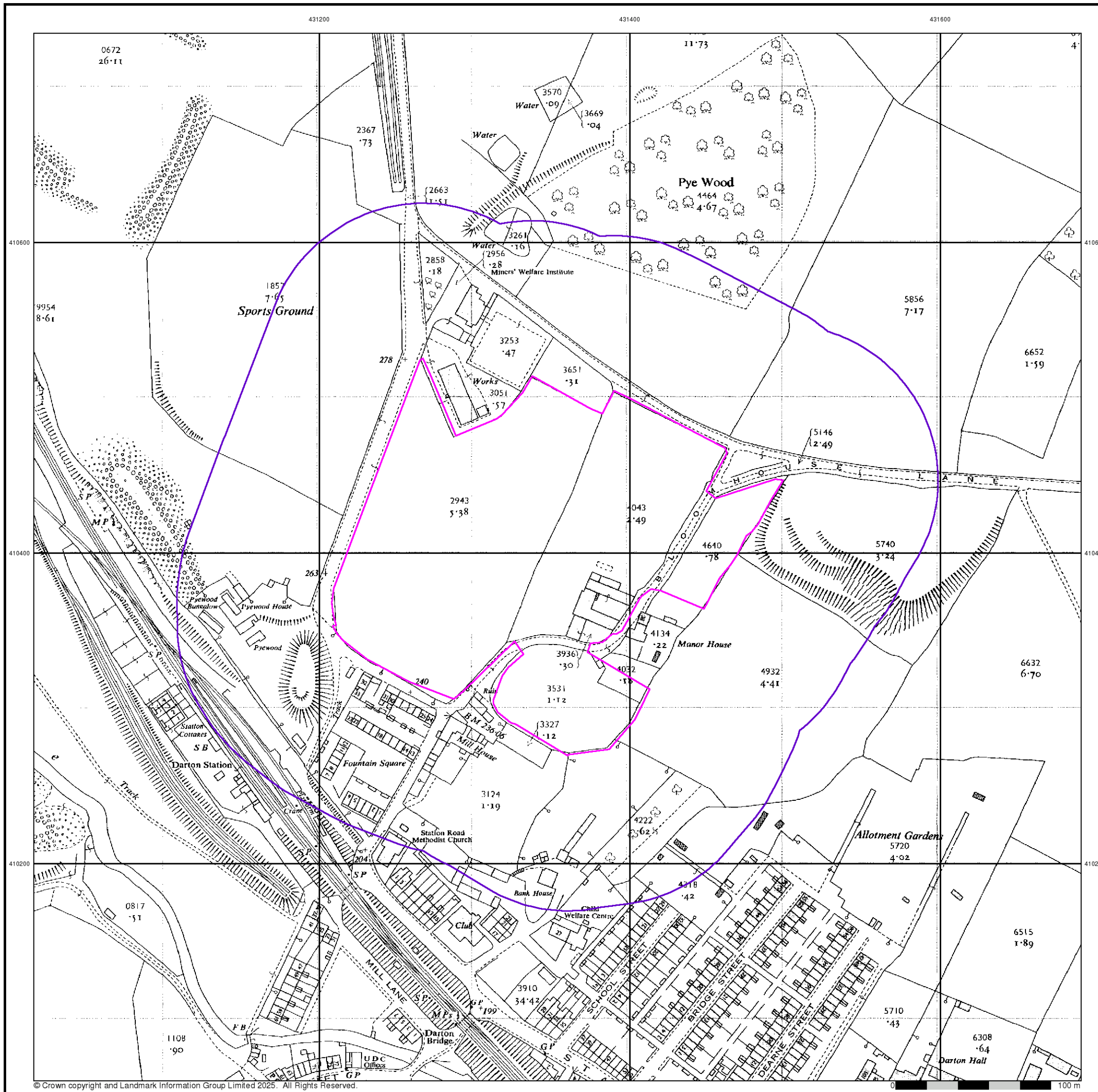
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Site Area (Ha): 4.17
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Site Details

Woolley Colliery Road, Darton, BARNSELY, S75 5JA



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Appendix E

Search Responses & other Correspondence



Envirocheck[®] Report:

Datasheet

Order Details:

Order Number:

390461214_1_1

Customer Reference:

5624

National Grid Reference:

431350, 410400

Slice:

A

Site Area (Ha):

4.17

Search Buffer (m):

1000

Site Details:

Woolley Colliery Road

Darton

BARNSLEY

S75 5JA

Client Details:

Mr M Perrin

Lithos Consulting Ltd

Parkhill

Walton Road

Wetherby

LS22 5DZ

Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	29
Hazardous Substances	32
Geological	33
Industrial Land Use	46
Sensitive Land Use	55
Data Currency	56
Data Suppliers	61
Useful Contacts	62

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination. For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client. In this datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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Radon Potential dataset Copyright Notice

Information supplied from a joint dataset compiled by The British Geological Survey and Public Health England. The probability result is only valid for properties above ground. All basement and cellar areas are considered to be at additional risk from high radon levels. If an underground room such as a cellar or basement makes up part of the living or working accommodation, the property should be tested regardless of Radon Affected Area status.

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Report Version v53.0

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 4		6	5	13
Prosecutions					
Enforcement and Prohibition Notices					
Integrated Pollution Controls	pg 10				5
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control	pg 11				1
Local Authority Pollution Prevention and Controls	pg 11				10
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 12		Yes		
Pollution Incidents to Controlled Waters	pg 12		16	7	14
Historical Prosecutions					
Registered Radioactive Substances					
Substantiated Pollution Incident Register	pg 18			2	
Water Abstractions	pg 19				4 (*1)
Water Industry Act Referrals					
Groundwater Vulnerability Map	pg 20	Yes	n/a	n/a	n/a
Groundwater Vulnerability - Soluble Rock Risk			n/a	n/a	n/a
Groundwater Vulnerability - Local Information			n/a	n/a	n/a
Bedrock Aquifer Designations	pg 20	Yes	n/a	n/a	n/a
Superficial Aquifer Designations			n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences	pg 20		Yes	n/a	n/a
Flooding from Rivers or Sea without Defences	pg 21		Yes	n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
OS Water Network Lines	pg 21		1	6	47
Water Framework Directive - Catchment	pg 27	Yes	Yes		Yes
Water Framework Directive - Groundwater	pg 28	Yes			Yes
Water Framework Directive - Surface Waters	pg 28		Yes		

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites	pg 29				2
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)					
Local Authority Landfill Coverage	pg 29	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites	pg 29				2
Potentially Infilled Land (Non-Water)	pg 29		6	4	12
Potentially Infilled Land (Water)	pg 31		2		2
Registered Landfill Sites	pg 31				1
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)	pg 32				1
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					

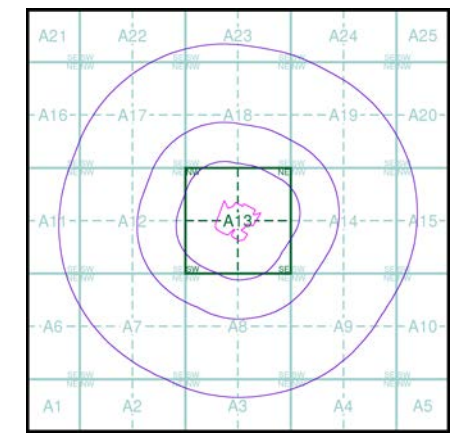
Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Geological					
BGS 1:625,000 Solid Geology	pg 33	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 33	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 39		5	2	24
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas	pg 44	Yes	n/a	n/a	n/a
Mining Instability	pg 44	Yes	n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 44	Yes		n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 44	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 44	Yes	Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 44	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 45	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 45	Yes		n/a	n/a
Radon Potential - Radon Affected Areas	pg 45	Yes	n/a	n/a	n/a
Radon Potential - Radon Protection Measures	pg 45	Yes	n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 46		2	8	30
Fuel Station Entries	pg 49				1
Points of Interest - Commercial Services	pg 49			6	14
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 51		2	5	15
Points of Interest - Public Infrastructure	pg 53		3	5	5
Points of Interest - Recreational and Environmental	pg 54		2	2	3
Underground Electrical Cables					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland	pg 55				2
Areas of Adopted Green Belt	pg 55	1	1	1	
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones	pg 55	1			1
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					



- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point
 - Map ID
 - Several of Type at Location
- Agency and Hydrological**
- Contaminated Land Register Entry or Notice (Location)
 - Discharge Consent
 - Enforcement or Prohibition Notice
 - Integrated Pollution Control
 - Local Authority Integrated Pollution Prevention and Control
 - Local Authority Pollution Prevention and Control
 - Local Authority Pollution Prevention and Control Enforcement
 - Pollution Incident to Controlled Waters
 - Historical Prosecutions
 - Prosecutions
 - Registered Radioactive Substance
 - River Network or Water Feature
 - Substantiated Pollution Incident Register
 - Water Abstraction
 - Water Industry Act Referral
- Waste**
- BGS Recorded Landfill Site (Location)
 - BGS Recorded Landfill Site
 - EA Historic Landfill (Buffered Point)
 - EA Historic Landfill (Polygon)
 - Integrated Pollution Control Registered Waste Site
 - Licensed Waste Management Facility (Landfill Boundary)
 - Licensed Waste Management Facility (Location)
 - Local Authority Recorded Landfill Site (Location)
 - Local Authority Recorded Landfill Site
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Registered Landfill Site
 - Registered Landfill Site (Point Buffered to 100m)
 - Registered Landfill Site (Point Buffered to 250m)
 - Registered Waste Transfer Site (Location)
 - Registered Waste Transfer Site
 - Registered Waste Treatment or Disposal Site (Location)
 - Registered Waste Treatment or Disposal Site
- Hazardous Substances**
- COMAH Site
 - Explosive Site
 - NIHHS Site
 - Planning Hazardous Substance Consent
 - Planning Hazardous Substance Enforcement
- Geological**
- BGS Recorded Mineral Site

Site Sensitivity Map - Slice A



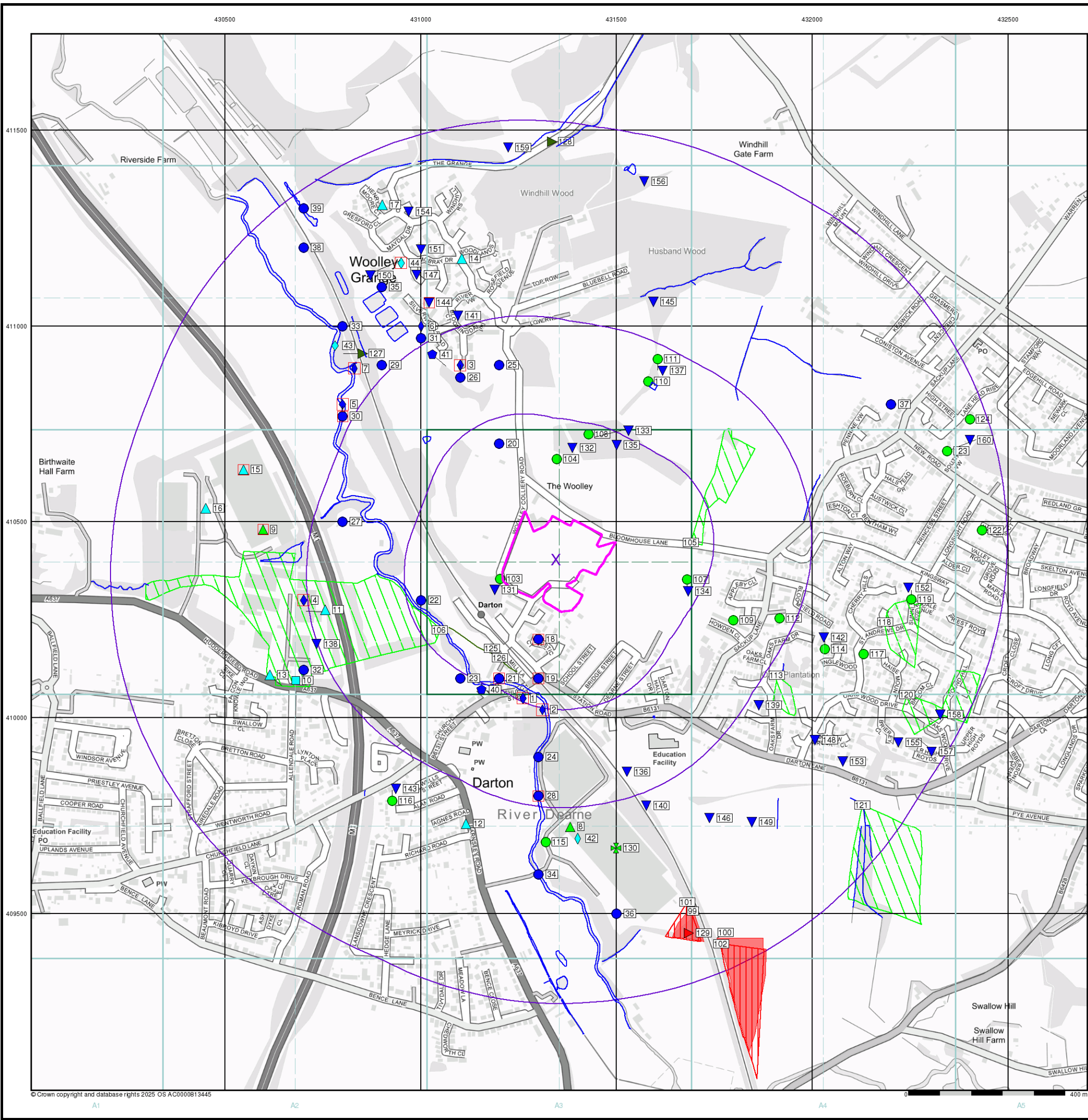
Order Details

Order Number: 390461214_1_1
 Customer Ref: 5624
 National Grid Reference: 431350, 410400
 Slice: A
 Site Area (Ha): 4.17
 Search Buffer (m): 1000

Site Details
 Woolley Colliery Road, Darton, BARNSELY, S75 5JA

Landmark
 INFORMATION GROUP

Tel: 0844 844 9952
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk



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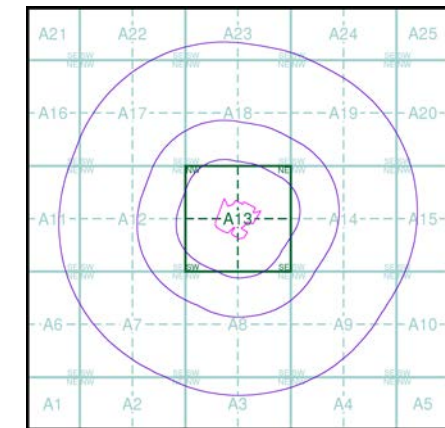
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



Order Details

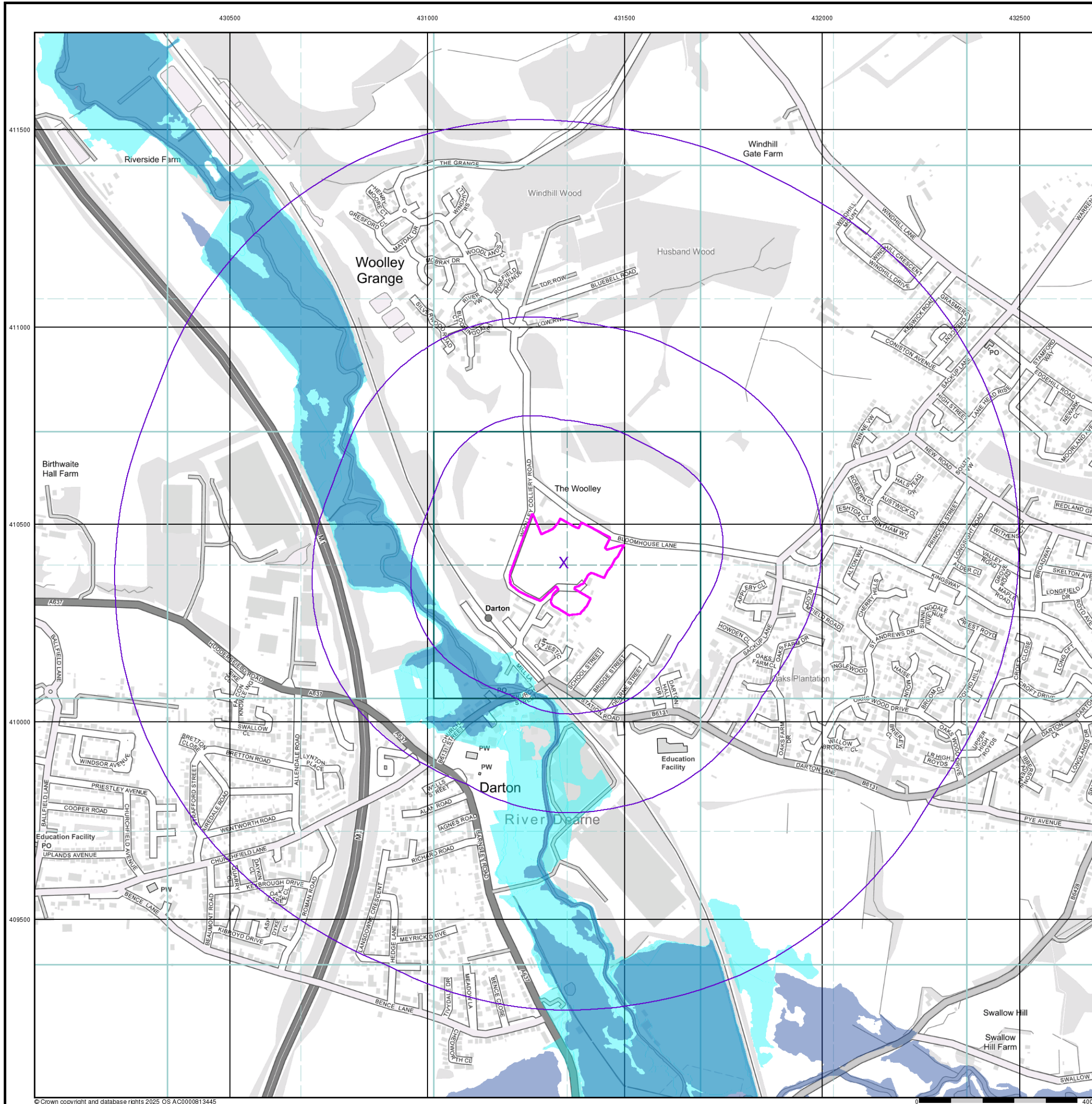
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 Slice: A
 Site Area (Ha): 4.17
 Search Buffer (m): 1000

Site Details

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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

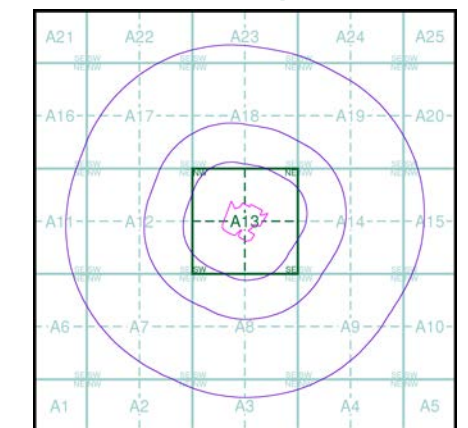
OS Water Network Data

- | | |
|--------------|-------------------------|
| Canal | Drain |
| Reservoir | Other |
| Foreshore | Lake |
| Marsh | Transfer |
| Tidal River | Lock Or Flight Of Locks |
| Inland River | Sea |

Contours (height in meters)

- Standard Contour 105
- Master Contour 100
- Spot Height 167.3
- | | |
|-----|-----------------|
| MLW | Mean Low Water |
| MHW | Mean High Water |

OS Water Network Map - Slice A



Order Details

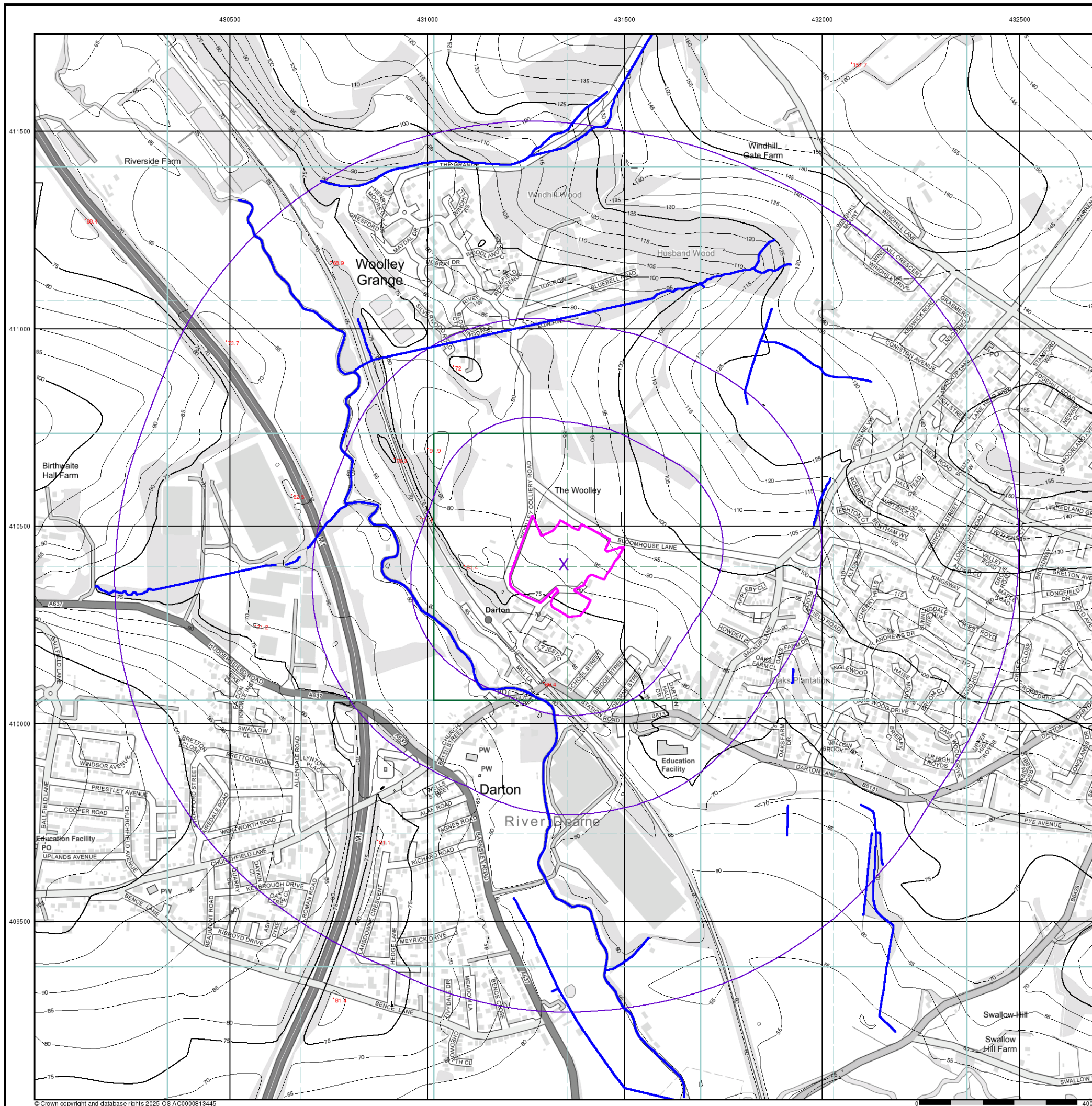
Order Number: 390461214_1_1
 Customer Ref: 5624
 National Grid Reference: 431350, 410400
 Slice: A
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 Search Buffer (m): 1000

Site Details

Woolley Colliery Road, Darton, BARNSELY, S75 5JA

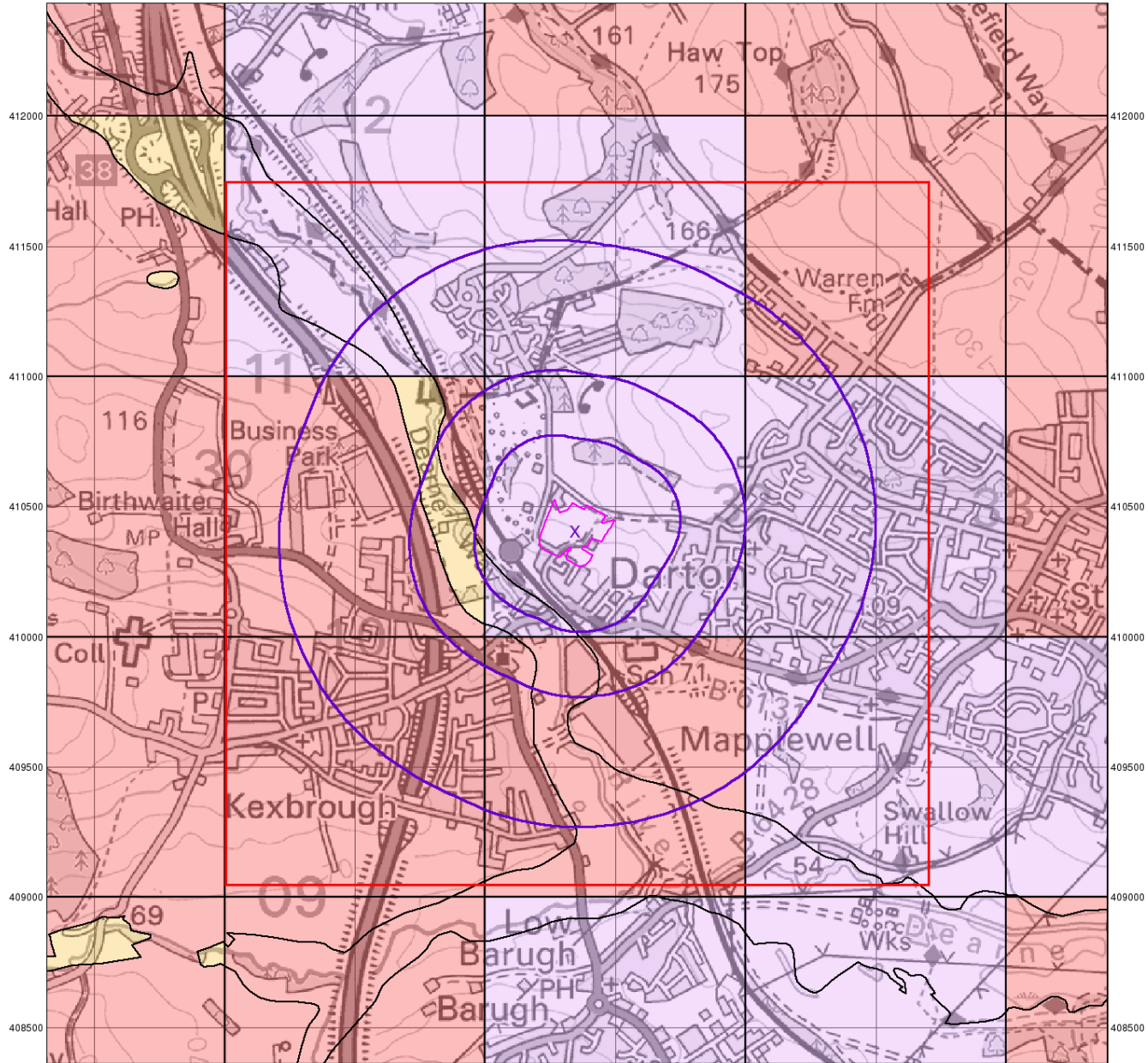


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0 1 km



Groundwater Vulnerability

General

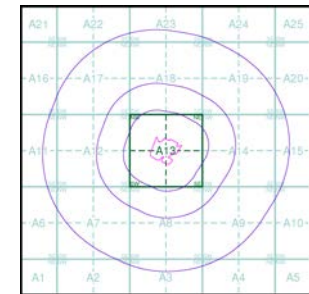
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

- | Bedrock Aquifers | Superficial Aquifers |
|-----------------------------------------|-----------------------------------------|
| High Vulnerability, Principal Aquifer | High Vulnerability, Principal Aquifer |
| High Vulnerability, Secondary Aquifer | High Vulnerability, Secondary Aquifer |
| Medium Vulnerability, Principal Aquifer | Medium Vulnerability, Principal Aquifer |
| Medium Vulnerability, Secondary Aquifer | Medium Vulnerability, Secondary Aquifer |
| Low Vulnerability, Principal Aquifer | Low Vulnerability, Principal Aquifer |
| Low Vulnerability, Secondary Aquifer | Low Vulnerability, Secondary Aquifer |

- Unproductive Aquifer
- Soluble Rock

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 390461214_1_1
 Customer Ref: 5624
 National Grid Reference: 431350, 410400
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 Site Area (Ha): 4.17
 Search Buffer (m): 1000

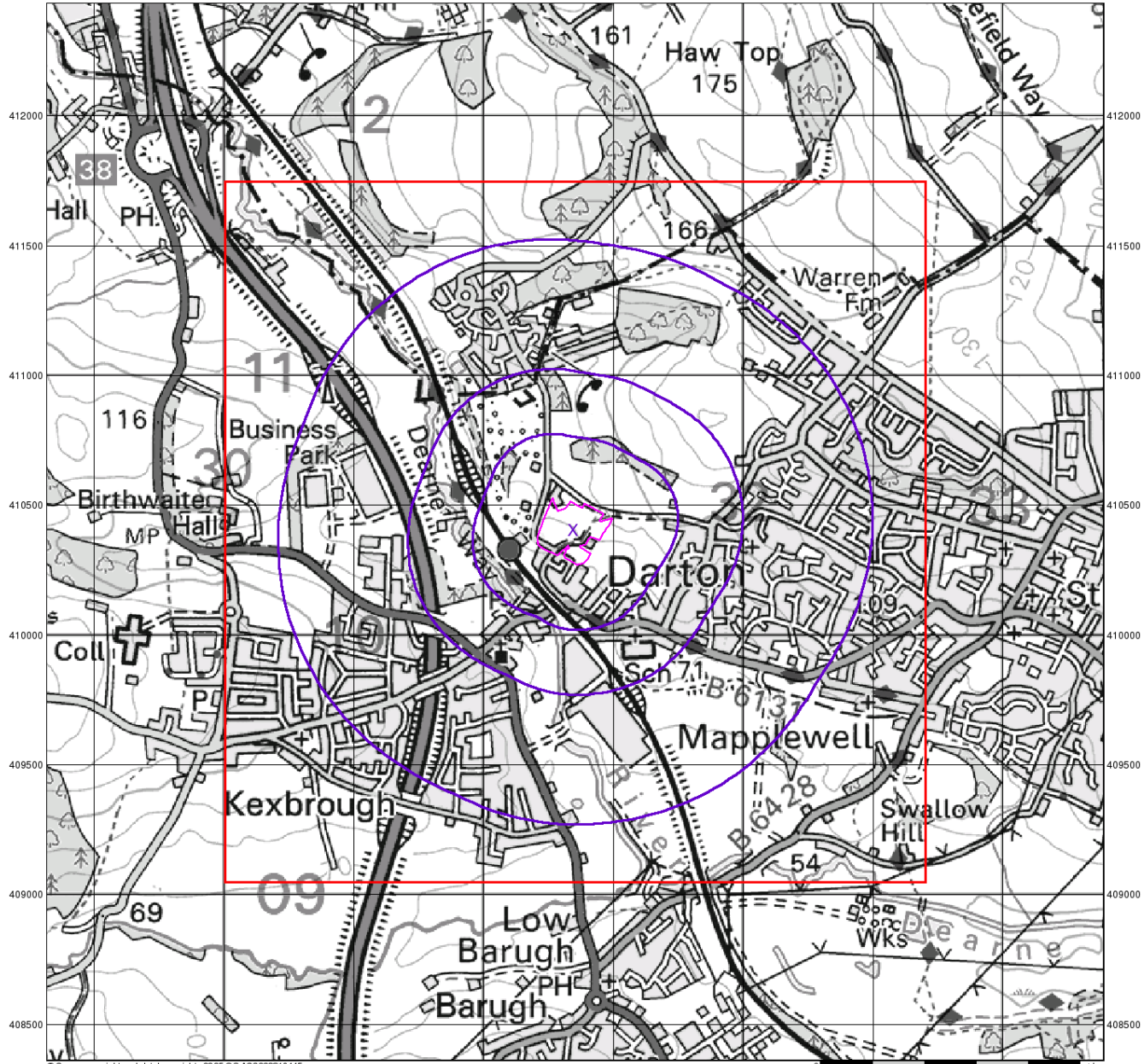
Site Details

Woolley Colliery Road, Darton, BARNSELY, S75 5JA



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Source Protection Zones

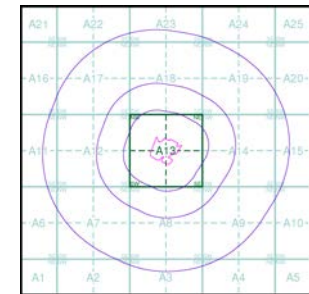
General

- ◊ Specified Site
- Specified Buffer(s)
- ✕ Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 390461214_1_1
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 Slice: A
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 Search Buffer (m): 1000

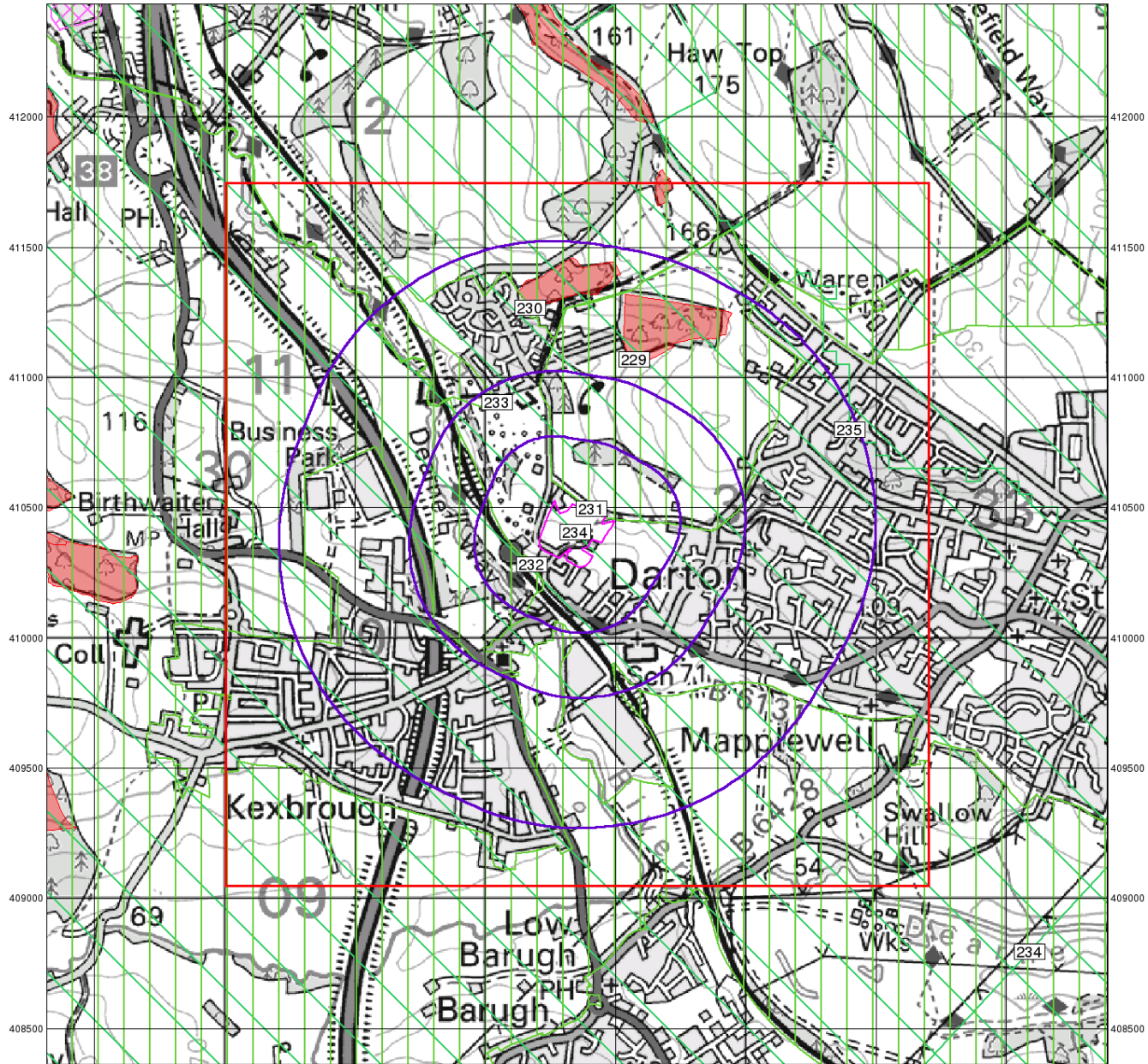
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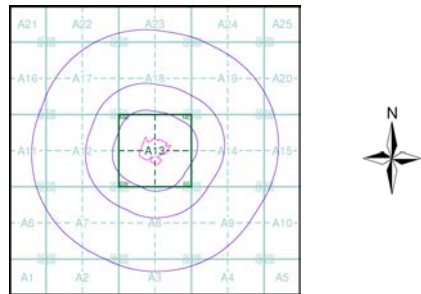
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Sensitive Land Uses

- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point
 - Slice
 - Map ID
- Sensitive Land Uses**
- Ancient Woodland
 - Area of Adopted Green Belt
 - Area of Unadopted Green Belt
 - Area of Outstanding Natural Beauty
 - Environmentally Sensitive Area
 - Forest Park
 - Local Nature Reserve
 - Marine Nature Reserve
 - National Nature Reserve
 - National Park
 - Nitrate Sensitive Area
 - Nitrate Vulnerable Zone
 - Ramsar Site
 - Site of Special Scientific Interest
 - Special Area of Conservation
 - Special Protection Area
 - World Heritage Sites

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 390461214_1_1
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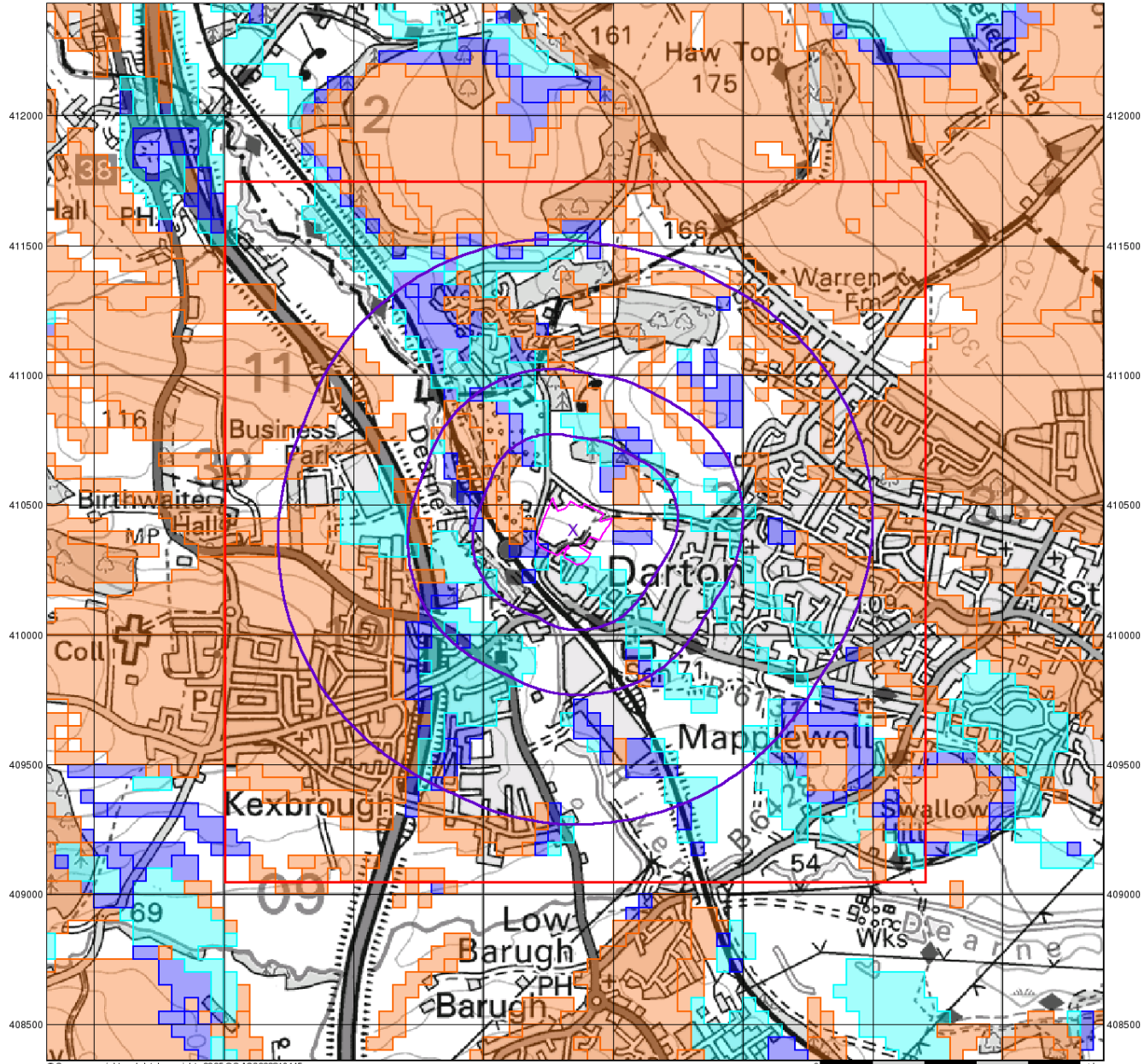
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BGS Flood GFS Data

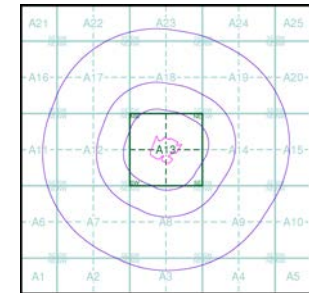
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice

Agency and Hydrological (Flood)

- Limited Potential for Groundwater Flooding to Occur
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Potential for Groundwater Flooding to Occur at Surface

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 390461214_1_1
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DAN PLATFORD
LITHOS CONSULTING LTD
PARKHILL
WALTON ROAD
WETHERBY
LS22 5DZ
UNITED KINGDOM

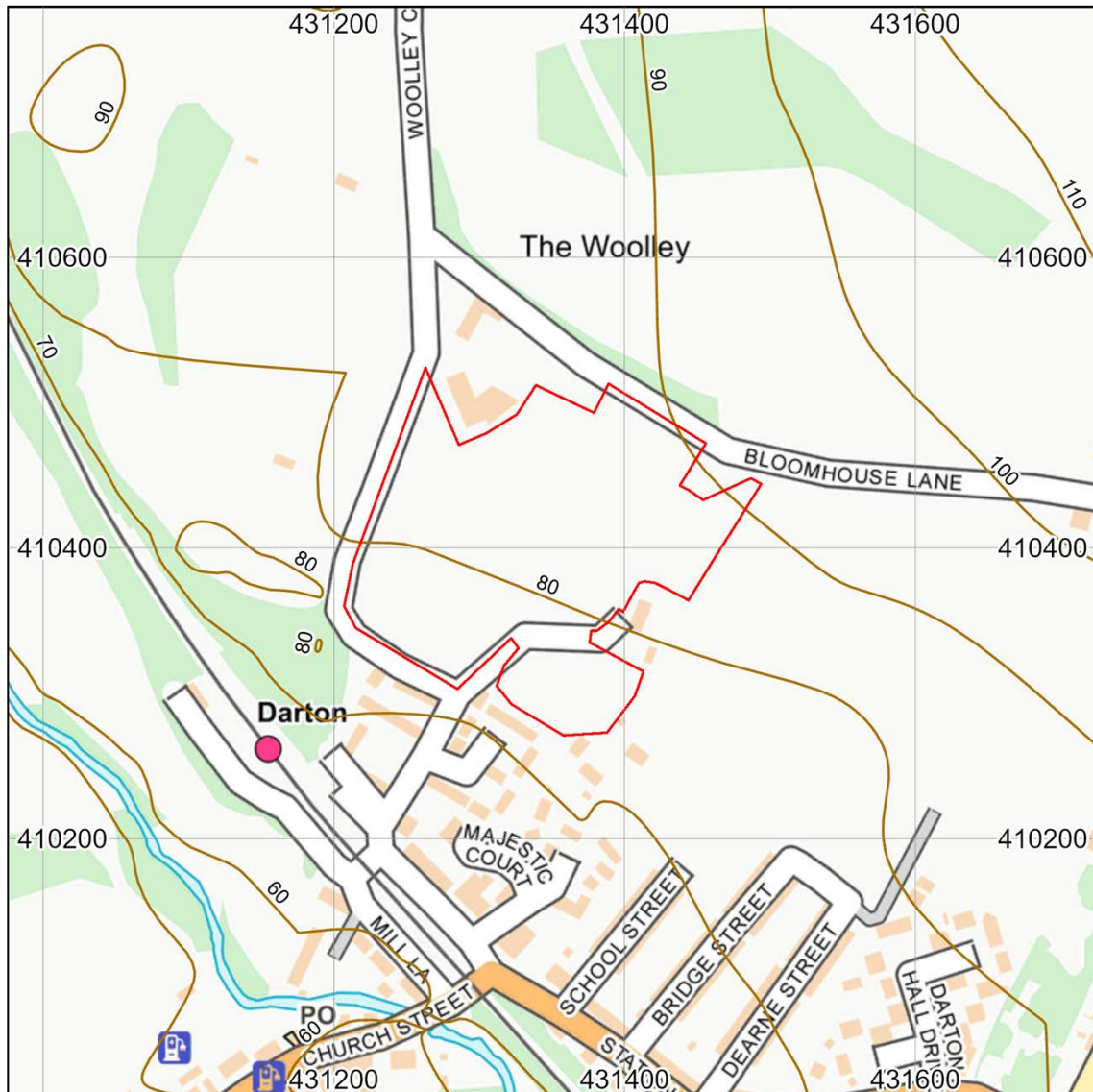
Radon Report

Advisory report on the requirement for radon protective measures in new buildings, conversions and extensions to existing buildings. The report also indicates whether a site is located within a radon Affected Area

Report Id: *BGS_345776/64309*

Client reference: *PO25440/DP/5624*

Search location



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Search location indicated in red

This report describes a site located at National Grid Reference 431350, 410398. Note that for sites of irregular shape, this point may lie outside the site boundary. Where the client has submitted a site plan the assessment will be based on the area given.

Radon Report: UK

When extensions are made to existing buildings in high radon areas, or new buildings are constructed in these areas, the Building Regulations for England, Wales, Scotland and Northern Ireland require that protective measures are taken against radon entering the building.

This report provides information on whether radon protective measures are required. Depending on the probability of buildings having high radon levels, the Regulations may require either:

1. No protective measures
2. Basic protective measures
3. Full protective measures

This is an advisory report on the requirement for radon protective measures in new buildings, conversions and extensions. The report also indicates whether a site is located within a radon Affected Area

Requirement for radon protective measures

The determination below follows advice in *BR211 Radon: Guidance on protective measures for new buildings (2023 edition)*, which also provides guidance on what to do if the result indicates that protective measures are required.

Is the property in an area where radon protective measures are required for new buildings or extensions to existing ones as described in publication BR211 (2023 edition) Radon: Guidance on protective measures for new buildings?

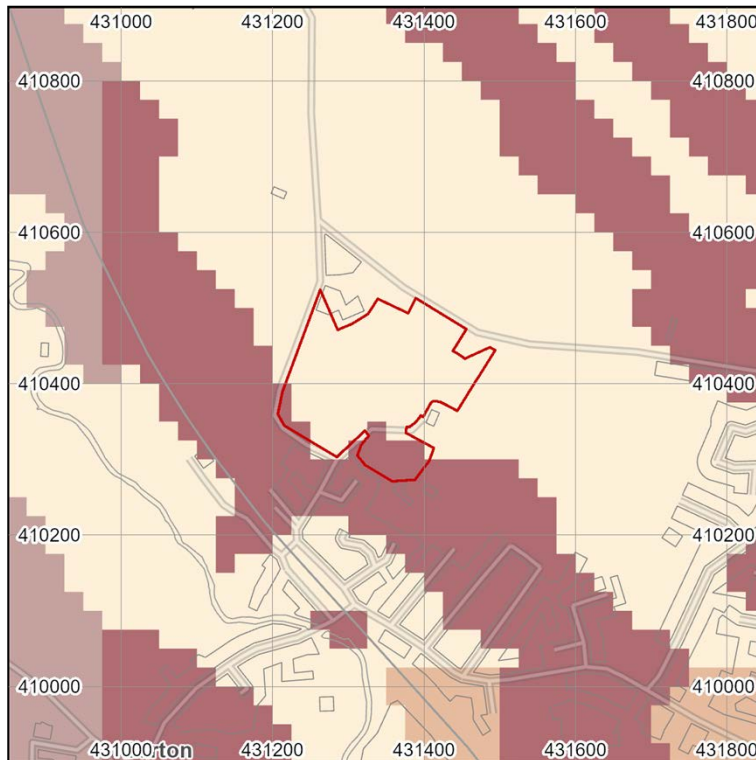
BASIC RADON PROTECTIVE MEASURES ARE REQUIRED FOR THE REPORT AREA.

More details of the protective measures required are available in *BR211 Radon: Guidance on protective measures for new buildings (2023 Edition)*.

Whether or not the radon level in a building is above or below the radon Action Level can only be established by having the building tested. The UKHSA provides a radon testing service which can be accessed at www.ukradon.org or by telephone (01235 822622).

If you require further information or guidance, you should contact your local authority building control officer or approved inspector.

Radon Affected Area



% Homes estimated to be at or above the action level
0-1%
1-3%
3-5%
5-10%
10-30%
30-100%

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 Scale: 1:10 000 (1cm = 100 m)
Search area indicated in red

Is the property in a radon Affected Area as defined by the UK Health Security Agency (UKHSA) and if so what percentage of homes are estimated to be at or above the Action Level? YES

Additional Information

THE PROPERTY IS IN A RADON AFFECTED AREA WHERE 5 TO 10% OF HOMES ARE ESTIMATED TO BE AT OR ABOVE THE ACTION LEVEL.

The UKHSA recommends a radon 'Action Level' of 200 Becquerels per cubic metre of air (Bq m^{-3}) for the annual average of the radon gas concentration in a home. Where 1% or more of homes are estimated to be at or above the Action Level the area should be regarded as a radon Affected Area.

This report informs you whether the property is in a radon Affected Area and the percentage of homes that are estimated to be at or above the radon Action Level at this location. Being in an Affected Area does not necessarily mean there is a high radon level within the property; the only way to determine the radon level is to carry out a radon measurement.

The UKHSA advises that radon gas should be measured in all properties within radon Affected Areas and that homes with radon levels at or above the Action Level (200 Bq m⁻³) should be remediated. Householders with levels between the Target Level (100 Bq m⁻³) and Action Level should seriously consider reducing their radon level, especially if they are at greater risk, such as if they are current or ex smokers. Whether or not a home is in fact above or below the Action Level or Target Level can only be established by having the building tested. The UKHSA provides a validated radon testing service which can be accessed at www.ukradon.org.

The information in this report provides an answer to one of the standard legal enquiries on house purchase in England and Wales, known as Law Society CON29 Enquiries of the Local Authority (2016); 3.14 Radon Gas: Do records indicate that the property is in a “Radon Affected Area” as identified by the UKHSA. The data can also be used to advise house buyers and sellers in Scotland and Northern Ireland.

If you are buying a new build property in a Radon Affected Area, you should ask the builder whether radon protective measures were incorporated in the construction of the property.

If you are buying a currently occupied property in a radon Affected Area, you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were at or above the radon Action Level and if so, whether remedial measures were installed, radon levels were re-tested, and if the results of re-testing confirmed the effectiveness of the measures.

Further information on radon is available from the UKHSA at www.ukradon.org.

What is radon?

Radon is a naturally occurring radioactive gas, which is produced by the radioactive decay of radium which, in turn, is derived from the radioactive decay of uranium. Uranium is found in small quantities in all soils and rocks, although the amount varies from place to place. Radon released from rocks and soils is quickly diluted in the atmosphere. Concentrations in the open air are normally very low and do not present a hazard. Radon that enters enclosed spaces such as some buildings (particularly basements), caves, mines, and tunnels may reach high concentrations in some circumstances. The construction method and degree of ventilation will influence radon levels in individual buildings. A person's exposure to radon will also vary according to how particular buildings and spaces are used.

Inhalation of the radioactive decay products of radon gas increases the chance of developing lung cancer. If individuals are exposed to high concentrations for significant periods of time, there may be cause for concern. In order to limit the risk to individuals, the Government has adopted an Action Level for radon in homes of 200 becquerels per cubic metre (Bq m^{-3}). The Government advises householders that, where the radon level is at or above the Action Level, measures should be taken to reduce the concentration.

Radon in workplaces

The Ionising Radiation Regulations 2017 require employers to take action when radon is present above a defined level in the workplace. Advice may be obtained from your local Health and Safety Executive Area Office or the Environmental Health Department of your local authority. The BRE publishes a guide (BR293): **Radon in the workplace**. BRE publications may be obtained from the BRE Bookshop, Tel: 01923 664262, email: bookshop@bre.co.uk website: www.brebookshop.com

Contact Details

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General Terms & Conditions

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- Note that for some sites, the latest available records may be historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

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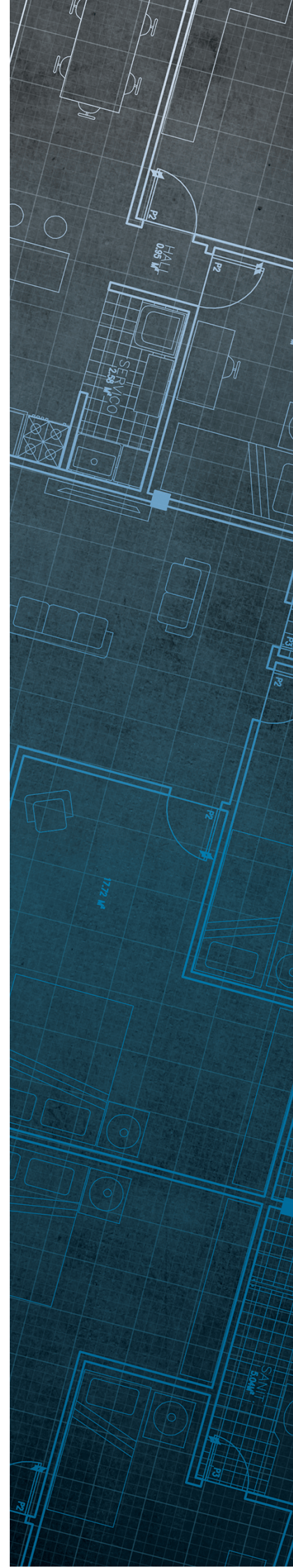
The Coal
Authority

Consultants Coal Mining Report

Woolley Colliery Road
Woolley Colliery Road
Darton
Barnsley
South Yorkshire
S75 5JA

Date of enquiry: 3 November 2025
Date enquiry received: 3 November 2025
Issue date: 3 November 2025

Our reference: 51003535504001
Your reference: PO25318/5624/wn



Consultants

Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

LITHOS CONSULTING

Enquiry address

Woolley Colliery Road
Woolley Colliery Road
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Barnsley
South Yorkshire
S75 5JA

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Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	TOP HAIGH MOOR	Coal	6J4Y	21	Beneath Property	6.9	North-East	107	1913
unnamed	TOP HAIGH MOOR	Coal	6J4X	31	Beneath Property	6.9	North-East	107	1913
unnamed	LOW HAIGH MOOR	Coal	6J50	50	Beneath Property	6.4	North-East	61	1915
unnamed	FENTON	Coal	6J5C	157	Beneath Property	7.1	North-East	205	1956
unnamed	MIDDLETON MAIN	Coal	6J5O	205	Beneath Property	7.8	North	145	1977
unnamed	WHEATLEY LIME	Coal	6J5N	236	Beneath Property	6.8	North-East	91	1943

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

Distance to spine roadway (m)	Direction to spine roadway
Within	N/A

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Adit	431410-001	431167 410356	has been treated to an unknown specification by SYMAS (1988).	Coal	
Adit	431410-002	431184 410347	has been treated to an unknown specification by SYMAS (1988).	Coal	
Adit	431410-021	431561 410512	Treatment details unknown.*	Coal	
Shaft	431410-042	431284 410281	was excavated to its base and subsequently filled to the surface with concrete by British Coal in May 1987.	Coal	

*For your information, before the coal industry was nationalised in 1947, there was no requirement for a mine operator to record mine entry treatment details when a mine was abandoned. Therefore, it is not unusual for us to have no treatment details for many of the 176,000 recorded mine entries on our database. Despite this lack of information, please be assured that the fact we have no treatment recorded does not necessarily mean that the mine entry was left untreated when abandoned.

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

NE816	5770	NE695
16548	NE978	NE996
7368	NE1034	

For assistance in identifying the specific abandoned mine plans relevant to your requirements, **please contact us at InformationManagers@MiningRemediation.gov.uk**.

Outcrops

No outcrops recorded.

Geological faults, fissures and breaklines

Please refer to the 'Summary of findings' map (on separate sheet) for details of any geological faults, fissures or breaklines either within or intersecting the enquiry boundary.

Faults under or close to the property recorded.

Opencast mines

Please refer to the "Summary of findings" map (on separate sheet) for details of any opencast areas within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

Distance to site investigation (m)	Direction
Within	N/A
Within	N/A
Within	N/A

See Section 4 for further information.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Future development

If development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply specialist engineering practice required for former mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or coal mines without first obtaining the permission of the Coal Authority.

MINE GAS: Please note, if there are no recorded instances of mine gas within 500m of the enquiry boundary, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded. Developers should be aware that the investigation of coal seams, mine workings or mine entries may have the potential to generate and/or displace underground gases. Associated risks both to the development site and any neighbouring land or properties should be fully considered when undertaking any ground works. The need for effective measures to prevent gases migrating onto any land or into any properties, either during investigation or remediation work, or after development must also be assessed and properly addressed. In these instances, the Coal Authority recommends that a more detailed Gas Risk Assessment is undertaken by a competent assessor.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

Site investigations

The site is within an area of previous interest. It is close to where the Coal Authority has received information relating to past site investigations.

The site requires further investigation and may influence how you approach your risk assessment.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please email us at reports@miningremediation.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **email us at reports@miningremediation.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission. Please note, if there are no recorded instances of mine gas reported, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices








Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

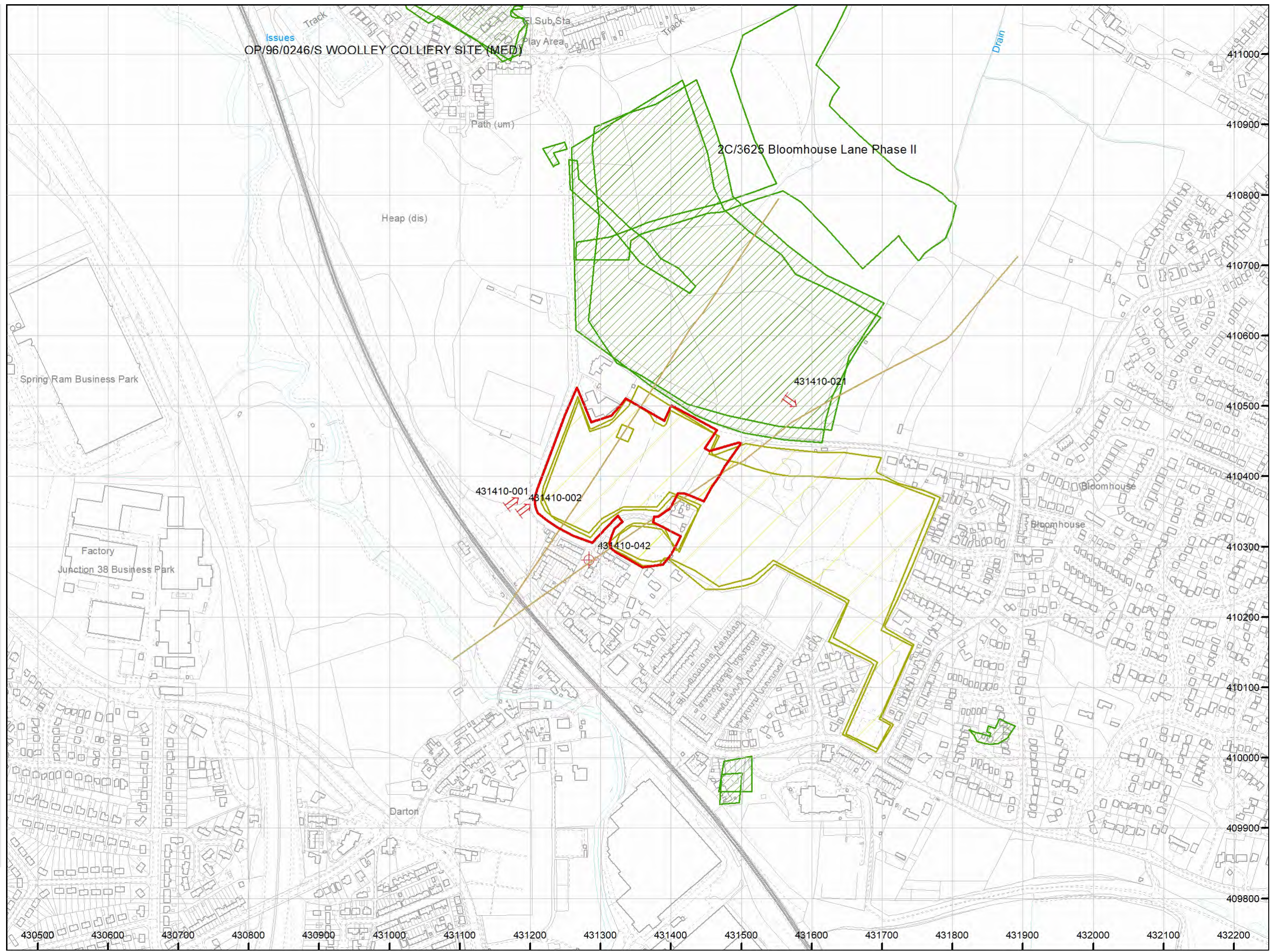
Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

- Approximate position of the enquiry boundary shown 
- Disused mine shaft 
- Disused adit 
- Geological faults 
- Opencast mine licence area 
- Unlicensed opencast site 
- Site investigations 



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The Coal
Authority

Issued by:

The Coal Authority, Property Search Services, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire, NG18 4RG
Website: www.groundstability.com Phone: 0345 762 6848

**LITHOS CONSULTING
PARKHILL
WALTON ROAD
WETHERBY
LEEDS
LS22 5DZ**

Our reference: **71009832747002**
Your reference: **PO25438**
Date of your enquiry: **19 November 2025**
Date we received your enquiry: **19 November 2025**
Date of issue: **19 November 2025**

This report is for the property described in the address below and the attached plan.

Shaft Plan and Data Sheets

**WOOLLEY COLLIERY ROAD, WOOLLEY COLLIERY ROAD, DARTON, BARNESLEY, SOUTH
YORKSHIRE, S75 5JA**

I refer to the enquiry dated 19 November 2025, received 19 November 2025, in connection with the above.

As requested I enclose the mine entry data sheet(s) held for the mine entry/entries referred to.

Mine Entry Data

Shaft/adit:	Adit
Reference:	431410-001
Source:	Ab Plans NE979 NE978 M1095 7368/1/2
Colliery name:	Unknown
Entry name:	Pyewood Colliery Adit
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	Unknown
Diameter of shaft (m):	Unknown
Probable adit azimuth:	53
Treatment details:	has been treated to an unknown specification by SYMAS (1988).
Conveyance:	Not Applicable
Easting:	431167
Northing:	410356
Other information:	None

Mine Entry Data (continued)

Shaft/adit:	Shaft
Reference:	431410-042
Source:	Measured on Site
Colliery name:	Unknown
Entry name:	Possible Well
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	6.5
Diameter of shaft (m):	1.4
Probable adit azimuth:	Not Applicable
Treatment details:	was excavated to its base and subsequently filled to the surface with concrete by British Coal in May 1987.
Conveyance:	Not Applicable
Easting:	431284
Northing:	410281
Other information:	None

Mine Entry Data (continued)

Shaft/adit:	Adit
Reference:	431410-002
Source:	Ab plans NE979 NE978 M1095 7368/1/2
Colliery name:	Unknown
Entry name:	Pyewodd Colliery Adit
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	Unknown
Diameter of shaft (m):	Unknown
Probable adit azimuth:	53
Treatment details:	has been treated to an unknown specification by SYMAS (1988).
Conveyance:	Not Applicable
Easting:	431184
Northing:	410347
Other information:	None

Location map

Approximate position of enquiry



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This plan shows the approximate location of the disused mine entry / entries referred to in the attached mining report. For reasons of clarity, mine entry symbols may not be drawn to the same scale as the plan.

Property owners have the benefit of statutory protection (under the Coal Mining Subsidence Act 1991). This contains provision for the making good, to the reasonable satisfaction of the owner, of physical damage from disused coal mine workings including disused coal mine entries. A leaflet setting out the rights and obligations of either the Coal Authority or other responsible persons under the 1991 Act can be obtained by visiting www.groundstability.com.

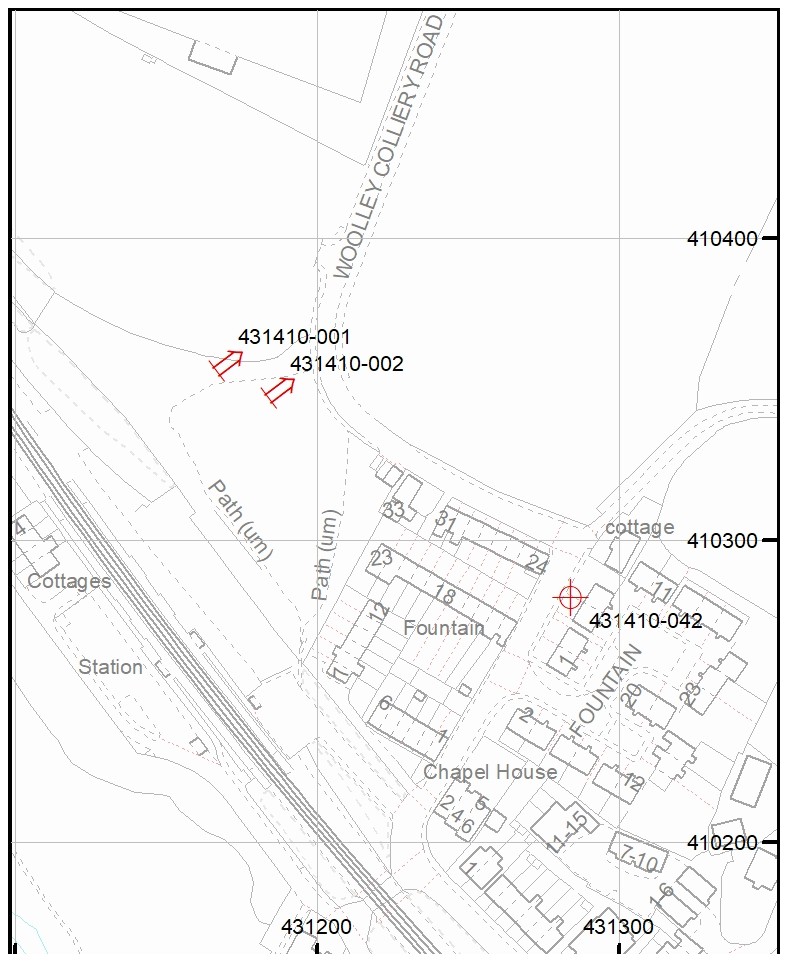
If you wish to discuss the relevance of any of the information contained in this report, you should seek the advice of a qualified mining engineer or surveyor. If you or your advisor wish to examine the source plans from which the information has been taken, these are available to view, free of charge, at our Head Office in Mansfield. To book an appointment please ring 0345 762 6848. Should you or your advisor wish to carry out a physical investigation that may enter, disturb or interfere with any disused mine entry, prior permission of the owner must be sought. For coal mine entries, the owner will normally be the Coal Authority.

The Coal Authority, regardless of responsibility and in conjunction with other public bodies, provide an emergency call out facility in coalfield areas to assess the public safety implications of mining features (including disused mine entries).

Our emergency telephone number is 0800 288 4242.

Key

Disused Adit or Mineshaft



Appendix F

Trial Pit Logs



Trial Pit Log

TrialPit No
SA101
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431294.94 - 410460.25
Level: 84.85 Date 09/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.30

Client: Homes by Honey Depth 2.70 Scale 1:20 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J,K&T					MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Frequent rootlets. (MADE GROUND TOPSOIL)
	0.40	J,K&T		0.30	84.55		MADE GROUND: Greyish brown and black slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of mudstone, siltstone and coal. (COLLIERY SPOIL)
	0.50	D		0.60	84.25		Stiff grey mottled light brown slightly gravelly slightly sandy CLAY. Gravel is subangular fine to coarse of mudstone. (COHESIVE RESIDUAL SOIL)
	1.00	D					
	1.10	HSV	HSV=90kPa				
	2.30	D		2.20	82.65		Grey clayey angular to subangular fine to coarse GRAVEL of siltstone, mudstone and sandstone. (GRANULAR RESIDUAL SOIL)
				2.70	82.15		End of Pit at 2.70m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
SA102
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431265.54 - 410447.83 Date 09/12/2025
Level: 83.10

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.30 Scale 1:20

Client: Homes by Honey Depth 2.50 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J,K&T		0.30	82.80		
	0.40	J,K&T					
	0.50	D					
				0.80	82.30		
	1.10	D					
	1.20	HSV	HSV=120kPa	1.30	81.80		
				2.50	80.60		End of Pit at 2.50m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP101
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431234.55 - 410394.42 Date 09/12/2025
Level: 78.45

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 0.60 x 3.00 Scale 1:20

Client: Homes by Honey Depth 1.00 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J,K&T					MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Frequent rootlets. (MADE GROUND TOPSOIL)
	0.40	J,K&T		0.30	78.15		MADE GROUND: Greyish brown and black slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse coal, mudstone and sandstone. (COLLIERY SPOIL)
	0.50	D		0.60	77.85		Stiff light brown slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
	0.80 0.80	D HSV	HSV=72kPa	1.00	77.45		At 1.0m, trial pit terminated due to surface water ingress. End of Pit at 1.00m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP102
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431354.64 - 410305.05
Level: 77.00 Date 09/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00 Scale 1:20

Client: Homes by Honey Depth 3.20 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T					Dark brown slightly sandy CLAY. Frequent rootlets. (TOPSOIL)
	0.60 0.60	D HSV	HSV=68kPa	0.30	76.70		Stiff light brown mottled grey slightly gravelly CLAY. Gravel is angular fine to coarse of mudstone. (COHESIVE RESIDUAL SOIL)
	1.10 1.20	HSV D	HSV=105kPa	1.40	75.60		Grey and brown sandy clayey angular to subangular fine to coarse GRAVEL of siltstone and mudstone. (GRANULAR RESIDUAL SOIL)
	2.50	D					From 3.0m to 3.1m, lens of gravel of coal.
				3.20	73.80		End of Pit at 3.20m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP103
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431378.96 - 410310.77
Level: 78.20 Date 09/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 0.60 x 3.00 Scale 1:20

Client: Homes by Honey Depth 3.30 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T		0.30	77.90		Dark brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Frequent rootlets. (TOPSOIL)
	0.20	B					
	0.60	D		1.60	76.60		Stiff light brown mottled grey slightly gravelly CLAY. Gravel is angular fine to coarse of mudstone. (COHESIVE RESIDUAL SOIL)
	0.70	HSV	HSV=75kPa				
	1.10	D		1.60	76.60		From 1.2m to 1.6m, increased gravel content in the clay.
	1.20	HSV	HSV=85kPa				
	2.30	D		3.30	74.90		Greyish brown sandy clayey angular to subangular fine to coarse GRAVEL of siltstone, mudstone and sandstone. (GRANULAR RESIDUAL SOIL)
	3.10	D					
	End of Pit at 3.30m						

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP104
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431391.48 - 410361.76 Date 09/12/2025
Level: 81.15

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00 Scale 1:20

Client: Homes by Honey Depth 2.10 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.05	T		0.10	81.05		Strong light grey CONCRETE, 60% matrix, 40% aggregate. (CONCRETE) <i>From 0.0m to 1.0m, minor spalling of sidewalls.</i>
	0.20	J,K&T		0.30	80.85		MADE GROUND: Dark brown sandy subangular to subrounded fine to coarse GRAVEL of clinker. (ASH & CLINKER)
	0.80	J,K&T					MADE GROUND: Firm light brown and grey gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of siltstone. (COHESIVE MADE GROUND) <i>From 0.5m, surface water seepages. At 0.6m, brick.</i>
							<i>At 1.0m, clay pipe, dry, running southeast to northwest.</i>
	1.50	D		1.20	79.95		Strong brown and grey SILTSTONE recovered as tabular gravel. (PENNINE MIDDLE COAL MEASURES) <i>From 1.3m, difficult to excavate.</i>
							<i>At 2.1m, refusal.</i>
				2.10	79.05		End of Pit at 2.10m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable between 0.0m and 1.0m depth during excavation.





Trial Pit Log

TrialPit No
TP105
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431273.05 - 410385.31
Level: 78.30 Date 10/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 0.60 x 3.00 Scale 1:20

Client: Homes by Honey Depth 3.20 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J,K&T					MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies and rare glass. Frequent rootlets. (MADE GROUND TOPSOIL)
	0.20	B		0.30	78.00		
	0.40	J,K&T		0.60	77.70		MADE GROUND: Dark greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies and rare ceramic. (COLLIERY SPOIL) <i>At 0.5m, lens of gravel of coal.</i>
	1.00	HSV	HSV=105kPa				
	1.50	D					Stiff light brown mottled grey slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of mudstone, siltstone, sandstone and coal. (COHESIVE RESIDUAL SOIL) <i>From 0.5m, surface water seepages.</i>
	1.50	HSV	HSV=92kPa				
							<i>From 1.8m to 1.9m, lens of gravel of coal.</i>
	2.50	D		2.30	76.00		
	3.00	D		3.20	75.10		Light brown sandy clayey angular to subangular fine to coarse GRAVEL of siltstone, mudstone and sandstone. (GRANULAR RESIDUAL SOIL)
							End of Pit at 3.20m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP106
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431272.75 - 410330.62 Date 10/12/2025
Level: 74.45

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00 Scale 1:20

Client: Homes by Honey Depth 3.30 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.10	J,K&T	HSV=90kPa	0.30	74.15		MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies and rare plastic and brick. Frequent rootlets, some roots. (MADE GROUND TOPSOIL)
	0.20	B					MADE GROUND: Dark greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Rare full brick. (COHESIVE MADE GROUND)
	0.50	J,K&T		1.00	73.45		At 0.6m, stone slab approx. 0.8m x 0.3m, and rebar.
	1.30	D					Stiff light brown mottled grey slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)
	1.30	HSV		From 1.2m to 1.3m, lens of gravel of coal.			
	2.20	D		From 1.4m, groundwater seepages.			
3.00	D	2.60	71.85		Light brown sandy clayey angular to subangular fine to coarse GRAVEL of siltstone, mudstone and sandstone. (GRANULAR RESIDUAL SOIL)		
3.30	D				End of Pit at 3.30m		

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered at 1.4m during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP107
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431338.44 - 410400.70 Date 10/12/2025
Level: 81.30

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00 Scale 1:20

Client: Homes by Honey Depth 3.30 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J,K&T					MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Frequent rootlets. (MADE GROUND TOPSOIL)
	0.20	B		0.30	81.00		
	0.40	J,K&T		0.50	80.80		MADE GROUND: Dark greyish brown gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone and coal. (COLLIERY SPOIL)
	0.60	D					From 0.4m, surface water seepage. Stiff light brown mottled grey slightly gravelly slightly sandy CLAY. Gravel is subangular fine to medium of mudstone, siltstone and coal. (COHESIVE RESIDUAL SOIL)
	1.00	HSV	HSV=74kPa				From 1.0m to 1.1m, lens of gravel of coal.
	1.70	D					
	1.70	HSV	HSV=98kPa				
	2.50	D					From 2.3m to 2.4m, lens of gravel of coal.
	2.90			2.90	78.40		Light brown sandy clayey angular fine to coarse GRAVEL of siltstone, sandstone and mudstone. (GRANULAR RESIDUAL SOIL)
	3.10	D		3.30	78.00		
							End of Pit at 3.30m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP108
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton

Project No.
5624

Co-ords: 431337.92 - 410474.16
Level: 86.70

Date
10/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket.

Dimensions (m): 3.00

Scale
1:20

Client: Homes by Honey

Depth
3.20

0.60

Logged
CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T		0.30	86.40		Greyish brown slightly gravelly slightly sandy CLAY. Gravel is of mixed lithologies. Frequent rootlets, some roots. (TOPSOIL)
	0.20	B					
	0.60	D		1.20	85.50		Stiff grey mottled light brown slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of mudstone and sandstone. (COHESIVE RESIDUAL SOIL)
	0.60	HSV	HSV=78kPa				
	1.00	HSV	HSV=118kPa				
	1.60	D		3.20	83.50		Dark brown sandy clayey GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)
	2.80	D					
End of Pit at 3.20m							

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP109
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431412.93 - 410472.71
Level: 87.20 Date 10/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00 Scale 1:20

Client: Homes by Honey Depth 3.50 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T					Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular fine to coarse of mudstone. Frequent rootlets. (TOPSOIL)
	0.20	B					
				0.50	86.70		Stiff light brown mottled grey slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)
	1.00	HSV	HSV=105kPa				
	1.20	D					
	1.60	D					
				1.90	85.30		Grey sandy clayey angular to subangular fine to coarse GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)
	3.00	D					
				3.50	83.70		End of Pit at 3.50m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP110
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431369.19 - 410358.20
Level: 81.10 Date 10/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 0.60 x 3.00 Scale 1:20

Client: Homes by Honey Depth 2.90 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.05	J,K&T		0.10	81.00		Strong light grey CONCRETE, 60% matrix, 40% aggregate. (CONCRETE) <i>Breaker used through concrete.</i>
	0.20	J,K&T		0.30	80.80		MADE GROUND: Brownish red and grey subangular COBBLES of bricks and mortar with occasional boulders and some very sandy angular to subangular fine to coarse gravel. (GRANULAR MADE GROUND)
	0.60	D		0.50	80.60		MADE GROUND: Dark brown sandy clayey subangular to subrounded fine to coarse GRAVEL of quartz. (GRANULAR MADE GROUND)
	0.70	J,K&T		1.00	80.10		Stiff light brown mottled grey gravelly slightly sandy CLAY. Gravel is subangular fine to coarse of siltstone, mudstone and coal. (COHESIVE RESIDUAL SOIL) <i>From 0.5m to 1.0m, possibly reworked natural - clay not as well structured as below.</i>
	1.50	D		1.80	79.30		Stiff light brown gravelly CLAY. Gravel is angular to subangular fine to coarse of siltstone, mudstone and sandstone. (COHESIVE RESIDUAL SOIL)
	2.30	D		2.50	78.60		Light brown sandy clayey angular to subangular fine to coarse GRAVEL of siltstone, mudstone and sandstone. (GRANULAR RESIDUAL SOIL)
	2.80	D		2.90	78.20		Moderately strong light brown SILTSTONE, with interbedded mudstone and sandstone recovered as clayey gravel. (PENNINE MIDDLE COAL MEASURES)
							End of Pit at 2.90m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP111
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431391.36 - 410392.31
Level: 83.25 Date 10/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00

Client: Homes by Honey Depth 3.10 Scale 1:20 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J,K&T		0.30	82.95		Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Frequent rootlets. (TOPSOIL) <i>Sample at 0.1m taken from south of pit.</i>
	0.60 0.60	D HSV	HSV=55kPa				Stiff light brown mottled grey slightly sandy CLAY. (COHESIVE RESIDUAL SOIL) <i>From 0.3m to 0.7m, brick wall in south of pit.</i>
	0.80	J,K&T					<i>Sample at 0.8m taken from south of pit.</i>
	1.20 1.30	HSV D	HSV=60kPa	1.80	81.45		Grey very clayey angular to subrounded fine to coarse GRAVEL of mudstone and siltstone. (GRANULAR RESIDUAL SOIL)
	2.50	D		3.10	80.15		End of Pit at 3.10m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP112
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton

Project No.
5624

Co-ords: 431392.75 - 410417.03
Level: 84.45

Date
10/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket.

Dimensions (m): 3.00

Scale
1:20

Client: Homes by Honey

Depth
2.90

0.60



Logged
CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T		0.40	84.05		Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Frequent rootlets. (TOPSOIL)
	0.60 0.60	D HSV	HSV=55kPa				Stiff light brown mottled grey slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to medium of mudstone. (COHESIVE RESIDUAL SOIL)
	1.20	HSV	HSV=115kPa	1.60	82.85		Stiff grey slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to medium of mudstone. (COHESIVE RESIDUAL SOIL)
	2.60	D		2.90	81.55		End of Pit at 2.90m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP113
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431456.78 - 410393.01
Level: 85.90 Date 11/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00 Scale 1:20

Client: Homes by Honey Depth 3.20 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T					Dark greyish brown slightly gravelly slightly sandy CLAY. Gravel is angular to subrounded fine to coarse of mixed lithologies. Frequent rootlets, some roots. (TOPSOIL)
	0.20	B					
	0.60	D		0.40	85.50		Stiff grey mottled light brown slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to medium of siltstone and mudstone. (COHESIVE RESIDUAL SOIL) <i>From 0.8m to 1.3m, increasing gravel of mudstone content.</i>
	0.60	HSV	HSV=65kPa				
	1.20	HSV	HSV=90kPa	1.30	84.60		Grey sandy clayey angular to subangular fine to coarse GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)
	1.50	D					
	2.20	D		1.80	84.10		Dark grey sandy clayey angular to subangular fine to coarse GRAVEL of siltstone, mudstone and sandstone. (GRANULAR RESIDUAL SOIL)
	3.00	D					
				3.20	82.70		End of Pit at 3.20m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP114
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431429.99 - 410431.25
Level: 86.70 Date 11/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00 Scale 1:20

Client: Homes by Honey Depth 2.20 0.60 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T		0.40	86.30		Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Frequent rootlets, some roots. (TOPSOIL)
	0.20	B					
	0.60	D	HSV=70kPa	1.80	84.90		Stiff light brown mottled grey slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to medium of mudstone, siltstone and coal. (COHESIVE RESIDUAL SOIL) <i>From 0.4m, surface water seepage.</i>
	0.60	HSV					
	1.20	HSV	HSV=85kPa	2.00	84.50		Strong light brown SILTSTONE recovered as angular to subangular fine to coarse gravel. (PENNINE MIDDLE COAL MEASURES) <i>From 2.0m, difficult to excavate.</i> <i>At 2.2m, refusal.</i>
		D					
				2.20	84.50		End of Pit at 2.20m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP115
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431355.99 - 410385.78 Date 11/12/2025
Level: 80.80

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 0.60 x 3.00 Scale 1:20

Client: Homes by Honey Depth 3.00 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 0.20	J&T B		0.30	80.50		Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Frequent rootlets, some roots. (TOPSOIL)
	0.70 0.70	D HSV	HSV=70kPa				Stiff light brown mottled grey slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to medium siltstone, mudstone and coal. (COHESIVE RESIDUAL SOIL)
	1.10 1.20	D HSV	HSV=73kPa				
							<i>From 1.3m to 1.4m, lens of gravel of coal.</i>
				2.10	78.70		Strong light brown SILTSTONE recovered as tabular gravel. (PENNINE MIDDLE COAL MEASURES)
	2.50	D					<i>From 2.5m, difficult to excavate.</i>
				3.00	77.80		<i>At 3.0m, refusal.</i>
							End of Pit at 3.00m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP116
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431351.40 - 410443.04 Date 11/12/2025
Level: 84.40

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00 Scale 1:20

Client: Homes by Honey Depth 3.20 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J,K&T		0.20	84.20		MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies and rare ceramic. Frequent rootlets. (MADE GROUND TOPSOIL)
	0.30	J,K&T		0.40	84.00		MADE GROUND: Dark greyish brown and black gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse coal. (COLLIERY SPOIL)
	0.60 0.60	D HSV	HSV=110kPa				Stiff light brown mottled grey slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse siltstone. (COHESIVE RESIDUAL SOIL)
	1.10 1.20	D HSV	HSV=80kPa	1.40	83.00		Grey sandy clayey angular to subangular fine to coarse GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)
	2.80	D		3.20	81.20		End of Pit at 3.20m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP117
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431308.40 - 410421.49
Level: 82.20 Date 11/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 0.60 x 3.00 Scale 1:20

Client: Homes by Honey Depth 2.70 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 0.15	J,K&T B		0.20	82.00		MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Frequent rootlets. (MADE GROUND TOPSOIL)
	0.30	J,K&T		0.40	81.80		MADE GROUND: Dark greyish brown and black gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of coal and mudstone. (COLLIERY SPOIL)
	0.60 0.70	HSV D	HSV=68kPa				Stiff light brown mottled grey slightly gravelly slightly sandy CLAY. Gravel is angular to subrounded fine to coarse of siltstone and mudstone. (COHESIVE RESIDUAL SOIL)
	1.20 1.40	HSV D	HSV=95kPa				
				1.90	80.30		Grey sandy clayey angular to subangular fine to coarse GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)
	2.40	D					
				2.70	79.50		End of Pit at 2.70m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP118
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431312.26 - 410354.82 Date 11/12/2025
Level: 77.10

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00 Scale 1:20

Client: Homes by Honey Depth 3.00 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J,K&T					MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies and rare ceramic. Frequent rootlets. (MADE GROUND TOPSOIL)
	0.20	B		0.30	76.80		
	0.40	J,K&T		0.60	76.50		MADE GROUND: Greyish brown and black gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of coal and mudstone. (COLLIERY SPOIL)
	0.70	HSV	HSV=75kPa				Stiff grey mottled light brown slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse siltstone and mudstone. (COHESIVE RESIDUAL SOIL)
	1.20	D					
	1.20	HSV	HSV=130kPa				
				1.90	75.20		Grey sandy clayey angular to subangular fine to coarse GRAVEL of mudstone and siltstone. (GRANULAR RESIDUAL SOIL)
	2.20	D					
				3.00	74.10		End of Pit at 3.00m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP119
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431241.61 - 410354.25
Level: 76.05 Date 11/12/2025

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 0.60 x 3.00 Scale 1:20

Client: Homes by Honey Depth 2.80 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J,K&T					MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies and rare ceramic. Frequent rootlets. (MADE GROUND TOPSOIL)
	0.20	B		0.30	75.75		
	0.40	J,K&T		0.60	75.45		MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is angular to subrounded mixed lithologies, including coal and brick. (COLLIERY SPOIL)
	0.90	D					Stiff light brown slightly gravelly slightly sandy CLAY. Gravel is angular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
	1.00	HSV	HSV=85kPa	1.20	74.85		
	1.80	D					Moderately strong light brown SANDSTONE recovered as sandy tabular gravel and cobbles. (PENNINE MIDDLE COAL MEASURES)
							<i>From 2.2m, difficult to excavate.</i>
							<i>At 2.8m, refusal.</i>
				2.80	73.25		End of Pit at 2.80m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP120
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431254.84 - 410409.52 Date 11/12/2025
Level: 79.80

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 0.60 x 3.00 Scale 1:20

Client: Homes by Honey Depth 2.90 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 0.15	J,K&T B		0.20	79.60		MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Frequent rootlets. (MADE GROUND TOPSOIL)
	0.40	J,K&T		0.50	79.30		MADE GROUND: Greyish brown and black sandy clayey GRAVEL of mudstone, siltstone, sandstone and coal. (COLLIERY SPOIL)
	0.70 0.80	HSV D	HSV=98kPa				Stiff light brown slightly gravelly slightly sandy CLAY. Gravel is subangular fine to medium of sandstone, mudstone, coal and siltstone. (COHESIVE RESIDUAL SOIL)
	1.20 1.30	HSV D	HSV=92kPa				
				1.70	78.10		Moderately strong light brown SILTSTONE recovered as sandy tabular gravel. (PENNINE MIDDLE COAL MEASURES)
	2.30	D					From 2.3m, difficult to excavate.
				2.90	76.90		At 2.9m, refusal. End of Pit at 2.90m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

TrialPit No
TP121
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431361.34 - 410481.78 Date 11/12/2015
Level: 86.60

Equipment & Method: JCB 3CX with 0.6m wide toothed bucket. Dimensions (m): 3.00 Scale 1:20

Client: Homes by Honey Depth 3.00 Logged CD

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J,K&T		0.20	86.40		MADE GROUND: Greyish brown slightly gravelly slightly sandy CLAY. Gravel is angular to subrounded fine to coarse of mixed lithologies. Frequent rootlets. (MADE GROUND TOPSOIL)
	0.30	J,K&T		0.40	86.20		MADE GROUND: Dark greyish brown and black gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of coal, mudstone and siltstone. (COLLIERY SPOIL)
	0.60	HSV	HSV=62kPa				Stiff light brown mottled grey slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse siltstone. (COHESIVE RESIDUAL SOIL)
	1.20	HSV	HSV=115kPa				<i>From 1.2m to 1.8m, clay is grey mottled light brown.</i>
	1.40	D					<i>From 1.6m to 1.7m, lens of gravel of coal.</i>
				1.80	84.80		Greyish brown and light brown very clayey gravelly SAND. Gravel is angular to subangular fine to medium of mudstone and siltstone. (GRANULAR RESIDUAL SOIL)
	2.50	D					
	2.60	B					
				3.00	83.60		End of Pit at 3.00m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.



Appendix G
Probeholes Logs

Rotary Core Log

Borehole No.

PH101

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431233.17 - 410379.28	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	77.60	Scale	1:100
Client:	Homes by Honey			Dates:	08/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.30	77.30		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic.	1
							1.50	76.10		Orangeish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							5.00	72.60		Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	5
							6.00	71.60		Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	7
										<i>At 7.5m, band of grey sandstone.</i>	8
											9
											10
											11
											12
							14.00	63.60		Black bright COAL. (TOP HAIGH MOOR)	14
							14.60	63.00		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	15
							14.70	62.90		Black bright COAL. (TOP HAIGH MOOR)	15
							15.00	62.60		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	16
											17
											18
											19
											20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH101

Sheet 2 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431233.17 - 410379.28	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	77.60	Scale	1:100
Client:	Homes by Honey			Dates:	08/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
										Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	21
							23.00	54.60			22
										Black bright COAL. (LOW HAIGH MOOR)	23
							24.50	53.10			24
										Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	25
											26
											27
											28
											29
							30.00	47.60			End of Borehole at 30.000m
											31
											32
											33
											34
											35
											36
											37
											38
											39
											40

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH101A

Sheet 1 of 1

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431234.26 - 410380.49	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	77.75	Scale	1:100
Client:	Homes by Honey			Dates:	08/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.30	77.45		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic. (TOPSOIL) Orangish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL) Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	1
							1.50	76.25			2
							4.00	73.75			3
										End of Borehole at 4.000m	4
											5
											6
											7
											8
											9
											10
											11
											12
											13
											14
											15
											16
											17
											18
											19
											20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Monitoring well installed with a response zone from 1.0m to 4.0m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH102

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431255.38 - 410365.50	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	76.70	Scale	1:100
Client:	Homes by Honey			Dates:	09/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	76.30		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal. (TOPSOIL)	1
							2.00	74.70		Orangish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							5.60	71.10		Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	6
							6.10	70.60		Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	7
											8
											9
											10
											11
											12
											13
											14
											15
							16.60	60.10		<i>From 15.8m to 16.5m, light grey and light greyish brown.</i> Black bright COAL. (TOP HAIGH MOOR)	16
							17.60	59.10		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	17
											18
											19
											20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.
PH102
Sheet 2 of 2

Project Name: Woolley Colliery Road, Darton	Project No. 5624	Co-ords: 431255.38 - 410365.50	Hole Type RO
Equipment & Method: Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.	Level: 76.70		Scale 1:100
Client: Homes by Honey	Dates: 09/12/2025		Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
										Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	21
							23.00	53.70		Black bright COAL. (LOW HAIGH MOOR)	23
							24.00	52.70		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	24
											25
											26
											27
											28
											29
							30.00	46.70		End of Borehole at 30.000m	30
											31
										32	
										33	
										34	
										35	
										36	
										37	
										38	
										39	
										40	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH103

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431243.66 - 410442.93	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	82.00	Scale	1:100
Client:	Homes by Honey			Dates:	09/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	81.60		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal. (TOPSOIL)	1
							1.80	80.20		Brownish grey OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
							3.20	78.80		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							4.20	77.80		Dark grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	4
							4.80	77.20		Black dull COAL with dark grey MUDSTONE bands. (PENNINE MIDDLE COAL MEASURES)	5
							7.00	75.00		Brownish grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	6
							10.50	71.50		Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	7
							10.80	71.20		Brown SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	11
							13.00	69.00		Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	12
										Grey firm grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	13
											14
											15
											16
											17
											18
											19
											20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH103

Sheet 2 of 2

Project Name:	Woolley Colliery Road, Darton	Project No. 5624	Co-ords:	431243.66 - 410442.93	Hole Type RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.		Level:	82.00	Scale 1:100
Client:	Homes by Honey		Dates:	09/12/2025	Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
										Grey firm grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	21
											22
											23
							23.80	58.20		<i>At 23.8m, band of light brown sandstone.</i>	
							24.10	57.90		Dark grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	24
										Black bright COAL. (TOP HAIGH MOOR)	25
							24.90	57.10		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	26
											27
											28
											29
										30	
										31	
										32	
										33	
						32.90	49.10		Black bright COAL. (LOW HAIGH MOOR)	34	
						34.00	48.00		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	35	
										36	
						36.00	46.00		End of Borehole at 36.000m	37	
										38	
										39	
										40	

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH103A

Sheet 1 of 1

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431245.48 - 410442.48	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air-mist & water flush.			Level:	81.95	Scale	1:100
Client:	Homes by Honey			Dates:	12/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	81.55		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal. (TOPSOIL)	1
							1.80	80.15		Brownish grey OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
							3.20	78.75		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							4.00	77.95		Dark grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	4
										End of Borehole at 4.000m	5
											6
											7
											8
											9
											10
											11
											12
											13
											14
											15
											16
											17
											18
											19
											20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Monitoring well installed with a response zone from 2.0m to 4.0m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH104

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431244.16 - 410409.63	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	79.45	Scale	1:100
Client:	Homes by Honey			Dates:	09/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	79.05		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal. (TOPSOIL)	1
							1.70	77.75		Brownish grey and orangish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	3
											4
											5
											6
											7
											8
											9
											10
											11
							12.10	67.35		Light grey fine grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	12
							13.00	66.45		Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	13
											14
											15
							16.40	63.05			16
							16.60	62.85		Void. No returns. (POSSIBLE MINE WORKINGS) Soft drilling. No returns. (POSSIBLE MINE WORKINGS)	17
											18
							18.50	60.95			18
							19.00	60.45		Void. No returns. (POSSIBLE MINE WORKINGS) Soft drilling. No returns. (POSSIBLE MINE WORKINGS)	19
											20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.
PH104
Sheet 2 of 2

Project Name: Woolley Colliery Road, Darton	Project No. 5624	Co-ords: 431244.16 - 410409.63	Hole Type RO
Equipment & Method: Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.	Level: 79.45		Scale 1:100
Client: Homes by Honey	Dates: 09/12/2025		Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							21.00	58.45		Soft drilling. No returns. (POSSIBLE MINE WORKINGS)	21
										Solid drilling. No returns. (PENNINE MIDDLE COAL MEASURES)	22
							24.00	55.45			23
											24
										At 24.0m, hole terminated due to no returns. End of Borehole at 24.000m	25
											26
											27
											28
											29
											30
											31
											32
											33
											34
											35
											36
											37
											38
											39
											40

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH105

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431253.48 - 410395.57	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	78.75	Scale	1:100
Client:	Homes by Honey			Dates:	09/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	78.35		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic. (TOPSOIL)	1
							1.60	77.15		Greyish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	3
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	4
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	5
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	6
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	7
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	8
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	9
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	10
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	11
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	12
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	13
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	14
							14.70	64.05		Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	15
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	16
										Grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	17
							17.90	60.85		Black bright COAL. (TOP HAIGH MOOR)	18
							18.20	60.55		Dark grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	19
							18.40	60.35		Black bright COAL. (TOP HAIGH MOOR)	19
							19.00	59.75		Black bright COAL. (TOP HAIGH MOOR)	20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH105

Sheet 2 of 2

Project Name: Woolley Colliery Road, Darton	Project No. 5624	Co-ords: 431253.48 - 410395.57	Hole Type RO
Equipment & Method: Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.		Level: 78.75	Scale 1:100
Client: Homes by Honey		Dates: 09/12/2025	Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
[Pattern]										Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	21
							27.20	51.55			22
							27.90	50.85		Black bright COAL. (LOW HAIGH MOOR)	23
										Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	24
											25
											26
											27
											28
											29
							30.00	48.75		End of Borehole at 30.000m	30
											31
											32
											33
											34
											35
											36
											37
											38
											39
											40

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH106

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431291.05 - 410405.98	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	80.45	Scale	1:100
Client:	Homes by Honey			Dates:	09/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	80.05		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal. (TOPSOIL)	1
							1.50	78.95		Orangish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							4.80	75.65		Black dull COAL with dark grey MUDSTONE bands. (PENNINE MIDDLE COAL MEASURES)	5
							5.80	74.65		Greyish brown med grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	6
											7
											8
											9
											10
											11
											12
							14.10	66.35		Light grey SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	14
											15
							16.50	63.95		Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	17
											18
											19
											20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH106

Sheet 2 of 2

Project Name:	Woolley Colliery Road, Darton	Project No. 5624	Co-ords:	431291.05 - 410405.98	Hole Type RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.		Level:	80.45	Scale 1:100
Client:	Homes by Honey		Dates:	09/12/2025	Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
										Light greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	21
							23.80	56.65			22
							24.60	55.85		Black bright COAL. (TOP HAIGH MOOR)	24
										Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	25
											26
											27
											28
											29
											30
								31.80	48.65		Black bright COAL. (LOW HAIGH MOOR)
							32.80	47.65		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	33
										34	
										35	
							36.00	44.45		End of Borehole at 36.000m	36
											37
											38
											39
											40

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH106A

Sheet 1 of 1

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431292.18 - 410406.38	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	80.50	Scale	1:100
Client:	Homes by Honey			Dates:	09/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	80.10		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal. (TOPSOIL) Orangish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL) Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	1
							1.50	79.00			2
							4.00	76.50			3
										End of Borehole at 4.000m	4
											5
											6
											7
											8
											9
											10
											11
											12
											13
											14
											15
											16
											17
											18
											19
											20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Monitoring well installed with a response zone from 2.0m to 4.0m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH107

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431314.56 - 410387.04	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	79.60	Scale	1:100
Client:	Homes by Honey			Dates:	10/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	79.20		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare and coal. (TOPSOIL)	1
							1.80	77.80		Brownish grey OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							3.80	75.80		Black dull COAL with dark grey MUDSTONE bands. (PENNINE MIDDLE COAL MEASURES)	4
							4.20	75.40		Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	5
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	6
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	7
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	8
							8.90	70.70		Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	9
							9.50	70.10		Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	10
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	11
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	12
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	13
							13.40	66.20		Black dull COAL with dark grey MUDSTONE bands. (PENNINE MIDDLE COAL MEASURES)	14
							13.80	65.80		Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	15
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	16
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	17
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	18
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	19
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH108

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No. 5624	Co-ords:	431287.78 - 410336.77	Hole Type RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and water flush.		Level:	75.05	Scale 1:100
Client:	Homes by Honey		Dates:	10/12/2025	Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	74.65		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic. (TOPSOIL)	1
							1.50	73.55		Brownish grey OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	3
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	12
							11.80	63.25			13
											14
											15
											16
											17
											18
											19
											20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH108

Sheet 2 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431287.78 - 410336.77	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and water flush.			Level:	75.05	Scale	1:100
Client:	Homes by Honey			Dates:	10/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES) <i>At 19.8m, band of brown siltstone.</i>	21
							22.80	52.25			22
									■	Black bright COAL. (TOP HAIGH MOOR)	23
							24.00	51.05	▨	Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	24
											25
											26
											27
											28
											29
								31.50	43.55	■	Black bright COAL. (LOW HAIGH MOOR)
						32.60	42.45				33
						33.00	42.05			Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES) End of Borehole at 33.000m	33
											34
											35
											36
											37
											38
											39
											40

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH108A

Sheet 1 of 1

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431288.99 - 410338.30	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and water flush.			Level:	75.25	Scale	1:100
Client:	Homes by Honey			Dates:	10/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	74.85		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic. (TOPSOIL)	1
							1.50	73.75			2
										Greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							4.00	71.25		End of Borehole at 4.000m	4
											5
											6
											7
											8
											9
											10
											11
											12
											13
											14
											15
											16
											17
											18
											19
											20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Monitoring well installed with a response zone from 2.0m to 4.0m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH109

Sheet 1 of 2

Project Name: Woolley Colliery Road, Darton	Project No. 5624	Co-ords: 431356.94 - 410463.67	Hole Type RO
Equipment & Method: Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.		Level: 85.70	Scale 1:100
Client: Homes by Honey		Dates: 11/12/2025	Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	85.30		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic.	1
							1.30	84.40		(TOPSOIL)	
										Orangish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							4.30	81.40		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	4
							7.20	78.50		Dark grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	5
							8.00	77.70		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	6
							12.50	73.20		Black dull COAL with dark grey MUDSTONE bands. (PENNINE MIDDLE COAL MEASURES)	7
							12.90	72.80		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	8
							13.50	72.20		Black dull COAL with dark grey MUDSTONE bands. (PENNINE MIDDLE COAL MEASURES)	9
							13.70	72.00		Light grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	10
							19.60	66.10		Black dull COAL with dark grey MUDSTONE	11
							19.90	65.80		Black dull COAL with dark grey MUDSTONE	12

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 22.0m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.





Rotary Core Log

Borehole No.
PH109
Sheet 2 of 2

Project Name: Woolley Colliery Road, Darton	Project No. 5624	Co-ords: 431356.94 - 410463.67	Hole Type RO
Equipment & Method: Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.		Level: 85.70	Scale 1:100
Client: Homes by Honey		Dates: 11/12/2025	Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
	▼									Black dull COAL with dark grey MUDSTONE bands. (PENNINE MIDDLE COAL MEASURES) Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	21
										<i>From 22.0m, groundwater.</i>	22
											23
										<i>From 23.5m to 37.0m, intermittent flush returns. Solid drilling.</i>	24
											25
											26
											27
											28
											29
											30
											31
											32
											33
											34
											35
											36
							37.00	48.70		<i>At 37.0m, hole terminated due to poor flush returns.</i>	37
										End of Borehole at 37.000m	38
											39
											40

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 22.0m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.





Rotary Core Log

Borehole No.
PH109A
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton	Project No. 5624	Co-ords: 431358.98 - 410461.30	Hole Type RO
Equipment & Method: Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.		Level: 85.50	Scale 1:100
Client: Homes by Honey		Dates: 11/12/2025	Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	85.10		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic. (TOPSOIL) Orangish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL) Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	1
							1.30	84.20			2
											3
							4.00	81.50		End of Borehole at 4.000m	4
											5
											6
											7
											8
											9
											10
											11
											12
											13
											14
											15
											16
											17
											18
											19
											20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Monitoring well installed with a response zone from 2.0m to 4.0m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH110

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.:	5624	Co-ords:	431323.78 - 410435.83	Hole Type:	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.	Level:	83.80	Scale:	1:100	Logged By:	DP
Client:	Homes by Honey	Dates:	11/12/2025				

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	83.40		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal.	1
							1.40	82.40		(TOPSOIL) Greyish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL) Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	2
											3
											4
											5
											6
											7
							8.20	75.60		Black dull COAL.	8
							8.40	75.40		(PENNINE MIDDLE COAL MEASURES) Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	9
											10
											11
							12.50	71.30		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	13
							14.00	69.80		Black dull COAL with dark grey MUDSTONE bands.	14
							14.30	69.50		(PENNINE MIDDLE COAL MEASURES) Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	15
											16
											17
											18
											19
											20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH110

Sheet 2 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431323.78 - 410435.83	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	83.80	Scale	1:100
Client:	Homes by Honey			Dates:	11/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description		
				TCR	SCR	RQD						
							20.50	63.30		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)		
							21.00	62.80		Dark grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	21	
										Black bright COAL. (TOP HAIGH MOOR)	22	
							22.30	61.50		Greyish brown medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	23	
											24	
											25	
											26	
											27	
								28.80	55.00			28
								29.30	54.50		Soft drilling. Returns of greyish brown SANDSTONE. (PENNINE MIDDLE COAL MEASURES) <i>From 28.8m to 29.3m, soft drilling/broken ground with returns. Possible fractures due to faulting.</i>	29
							30.50	53.30		Black bright COAL. (LOW HAIGH MOOR)	30	
										Brownish grey medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	31	
											32	
							33.00	50.80		End of Borehole at 33.000m	33	
											34	
											35	
											36	
											37	
											38	
											39	
											40	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH111

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.:	5624	Co-ords:	431428.75 - 410451.08	Hole Type:	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.	Level:	87.15	Scale:	1:100	Logged By:	DP
Client:	Homes by Honey	Dates:	11/12/2025				

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	86.75		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic.	1
							1.50	85.65		Greyish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							5.00	82.15		Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	4
											5
											6
											7
											8
											9
							10.50	76.65		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	10
											11
											12
											13
							14.50	72.65		Black dull COAL with dark grey MUDSTONE bands.	14
							15.20	71.95		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	15
							16.00	71.15		Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	16
							16.30	70.85		Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	17
											18
										At 18.0m, groundwater.	19
											20

Remarks	1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.	
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Rotary Core Log

Borehole No.

PH111

Sheet 2 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431428.75 - 410451.08	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	87.15	Scale	1:100
Client:	Homes by Honey			Dates:	11/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							21.00	66.15	xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	21
							21.80	65.35	■	Black dull COAL with dark grey MUDSTONE bands. (PENNINE MIDDLE COAL MEASURES)	22
									▨	Grey MUDSTONE and brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	23
									▨		24
									▨		25
									▨		26
									▨	<i>From 26.0m to 30.5m, intermittent flush returns. Solid drilling.</i>	27
									▨		28
							29.00	58.15	■	Black dull COAL with dark grey MUDSTONE bands. (PENNINE MIDDLE COAL MEASURES)	29
							29.40	57.75	▨	Grey MUDSTONE and brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	30
								▨	<i>From 30.5m, no returns. Solid drilling.</i>	31	
						32.00	55.15		<i>At 32.0m, hole terminated due to no flush returns. End of Borehole at 32.000m</i>	32	
										33	
										34	
										35	
										36	
										37	
										38	
										39	
										40	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.





Rotary Core Log

Borehole No.
PH111A
Sheet 1 of 1

Project Name: Woolley Colliery Road, Darton Project No. 5624 Co-ords: 431428.27 - 410449.54 Hole Type RO

Equipment & Method: Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush. Level: 87.00 Scale 1:100

Client: Homes by Honey Dates: 11/12/2025 Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	86.60		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic. (TOPSOIL)	1
							1.50	85.50		Greyish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL) Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	2
							4.00	83.00		End of Borehole at 4.000m	3
											4
											5
											6
											7
											8
											9
											10
											11
											12
											13
											14
											15
											16
											17
											18
											19
											20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Monitoring well installed with a response zone from 2.0m to 4.0m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH112

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431427.90 - 410418.75	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	86.80	Scale	1:100
Client:	Homes by Honey			Dates:	11/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		0.40				0.40	86.40		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and frequent plastic and rare metal. (TOPSOIL)	1	
		1.50				1.50	85.30		Greyish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2	
										Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	3
										Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	4
										Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	5
										Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	6
										Dark grey MUDSTONE with black dull COAL bands. (PENNINE MIDDLE COAL MEASURES)	7
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	8
										Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	9
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	10
										Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	11
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	12
									Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	13	
									Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	14	
									Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	15	
									Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	16	
									Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	17	
									Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	18	
									Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	19	
									Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	20	

Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.	
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Rotary Core Log

Borehole No.

PH112

Sheet 2 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.:	5624	Co-ords:	431427.90 - 410418.75	Hole Type:	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.	Level:	86.80	Scale:	1:100	Logged By:	DP
Client:	Homes by Honey	Dates:	11/12/2025				

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description		
				TCR	SCR	RQD						
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	21	
							25.20	61.60				22
							26.00	60.80		Black dull COAL with dark grey MUDSTONE bands. (PENNINE MIDDLE COAL MEASURES)	26	
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	27	
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	From 29.0m to 30.5m, intermittent flush returns. Solid drilling.	29	
							30.50	56.30	xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Solid drilling. No returns. (PENNINE MIDDLE COAL MEASURES)	31	
							31.00	55.80		From 30.5m, no returns. Solid drilling.	31	
							31.80	55.00	xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Soft drilling. No returns. (POSSIBLE MINE WORKINGS)	32	
							33.00	53.80	xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Solid drilling. No returns. (PENNINE MIDDLE COAL MEASURES)	33	
										At 33.0m, hole terminated due to no flush returns. End of Borehole at 33.000m	33	
											34	
											35	
											36	
											37	
											38	
											39	
											40	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH113

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.:	5624	Co-ords:	431366.91 - 410407.18	Hole Type:	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.	Level:	82.75	Scale:	1:100	Logged By:	DP
Client:	Homes by Honey	Dates:	11/12/2025				

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	82.35		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic.	1
							1.30	81.45		Greyish brown and grey OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							4.50	78.25		Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	4
							4.70	78.05		Grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	5
										Dark grey MUDSTONE with black dull COAL bands. (PENNINE MIDDLE COAL MEASURES)	6
							15.50	67.25		Dark grey MUDSTONE with black dull COAL bands. (PENNINE MIDDLE COAL MEASURES)	7
							16.70	66.05		Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	8
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	9
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	10
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	11
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	12
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	13
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	14
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	15
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	16
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	17
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	18
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	19
										Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH113

Sheet 2 of 2

Project Name: Woolley Colliery Road, Darton	Project No. 5624	Co-ords: 431366.91 - 410407.18	Hole Type RO
Equipment & Method: Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.		Level: 82.75	Scale 1:100
Client: Homes by Honey		Dates: 11/12/2025	Logged By DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description		
				TCR	SCR	RQD						
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	21	
							23.20 23.50	59.55 59.25	xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Dark grey MUDSTONE. (PENNINE MIDDLE COAL MEASURES)	22	
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	23	
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx		24	
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx		25	
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx		26	
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx		27	
									xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	<i>From 28.0m to 29.0m, driller noted softer drilling. Full returns.</i>	28	
								29.00	53.75	Light grey fine to medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	29
								32.50 33.00	50.25 49.75	Brownish grey fine to medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES) End of Borehole at 33.000m	30
											31	
											32	
											33	
											34	
											35	
											36	
											37	
											38	
											39	
											40	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH113A

Sheet 1 of 1

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431365.81 - 410406.69	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air flush.			Level:	82.65	Scale	1:100
Client:	Homes by Honey			Dates:	11/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	82.25		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal and plastic. (TOPSOIL) Greyish brown and grey OVERBURDEN. (COHESIVE RESIDUAL SOIL) Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	1
							1.30	81.35			2
											3
							4.00	78.65		End of Borehole at 4.000m	4
											5
											6
											7
											8
											9
											10
											11
											12
											13
											14
											15
											16
											17
											18
											19
											20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Monitoring well installed with a response zone from 2.0m to 4.0m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH114

Sheet 1 of 1

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431334.62 - 410307.15	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air-mist & water flush.			Level:	75.65	Scale	1:100
Client:	Homes by Honey			Dates:	12/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	75.25		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal. (TOPSOIL)	1
							2.00	73.65		Greyish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
							3.00	72.65		Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							3.20	72.45		Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	3
										Greyish brown fine to medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	4
											5
											6
							6.50	69.15		Grey SILSTONE. (PENNINE MIDDLE COAL MEASURES)	7
							8.00	67.65		Greyish brown fine to medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	8
											9
											10
											11
											12
											13
											14
							15.20	60.45		Soft drilling. No returns. (PENNINE MIDDLE COAL MEASURES)	15
							15.50	60.15		From 15.2m to 15.5m, soft drilling/broken ground. No returns. Possible fractures due to faulting. Solid drilling. No returns. (PENNINE MIDDLE COAL MEASURES)	16
											17
							18.00	57.65		At 18.0m, hole terminated due to no flush returns. End of Borehole at 18.000m	18
											19
											20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH115

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.:	5624	Co-ords:	431365.72 - 410285.60	Hole Type:	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air-mist & water flush.	Level:	74.85	Scale:	1:100	Logged By:	DP
Client:	Homes by Honey	Dates:	12/12/2025				

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	74.45		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal. (TOPSOIL)	1
							1.80	73.05		Greyish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL) Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	2
							4.20	70.65		Brown fine grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	4
							5.00	69.85		Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	5
							9.00	65.85		Greyish brown fine to medium grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	9
										<i>From 11.0m, to 14.0m, intermittent flush returns. Solid drilling.</i>	11
							14.00	60.85		Soft drilling. No returns. (PENNINE MIDDLE COAL MEASURES)	14
							14.40	60.45		<i>From 14.0m to 14.4m, soft drilling/broken ground. Possible fractures due to faulting.</i> Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	15
							20.00	54.85			20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Rotary Core Log

Borehole No.

PH115A

Sheet 1 of 1

Project Name:	Woolley Colliery Road, Darton	Project No.	5624	Co-ords:	431364.00 - 410286.00	Hole Type	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air-mist & water flush.			Level:	74.80	Scale	1:100
Client:	Homes by Honey			Dates:	12/12/2025	Logged By	DP

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	74.40		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal. (TOPSOIL)	1
							1.80	73.00		Greyish brown and grey OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							4.00	70.80		End of Borehole at 4.000m	4
											5
											6
											7
											8
											9
											10
											11
											12
											13
											14
											15
											16
											17
											18
											19
											20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Monitoring well installed with a response zone from 2.0m to 4.0m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Rotary Core Log

Borehole No.

PH116

Sheet 1 of 2

Project Name:	Woolley Colliery Road, Darton	Project No.:	5624	Co-ords:	431360.13 - 410318.17	Hole Type:	RO
Equipment & Method:	Mustang tracked drilling rig equipped with 100mm tri-cone bit and air-mist & water flush.	Level:	78.55	Scale:	1:100	Logged By:	DP
Client:	Homes by Honey	Dates:	12/12/2025				

Well	Water Strikes	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.40	78.15		Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine to coarse of mixed lithologies and rare coal. (TOPSOIL)	1
							1.80	76.75		Greyish brown OVERBURDEN. (COHESIVE RESIDUAL SOIL)	2
										Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	3
							6.00	72.55		Black dull COAL. (PENNINE MIDDLE COAL MEASURES)	6
							6.30	72.25		Brownish grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	7
							9.00	69.55		Grey fine grained SANDSTONE. (PENNINE MIDDLE COAL MEASURES)	9
							12.00	66.55		Grey SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	12
							16.50	62.05		Greyish brown SILTSTONE. (PENNINE MIDDLE COAL MEASURES)	17

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Appendix H
Chemical Test Results

Certificate of Analysis

Certificate Number 25-29580

Issued: 08-Jan-26

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference 25-29580

Client Reference ~ 5624

Order No ~ PO25634

Contract Title ~ Woolley Colliery Road, Darton

Description 25 Soil samples.

Date Received 17-Dec-25

Date Started 17-Dec-25

Date Completed 08-Jan-26

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. 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 except in full, without the prior written approval of the laboratory.

Approved By



Reyhan Irfan
Operations Manager



2139

Sample Deviations present. See Deviation Table Section for details.

Summary of Chemical Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	2616953	2616954	2616955	2616956	2616957	2616958
Sample ID ~	TP104	TP104	TP106	TP110	TP111	TP111
Depth ~	0.20	0.80	0.50	0.70	0.80	0.10
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	09/12/2025	09/12/2025	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >10mm	DETSC 1003*	1	% m/m	38	21	6.0	15	1.0	18
Moisture Content	DETSC 1004	0.1	%	23	11	20	13	18	25
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	40	7.2	13	7.1	7.6	18
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.2	0.3	0.5	0.2	0.2	0.5
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	< 0.1	0.2	< 0.1	< 0.1	0.9
Chromium	DETSC 2301#	0.15	mg/kg	9.1	23	15	17	15	17
Chromium III	DETSC 2301*	0.15	mg/kg	9.1	23	15	17	15	17
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	73	57	30	27	21	37
Lead	DETSC 2301#	0.3	mg/kg	120	25	51	16	13	72
Magnesium Aqueous Extract (2:1)	DETSC 2076*	10	mg/l		< 10	< 10	< 10		
Mercury	DETSC 2325#	0.05	mg/kg	0.07	< 0.05	0.07	< 0.05	< 0.05	0.11
Nickel	DETSC 2301#	1	mg/kg	30	30	18	26	24	18
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	0.7	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	36	23	28	20	16	26
Zinc	DETSC 2301#	1	mg/kg	41	120	89	96	66	310
Inorganics									
pH	DETSC 2008#		pH	8.0	8.4	7.9	7.2	7.0	6.6
Total Organic Carbon	DETSC 2084#	0.5	%	21	1.3	4.7	< 0.5	0.6	7.0
Chloride Aqueous Extract (2:1)	DETSC 2055	1	mg/l		3.8	11	250		
Nitrate Aqueous Extract as NO3 (2:1)	DETSC 2055	1	mg/l		< 1.0	8.8	16		
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l		120	44	25		
Petroleum Hydrocarbons									
EPH >C10-C12	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00		
EPH >C12-C16	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00		
EPH >C16-C21	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00		
EPH >C21-C35	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00		
EPH >C35-C40	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00		
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg					< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg					< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg					< 0.01	< 0.01
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg					< 1.50	< 1.50
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg					< 1.20	< 1.20
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg					< 1.50	< 1.50
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg					< 3.40	< 3.40
Aliphatic C5-C35	DETSC 3521*	10	mg/kg					< 10.00	< 10.00
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg					< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg					< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg					< 0.01	< 0.01
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg					< 0.90	< 0.90

Summary of Chemical Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	2616953	2616954	2616955	2616956	2616957	2616958
Sample ID ~	TP104	TP104	TP106	TP110	TP111	TP111
Depth ~	0.20	0.80	0.50	0.70	0.80	0.10
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	09/12/2025	09/12/2025	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg					< 0.50	< 0.50
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg					1.29	1.37
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg					1.81	1.90
Aromatic C5-C35	DETSC 3521*	10	mg/kg					< 10.00	< 10.00
TPH Ali/Aro Total C5-C35	DETSC 3521*	10	mg/kg					< 10.00	< 10.00
VPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1		
EPH >C10-C40	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00		
Benzene	DETSC 3321#	0.01	mg/kg					< 0.01	< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg					< 0.01	< 0.01
Toluene	DETSC 3321#	0.01	mg/kg					< 0.01	< 0.01
Xylene	DETSC 3321#	0.01	mg/kg					< 0.01	< 0.01
MTBE	DETSC 3321	0.01	mg/kg					< 0.01	< 0.01
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.16	< 0.03	0.05	< 0.03	< 0.03	0.05
Pyrene	DETSC 3303#	0.03	mg/kg	0.16	< 0.03	0.04	< 0.03	< 0.03	0.04
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.08	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.10	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.12	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.08	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.06	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.90	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Summary of Chemical Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	2616959	2616960	2616961	2616962	2616963	2616964
Sample ID ~	TP110	SA101	TP105	TP106	TP116	TP118
Depth ~	0.20	0.10	0.10	0.10	0.10	0.10
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	11/12/2025	09/12/2025	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >10mm	DETSC 1003*	1	% m/m	11	1.0	2.0	1.0	1.0	9.0
Moisture Content	DETSC 1004	0.1	%	18	26	30	21	26	22
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	9.9	16	15	18	26	19
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.3	0.8	1.3	0.7	0.8	0.8
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	0.5	0.3	0.3	0.4	0.3
Chromium	DETSC 2301#	0.15	mg/kg	12	21	17	17	20	17
Chromium III	DETSC 2301*	0.15	mg/kg	12	21	17	17	20	17
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	24	39	32	39	57	37
Lead	DETSC 2301#	0.3	mg/kg	25	54	50	62	70	50
Magnesium Aqueous Extract (2:1)	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.10	0.08	0.12	0.14	0.15
Nickel	DETSC 2301#	1	mg/kg	20	32	19	21	28	21
Selenium	DETSC 2301#	0.5	mg/kg	0.7	0.6	0.6	0.6	0.6	0.7
Vanadium	DETSC 2301#	0.8	mg/kg	23	37	30	32	33	32
Zinc	DETSC 2301#	1	mg/kg	66	140	84	95	140	84
Inorganics									
pH	DETSC 2008#		pH	9.2	7.6	7.7	8.0	7.1	7.9
Total Organic Carbon	DETSC 2084#	0.5	%	4.3	7.7	6.0	7.8	7.7	7.3
Chloride Aqueous Extract (2:1)	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3 (2:1)	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l						
Petroleum Hydrocarbons									
EPH >C10-C12	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
EPH >C12-C16	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
EPH >C16-C21	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
EPH >C21-C35	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
EPH >C35-C40	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg						
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg						
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg						
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg						
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg						
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg						
Aliphatic C5-C35	DETSC 3521*	10	mg/kg						
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg						
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	2616959	2616960	2616961	2616962	2616963	2616964
Sample ID ~	TP110	SA101	TP105	TP106	TP116	TP118
Depth ~	0.20	0.10	0.10	0.10	0.10	0.10
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	11/12/2025	09/12/2025	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg						
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg						
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg						
Aromatic C5-C35	DETSC 3521*	10	mg/kg						
TPH Ali/Aro Total C5-C35	DETSC 3521*	10	mg/kg						
VPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
EPH >C10-C40	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
Benzene	DETSC 3321#	0.01	mg/kg						
Ethylbenzene	DETSC 3321#	0.01	mg/kg						
Toluene	DETSC 3321#	0.01	mg/kg						
Xylene	DETSC 3321#	0.01	mg/kg						
MTBE	DETSC 3321	0.01	mg/kg						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.05	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.04	0.10	0.04	< 0.03	0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.03	0.08	0.04	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	0.27	< 0.10	< 0.10	< 0.10

Summary of Chemical Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	2616965	2616966	2616967	2616968	2616969	2616970
Sample ID ~	TP121	SA101	SA102	TP101	TP105	TP107
Depth ~	0.10	0.40	0.40	0.40	0.40	0.40
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	11/12/2025	09/12/2025	09/12/2025	09/12/2025	11/12/2025	11/12/2025
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >10mm	DETSC 1003*	1	% m/m	28	41	3.0	1.0	2.0	1.0
Moisture Content	DETSC 1004	0.1	%	21	16	8.4	17	22	22
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	25	77	86	72	19	37
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.4	0.5	0.6	0.6	0.7	0.6
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	< 0.1	0.1	< 0.1	0.2	< 0.1
Chromium	DETSC 2301#	0.15	mg/kg	16	5.1	8.2	5.5	16	17
Chromium III	DETSC 2301*	0.15	mg/kg	16	5.1	8.2	5.5	16	17
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	55	40	45	32	35	60
Lead	DETSC 2301#	0.3	mg/kg	57	27	23	27	43	53
Magnesium Aqueous Extract (2:1)	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg	0.15	0.27	0.24	0.16	0.10	0.15
Nickel	DETSC 2301#	1	mg/kg	21	15	32	6.3	21	13
Selenium	DETSC 2301#	0.5	mg/kg	0.8	1.8	2.9	1.6	0.8	1.0
Vanadium	DETSC 2301#	0.8	mg/kg	31	16	12	13	30	27
Zinc	DETSC 2301#	1	mg/kg	77	34	55	17	81	47
Inorganics									
pH	DETSC 2008#		pH	5.0	3.8	5.8	3.4	8.3	6.7
Total Organic Carbon	DETSC 2084#	0.5	%	7.8	25	16	31	7.0	13
Chloride Aqueous Extract (2:1)	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3 (2:1)	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l						
Petroleum Hydrocarbons									
EPH >C10-C12	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
EPH >C12-C16	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
EPH >C16-C21	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
EPH >C21-C35	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
EPH >C35-C40	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg						
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg						
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg						
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg						
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg						
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg						
Aliphatic C5-C35	DETSC 3521*	10	mg/kg						
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg						
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	2616965	2616966	2616967	2616968	2616969	2616970
Sample ID ~	TP121	SA101	SA102	TP101	TP105	TP107
Depth ~	0.10	0.40	0.40	0.40	0.40	0.40
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	11/12/2025	09/12/2025	09/12/2025	09/12/2025	11/12/2025	11/12/2025
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg						
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg						
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg						
Aromatic C5-C35	DETSC 3521*	10	mg/kg						
TPH Ali/Aro Total C5-C35	DETSC 3521*	10	mg/kg						
VPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
EPH >C10-C40	DETSC 3521#	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
Benzene	DETSC 3321#	0.01	mg/kg						
Ethylbenzene	DETSC 3321#	0.01	mg/kg						
Toluene	DETSC 3321#	0.01	mg/kg						
Xylene	DETSC 3321#	0.01	mg/kg						
MTBE	DETSC 3321	0.01	mg/kg						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	0.04	0.17	0.05	< 0.03	0.04
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.06	0.10	0.07	0.09	0.06
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.17	0.05
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.14	0.04
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.06	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.07	0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.05	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.05	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	0.27	0.11	0.63	0.15

Summary of Chemical Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	2616971	2616972	2616973	2616974	2616975	2616976
Sample ID ~	TP118	TP103	TP108	TP109	TP113	TP114
Depth ~	0.40	0.10	0.10	0.10	0.10	0.10
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	11/12/2025	09/12/2025	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >10mm	DETSC 1003*	1	% m/m	4.0	2.0	1.0	< 1.0	7.0	1.0
Moisture Content	DETSC 1004	0.1	%	22	27	26	27	22	28
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	36	17	25	15	14	12
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.8	0.6	0.9	0.6	0.4	0.6
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.3	0.4	0.5	0.2	0.2
Chromium	DETSC 2301#	0.15	mg/kg	15	20	19	22	14	20
Chromium III	DETSC 2301*	0.15	mg/kg	15	20	19	22	14	20
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	37	36	41	39	37	26
Lead	DETSC 2301#	0.3	mg/kg	47	52	68	51	88	41
Magnesium Aqueous Extract (2:1)	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg	0.12	0.09	0.10	0.08	0.10	0.07
Nickel	DETSC 2301#	1	mg/kg	20	23	24	27	19	17
Selenium	DETSC 2301#	0.5	mg/kg	1.1	1.0	1.5	2.2	< 0.5	0.7
Vanadium	DETSC 2301#	0.8	mg/kg	26	38	29	35	21	27
Zinc	DETSC 2301#	1	mg/kg	70	100	110	120	74	77
Inorganics									
pH	DETSC 2008#		pH	6.2	7.2	7.1	6.2	5.7	6.8
Total Organic Carbon	DETSC 2084#	0.5	%	9.9	5.2	7.2	4.0	7.2	4.1
Chloride Aqueous Extract (2:1)	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3 (2:1)	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l						
Petroleum Hydrocarbons									
EPH >C10-C12	DETSC 3521#	10	mg/kg	< 10.00					
EPH >C12-C16	DETSC 3521#	10	mg/kg	< 10.00					
EPH >C16-C21	DETSC 3521#	10	mg/kg	< 10.00					
EPH >C21-C35	DETSC 3521#	10	mg/kg	< 10.00					
EPH >C35-C40	DETSC 3521#	10	mg/kg	< 10.00					
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg						
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg						
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg						
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg						
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg						
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg						
Aliphatic C5-C35	DETSC 3521*	10	mg/kg						
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg						
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	2616971	2616972	2616973	2616974	2616975	2616976
Sample ID ~	TP118	TP103	TP108	TP109	TP113	TP114
Depth ~	0.40	0.10	0.10	0.10	0.10	0.10
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	11/12/2025	09/12/2025	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg						
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg						
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg						
Aromatic C5-C35	DETSC 3521*	10	mg/kg						
TPH Ali/Aro Total C5-C35	DETSC 3521*	10	mg/kg						
VPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1					
EPH >C10-C40	DETSC 3521#	10	mg/kg	< 10.00					
Benzene	DETSC 3321#	0.01	mg/kg						
Ethylbenzene	DETSC 3321#	0.01	mg/kg						
Toluene	DETSC 3321#	0.01	mg/kg						
Xylene	DETSC 3321#	0.01	mg/kg						
MTBE	DETSC 3321	0.01	mg/kg						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	0.06	< 0.03	0.11	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.07	0.03	0.12	< 0.03	0.21	0.04
Pyrene	DETSC 3303#	0.03	mg/kg	0.06	< 0.03	0.09	< 0.03	0.18	0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	0.05	< 0.03	0.07	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.04	< 0.03	0.06	< 0.03	0.09	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	0.04	< 0.03	0.07	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	0.04	< 0.03	0.07	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.04	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.17	< 0.10	0.42	< 0.10	0.80	< 0.10

Summary of Chemical Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	2616977
Sample ID ~	TP115
Depth ~	0.10
Other ID ~	
Sample Type ~	SOIL
Sampling Date ~	11/12/2025
Sampling Time ~	n/s

Test	Method	LOD	Units	
Preparation				
Stones >10mm	DETSC 1003*	1	% m/m	1.0
Moisture Content	DETSC 1004	0.1	%	24
Metals				
Arsenic	DETSC 2301#	0.2	mg/kg	12
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.5
Cadmium	DETSC 2301#	0.1	mg/kg	0.3
Chromium	DETSC 2301#	0.15	mg/kg	20
Chromium III	DETSC 2301*	0.15	mg/kg	20
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	30
Lead	DETSC 2301#	0.3	mg/kg	48
Magnesium Aqueous Extract (2:1)	DETSC 2076*	10	mg/l	
Mercury	DETSC 2325#	0.05	mg/kg	0.06
Nickel	DETSC 2301#	1	mg/kg	24
Selenium	DETSC 2301#	0.5	mg/kg	1.1
Vanadium	DETSC 2301#	0.8	mg/kg	29
Zinc	DETSC 2301#	1	mg/kg	99
Inorganics				
pH	DETSC 2008#		pH	6.0
Total Organic Carbon	DETSC 2084#	0.5	%	4.0
Chloride Aqueous Extract (2:1)	DETSC 2055	1	mg/l	
Nitrate Aqueous Extract as NO3 (2:1)	DETSC 2055	1	mg/l	
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	
Petroleum Hydrocarbons				
EPH >C10-C12	DETSC 3521#	10	mg/kg	
EPH >C12-C16	DETSC 3521#	10	mg/kg	
EPH >C16-C21	DETSC 3521#	10	mg/kg	
EPH >C21-C35	DETSC 3521#	10	mg/kg	
EPH >C35-C40	DETSC 3521#	10	mg/kg	
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg	
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg	
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg	
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg	
Aliphatic C5-C35	DETSC 3521*	10	mg/kg	
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg	

Summary of Chemical Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	2616977
Sample ID ~	TP115
Depth ~	0.10
Other ID ~	
Sample Type ~	SOIL
Sampling Date ~	11/12/2025
Sampling Time ~	n/s

Test	Method	LOD	Units	
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg	
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg	
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg	
Aromatic C5-C35	DETSC 3521*	10	mg/kg	
TPH Ali/Aro Total C5-C35	DETSC 3521*	10	mg/kg	
VPH (C6-C10)	DETSC 3321*	0.1	mg/kg	
EPH >C10-C40	DETSC 3521#	10	mg/kg	
Benzene	DETSC 3321#	0.01	mg/kg	
Ethylbenzene	DETSC 3321#	0.01	mg/kg	
Toluene	DETSC 3321#	0.01	mg/kg	
Xylene	DETSC 3321#	0.01	mg/kg	
MTBE	DETSC 3321	0.01	mg/kg	
PAHs				
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10

Summary of Asbestos Analysis

Soil Samples

Our Ref 25-29580

Client Ref ~ 5624

Contract Title ~ Woolley Colliery Road, Darton

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2616953	TP104 0.20	SOIL	NAD	none	Lucy Lindsley
2616954	TP104 0.80	SOIL	NAD	none	Lucy Lindsley
2616955	TP106 0.50	SOIL	NAD	none	Lucy Lindsley
2616956	TP110 0.70	SOIL	NAD	none	Lucy Lindsley
2616957	TP111 0.80	SOIL	NAD	none	Lucy Lindsley
2616958	TP111 0.10	SOIL	NAD	none	Lucy Lindsley
2616959	TP110 0.20	SOIL	NAD	none	Lucy Lindsley
2616960	SA101 0.10	SOIL	NAD	none	Lucy Lindsley
2616961	TP105 0.10	SOIL	NAD	none	Lucy Lindsley
2616962	TP106 0.10	SOIL	NAD	none	Lucy Lindsley
2616963	TP116 0.10	SOIL	NAD	none	Lucy Lindsley
2616964	TP118 0.10	SOIL	NAD	none	Lucy Lindsley
2616965	TP121 0.10	SOIL	NAD	none	Lucy Lindsley
2616966	SA101 0.40	SOIL	NAD	none	Lucy Lindsley
2616967	SA102 0.40	SOIL	NAD	none	Lucy Lindsley
2616968	TP101 0.40	SOIL	NAD	none	Lucy Lindsley
2616969	TP105 0.40	SOIL	NAD	none	Lucy Lindsley
2616970	TP107 0.40	SOIL	NAD	none	Lucy Lindsley
2616971	TP118 0.40	SOIL	NAD	none	Lucy Lindsley
2616972	TP103 0.10	SOIL	NAD	none	Lucy Lindsley
2616973	TP108 0.10	SOIL	NAD	none	Lucy Lindsley
2616974	TP109 0.10	SOIL	NAD	none	Lucy Lindsley
2616975	TP113 0.10	SOIL	NAD	none	Lucy Lindsley
2616976	TP114 0.10	SOIL	NAD	none	Lucy Lindsley
2616977	TP115 0.10	SOIL	NAD	none	Lucy Lindsley

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 25-29580

Client Ref ~ 5624

Contract ~ Woolley Colliery Road, Darton

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date		Containers Received	Holding time exceeded for tests	Incorrect container for tests	Headspace in container for tests
		Sampled ~					
2616953	TP104 0.20 SOIL	09/12/25		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)		
2616954	TP104 0.80 SOIL	09/12/25		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)		
2616955	TP106 0.50 SOIL	11/12/25		GJ 250ml, GJ 60ml, PT 1L			
2616956	TP110 0.70 SOIL	11/12/25		GJ 250ml, GJ 60ml, PT 1L			
2616957	TP111 0.80 SOIL	11/12/25		GJ 250ml, GJ 60ml, PT 1L			
2616958	TP111 0.10 SOIL	11/12/25		GJ 250ml, GJ 60ml, PT 1L			
2616959	TP110 0.20 SOIL	11/12/25		GJ 250ml, GJ 60ml, PT 1L			
2616960	SA101 0.10 SOIL	09/12/25		GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)		
2616961	TP105 0.10 SOIL	11/12/25		GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))			BTEX/C5-10, HS
2616962	TP106 0.10 SOIL	11/12/25		GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))			BTEX/C5-10, HS
2616963	TP116 0.10 SOIL	11/12/25		GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))			BTEX/C5-10, HS
2616964	TP118 0.10 SOIL	11/12/25		GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))			BTEX/C5-10, HS
2616965	TP121 0.10 SOIL	11/12/25		GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))			BTEX/C5-10, HS
2616966	SA101 0.40 SOIL	09/12/25		GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))	pH + Conductivity (7 days)		BTEX/C5-10, HS
2616967	SA102 0.40 SOIL	09/12/25		GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))	pH + Conductivity (7 days)		BTEX/C5-10, HS
2616968	TP101 0.40 SOIL	09/12/25		GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))	pH + Conductivity (7 days)		BTEX/C5-10, HS
2616969	TP105 0.40 SOIL	11/12/25		GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))			BTEX/C5-10, HS

Information in Support of the Analytical Results

Our Ref 25-29580

Client Ref ~ 5624

Contract ~ Woolley Colliery Road, Darton

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Incorrect container for tests	Headspace in container for tests
2616970	TP107 0.40 SOIL	11/12/25	GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))			BTEX/C5-10, HS
2616971	TP118 0.40 SOIL	11/12/25	GJ 250ml ((Headspace)), GJ 60ml ((Headspace)), PT 1L ((Headspace))			BTEX/C5-10, HS
2616972	TP103 0.10 SOIL	09/12/25	GJ 250ml, PT 1L	pH + Conductivity (7 days)		
2616973	TP108 0.10 SOIL	11/12/25	GJ 250ml, PT 1L			
2616974	TP109 0.10 SOIL	11/12/25	GJ 250ml, PT 1L			
2616975	TP113 0.10 SOIL	11/12/25	GJ 250ml, PT 1L			
2616976	TP114 0.10 SOIL	11/12/25	GJ 250ml, PT 1L			
2616977	TP115 0.10 SOIL	11/12/25	GJ 250ml			

Key: G-Glass P-Plastic J-Jar T-Tub

Normec DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 250µm sieve

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Information in Support of the Analytical Results

Our Ref 25-29580

Client Ref ~ 5624

Contract ~ Woolley Colliery Road, Darton

Key:

~ Sample details are provided by the client and can affect the validity of the results

* -not accredited.

-MCERTS (accreditation only applies if report carries the MCERTS logo).

\$ -subcontracted.

n/s -not supplied.

I/S -insufficient sample.

U/S -unsuitable sample.

t/f -to follow.

nd -not detected.

End of Report Ver 25.10.03

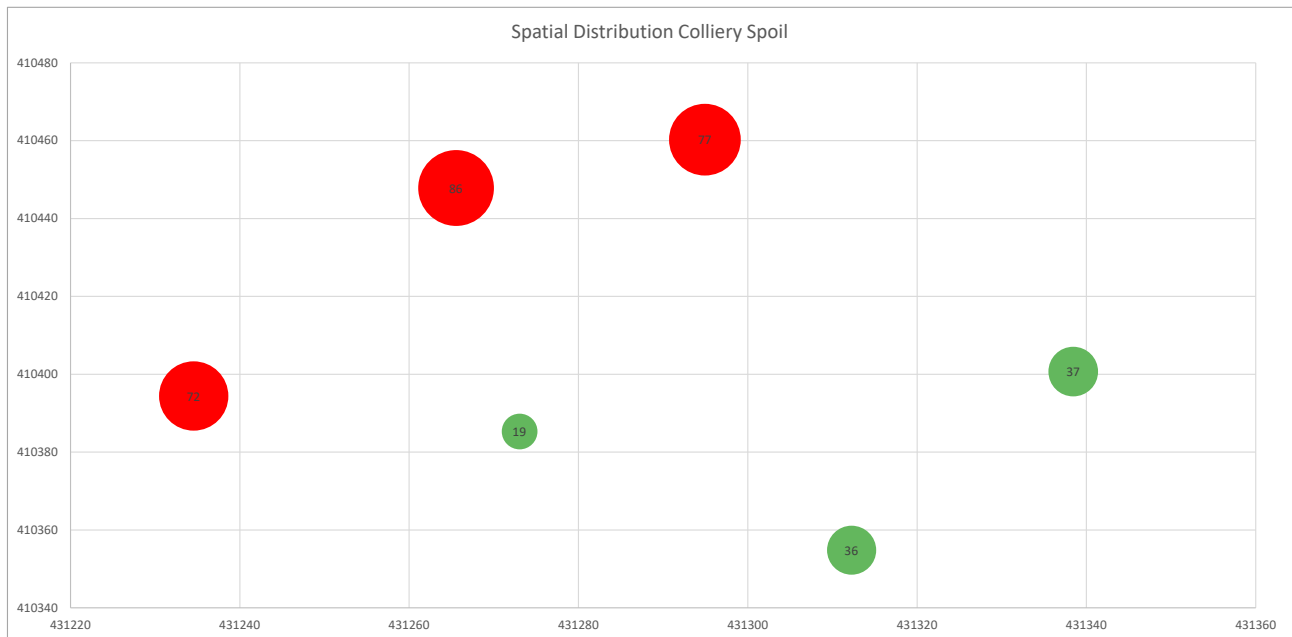
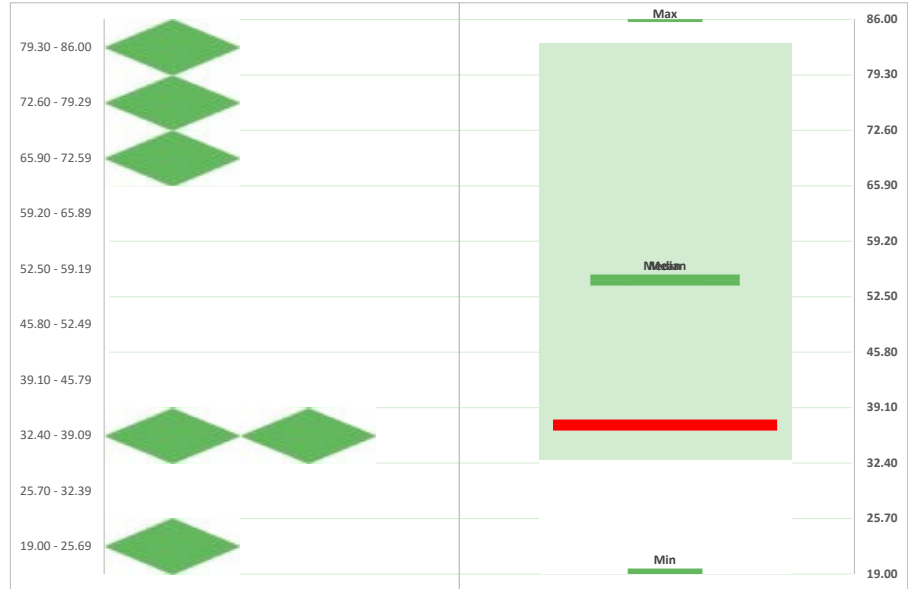
Woolley Colliery Roac, Darton



Job No: 5624
 Engineer: DP
 Date: 21 January 2026

Colliery Spoil: Dataset for As - Dot & Box Plots and Summary Statistics

Determinant	As
Critical concentration	37.00
No. samples	6.00
Max	86.00
Mean	54.50
Min	19.00
Median	54.50
Standard Deviation	27.25
Standard Error	11.13
T value	2.57
Upper Confidence Level (95%)	83.10
Upper Confidence Level (80%)	70.92
Lower Confidence Level (5%)	32.69
Transform data	Normal
Upper Confidence Level for chart	95%



Spatial distribution can show sampling clusters based on ground type it **does not** identify areas of contamination

Appendix I
Geotechnical Test Results



LABORATORY REPORT



Contract Number: PSL25/9901

Report Date: 19 January 2026

Client's Reference: 5624

Client Name: Lithos Consulting
Parkhill
Walton Road
Wetherby
North Yorkshire
LS22 5DZ

For the attention of: Dan Platford/Ally Devine

Contract Title: Woolley Colliery Road, Darton

Date Received: 18/12/2025

Date Commenced: 18/12/2025

Date Completed: 19/1/2026

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
(Managing Director)

R Berriman
(Associate Director)

S Royle
(Laboratory Manager)

L Knight
(Assistant Laboratory Manager)

S Eyre
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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP103	2	B	0.20		Brown TOPSOIL.
TP109	2	B	0.20		Brown TOPSOIL.
TP106	2	B	0.20		Brown TOPSOIL.
TP117	2	B	0.20		Brown TOPSOIL.
TP120	2	B	0.20		Brown TOPSOIL.
SA101	4	D	1.00		Brown slightly sandy slightly gravelly CLAY.
SA102	4	D	1.10		Brown slightly sandy CLAY.
TP103	4	D	1.10		Brown slightly sandy slightly gravelly CLAY.
TP105	4	D	1.50		Brown slightly sandy CLAY.
TP106	4	D	1.30		Brown slightly sandy slightly gravelly CLAY.
TP107	5	D	1.70		Brown slightly sandy CLAY.
TP107	6	D	2.50		Brown mottled grey slightly sandy slightly gravelly CLAY.
TP109	3	D	1.20		Brown mottled grey CLAY.
TP110	5	D	1.50		Brown mottled grey slightly sandy slightly gravelly CLAY.
TP111	4	D	1.30		Brown mottled grey slightly sandy CLAY.
TP113	3	D	0.60		Brown mottled grey slightly sandy CLAY.
TP115	4	D	1.10		Brown slightly sandy slightly gravelly CLAY.
TP116	4	D	1.10		Brown mottled grey slightly sandy CLAY.
TP117	5	D	1.40		Brown mottled grey slightly sandy CLAY.



Woolley Colliery Road, Darton

Contract No:

PSL25/9901

Client Ref:

5624

SUMMARY OF SOIL CLASSIFICATION TESTS

BS 1377 - Part 2 : 2022 in accordance with BS EN ISO 17892 (as below)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Water Content %	Linear Shrinkage	Particle Density Mg/m ³	Liquid Limit %	Plastic Limit %	Plasticity Index %	Passing 0.425mm %	Remarks
SA101	4	D	1.00		22.5			62	28	34	98	High Plasticity CIH
SA102	4	D	1.10		27.3			66	27	39	100	High Plasticity CIH
TP103	4	D	1.10		21.4			50	24	26	98	High Plasticity CIH
TP105	4	D	1.50		19.7			60	26	34	100	High Plasticity CIH
TP106	4	D	1.30		29.3			64	26	38	98	High Plasticity CIH
TP107	5	D	1.70		29.3			69	29	40	100	High Plasticity CIH
TP107	6	D	2.50		24.5			68	29	39	87	High Plasticity CIH
TP109	3	D	1.20		44.5			106	39	67	100	Organic Plasticity CIHO
TP110	5	D	1.50		12.6			43	20	23	98	Medium Plasticity CIM
TP111	4	D	1.30		26.5			60	26	34	100	High Plasticity CIH
TP113	3	D	0.60		15.2			54	24	30	100	High Plasticity CIH
TP115	4	D	1.10		30.9			63	27	36	90	High Plasticity CIH
TP116	4	D	1.10		13.6			38	20	18	100	Medium Plasticity CIM
TP117	5	D	1.40		21.1			55	25	30	100	High Plasticity CIH
TP118	4	D	1.20		13.5			57	25	32	61	High Plasticity CIH

Water Content - BS 1377 - Part 2 : 2022 : Clause 4 in accordance with BS EN ISO 17892 - 1 : 2014 + A1 : 2022

Linear Shrinkage - BS 1377 - Part 2 : 2022 : Clause 7

Particle Density (Gas Jar method) - BS 1377 - Part 2 : 2022 : Clause 9

Liquid, Plastic Limit & Plasticity Index - BS 1377 - Part 2 : 2022 : Clause 5 & 6 in accordance with BS EN ISO 17892 - 12 : 2018 + A2 : 2022

SYMBOLS : NP = Non Plastic



Woolley Colliery Road, Darton

Contract No:

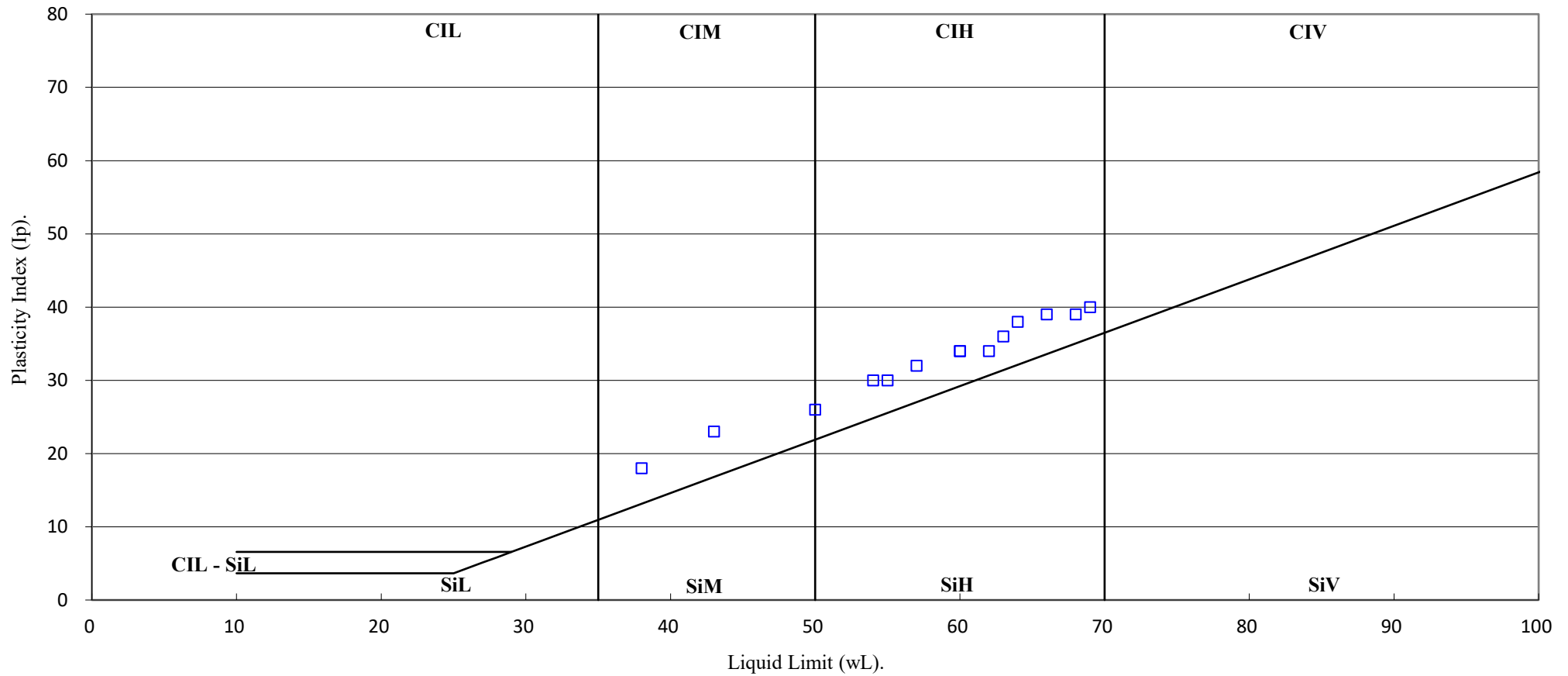
PSL25/9901

Client Ref:

5624

PLASTICITY CHART

BS EN ISO 14688-2:2017 Clause 4.4



Woolley Colliery Road, Darton

Contract No:

PSL25/9901

Client Ref:

5624



SUMMARY OF SOIL CLASSIFICATION TESTS

BS 1377 - Part 2 : 2022 in accordance with BS EN ISO 17892 (as below)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Water Content %	Linear Shrinkage	Particle Density Mg/m ³	Liquid Limit %	Plastic Limit %	Plasticity Index %	Passing 0.425mm %	Remarks
TP121	3	D	1.40		20.7			61	26	35	100	High Plasticity CIH
TP108	4	D	1.60		10.2				NP			
TP113	4	D	1.50		12.3				NP			
TP118	5	D	2.20		9.8				NP			

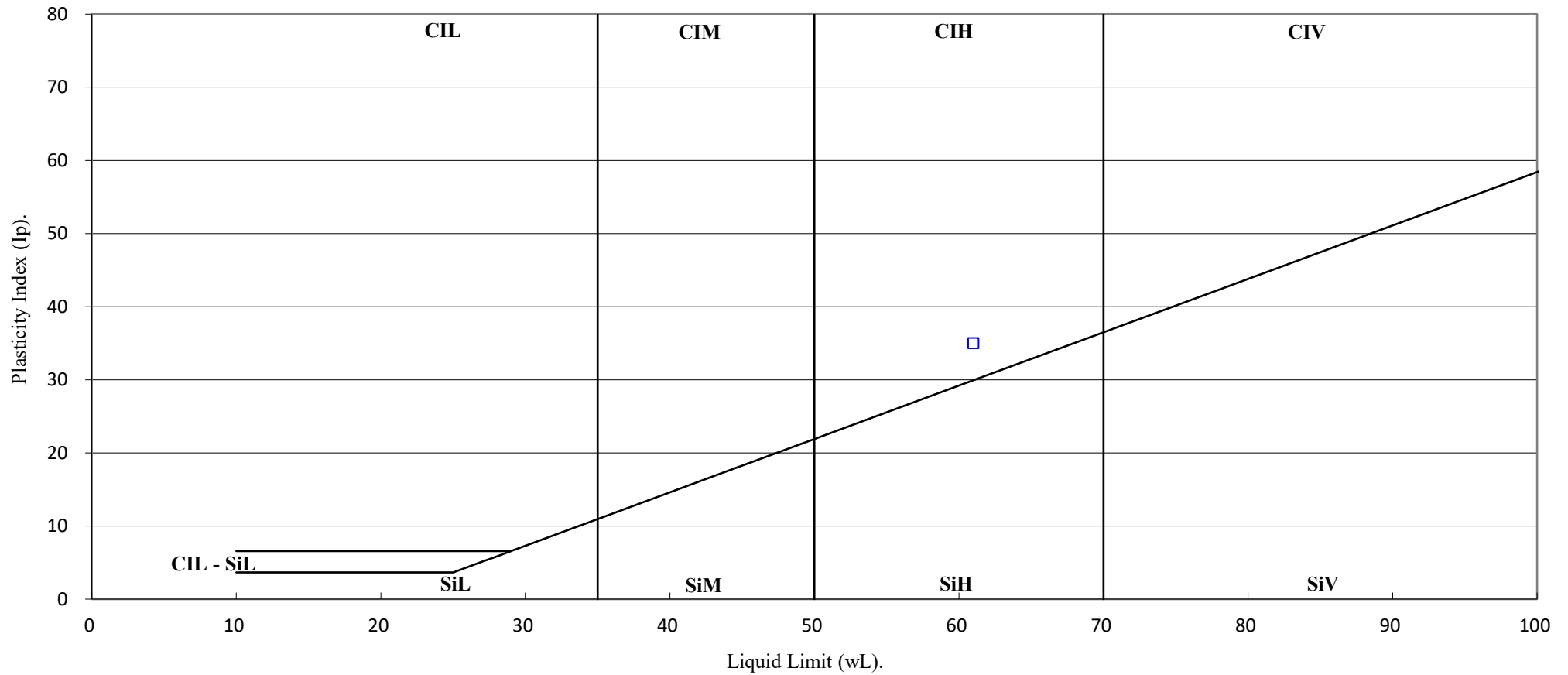
Water Content - BS 1377 - Part 2 : 2022 : Clause 4 in accordance with BS EN ISO 17892 - 1 : 2014 + A1 : 2022
 Linear Shrinkage - BS 1377 - Part 2 : 2022 : Clause 7
 Particle Density (Gas Jar method) - BS 1377 - Part 2 : 2022 : Clause 9
 Liquid, Plastic Limit & Plasticity Index - BS 1377 - Part 2 : 2022 : Clause 5 & 6 in accordance with BS EN ISO 17892 - 12 : 2018 + A2 : 2022

SYMBOLS : NP = Non Plastic

		<p>Woolley Colliery Road, Darton</p>	Contract No:
			PSL25/9901
			Client Ref:
			5624

PLASTICITY CHART

BS EN ISO 14688-2:2017 Clause 4.4



Woolley Colliery Road, Darton

Contract No:

PSL25/9901

Client Ref:

5624

PARTICLE SIZE DISTRIBUTION TEST

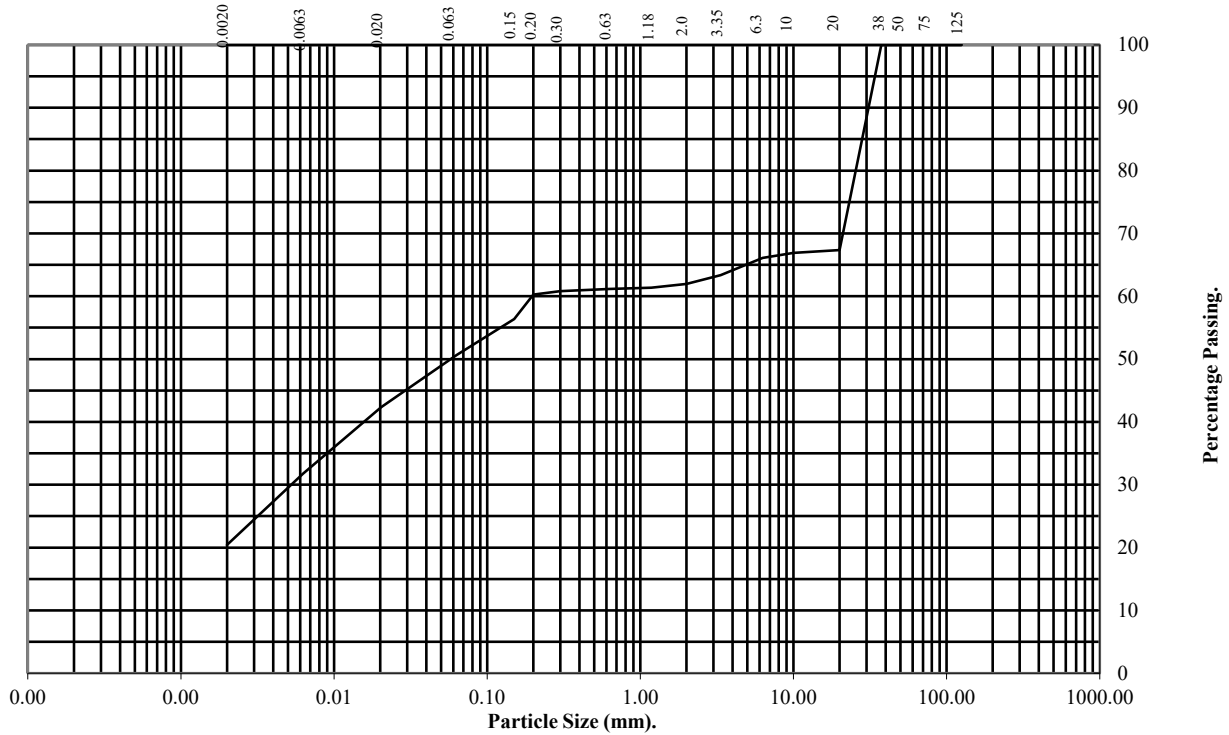
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TP103 **Top Depth (m):** 0.20

Sample Number: 2 **Base Depth (m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	67
10	67
6.3	66
3.35	63
2	62
1.18	61
0.63	61
0.3	61
0.2	60
0.15	56
0.063	51

Particle Diameter	Percentage Passing
0.020	42
0.0063	32
0.0020	20
<i>Particle Density - 2.65 Mg/m³ assumed</i>	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	38
Sand	11
Silt	31
Clay	20

Remarks:

See Summary of Soil Descriptions



Woolley Colliery Road, Darton

Contract No:
PSL25/9901
Client Ref:
5624

PARTICLE SIZE DISTRIBUTION TEST

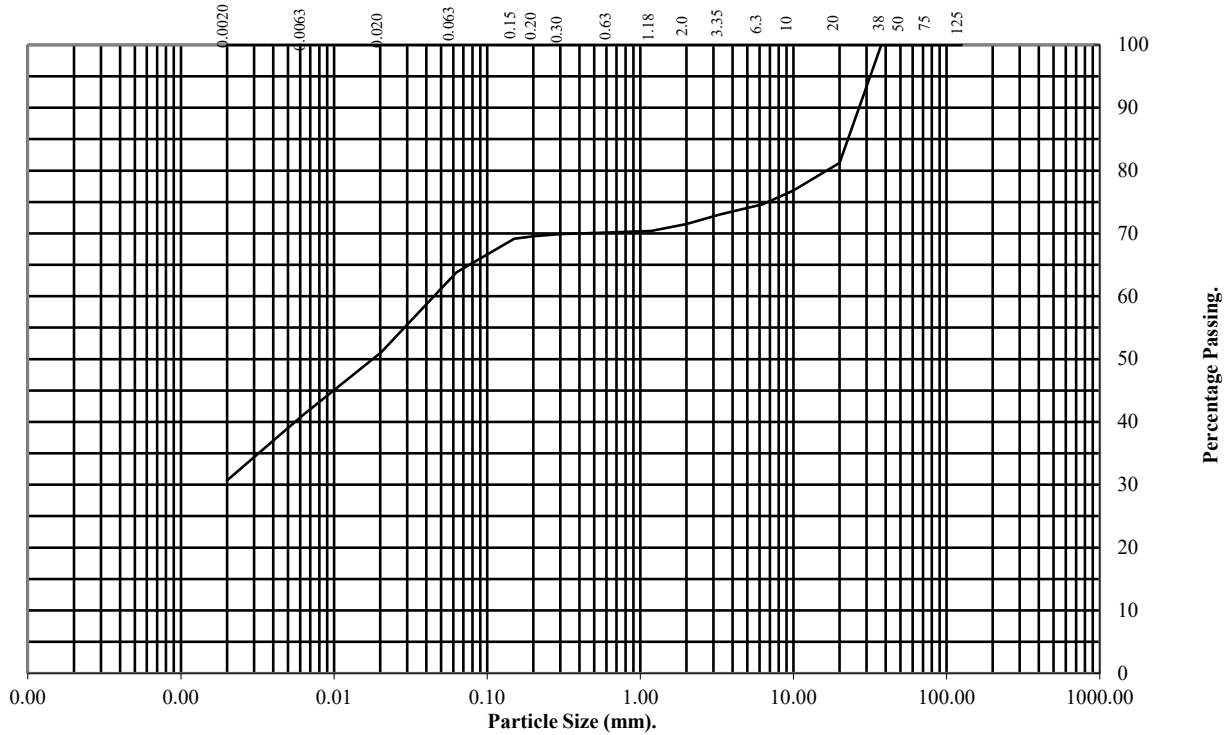
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TP106 **Top Depth (m):** 0.20

Sample Number: 2 **Base Depth (m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	81
10	77
6.3	75
3.35	73
2	71
1.18	70
0.63	70
0.3	70
0.2	70
0.15	69
0.063	64

Particle Diameter	Percentage Passing
0.020	51
0.0063	41
0.0020	31
<i>Particle Density - 2.65 Mg/m3 assumed</i>	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	29
Sand	7
Silt	33
Clay	31

Remarks:

See Summary of Soil Descriptions



Woolley Colliery Road, Darton

Contract No:
PSL25/9901
Client Ref:
5624

PARTICLE SIZE DISTRIBUTION TEST

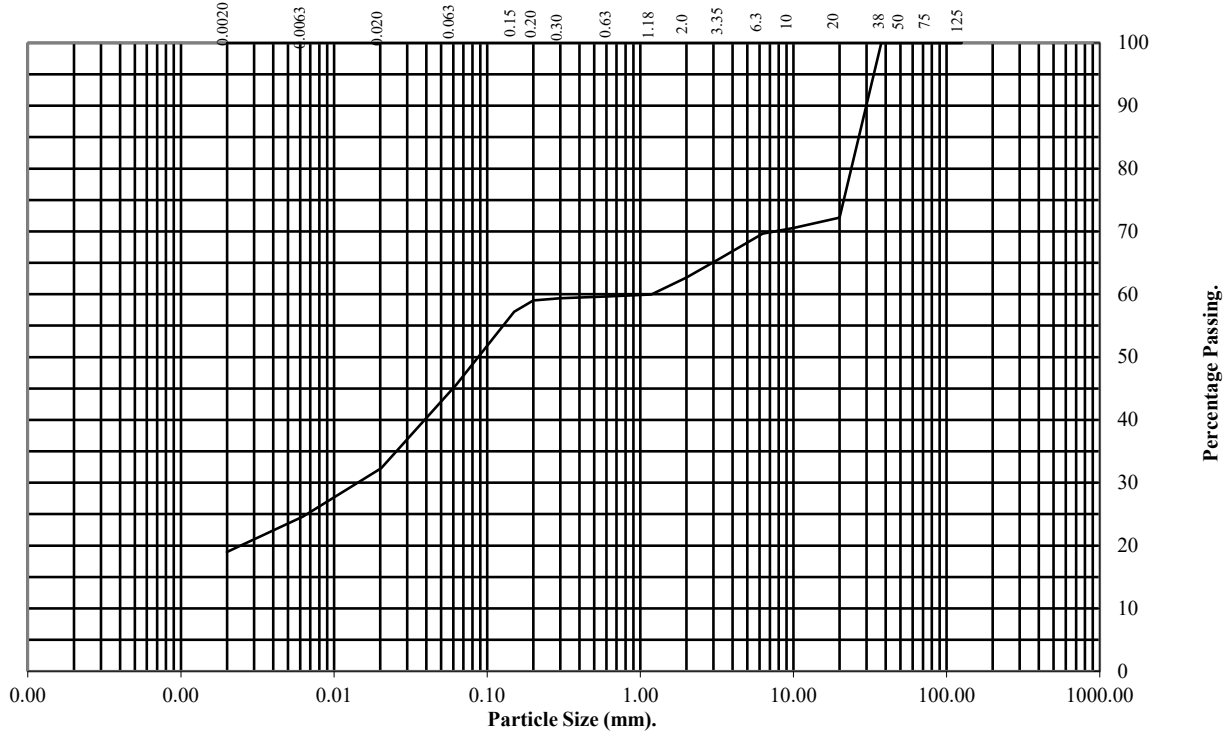
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TP109 **Top Depth (m):** 0.20

Sample Number: 2 **Base Depth (m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	72
10	71
6.3	70
3.35	66
2	63
1.18	60
0.63	60
0.3	59
0.2	59
0.15	57
0.063	46

Particle Diameter	Percentage Passing
0.020	32
0.0063	25
0.0020	19
<i>Particle Density - 2.65 Mg/m³ assumed</i>	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	37
Sand	17
Silt	27
Clay	19

Remarks:

See Summary of Soil Descriptions



Woolley Colliery Road, Darton

Contract No:
PSL25/9901
Client Ref:
5624

PARTICLE SIZE DISTRIBUTION TEST

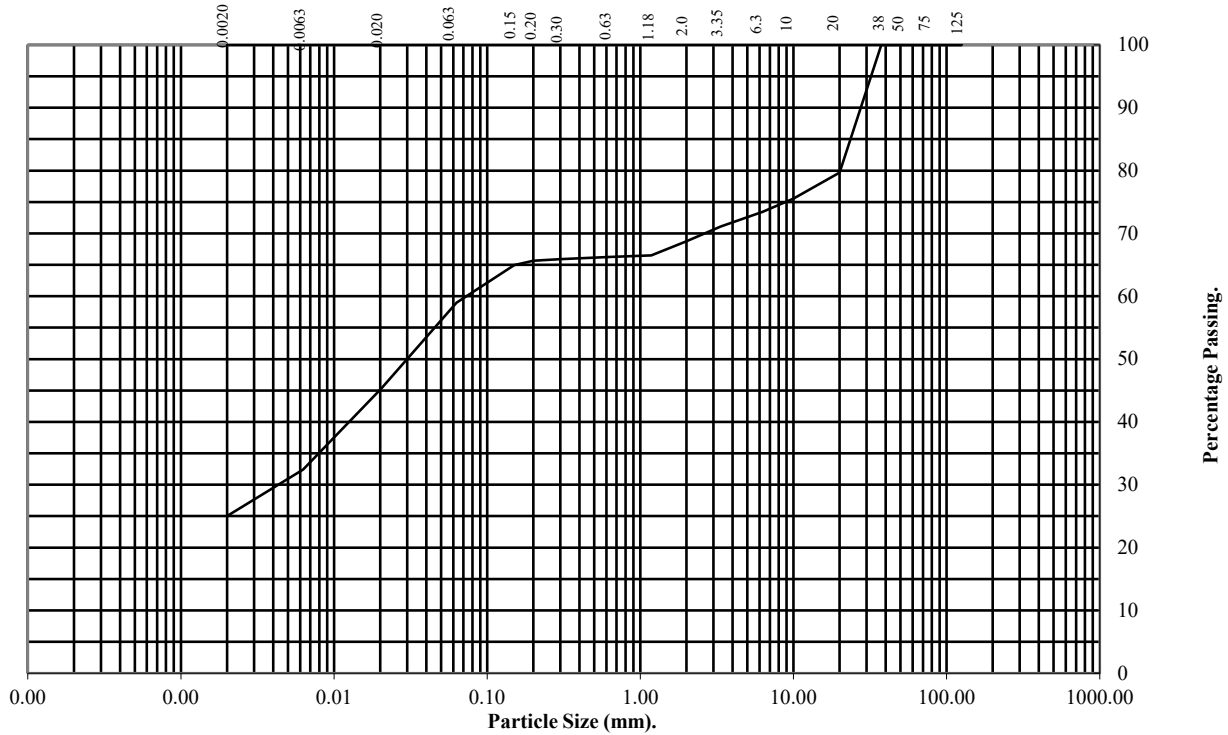
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TP117 Top Depth (m): 0.20

Sample Number: 2 Base Depth (m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	80
10	76
6.3	73
3.35	71
2	69
1.18	66
0.63	66
0.3	66
0.2	66
0.15	65
0.063	59

Particle Diameter	Percentage Passing
0.020	45
0.0063	32
0.0020	25
<i>Particle Density - 2.65 Mg/m3 assumed</i>	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	31
Sand	10
Silt	34
Clay	25

Remarks:

See Summary of Soil Descriptions



Woolley Colliery Road, Darton

Contract No:
PSL25/9901
Client Ref:
5624

PARTICLE SIZE DISTRIBUTION TEST

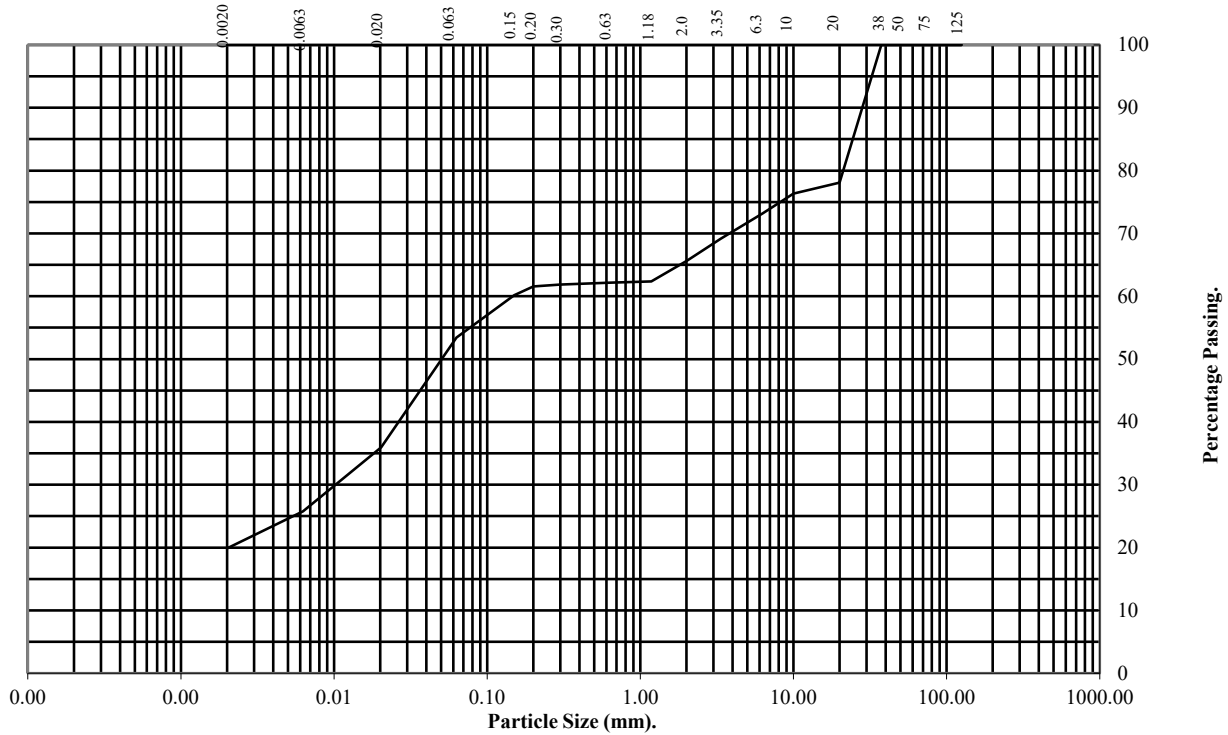
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TP120 Top Depth (m): 0.20

Sample Number: 2 Base Depth (m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	78
10	76
6.3	73
3.35	69
2	66
1.18	62
0.63	62
0.3	62
0.2	62
0.15	60
0.063	53

Particle Diameter	Percentage Passing
0.020	36
0.0063	26
0.0020	20
<i>Particle Density - 2.65 Mg/m³ assumed</i>	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	34
Sand	13
Silt	33
Clay	20

Remarks:

See Summary of Soil Descriptions



Woolley Colliery Road, Darton

Contract No:
PSL25/9901
Client Ref:
5624

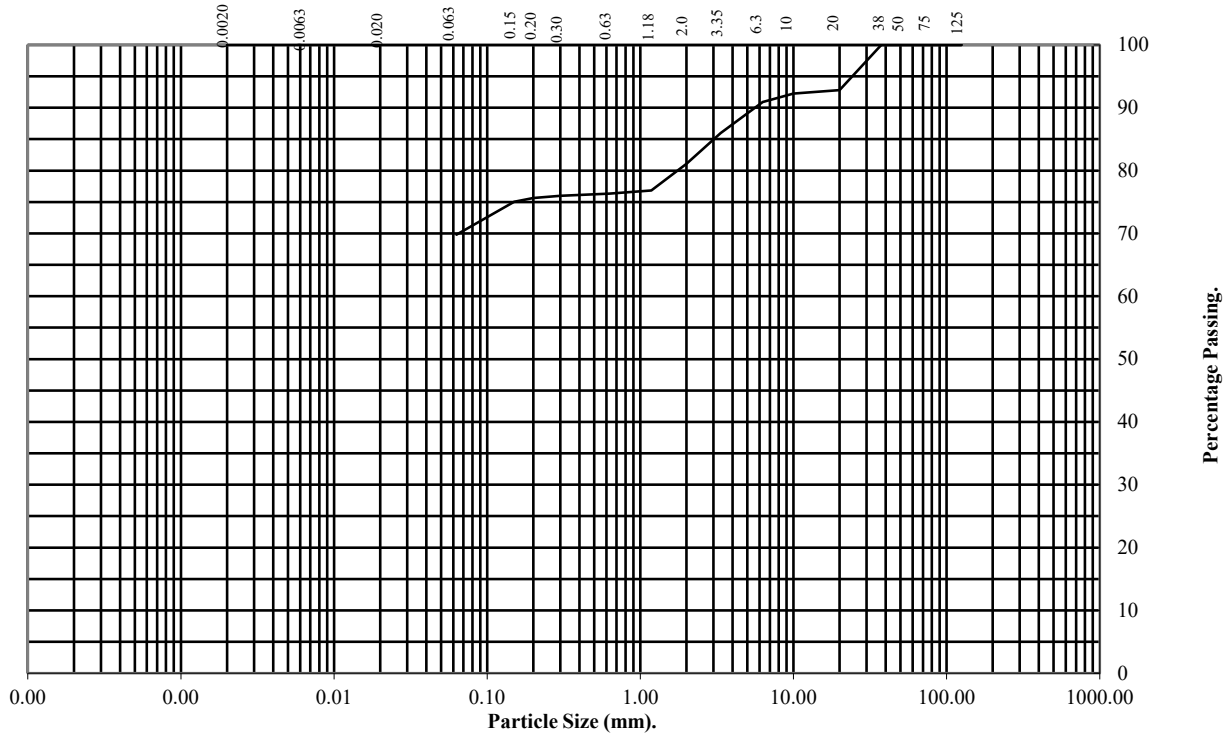
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016
Sieve Method, Clause 5.2

Hole Number: TP121 Top Depth (m): 2.60

Sample Number: 5 Base Depth (m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	93
10	92
6.3	91
3.35	86
2	81
1.18	77
0.63	76
0.3	76
0.2	76
0.15	75
0.063	70

Soil Fraction	Total Percentage
Cobbles	0
Gravel	19
Sand	11
Silt/Clay	70

Remarks:

See Summary of Soil Descriptions



Woolley Colliery Road, Darton

Contract No:
PSL25/9901
Client Ref:
5624

Analytical Test Report	E26/00025/PSL/26-00103
Clients Project Reference	PSL25/9901 Woolley Colliery Road, Darton
Clients Order Number	PSL25/9901
Sample(s) Analysed	20
Sample(s) received / instructed	06/01/2026 / 06/01/2026
Sample(s) Tested	06/01/2026 to 13/01/2026
Report issued	14/01/2026
Report issue number	1

Tested on Behalf of
Professional Soils Laboratory
5/7 Hexthorpe Road
Hexthorpe
Doncaster
DN4 0AR

Signed



James Gane
Analytical Services Manager

Notes:

General

This report shall not be reproduce except in full

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples were supplied by customer, results apply to the samples as received.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at 30°C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Stone Content was determined in accordance with CTS method statement MS - CL - Sample Prep and refers to the percentage of stones retained on a 10mm BS test sieve.

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

U = UKAS Accreditation, M = MCERTS Accreditation, N = Unaccredited, SC = Subcontracted

E26/00025/PSL/26-00103

PSL25/9901 Woolley Colliery Road, Darton

Analytical Test Results - ENV Analysis Soils

Lab Reference	675338	675339	675340	675341
Client Sample ID	-	-	-	-
Client Sample Location	SA101	TP103	TP106	TP107
Client Sample Type	D	D	D	D
Client Sample Number	4	4	4	6
Depth - Top (m)	1	1.1	1.3	2.5
Depth - Bottom (m)	1	1.1	1.3	2.5
Date of Sampling	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Time of Sampling	-	-	-	-
Sample Matrix	Clay	Clay	Clay	Clay
Determinant	Units	LOD	Accreditation	
pH	pH units	1	M	4.0 6.8 6.5 4.6
Water Soluble Sulphate (as SO4)	mg/L	10	N	1500 130 220 450

E26/00025/PSL/26-00103

PSL25/9901 Woolley Colliery Road, Darton

Analytical Test Results - ENV Analysis Soils

Lab Reference	675342	675343	675344	675345
Client Sample ID	-	-	-	-
Client Sample Location	TP109	TP110	TP111	TP113
Client Sample Type	D	D	D	D
Client Sample Number	3	3	2	3
Depth - Top (m)	1.2	0.6	0.6	0.6
Depth - Bottom (m)	1.2	0.6	0.6	0.6
Date of Sampling	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Time of Sampling	-	-	-	-
Sample Matrix	Clay	Other	Clay	Clay
Determinant	Units	LOD	Accreditation	
pH	pH units	1	M	5.2
Water Soluble Sulphate (as SO4)	mg/L	10	N	99
				39
				15
				27

E26/00025/PSL/26-00103

PSL25/9901 Woolley Colliery Road, Darton

Analytical Test Results - ENV Analysis Soils

Lab Reference	675346	675347	675348	675349
Client Sample ID	-	-	-	-
Client Sample Location	TP115	TP116	SA101	TP103
Client Sample Type	D	D	D	D
Client Sample Number	3	4	5	5
Depth - Top (m)	0.7	1.1	2.3	2.3
Depth - Bottom (m)	0.7	1.1	2.3	2.3
Date of Sampling	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Time of Sampling	-	-	-	-
Sample Matrix	Clay	Clay	Other	Other
Determinant	Units	LOD	Accreditation	
pH	pH units	1	M	6.3 6.6 6.9 6.6
Water Soluble Sulphate (as SO4)	mg/L	10	N	44 270 280 110

E26/00025/PSL/26-00103

PSL25/9901 Woolley Colliery Road, Darton

Analytical Test Results - ENV Analysis Soils

Lab Reference	675350	675351	675352	675353
Client Sample ID	-	-	-	-
Client Sample Location	TP105	TP108	TP111	TP113
Client Sample Type	D	D	D	D
Client Sample Number	6	4	5	4
Depth - Top (m)	3	1.6	2.5	1.5
Depth - Bottom (m)	3	1.6	2.5	1.5
Date of Sampling	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Time of Sampling	-	-	-	-
Sample Matrix	Other	Other	Other	Other
Determinant	Units	LOD	Accreditation	
pH	pH units	1	M	5.8 6.4 6.4 6.6
Water Soluble Sulphate (as SO4)	mg/L	10	N	130 63 30 52

E26/00025/PSL/26-00103

PSL25/9901 Woolley Colliery Road, Darton

Analytical Test Results - ENV Analysis Soils

Lab Reference	675354	675355	675356	675357
Client Sample ID	-	-	-	-
Client Sample Location	TP104	TP114	TP120	TP119
Client Sample Type	D	D	D	D
Client Sample Number	4	4	6	5
Depth - Top (m)	1.5	2	2.3	1.8
Depth - Bottom (m)	1.5	2	2.3	1.8
Date of Sampling	11/12/2025	11/12/2025	11/12/2025	11/12/2025
Time of Sampling	-	-	-	-
Sample Matrix	Other	Other	Other	Other
Determinant	Units	LOD	Accreditation	
pH	pH units	1	M	6.8
Water Soluble Sulphate (as SO4)	mg/L	10	N	19
				20
				260
				18

E26/00025/PSL/26-00103

PSL25/9901 Woolley Colliery Road, Darton

Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
675338	-	SA101	SOIL	-	Grey slightly gravelly slightly sandy silty clay	-	-	100
675339	-	TP103	SOIL	-	Grey slightly gravelly slightly sandy silty clay	-	-	100
675340	-	TP106	SOIL	-	Brown slightly gravelly slightly sandy silty clay	-	-	100
675341	-	TP107	SOIL	-	Grey slightly gravelly slightly sandy silty clay	-	-	100
675342	-	TP109	SOIL	-	Brown slightly gravelly slightly sandy silty clay	-	-	100
675343	-	TP110	SOIL	-	Brown slightly gravelly mudstone	-	-	100
675344	-	TP111	SOIL	-	Brown slightly gravelly slightly sandy silty clay	-	-	100
675345	-	TP113	SOIL	-	Grey slightly gravelly slightly sandy silty clay	-	-	100
675346	-	TP115	SOIL	-	Brown slightly gravelly slightly sandy silty clay	-	-	100
675347	-	TP116	SOIL	-	Brown slightly gravelly slightly sandy silty clay	-	-	100
675348	-	SA101	SOIL	-	Grey mudstone	-	-	100
675349	-	TP103	SOIL	-	Grey mudstone	-	-	100
675350	-	TP105	SOIL	-	Brown mudstone	-	-	100
675351	-	TP108	SOIL	-	Grey mudstone	-	-	100
675352	-	TP111	SOIL	-	Grey mudstone	-	-	100
675353	-	TP113	SOIL	-	Grey mudstone	-	-	100
675354	-	TP104	SOIL	-	Grey mudstone	-	-	100
675355	-	TP114	SOIL	-	Grey mudstone	-	-	100
675356	-	TP120	SOIL	-	Brown mudstone	-	-	100
675357	-	TP119	SOIL	-	Brown mudstone	-	-	100

E26/00025/PSL/26-00103

PSL25/9901 Woolley Colliery Road, Darton

Analysis Methodologies - Please refer to sample comments page (if present) for any changes to methods Methods

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preparation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis

E26/00025/PSL/26-00103

PSL25/9901 Woolley Colliery Road, Darton

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided

No time of sampling provided

C - Received in inappropriate container

H - Contains headspace

T - Temperature on receipt exceeds storage temperature

R - Sample(s) received with less than 2 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations

X - Exceeds

whilst in laboratory

sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
675338		SA101			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675339		TP103			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675340		TP106			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675341		TP107			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675342		TP109			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675343		TP110			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675344		TP111			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675345		TP113			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675346		TP115			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675347		TP116			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675348		SA101			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675349		TP103			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675350		TP105			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675351		TP108			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675352		TP111			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675353		TP113			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675354		TP104			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675355		TP114			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675356		TP120			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X
675357		TP119			MS - CL - pH in Soils, MS - CL - Anions by Aquakem (2:1Extract)	R X

Analytical Test Report	E26/00718/PSL/26-02480	Tested on Behalf of
Clients Project Reference	PSL25/9901 Woolley Colliery Road, Darton	Professional Soils Laboratory
Clients Order Number	PSL25/9901	5/7 Hexthorpe Road
Sample(s) Analysed	3	Hexthorpe
Sample(s) received / instructed	21/01/2026 / 21/01/2026	Doncaster
Sample(s) Tested	21/01/2026 to 28/01/2026	
Report issued	28/01/2026	DN4 0AR
Report issue number	1	

Signed



James Gane
Analytical Services Manager

Notes:

General

This report shall not be reproduce except in full

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples were supplied by customer, results apply to the samples as received.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30°C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Stone Content was determined in accordance with CTS method statement MS - CL - Sample Prep and refers to the percentage of stones retained on a 10mm BS test sieve.

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

U = UKAS Accreditation, M = MCERTS Accreditation, N = Unaccredited, SC = Subcontracted

E26/00718/PSL/26-02480

PSL25/9901 Woolley Colliery Road, Darton

Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
687382	-	SA101	SOIL	-	Light greyish brown slightly sandy silty clay	-	-	100
687383	-	TP107	SOIL	-	Greyish brown slightly gravelly slightly sandy silty clay with rare organic matter	-	-	100
687384	-	TP109	SOIL	-	Brown slightly sandy silty clay	-	-	100

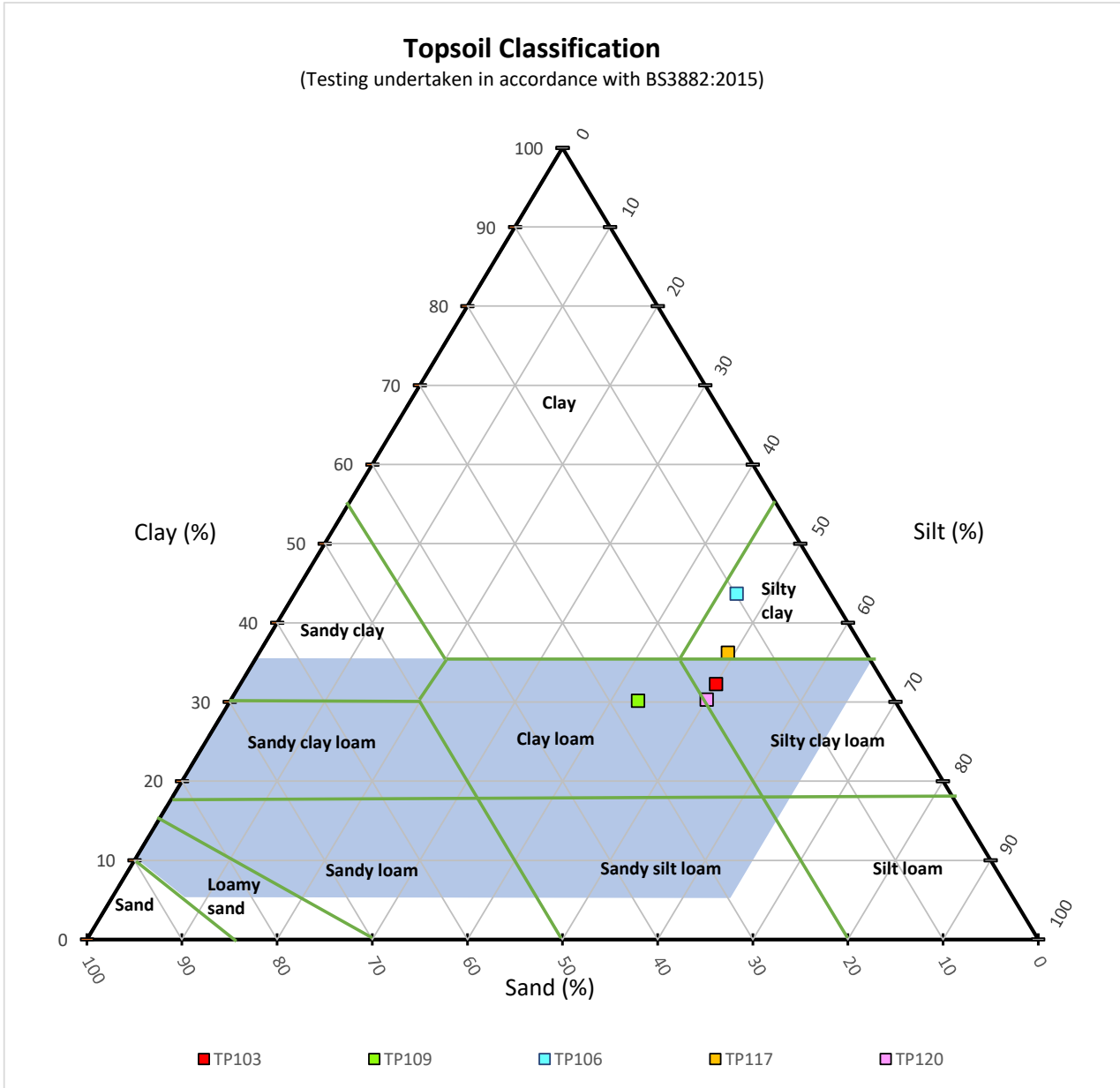
E26/00718/PSL/26-02480

PSL25/9901 Woolley Colliery Road, Darton

Analysis Methodologies - Please refer to sample comments page (if present) for any changes to methods Methods

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preparation	Test Details
1377MGICP	BS1377 WS Magnesium (ICP)	Oven dried	Passing 2mm test sieve	Water Soluble Magnesium testing of Soil in accordance with BS 1377 : Part 3 : 2018 + A1 : 2021 Clause 10.
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis

Site:	Woollery Colliery Road, Darton
Lithos Job Number:	5624
Client:	Homes by Honey
Lab Results Rpt Ref.	PSL25/9901
Date Report Issued:	19/01/2026



- = Area within which the texture of Topsoil is required to fall
- = Texture Group Boundary

Appendix J
Soakaway Test Results

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991



Client:	Homes by Honey
Engineer:	GW
Job Name:	Woolley Road Colliery, Darton
Job No.:	5624

Date:	09/12/2025
Trial Pit No.	SA101
Test No.	1

Time	Elapsed Time (min)	Depth to water from ground level	
		(m)	(mm)
12:58	0	1.23	1230
12:59	1	1.23	1230
13:00	2	1.24	1240
13:01	3	1.24	1240
13:02	4	1.24	1240
13:03	5	1.25	1250
13:08	10	1.25	1250
13:13	15	1.25	1250
13:18	20	1.25	1250
13:28	30	1.25	1250
13:43	45	1.25	1250
14:13	75	1.25	1250
14:43	105	1.25	1250
15:03	125	1.25	1250
15:18	140	1.25	1250

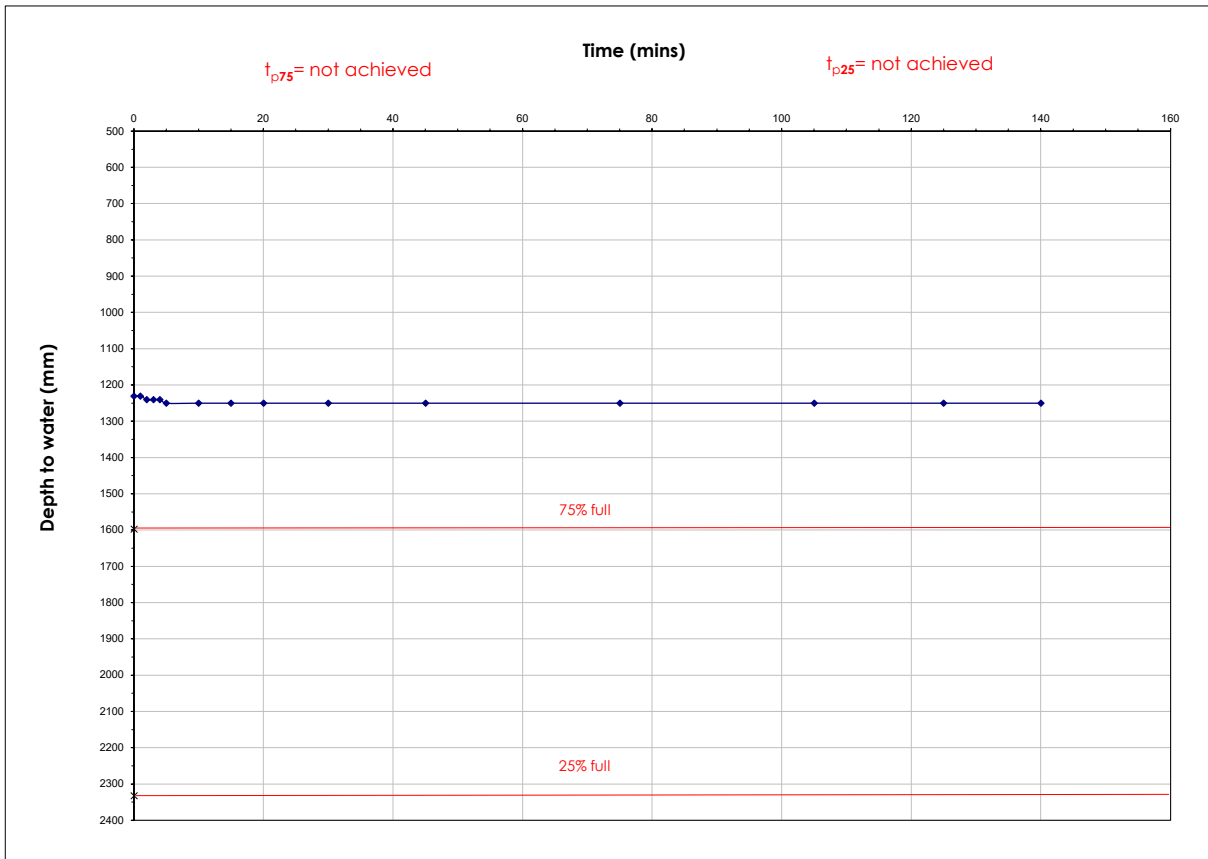
SOAKAWAY TRIAL PIT			
Dimensions		(m)	(mm)
Length	=	3.30	3300
Width	=	0.80	800
Depth	=	2.70	2700

Effective Depth (% full)		(mm)	(m)
0.25	=	2332.5	2.33
0.50	=	1965	1.97
0.75	=	1597.5	1.60

Depth at start of test (mm)	=	1230
Depth at end of test (mm)	=	1250

Base area of pit	=	2.64
C_{p50} - 50% internal surface area inc. base	=	8.667
V_{p75-25} - Volume 75 - 25%	=	1.9404

Read from the graph:		
t_{p75} (min)	=	n/a
t_{p25} (min)	=	n/a



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991



Client:	Homes by Honey
Engineer:	GW
Job Name:	Woolley Road Colliery, Darton
Job No.:	5624

Date:	09/12/2025
Trial Pit No.	SA102
Test No.	1

Time	Elapsed Time (min)	Depth to water from ground level	
		(m)	(mm)
11:59	0	1.38	1380
12:00	1	1.38	1380
12:01	2	1.38	1380
12:02	3	1.39	1390
12:03	4	1.39	1390
12:04	5	1.40	1400
12:09	10	1.44	1440
12:14	15	1.48	1480
12:19	20	1.52	1520
12:24	25	1.55	1550
12:29	30	1.58	1580
12:39	40	1.64	1640
13:04	65	1.75	1750
13:29	90	1.85	1850
14:14	135	1.97	1970
14:44	165	2.02	2020
15:04	185	2.06	2060
15:34	215	2.11	2110
15:41	222	2.12	2120

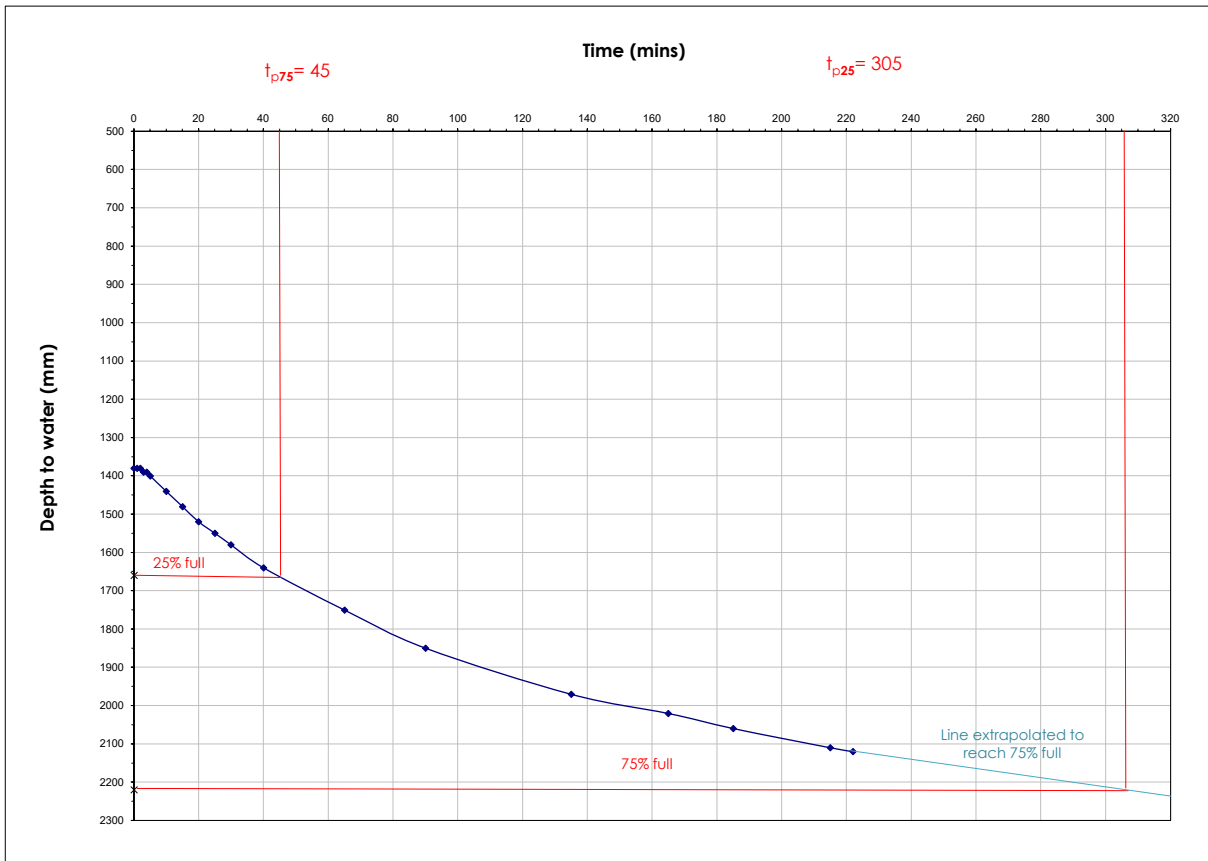
SOAKAWAY TRIAL PIT			
Dimensions		(m)	(mm)
Length	=	3.30	3300
Width	=	0.80	800
Depth	=	2.50	2500

Effective Depth (% full)		(mm)	(m)
0.25	=	2220	2.22
0.50	=	1940	1.94
0.75	=	1660	1.66

Depth at start of test (mm)	=	1380
Depth at end of test (mm)	=	2120

Base area of pit	=	2.64
C_{p50} - 50% internal surface area inc. base	=	7.232
V_{p75-25} - Volume 75 - 25%	=	1.4784

Read from the graph:			
t_{p75} (min)	=	45	
t_{p25} (min)	=	305	




Soil infiltration rate, f , (m/s) = 1.31E-05

Appendix K
Gas Monitoring Results

GAS MONITORING RESULTS


Visit 1

Job Title: Woolley Colliery Road, Darton							Job No: 5624						
Client: Homes by Honey							Sheet: 1 of 2						
Date: 16/01/2016	Arrival Time: 13:45	Depart Time: 16:00	Operator: Yasmeen Hughes										
Gas Monitoring Results:							Ambient Concentration (% Volume):						CH ₄ : ND
Monitoring Point	Groundwater level (m) bgl	Concentrations					Gas Flow Rates			Bottom of well m	Remarks		
		Initial / Peak		Steady		Lowest	Initial / Maximum	Steady	Time to fall from highest to steady				
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂	litre/hr	litre/hr	secs				
PH101A	3.95	ND	1.9	ND	1.9	14.9	ND	ND	120.0	3.99			
PH103A	3.45	ND	1.7	ND	1.7	8.1	ND	ND	120.0	3.50			
PH106A	3.54	ND	1.7	ND	1.7	12.7	-20.1	-18.3	120.0	4.23			
PH108A	2.52	ND	0.9	ND	0.9	16.5	-42.0	ND	120.0	4.68			
PH109A	1.12	ND	2.1	ND	2.1	16.2	104.9	6.8	120.0	3.87	Well bailed.		
PH111A	3.24	ND	ND	ND	ND	20.6	ND	ND	120.0	4.50	Bung missing and replaced.		
PH113A	3.44	ND	1.0	ND	1.0	13.9	25.9	ND	120.0	4.24			
PH115A	ND	ND	2.2	ND	2.2	17.7	27.0	ND	120.0	3.65			
Equipment Used: Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter							Next Calibration Date 04/03/2026			Key			
										ND	None Detected		
										NR	Not Recorded		
										1.0	Recorded value does not breach trigger levels		
										5.0	Recorded value breaches trigger level 1		
										10.0	Recorded value breaches trigger level 2		
Site Data:			Weather Station Data (DB-Barnsley)										
Temp (°C):			6	Barometric Pressure Trend: Rising									
Time:	13:45	15:15	16:00	03:55	09:55	13:58	14:58	15:59	19:57	Trigger level 1	CH ₄ : 1.0	CO ₂ : 5.0	O ₂ : 16.0
Pressure (mb):	995	994	994	989.2	992.6	994.2	994.7	995.4	997.5	Trigger level 2	5.0	10.0	10.0
Weather Conditions:		Sunny, Cold, Breezey, Damp											
Surface Ground Conditions:		Wet under foot											
Remarks:													

GAS MONITORING RESULTS

Visit 1 Bailed

Job Title:						Woolley Colliery Road, Darton		Job No:		5624	
Client:						Homes by Honey		Sheet:		2 of 2	
Date:		Arrival Time:		Depart Time:		Operator:					
16/01/2016		13:45		16:00		Yasmeen Hughes					



Gas Monitoring Results:											
Ambient Concentration (% Volume):			CH ₄ :	ND	CO ₂ :	ND	O ₂ :	20.6			

Monitoring Point	Groundwater level (m) bgl	Concentrations					Gas Flow Rates			Bottom of well m	Remarks
		Initial / Peak		Steady		Lowest	Initial / Maximum litre/hr	Steady litre/hr	Time to fall from highest to steady secs		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
PH101A	-	-	-	-	-	-	-	-	-	-	
PH103A	-	-	-	-	-	-	-	-	-	-	
PH106A	-	-	-	-	-	-	-	-	-	-	
PH108A	-	-	-	-	-	-	-	-	-	-	
PH109A	3.68	ND	0.2	ND	0.2	20.5	64.5	1.6	120.0	3.86	Bailed from 15:07 to 15:15. 12L. Groundwater level rose 5cm in 40minutes.
PH111A	-	-	-	-	-	-	-	-	-	-	
PH113A	-	-	-	-	-	-	-	-	-	-	
PH115A	-	-	-	-	-	-	-	-	-	-	

Equipment Used:				Next Calibration Date				Key			
Gas Data GFM436 Infrared Gas Analyser				04/03/2026				ND None Detected			
Geotechnical Instruments Dipmeter								NR Not Recorded			
								1.0 Recorded value does not breach trigger levels			
								5.0 Recorded value breaches trigger level 1			
								10.0 Recorded value breaches trigger level 2			

Site Data:			Weather Station Data (**Station)								
Temp (°C):			Barometric Pressure Trend:								
Time:	13:45	15:15	16:00								
Pressure (mb):	995	994	994								
Weather Conditions:		Sunny, Cold, Breezey, Damp									
Surface Ground Conditions:		Wet under foot									

Remarks:											
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