LITHOS

Preliminary Geoenvironmental Investigation

Land at Barnsley West, Land Transfer 2

For Strata Homes Ltd

Report no: 4651/1

Date: November 2022

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BARNSLEY WEST, LAND TRANSFER 2 SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	4651	**Site area/ha**	48 hectares
Client:	Strata Homes Ltd	**NGR:**	SE 317 072
Site:	Barnsley West, Land Transfer 2	**Nearest postcode:**	S75 2HA

The site is located to the north and south of Hermit Lane, approximately 3km west of Barnsley town centre and comprises arable and grazing farmland with a wooded valley and farm house/yard in the east.

Whilst the site has not been subject to previous development (with the exception of the farm house & yard) about 70% of the total area has been subject to coal extraction from the Craven II and Hunters Cottage Extension opencast sites, with subsequent backfilling of all excavations.

Lithos were commissioned by Strata to provide a preliminary geoenvironmental appraisal of the site. It is understood that the site is to be redeveloped with residential dwellings; a proposed layout is not currently available.

The current area of interest lies in the centre of a wider development site called Barnsley West (totalling c. 121 hectares) land to the north comprises Land Transfer 1 (c. 21.4ha; residential development) land to the east comprises Pogmoor Land (c. 7.8 hectares; residential development) and land to the south comprises a commercial/industrial development (c. 43.8 hectares).

Lithos' investigation included review of 3rd party data and an inspection of historical and geological maps and information provided by the British Geological Survey, and the Landmark Information Group, the Coal Authority, QGIS, and the Environment Agency. In addition, a site inspection has been carried out.

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

Issue	Remarks
Former uses	Site is essentially greenfield. However about 70% of the total area has been subject to opencast coal extraction.
Anticipated ground conditions	Veneer of Topsoil & Residual Soils over Lower Coal Measures bedrock (beyond the opencasts). Areas of deep Opencast Backfill comprising Topsoil & Cohesive Made Ground over reworked soils & bedrock within footprints of former collieries.
Anticipated contamination	To date no significant sources have been identified. However, made ground, coal extraction & agriculture all have the potential to have led to some ground/groundwater contamination.
Mining & quarrying	About 70% of the site has been subject to opencasting for coal to depths of up to c. 44mbgl. Some localised evidence of underground workings have been encountered in the south (during Hunters Extension opencast) & further shallow workings may be present.
Hazardous gas	Areas of landfill are located close to the eastern & western boundaries, shallow coal & workings are anticipated and deep made ground occupied c. 70% of the site's area. Consequently, the site is considered at risk from hazardous ground gasses & a Gas Risk Assessment should be undertaken prior to development commencing.
Flooding & drainage	Site lies in a Flood Zone 1 where the risk of flooding from rivers & the sea is low. Soakaways are unlikely to pose a suitable means of surface water disposal due to the presence of deep made ground across the site & there is likely to be a need for surface water balancing.
Preparatory works	Topsoil strip & stockpile. Regrade of site topography to levels determined during the geotechnical design phase. Subject to chosen foundation solutions & highways design there may be a need for turnover & re-engineering of made ground to enable construction.
Anticipated foundation solutions	Plots where made ground is c. <2.5m thick could be founded on strip/trench footings seated in Coal Measures bedrock or Residual Soils. Plots underlain by >2.5m of made ground shall require alternative foundation solutions; likely rafts, semi-rafts, reinforced strips/ring beams or piles. The depth of made ground beneath plots will be strongly affected by the final development platform levels.
Recommendations for ground investigation	Ground investigation is recommended comprising: • c. 170 trial pits (to determine shallow ground conditions & enable detailed logging of made ground & natural soils.

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Issue	Remarks
	• c. 85 trial trenches (delineating opencast highwalls). • c. 25 cable percussion boreholes (to retrieve geotechnical data & samples from depth). • c. 10 rotary cored boreholes (to retrieve samples of rock from the base of opencasts for detailed logging & sampling). c. 70 rotary open probeholes (to determine the depth of areas of opencast & investigate the presence of shallow coal & underground workings). Including c. 45 probeholes to install gas/groundwater monitoring wells. • c. 45 groups of stitched probeholes (to determine the line & profile of quarry highwalls)

At this stage, anticipated significant abnormals relating to geoenvironmental issues at the site are:

- Regrade of levels to those specified in the final geotechnical design.
- Turnover of the uppermost 3.0m (subject to SI findings) of made ground across the LT2 development platform and re-engineering of made ground to remove obstructions & enable the use of raft/reinforced ring beam foundations.
- Additional design & consideration to be given to any plots or structures which overlay the highwall zone of influence.
- Potential for shallow underground workings both outside, & below the base of, opencasts.

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Appendix C - Commission

Appendix D – Historical OS plans

Appendix E – Search responses

From	Date	Content
Landmark	08/09/2022	Envirocheck report
Coal Authority	09/09/2022	Consultants Coal Mining Report

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. We 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 on a CD.

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.

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.

PRELIMINARY GEOENVIRONMENTAL INVESTIGATION OF LAND AT BARNSLEY WEST, LAND TRANSFER 2

1 INTRODUCTION

1.1 The commission and brief

1.1.1 Lithos Consulting were commissioned by Strata Homes Ltd to carry out a preliminary geoenvironmental investigation of land between Barnsley town, Gawber and Higham.

1.1.2 The current area of interest comprises about 40% (c. 48 hectares) of a wider development area (c. 121 hectares, canned Barnsley West) and is referred to as Barnsley West Land Transfer 2 (LT2).

1.1.3 Remaining parcels comprise Barnsley West Land Transfer One (c. 21.4 hectares in the north), Barnsley West Pogmoor Land (c. 7.8 hectares to the east) and Barnsley West Commercial/Industrial Development (c. 43.8 hectares to the south).

1.1.4 Correspondence regarding Lithos' appointment, including the brief for this investigation, is included in Appendix C. The agreed scope of works included:

- A site walkover and inspection.
- An assessment of land use history.
- Determination of the site's environmental setting.
- A mining risk assessment in accordance with Coal Authority guidance.
- Assessment of anticipated ground conditions, including potential contaminants.
- Assessment of anticipated foundation and engineering issues associated with redevelopment for a residential end-use.
- Provision of recommendations for an appropriate ground investigation.

1.1.5 This Preliminary Investigation comprised an inspection of historical and geological maps and information provided by the British Geological Survey, the Landmark Information Group, the Coal Authority, and QGIS[1]. In addition, a site inspection has been carried out by Lithos.

1.1.6 Primary aims of this investigation were to identify salient geoenvironmental issues affecting the site to enable design and costing of an appropriate intrusive investigation, and to support the submission of a planning application.

1.2 The proposed development

1.2.1 It is understood that consideration is being given to redevelopment of the current area of interest with 'traditional' residential dwellings with associated gardens, areas of POS and adoptable roads and sewers. However no proposed layout has been made available to date.

1.2.2 The wider Barnsley West area is to be given to a mixed use development, with predominantly residential dwellings and a commercial centre and school to the north (LT1), residential dwellings to the southeast (Pogmoor Land) and commercial/industrial units to the south.

[1] *An Open Source Geographic Information System used by Lithos to access publicly available Government held digital data.*

1.3 Report format and limitations

1.3.1 Standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on assessment of the site's environmental setting.

1.3.2 General notes and limitations relevant to all Lithos preliminary 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 4651/1 presented in Appendix B to this report. Site details are summarised in the table below.

Detail	Remarks
Location	3km west of Barnsley town centre.
NGR	SE 317 072
Area	48 hectares (119 acres).

2.2 Site features

2.2.1 Lithos completed a walkover survey of the site on the 13th September 2022.

2.2.2 Existing salient features, at the time of the walkover are presented on Drawing 4651/3 in Appendix B to this report, and summarised in the table below:

Feature	Remarks
Current access	Via several gates off Hermit Lane which crosses the centre of the site.
Topography	Undulating with a general fall to the east & a valley in the east.
Approximate areas	2,500m² buildings 3,500m² tarmac hardstand (Hermit Lane) 2,000m² concrete/granular hardstand 14,000m² rough/overgrown grasses & woodland 53,000m² arable farmland 415,000m² grazing land (short maintained grasses)
Nature of boundaries	North & south – no physical boundary East – woodland, watercourse & fencing West – garden fences & hedgerows
Surrounding land uses	North – arable farmland & grazing land South – grazing land East – rough grassland, woodland, arable farmland. Gawber village beyond. West – Higham village & M1 motorway. Fields, woodland & golf course beyond.

2.2.3 A selection of site photographs are included on Drawing4651/4.

2.2.4 Hermit Lane runs east to west through the centre-south of the site.

2.2.5 Access to the site can be gained off Hermit lane by several metal gates which open into various fields to the north and south.

2.2.6 The topography of the site, and wider area, is rolling with a general fall to the east into a valley in the east of the site. The steepest gradients are across the sides of the valley (up to 1v:3h) but slopes across the majority of the area are around 1V:15h.

2.2.7 The valley is occupied by mature woodland and a small watercourse flows northeast along its base.

2.2.8 The majority of the site is occupied by grasses which were being grazed by horses and sheep at the time of walkover. It is understood that grasses are either used for grazing, or grown and harvested for hay / silage production.

2.2.9 An area of about 53,000m² in the west was empty awaiting planting with an arable crop.

2.2.10 Both the grassed areas and the arable farmland are divided up into fields by a mixture of post and wire fences and mature hedgerows. Hermit Lane is bordered by mature Hawthorne hedgerows.

2.2.11 A farmyard is located in the centre-southeast which is accessed off Hermit Lane and comprises a residential dwelling, external areas of hardstand and agricultural buildings (barns, stables etc) which are of a mixture of stone, brick, breeze block and portal framed construction. The farmyard remained in use for housing and rearing livestock (sheep and horses) at the time of walkover.

2.2.12 Adjacent to the farmyard, and north of Hermit Lane is a c. 900m² area of granular hardstand which is occupied by hay bales wrapped in polythene and agricultural trailers.

2.2.13 Overhead power utilities cross the far-north atop wooden poles.

3 SITE HISTORY

3.1 In order to investigate the development history and previous land uses at the site and immediate surrounding land, site centred extracts from Ordnance Survey (OS) plans dating back to 1855 have been examined. 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 with respect to the proposed end use. 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(s)	Site	Surrounding land
1855	**Craven Wood** in the centre-east. **Rhodes Wood** in the southwest. **Hermit Wood** in the far southeast. Hermit Lane crosses the site in the south with Hermit House and Hermit Cottage located off it in the centre-south. Two **ponds/excavations** shown to the south of Craven Wood and north of Hermit Lane. A footpath crosses the north. An **unnamed stream/drain** runs though Craven Wood. A field of rough pasture is shown in the far north. Rest of the site is occupied by fields.	Hermit Wood continues off site immediately south with Drury Spring (woodland) 50m south. Higham town and Higham Common Road c.250m west. Clay Cliff House with pump shown c.200m north along unnamed road. **Red Brook Bleach Works** with sluice shown 100m northeast. Red Brook and Red Brook Plantation immediately northeast and east. Gawber town shown 300m east. **Gravel Pit** shown 250m east. Hermit Lane continues off-site towards Gawber with St Thomas' Church shown off it 150m east.
1893	Rhodes Wood renamed **Velvet Wood**. Rough pasture no longer shown in the far north.	Higham Common village shown 100m southwest with **Higham Colliery** 350m southwest. Gravel Pit now labelled as **Coal Pit**. A vicarage and grave yard now shown alongside St Thomas' Church.
1906	No significant changes.	Higham Colliery now labelled as disused. Red Brook Bleach Works labelled as **Redbrook Linen Works**. Coal Pit to the east no longer shown.
1931	Hermit Wood no longer shown with rough grassland & occasional trees now shown. Hermit Cottage no longer shown.	Higham Colliery no longer shown. Rail sidings and spoil heaps shown 200m northeast, associated with Barugh Coke & By-Product Works 500m north. Additional grave yard shown south of St Thomas' Church.

Date(s)	Site	Surrounding land
1948	No significant changes	Expansion of Higham to the west. Road c.200m north labelled Barugh Green Lane. Residential development shown immediately northeast.
1956	Rough grassland & trees are no longer shown where Hermit Wood was located.	Drury Spring no longer shown to the south.
1960 - 1962	Much of the centre and north of the site labelled as **opencast workings**. Velvet Wood no longer shown. Much of Craven Wood no longer shown with thin strip remaining in centre-east. Pond no longer shown on eastern boundary.	**Opencast workings** shown immediately northwest. Opencast workings shown 150m southeast. Barugh Green Lane renamed Barugh Green Road.
1973	Opencast workings no longer shown with site split into several fields. Pond in the centre-south no longer shown.	New motorway (M1) shown 250m southwest beyond Higham. Rail sidings no longer shown 250m north with area now labelled as **disused tip**. Several works buildings shown 250m north. Redbrook Linen Works no longer labelled as works, building still present. Opencast workings no longer shown southeast. Expansion of Gawber and Pogmoor to east and southeast.
1983	Building shown in the northeast.	Expansion of Higham to the west with new housing shown immediately west. Continued expansion of Gawber and Pogmoor to east and southeast.
1993	Building no longer shown in the northeast. Expansion of Hermit House Farm.	Continued expansion of Gawber and Pogmoor to east and southeast.
2000	**Pond** shown within Craven Wood.	Former Redbrook Linen Works now labelled depot.
2006	No significant changes.	Claycliffe Business Park and other industry shown c.250m north.
2016		Depot building (former Redbrook Linen Works) to northeast no longer shown.
2021		No significant changes.

3.3 The surrounding villages of Higham, Barugh Green and Gawber predominantly housed colliery workers throughout the 19th and early 20th centuries. Collieries were located across the wider surrounding area including Higham Colliery (c. 750m west, operated from 1854 to 1898), Beevers Colliery (c. 400m east, operated from 1888 to 1925) and Dodworth Colliery (c. 1km south, operated from 1855 to 1899).

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). The responses received from the Coal Authority, the BGS and extracts from the Landmark Report are presented in Appendix E.

Issue	Data reviewed	
Geology	1:10,000 BGS map (Sheet SE30NW) BGS Memoir 87 (1989)	Drift soils – No drift soils present, however much of the site in the north, centre and west underlain by backfilled opencast. Solid (bedrock) – Pennine Middle Coal Measures – Mudstone, Siltstone & Sandstone. Shallowest coal seam – Gawber & Dunsil Coal, outcrops in the south of the site. Strata Dip – generally 5° northeast. Faults – 3 faults cross the site; two in the south and centre-east in a northwest-southeast orientation and the third originating from the south most fault towards the north through the centre of the site.
Mining & Quarrying	Coal Authority, BGS maps & historical OS maps	About 70% of the site's area has been subject to opencast coal extraction. See Section 5 below.
Radon	Public Health England Environment Agency electronic open data via QGIS Envirocheck Report	The site lies in an area where between 1% and 3% of homes are estimated to be above the action level.
Hydrogeology		Source Protection Zone? None beneath site or surrounding area. Aquifer? Secondary A Aquifer (Solid). Groundwater abstractions? None within 1km. Soil leaching potential - Medium Pollution incidents? None of significance. Discharge consents? Attached to farmhouse in centre-southeast. Discharge of treated effluent to land/soakaway.
Hydrology		Nearest watercourse? Red Brook flows northeast through the east of the site. Catchment of Cawthorne Dyke > R. Dearne > R. Don. Water quality moderate ecological & failing chemical. Pollution incidents? 400m southwest April 2018. Ct. 2 significant incident. Release of contaminated minewater to surface watercourse. Abstractions? None within 1km. Discharge consents? On eastern boundary. Discharge of treated effluent to freshwater stream/river. Mrs Kay Hawley for domestic properties. July 2008 – ongoing.
Flood risk		The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low. 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.

4.2 Lithos' experience

4.2.1 Lithos has already completed a ground investigation across the LT1 area of the wider Barnsley West development site which comprised the excavation of 102 trial pits, 44 trial trenches, 20 cable percussion boreholes, to rotary cored boreholes, 70 rotary open probeholes and 17 stitched lines of probeholes.

4.2.2 The findings of Lithos' investigation are presented in our Report ref. 3104-1, dated March 2022.

4.2.3 Report 3104-1 focused on a separate area within the wider development which was underlain by a separate area of opencast (the Craven I site). However, given that opencasting at Craven I took place at a similar time and within similar geology to that beneath the current area of interest it is likely that ground conditions are similar, and a brief summary of Lithos' findings is given below.

4.2.4 About 60% of LT1 has been subject to opencast coal extraction targeting the Swallow Wood, Top Haigh and Low Haig Coal Seams. No evidence of underground workings was encountered, however this may not be the case for the current area of interest.

4.2.5 Backfill within the opencast comprised a veneer of Topsoil and a 'restoration layer' of Cohesive Made Ground (reworked Residual Soils) over Cohesive and Granular Opencast Backfill (clay with gravel, cobbles and boulders of mudstone) to a depth of up to 12.6m.

4.2.6 Natural ground comprised a veneer of medium to high strength Residual Soils (outside former opencast) over Coal Measures mudstone bedrock.

4.2.7 No evidence of gross contamination was encountered and Topsoil was considered to be chemically suitable for re-use (although visually quite clayey and of poor quality).

4.2.8 Foundations are expected to comprise 'traditional' strip footings outside of opencasts which will found in competent Residual Soils or bedrock at a minimum depth of 900mm. Foundations inside of opencasts are expected to comprise heavily reinforced strip footings founded on engineered fill which will likely be generated by excavation, screening and rolling in of site won opencast backfill.

4.3 Landfills

4.3.1 Known or suspected areas of landfill in the vicinity of the proposed development site are summarised below:

Location	NGR (proximity to site)	Remarks	Source of data
Higham Common Road, Higham	Immediately beyond western boundary	Mr J Cooper. Football pitch to rear of Mines Public House. Provider ref. EAHLD04323. Input from December 1993 to December 1994. Deposit included commercial waste.	Enviro-check Report & EA data.
Redbrook, Barnsley	180m northeast.	Northern Properties Ltd. South Yorkshire Industrial Estate. Provider ref. EAHLD04335. Input from September 1983 to January 1990. Deposit included inert & commercial waste.	
Redbrook, Barnsley	220m northeast	Tara Civil Engineering Ltd. Wilthorpe Road. Provider ref. EAHLD05744. Input from September 1983 to May 1998. Deposit included inert waste.	

4.3.2 At this stage it cannot be discounted that the above landfills do not pose a potential source of hazardous ground gasses although, given that the Redbrook landfills have been developed over with commercial buildings, it is unlikely that excessive volumes of degradable materials are present within them.

4.4 Hazardous gas

Methane & carbon dioxide

4.4.1 The site might be affected by sources of hazardous gas generation as it is:

- Located within 250m of known former & current landfill sites
- Anticipated to be underlain by significant areas of deep opencast backfill
- Potentially underlain by shallow mine workings.

4.4.2 Consequently, monitoring is recommended in order to determine appropriate gas protection measures for the proposed dwellings.

Radon

4.4.3 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. At present Approved Document C advocates basic measures for the probability banding 3% to 10% (full measures if >10%).

4.4.4 The Public Health England UK radon map and the Landmark report indicate that the site is in an area where **between 1% and 3%** of homes are estimated to be above the action level. Consequently, basic radon protection measures may not be required in new dwellings.

4.4.5 However, Public Health England would like to see all new build include basic measures. Given that the site lies in an area where >1% of homes are estimated to be above the action level, the Developer might consider providing all new dwellings with basic radon protection measures.

4.5 Agriculture

4.5.1 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
Sewage farming, slurry spreading	Methane, metals, nitrates, oxygen depletion
Carcase burial	Anthrax & other biohazards
Plant & animal protection	Pesticides & herbicides
Timber processing/treatment	Metals, PAH, chlorinated organics
Soil conditioners	Metals, sulphates, PAH
Equipment maintenance	Hydrocarbons, metals
Waste burial, land levelling, backfilling ponds/quarries	Methane, metals, PAH etc
Derelict buildings	Asbestos
Naturally occurring contaminants	Arsenic, metals

4.5.2 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.

4.5.3 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.

5 COAL & MINING

5.1 General

5.1.1 In July 2011 the Coal Authority (CA) formalised their requirements in relation to planning applications and introduced some new terminology relating to coal mining development areas. This Section provides the necessary mining risk assessment required by the proposed planning application.

5.2 Site geology

5.2.1 Several sources have been reviewed to determine the geology, including coal seams and underground/opencast workings, beneath this site. The anticipated geological succession is discussed below, and the underlying geology and coal mining features are shown on Drawing 4561/9.

BGS Data

5.2.2 Geological maps and the BGS Technical Report suggest that the following coal seams underlie the site at shallow depth:

- **Dunsil Coal**, 0.46m to 0.81m thick, outcropping in the southeast & underlaying the far-southeast.
- A **thin** coal seam about 10m below the Dunsil Coal.
- **Gawber Coal**, 0.72m thick, outcropping in the centre south, about 16m below the Dunsil Coal & underlying the south & east.
- **Swallow Wood Coal**, 0.3m to 1.18m thick in opencast highwalls, about 28m below the Dunsil Coal, underlying the majority of the site, but removed by opencast.
- **Top Haigh Moor Coal**, 0.69m to 1.19m thick, about 62m below the Dunsil Coal, underlying the entire site.
- **Low Haigh Moor Coal**, 0.43m to 1.02m thick, about 70m below the Dunsil Coal.

5.2.3 Further coal seams (the Lidgett Coal, the Joan Coal & the Flockton Thick Coal) lie at depths of 30m, 60m and 84m (respectively) below the Top Haigh Coal and consequently below the base of the Craven II opencast (see below).

5.2.4 Faulting in the far-west brings the Top Haigh Moor and Low Haigh Moor Coals close to surface.

5.2.5 Whilst the majority of the rock between the above coals is likely to comprise mudstone with intermittent sandstone and siltstone bands/beds, the Haigh Moor Rock Sandstone unit makes up the geology between the Swallow Wood and Top Haigh Coal Seams.

5.2.6 Examination of BGS mapping shows that about 70% of the total site area has been subject to opencast coal extraction.

5.2.7 The Low Haigh, Top Haigh and Swallow Wood Coals were all worked from the Barugh Colliery, which was located c. 1km north.

5.2.8 The BGS report also notes that the Top Haigh and Swallow Wood Coals are often synonymous (i.e. both names can refer to a single, or two separate seams, and mapping is often inconsistent). The seams are described as being of variable quality/thickness but are generally of a quality which justifies underground working.

5.2.9 It should be noted that there is some confusion in the local area relating to the naming of coal seams and several coals appear to 'chop and change' names in the geological literature; most notably the Top Haigh and Swallow Wood Coal Seams.

5.2.10 It should also be noted that seam outcrops plotted on geological maps have been known to be inaccurate by distances in excess of 100m. Approximate coal outcrops and areas of opencast are shown on Drawing 4454/9.

Coal Authority Mining Report

5.2.11 The majority of the site lies in a Development High Risk Area – areas with a specific mining legacy risk to the surface, including mine entries, shallow workings, coal, etc.

5.2.12 A Coal Authority Consultants Mining Report has been obtained which states that:

- There are known underground workings in 5 seams from between 43m and 325m depth beneath the site. The shallowest (*and potentially significant*) workings are in the Flockton Thick Coal which has a workings thickness of 0.68m.
- There may be probable underground workings (*i.e. the CA is aware of coal at shallow depth which could have been worked at some time in the past*).
- There are 6 known mine entries located within the site's boundary (see below).
- There are no CA managed tips, mines gas emissions or mine water treatment schemes within 500m.
- The site is located in an area where a notice to withdraw support was given in 1977.

5.2.13 The mining Report suggests that known underground workings are not present at shallow (i.e. less than 30m) depth, however that shallow coal is present which could contain workings which the CA have no record of. Further it should be noted that the presence of areas of opencast effectively removed competent cover from surface to the base of the opencast meaning that workings at 'intermediate' (c. 40m to c. 70m) depth may still pose a potential risk to surface stability and the proposed development.

5.2.14 Whilst the Coal Authority has an entitlement to Withdraw Support (i.e. continue mining coal from beneath the site) it is Lithos' understanding that no further underground mining is proposed in the UK, and this is unlikely to change in the foreseeable future. However, it would be prudent to discuss this with the Coal Authority prior to starting construction.

Coal Mining Abandonment Plans

5.2.15 Both BGS mapping and the Coal Authority mining report show areas of opencast across about 70% of the site's area as well as evidence of underground mining beneath the site and immediate surrounding area.

5.2.16 Abandonment plans have been obtained from the Coal Authority which record known workings from both underground and opencast methods across site. Abandonment plans are reproduced in Drawings 4561/8a to /8e and are discussed below.

Opencast abandonment plans

5.2.17 The following plans have been obtained which record known opencast workings across this site: CA Refs NE498, sheet 1 of 3 and NE498 Sheet 2 of 3 (*these plans are dated May 1964 which is expected to be the date of completion of opencast operations*) and NE375

5.2.18 Abandonment Plans **NE498** discuss two areas of opencast, named Craven I and Craven II. Craven I underlies land to the north whilst Craven II underlies the centre, north, east and west of the site.

5.2.19 Craven II targeted the Gawber, Thin, Swallow Wood, Top Haigh Moor and Low Haigh Moor coal seams. The Gawber Coal was only present/extracted in the northeast of the opencast where the seam outcrops.

5.2.20 The opencast reached depths of between about 20m and 40m below existing ground levels.

5.2.21 The plans include a stratigraphic column which provides the following coal seam thicknesses:

- **Gawber Coal:** two seams with single dirt parting; total thickness 0.90m.
- **Thin Coal**: single seam coal 0.35m thick, with a fireclay of 0.6m thickness.
- **Swallow Wood Coal**: (7.4m below thin); two seams with single dirt parting; total thickness of 0.91m.
- **Top Haigh Moor Coal**: (12.3m below Swallow Wood); three seams with two dirt partings & a seat earth; total thickness of 1.42m.
- **Low Haigh Moor Coal**: (7.1m below Top Haigh); two seams with single dirt parting; total thickness 0.63m.

5.2.22 The abandonment plans indicate that underground workings were not encountered in in any coal seams during opencast excavation works.

5.2.23 Abandonment Plan **NE375** discusses two areas of opencast in the far-south of the site which are called the Hunters Cottage Extension and which were part of a larger area of opencast to the south (within the Barnsley West commercial development land). The plans state that extraction at the extension began in October 1954 and was completed in May 1956.

5.2.24 The extension opencasts were excavated at two locations. The western location targeted the thin coal seam, reaching depths of between about 0.8m and 10mbgl, and the western excavation targeted the Gawber Coal Seam, reaching depths of between about 4m and 10mbgl.

5.2.25 The plan includes a stratigraphic column which provides the following coal seam thicknesses:

- **Gawber Coal:** two seams with a single dirt parting; total thickness 0.76m.
- **Thin Coal:** single seam; total thickness 0.38m.

5.2.26 No evidence of underground workings are recorded on the Craven II plans. However, the hunters Cottage extension plans record localised areas of underground workings within both the Gawber and the Thin Coal Seams, as well as in the Swallow Wood Coal Seam (within the wider opencast) off-site to the south.

5.2.27 Abandonment plan **NE59** records workings at the hunters Cottage opencast to the south, but does not record any workings beneath the current site.

Underground abandonment plans

5.2.28 Abandonment plans for the Flockton Thick Coal (plans NE584-44006, -443007, -443206 & -443207) have been obtained from the Coal Authority which on initial inspection indicated the Flockton Thick was shallowest in the northeast (c. 40mbgl) and deepest in the southwest (c. 130mbgl). This was supported by information contained within the Coal Authority Consultants Report for the site.

5.2.29 However, this would have resulted in the Flockton Thick seam dipping in the opposite direction to the published geology as well as information obtained from the opencast abandonment plans. Based on the levels recorded on the underground abandonment plans, the Flockton Thick would have been at c. 90m below the Low Haigh Moor coal in the southwest but stratigraphically above the Low Haigh Moor seam in the northeast.

5.2.30 Following liaison with the Coal Authority (see correspondence in Appendix E), it appears there has been a discrepancy on the CA database resulting in incorrect coal seam levels for the Flockton Thick. It has been clarified that the Flockton Thick does indeed dip towards the northeast and, given existing topography, lies at approximately 130mbgl across the entire site.

5.2.31 Consequently, any mineworkings in the Flockton Thick Coal will lie at depths of in excess of 30m below the base of the Craven II opencast and should therefore not pose a risk to surface stability.

5.3 Mine entries

5.3.1 Of the 6 known mine entries on site, the CA only have limited information as summarised in the table below.

5.3.2 Prior to finding recorded shafts (i.e. those referenced in the CA mining report), the CA will expect Strata's layout to assume a potential no-build "zone of influence" around each shaft based on the following calculation:

(0.5 x assumed shaft diameter) + departure + drift depth = zone of influence

5.3.3 In essence, departure relates to the degree of certainty with respect to the entry's location. The zones of influence here are:

Shaft Ref.	Grid ref.	Source	Departure/ m	Diameter /m	Depth to bedrock/m	Zone of influence (circle of radius)/m	Remarks
431406-002	431771 406978	Abdmt Plan	5	?	c. 40m	c. 46m	Likely removed to some extent by opencast.
431406-003	431771 406971		5	?	c. 40m	c. 46m	
431406-004	431746 406949		5	?	c. 40m	c. 46m	
431406-005	431840 406925		5	?	c. 40m	c. 46m	
431406-006	431838 406909		5	?	c. 40m	c. 46m	
431407-008	432004 407548		5	?	c. 40m	c. 46m	-

5.3.4 The locations of the above mine entries are shown on Drawing 4561/9.

5.3.5 It is worth noting that CA shaft positions are often only approximate, and in some cases the same shaft has been recorded in multiple locations, or some other feature such as a chimney has erroneously been recorded as a shaft.

5.3.6 The source of data for mine entries 413406-002 to 006 is the Coal Authority abandonment plan ref. NE375 (see Section 5.2.23 above and Drawing 4561/8b). Mine entries are not explicitly shown on the abandonment plan, but are inferred as overlaying localised areas of underground workings which were encountered during opencasting, indeed discussions with the Coal Authority suggests that the former British Coal Shaft Register notes that these are 'probable shaft positions from old workings in the opencast site.' As a result, it is highly likely that these mine entries were removed during opencasting and no longer pose a significant risk to surface or to the proposed development.

5.3.7 The source of data for mine entry ref. 431-407-008 is the Coal Authority abandonment plan ref. NE498 (see Section 5.2.18 above and Drawing 4561/8c). The plan states that the entry comprises a 36 inch (0.91m) diameter pumping shaft which reached the Low Haigh Moor Coal Seam at 44.09m depth. The shaft is shown as being located within the footprint of an area of opencast, given the Low Haigh Moor coal was extracted during opencasting, this mine entry is highly likely to have been **removed** during opencasting and should no longer pose a threat to the proposed development.

5.4 Ironstone

5.4.1 As well as containing valuable coal seams the Coal Measures include bands of ferrous rich ironstone which have historically been extracted by both underground and surface methods as a raw material for the production of iron and steel.

5.4.2 The BGS memoir notes that iron ore extraction and smelting took place in the surrounding area since the roman period, reaching its peak between the 12th and 17th century.

5.4.3 The major ironstone horizons of the general area are associated with the Flockton Thick Coal and are named the Tankersley Ironstone. In addition, the Swallow Wood Mine (an ironstone band) which lies stratigraphically above the Swallow Wood Coal has been subject to localised extraction.

5.4.4 Consequently, it cannot be discounted that ironstone may have been extracted in underground workings located just above the Flockton Thick and Swallow Wood Coals.

5.4.5 In Lithos' experience ironstone extraction usually takes place alongside coal extraction (often within the same mine) and therefore it may be the case that underground workings of the Swallow Wood Coal could have also removed ironstone. This often results in ironstone workings being mistakenly identified as coal extraction, and with the total possible thickness of workings being under-estimated.

5.4.6 It should be noted that no evidence of underground working of the Swallow Wood Coal has been encountered during historical opencasting, the 3rd party ground investigations or during Lithos' works across the wider Barnsley West Development (although this cannot be discounted).

5.4.7 The Flockton Thick Coal (and associated Tankersley Ironstone) is anticipated to lie at depths of c. 130m (c. 90m below the base of the Craven II opencast). At such a depth any workings in the Tankersley Ironstone is not anticipated to pose a significant risk to surface stability.

5.5 Mineral safeguarded areas

5.5.1 The site is underlain by coal and might therefore be considered by the Local Authority to lie within a Mineral Safeguarding Area (MSA).

5.5.2 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.

5.5.3 Specialist guidance on Mineral Safeguarding "A Guide to Mineral Safeguarding in England" has been produced by The Coal Authority and the British Geological Survey.

5.5.4 Paragraph 204 of the National Planning Policy Framework (NPPF) requires Local Authorities, when preparing Local Plans to:

- Define Minerals Safeguarding Areas and adopt appropriate policies in order that known locations of specific minerals resources of local and national importance are not needlessly sterilised by non-mineral development, whilst not creating a presumption that resources defined will be worked; and define Minerals Consultation Areas based on these Minerals Safeguarding Areas.
- 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.

5.5.5 NPPF Paragraph 204 notes that when determining planning applications, local planning authorities should give weight to the benefits of the mineral extraction.

5.5.6 As a consequence of the NPPF, and the presence of coal beneath the site, the Local Authority may require Strata to consider the opportunity to recover (extract) the coal.

5.5.7 However, it is worth noting that the UK market for coal is changing (driven by government carbon emission targets) – most notably very few power stations are still burning coal. Consequently, prior extraction of coal has become less attractive in recent times.

5.5.8 Applicants submitting planning applications may need to demonstrate to the Local Authority that they will extract the coal, unless:

- It can be shown it is not economically viable to do so, or
- It is not environmentally acceptable to do so, or
- The need for the development outweighs the need to extract the coal, or
- The coal will not be sterilised by the development

5.6 Summary of coal & mining

5.6.1 The majority of the site (c. 70% of the total site area) has been subject to opencast coal extraction. The Craven II opencast occupied the north and centre of the site reaching depths of between 20m and 44m. Additionally, the Hunters Cottage Extension opencast was formerly present in the far south and extracted coal to approximately 10m depth.

5.6.2 The shallowest recorded underground mineworkings are within the Flockton Thick Coal at c. 130m depth. Given a maximum recorded depth of c. 44m in the Craven II opencast, any mineworkings within the Flockton Thick seam should be at sufficient depth as to not pose a risk to surface stability.

5.6.3 However, the possibility of shallow, unrecorded mineworkings within the Dunsil, Gawber and Thin coals in the south of the site cannot be discounted and further investigation would be required.

5.6.4 A number of mine entries are recorded on site although based on information obtained from the Coal Authority it is highly likely these have been removed during opencast operations and therefore no longer pose a risk to development.

5.6.5 It should be noted that the risk of further unrecorded shafts or bell pits beyond areas of former opencasts cannot be discounted at this stage.

6 PREVIOUS INVESTIGATION FINDINGS

6.1 General

6.1.1 Strata have provided Lithos with a copies of the following reports:

- **1).** Geotechnical and Geo-environmental Site Appraisal Commentary, Barnsley West, report ref. 36284-001 issued by Eastwoods & Partners to Strata in October 2013.
- **2).** Geoenvironmental Desk Study Report, Barnsley West, report ref. JBW/DS/4848.v2 issued by JPG Group to Strata in July 2019.
- **3).** Preliminary Geoenvironmental Ground Investigation, Barnsley West, report ref. 4848-JPG-SW-XX-RP-G-0603-S2-P01, issued by JPG Group to Strata in July 2019.
- **4).** Coal Mining Risk Assessment and Coal Recovery Report, Residential Development (remainder of site), Barnsley West, report ref. 4848-JPG-Z1-XX-RP-G-1101-S2-P01, issued by JPG to Strata in August 2019.

6.1.2 It should be noted that all 4 of the above reports consider a larger area; the current area of interest (LT2) and the wider Barnsley West site to the north and south.

6.1.3 Third party exploratory hole locations are shown on Drawing 3104/10.

6.1.4 A summary of the ground conditions encountered in Reports 1 and 3 across the current area of interest is presented in the table on Page 17.

6.2 Report 1

Scope of works

6.2.1 Eastwood & Partners' Report comprises a 'high level' summary appraisal of an area of c. 80 hectares which includes LT2 as well as land to the north and south. The document comprises a review of historical mapping, geological mapping, and abandonment plans supplied by the Coal Authority. In addition, a ground investigation comprising 6 cable percussion boreholes was undertaken, three of which fall within the current site's boundary.

Summary of Eastwood's findings

6.2.2 The findings of Eastwood's desk study are consistent with those presented in Sections 2 to 5 of this report, although, given the scope of the report, generally with less detail. As the Report covers a larger area than the current site, much of the information is not relevant to this document however it does provide a good overview of the geology, features and mining issues affecting the wider area.

6.2.3 Three of the 6 cable percussion boreholes are relevant to this site, being located within the current area of interest and inside the former Craven II opencast.

6.2.4 SPT testing suggests that the made ground is generally medium dense to dense.

6.2.5 The Borehole logs provided comprise hand-written drillers logs which suggests that Eastwood's ground investigation was undertaken without the supervision of a geoenvironmental engineer.

6.3 Report 2

Scope of works

6.3.1 JPG's Report comprises a desk-based review of historical mapping, Coal Authority information, geological mapping and a site walkover. The report covers an area of c. 120 hectares including LT2 and land to the north and south.

6.3.2 JPG also reviewed the findings of Report 1 (above).

Summary of JPGs findings

6.3.3 JPG's desk study findings are consistent with those presented in Sections 2 to 5 of this report, and includes good detail, most notably in terms of coal mining information, although given JPGs report covers a much larger area much of the information is not relevant to LT2.

6.3.4 JPG highlight that localised ironstone mining could have taken place, most notably (for LT2) from iron rich bedrock around the Swallow Wood Coal Seam.

6.4 Report 3

Scope of works

6.4.1 JPG's report comprises a brief site overview, including reference to Report 2 and the findings of a ground investigation across an area of 116 hectares (including LT2 and land to the north and south, but excluding land to the northeast covered in Reports 1 & 2). In total the ground investigation comprised 14 trial pits and 28 rotary open probeholes. Of these 4 trial pits and 8 probeholes were located within LT2.

6.4.2 In-situ SPT testing was undertaken during drilling of the probeholes and samples were retrieved for chemical (12 samples) and geotechnical testing (20 samples). Monitoring wells and extensometers were installed in the probeholes and, on completion of the drilling, wells were monitored on 6 occasions for groundwater and hazardous gasses.

Summary of JPGs findings

6.4.3 Made Ground beneath LT2 is absent outside of former opencasts, but reaches depths of between 31.0m and 38.0m depth within the footprint of the Craven II opencast and comprises a veneer of Topsoil and Cohesive Made Ground (reworked Residual Soils) over clayey gravel with cobbles and boulders which JPG identified as Colliery Spoil. SPT testing suggests that the Colliery Spoil is generally medium dense to dense with N values broadly increasing with depth.

6.4.4 No evidence of grossly degradable materials, historical landfilling, tipping etc was recorded and, based on JPGs description of made ground at this site, it could be interpreted that the opencasts were backfilled with site-won arisings (re-worked coal measures bedrock).

6.4.5 No evidence of shallow underground workings were encountered beneath the LT2.

6.4.6 Settlement recorded by the extensometers by the time of reporting (July 2019) was negligible.

6.4.7 Laboratory CBR vales for shallow soils are typically greater than 5%.

6.4.8 No samples tested for contaminants (metals, organics, pesticides & asbestos) exceeded JPG's screening values and the site was considered to be essentially 'clean' and suitable for the proposed end use (residential & commercial development).

6.4.9 Characteristic Situation 2 (CS2) gas protective measures were recommended for all new properties across the site.

6.5 Report 4

Scope of works

6.5.1 JPG's report relates to an area of c. 70 hectares including LT2 and land to the north. Land to the northeast covered in Reports 1 and 2 is omitted and land to the far south covered in Reports 1, 2 and 3 is also omitted.

6.5.2 The report comprises a site description and review of CA information and abandonment plans, geological mapping and the information contained in Reports 1, 2 and 3.

Summary of JPG's findings

6.5.3 The findings of JPG's report are consistent with the information presented in Section 5 of this document, but with greater detail relating to the potential for settlement of backfilled areas of opencast, and the depth to shallow coal (no evidence of mineworkings recorded to date) as JPG had the benefit of reviewing the ground investigation date presented in Report 3.

6.5.4 A total of 6 mine entries were located within LT2 as well as further entries across the wider area.

6.5.5 Given the extensive opencast coal extraction which has already taken place, recovery of coal was considered unlikely to be viable, except where proposed earthworks and regrade of levels exposes coal for incidental extraction.

Rpt by	Hole ID	Final Depth (mbgl)	Depth to base (mbgl)					Rock-head (mbgl)	Penetration into bedrock (m)	Coal (top & base – mbgl)	Location	Comments
			Total Made Ground	Made Ground Topsoil	Cohesive Made Ground	Opencast Backfill	Residual Soil					
East-wood	BH01	21.85	21.8	0.15	-	21.8	-	21.8	0.06	-	Craven II	-
	BH02	10.5	9.9	0.25	1.8	9.9	-	9.9	0.6		Craven II	
	BH06	9.04	8.7	0.2	-	8.7	-	8.7	0.34	-	Craven II	-
JPG	TP104	3.0	>3.0	0.25	0.6	>3.0	-	-	-	-	Craven II	-
	TP105	2.4	>2.4	0.5	0.8	>2.4	-	-	-	-	Craven II	-
	TP106	2.0	>2.0	0.4	0.8	2.0	-	-	-	-	Craven II	-
	TP113	3.0	>3.0	0.4	1.0	3.0	-	-	-	-	Craven II	
JPG	BH104	39.0	31.0	0.25	-	31.0	-	31.0	8.0	-	Craven II	-
	BH105	28.5	>28.5	0.2	-	-	-	-	-	-	Craven II	-
	BH105A	40.5	38.0	0.2	-	38.0	-	30.0	2.5	-	Craven II	-
	BH106	40.0	38.5	0.2	-	38.5	-	38.5	1.5	-	Craven II	-
	BH107	36.0	0.4	0.4	-	-	2.0	2.0	34.0	8.4 – 9.4, 18.5 – 19.3, 26.2 – 27.3 & 30.8 – 31.0	Outside of opencast	No evidence of workings noted.
	BH119	20.0	0.2	0.2	-	-	-	0.2	19.8	6.0 – 6.8		
	BH120	40.0	0.25	0.25	-	-	3.5	3.5	36.5	11.7 – 12.2, 14.0 – 14.15, 22.3 – 23.9 & 31.4 – 32.4.		

6.6 Lithos comments

6.6.1 All 4 of the above reports cover a larger area than LT2 and consequently include ground related data and interpretations which are not of significance to LT2. However, data relating to land outside of LT2 does provide a useful overview of the geology and ground conditions across the general wider area.

6.6.2 The scope of works for Reports 2 and 3 (which included intrusive ground investigations) was limited and consequently only a limited number of exploratory holes and ground related data cover was captured within LT2.

6.6.3 Report 3 includes detailed consideration and recommendations relating to potential future settlement. However, further data and ground investigation is required to reduce uncertainty with regards to future settlement, most notably following any change of site ground levels.

6.6.4 JPG's settlement model suggests that anticipated settlement will be minimal, however given that some regrade is anticipated, allowance should be made for the effect of raising ground levels by placing fill across areas of made ground; this surcharging may increase settlement beyond the parameters of JPGs models.

6.6.5 Further intrusive ground investigation with a much closer spacing of exploratory holes is required to remove uncertainty in relation to ground conditions, most notably the line and nature of buried highwalls, the presence of any shallow underground workings, the nature and depth of made ground, the extent of below ground obstructions (boulders), the engineering properties of made ground and shallow soils, the nature of contamination and suitability of soils for re-use and the risk posed to future development by hazardous ground gasses.

7 PRELIMINARY CONCEPTUAL SITE MODEL

7.1.1 The site (LT2) comprises arable farmland and is essentially greenfield, however about 60% of the total site area has been subject to opencast coal extraction with subsequent backfilling of the opencast excavations. Based on the findings of 3rd party investigations it appears likely that excavations were backfilled with site-won arisings (re-worked coal measures bedrock) rather than landfill, refuse tipping, etc however in the absence of a comprehensive ground investigation this cannot be guaranteed.

7.1.2 A preliminary conceptual site model, presented as Drawing 3104/5 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 7 inclusive of this report.

7.1.3 Clearly, the conceptual model will be subject to modification in light of data arising from the proposed intrusive ground investigation. Potential contaminant linkages are shown on the preliminary conceptual site model.

7.2 Anticipated ground conditions & potential issues

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

Anticipated condition	Remarks
Made ground	Reworked Residual Soils and bedrock within the footprint of opencasts to depths of up to c. 40m.
Natural soils	Veneer of Topsoil & Residual Soils (likely medium to high strength gravelly clays) where outside footprint of opencast.
Bedrock	Lower Coal Measures (interbedded mudstone, siltstone & sandstone) below veneer of Residual Soils (outside open cast) & immediately below made ground (inside opencast).
Mineworkings	A total of 6 coal seams are present beneath the site, 5 of which may have been worked by underground methods, although extensive opencast will have removed shallow underground workings from opencast footprints. To date 3rd party exploratory holes have not encountered evidence of underground workings. Abandonment plans indicate workings in the Flockton Thick seam should be at sufficient depth to not pose a risk to surface stability.
Groundwater	Likely perched in made ground within opencast & anticipated at depth within bedrock.

7.2.2 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	1. Made Ground. 2. Farming operations. 3. Underground mineworkings.	1. Potential organic/inorganic contaminants & asbestos & Generation of hazardous gasses 2. See Section 4.5 3. Generation of hazardous gasses
Potential off-site contamination sources	1. Landfill. 2. Deep made ground.	1. Land to the north; migration of hazardous gasses. 2. Areas of opencast to the northeast & south; generation of hazardous gasses.
Potential geotechnical hazards	1. Deep made ground. 2. Buried highwalls. 3. Shallow mine entries/workings. 4. Sloping topography. 5. Below ground obstructions (boulders)	1. Foundation abnormals & potential for excessive settlement. 2. Potential for differential settlement. 3. Risk to surface stability & requirement for consolidation 4. Some levels regrade & earthworks likely to be required. 5. Foundation abnormals & pile refusal ("hanging piles").
Other potential constraints	1. Overhead utilities.	1. Cross the far-north of LT2 & may require easements or diversion.

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 As of March 2012, Planning Policy Statement (PPS23) was replaced by the National Planning Policy Framework (NPPF), supported by web-based planning practice guidance. The NPPF (updated in July 2021) includes the following with respect to contamination and site investigation:

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

8.5 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; and
- Adequate site investigation information, prepared by a competent person, is presented'.

8.6 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 BS10175[2])'.

This site

8.7 The underlying Coal Measures bedrock is classified as a Secondary A Aquifer. The nearest surface watercourse is Red Brook which flows east through the centre and east. Therefore, the site's environmental setting is considered to be of moderate sensitivity.

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

8.9 Whilst current use of the site is considered unlikely to have given rise to any significant ground and groundwater contamination historical opencast coal extraction and subsequent backfilling of excavations may well have.

8.10 However, it is considered that the site should be suitable for the proposed use subject to implementation of appropriate preparatory works.

[2] *BS10175 (2011) - Code of practice for the investigation of potentially contaminated sites*

9 GROUND INVESTIGATION DESIGN

9.1 Ground investigation design & strategy

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

Exploratory holes	Purpose
About 170 trial pits	To determine the general nature of soils underlying the site, including the: • Nature, distribution and thickness of made ground. • Nature, distribution and size of obstructions. • Nature, degree and extent of contamination. • Proportion of undesirable elements e.g. biodegradable matter, foundations etc. • Suitability of the ground for earthworks re-use, founding structures and highways.
About 85 trial trenches	To locate & describe the line & nature of buried highwalls around the opencast boundaries.
25 cable percussion boreholes	To determine the engineering properties of made ground within the former opencast, including the extents of obstructions & to install monitoring wells to: • Monitor for hazardous gasses. • Determine groundwater levels & flow direction.
10 rotary cored boreholes	To determine the engineering properties of bedrock in the base of the former opencast to inform piled foundation design.
About 70 rotary open probeholes	To determine whether shallow coal seams have been worked by underground methods and whether underground workings pose a potential risk to surface stability.
Including 45 probeholes	To install monitoring wells to: • Monitor for hazardous gasses. • Determine groundwater levels & flow direction.
About 45 groups of stitch probeholes	To locate & describe the line and geometry of the buried highwalls around the opencast boundaries.

9.1.2 Proposed exploratory hole locations should be 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 50m grid spacing should be appropriate, with additional exploratory locations scheduled as necessary in light of the ground conditions actually encountered.

9.1.3 Parts of the site are heavily vegetated and is not currently accessible for ground investigation. Furthermore, there may be ecological constraints (e.g. nesting birds), and it is recommended that Strata consult a qualified ecologist to confirm the absence of any protected plant or animal life prior to commencement of trial pitting.

9.1.4 Representative soil samples of natural and any man-made ground should be taken during the works. The number of soil samples taken should be reflective of the geological complexity actually encountered, but in general about 3 samples should be taken from most exploratory holes.

9.1.5 The investigation should be undertaken in general accordance with:

- BS5930:2015 "Code of practice for site investigation"
- BS10175:2017 "Code of practice for the investigation 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)

9.1.6 **Trial pitting / trenching** will enable determination of:

- Nature, distribution and thickness of shallow soils beyond the former opencasts
- Nature of made ground (uppermost 3m to 4m), 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
  - the location and extent of the opencasts, with some trenching to locate the quarry high wall
- Suitability of the ground for earthworks re-use, founding structures and highways.

9.1.7 The in-situ shear strengths of any cohesive soils encountered should be determined by use of a hand-held shear vane.

9.1.8 Deep made ground is anticipated, and consequently **soakaways** will not provide a viable solution for the disposal of surface water.

9.1.9 Access constraints within the farmyard area may necessitate the use of **dynamic sampling** techniques (mini-boreholes) cf. trial pits. It should be noted that window sampling allows only a limited inspection of the ground (cf trial pitting). Consequently, some uncertainties may remain and a supplementary, post-demolition ground investigation may be required.

9.1.10 **Mini-boreholes** will:

- Enable inspection of concrete slabs (thickness & any reinforcement) and underlying sub-base (especially with respect to fragments of ACM). A concrete corer can be used to cut a neat hole (450mm diameter). Hand digging within the cored hole to about 0.75m would allow sampling of shallow strata.
- Allow the installation of gas monitoring wells.
- Enable assessment of the density of granular soils either via discrete SPTs or dynamic probing.
- Allow investigation within buildings (including those still in use) and in areas of limited headroom.
- Minimise disturbance of the surface (a 150mm diameter tarmac/concrete core can be lifted and put to one side), allowing subsequent reinstatement.
- Enable the recovery of samples of tarmac, and investigation of road / area of car parking construction.

9.1.11 The **cable percussion boreholes** should be advanced to the base of the former opencasts (or refusal) in order to retrieve geotechnical data from depth, and also allow the installation of gas/groundwater monitoring wells.

9.1.12 Boreholes should be cased-off during drilling to at least rock head, in order to reduce the possibility of blowing sands, groundwater ingress, mis-sampling etc.

9.1.13 The ability to use temporary steel casing to line the borehole, during drilling using a cable percussion rig, enables the recovery of more reliable geotechnical data, and the installation of better/deeper monitoring wells (cf dynamic or window sampling boreholes using a mini-percussive drill rig).

9.1.14 SPT's should be performed in made ground, granular soils and firm\stiff cohesive soils on striking (i.e. change of stratum) and then at intervals of 1m to 1.5m. SPTs allow assessment of the in-situ density of granular soils, enabling determination of allowable bearing capacity and thereby definitive foundation advice.

9.1.15 Undisturbed, thin wall open-tube samples (UT100) should be obtained from natural in-situ cohesive soils on striking and then alternate with SPTs (except in soft clays where only UT100s will be recovered) at intervals of 1m to 1.5m.

9.1.16 Given the anticipated nature and thickness of made ground here, where utilised, piles are likely to be end-bearing in bedrock. In accordance with BS 8004[3] and EC7[4], piling contractors may request that boreholes be extended a minimum 5m into competent bedrock using rotary coring techniques. Strata should liaise with their preferred piling contractor(s) in advance of commissioning this investigation and inform Lithos whether or not rotary coring is required.

9.1.17 Routine **geotechnical soils analysis** (moisture content, Atterberg limits, pH, water soluble sulphate) should be scheduled on about 55 samples, with some compaction testing on samples of made ground to assess suitability for use in earthworks ground improvement.

9.1.18 Appropriate **chemical analyses** based on the findings of this Report should be allowed for. This is likely to comprise 80 samples for a suite including heavy metals, asbestos ID, TOC, banded TPH (with supplementary speciation where appropriate), and speciated PAH. In the event that ground contamination is more significant or different to that anticipated, it might be necessary to carry out additional chemical testing.

9.1.19 Around 70 **probeholes** should be sufficient to determine whether or not old mineworkings are present in the Gawber, Dunsil, Swallow Wood and Top Haigh coal seams, as well as possible ironstone workings above the Swallow Wood Coal. If present, probeholes should also be sufficient to determine whether or not mineworkings pose a significant risk to surface stability of the site (via assessment of seam depths, thicknesses and thicknesses of overlying competent bedrock). However, 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.

9.1.20 It will be necessary to submit an application (with the associated fee) to the Coal Authority (CA) for '*Permission to enter CA mining interests*'.

9.1.21 Given the proximity of surrounding housing (within 50m of much of the general site area), and in accordance with CA requirements it should be assumed that the probeholes will need to be advanced using water as the flushing medium.

9.1.22 Monitoring wells should be installed in about 45 shallow probeholes. The generation potential of potential **gas** sources (deep made ground, nearby landfill and underground workings) is considered likely to be moderate. Therefore, in accordance with CIRIA Report C665[5], it would be prudent to initially allow for 12 visits over a 9 month period. A hazardous gas risk assessment should be issued on completion of monitoring.

9.1.23 On completion of the fieldwork and laboratory testing a comprehensive bound, factual and interpretative report should be issued. This should contain detailed engineering records, laboratory test results, copies of all relevant correspondence and drawings of the site. The report should also include qualitative risk assessment with respect to both controlled waters and human health.

[3] *BS 8004 (2015) - Code of practice for foundations.*
[4] *BS EN 1997-1:2007. Eurocode 7: Geotechnical design – Part 2: Ground investigation & testing*
[5] *CIRIA C665: Assessing risks posed by hazardous ground gases to buildings (2007).*

10 CONCLUSIONS & RECOMMENDATIONS

10.1 General

10.1.1 The current area of interest comprises about 40% of a wider development area (c. 121 hectares) which is called Barnsley West. The current area occupies 48 hectares in the centre of the wider development and is called Barnsley West Land Transfer Two (LT2).

10.1.2 The site is occupied by a mix of arable and grazing farmland which is split by Hermit Farm Lane which runs east to west across the centre south. A farmhouse with associated yards, outbuildings and barns is located in the centre-southeast.

10.1.3 It is understood that Strata are considering acquisition of the site with a view to redevelopment with housing.

10.1.4 The main issues considered in this report, and in particular in Sections 3 & 4 are based on a review of historical maps and available geological/environmental data. This report provides an assessment of geoenvironmental issues and implications associated with the proposed residential redevelopment of the site, together with any implications for current use of the site.

10.2 Mining and quarrying

10.2.1 Much of the site is located in a Coal Authority Development High Risk Area (an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc).

10.2.2 About 70% of the total site area has been subject to opencast coal extraction targeting the Gawber, Thin, Swallow Wood, Top Haigh Moor and Low Haigh Moor Coal Seams.

10.2.3 Outside of areas of opencast coal seams underlie the site at shallow depths and it is possible that underground workings are present which could pose a risk to surface stability.

10.2.4 A total of 6 mine entries are located within the site's boundary. Opencasting has likely removed, or partly removed many of these mine entries.

10.2.5 It is possible that further unrecorded shafts, day holes and bell pits may be present outside of areas of opencast. Consideration could be given to a geophysical survey, although success would be dependent on the "contrast" between shaft backfill and the surrounding ground (i.e. the survey is likely to be more successful if shaft backfill is significantly different material or less dense than the surrounding ground). Follow-up intrusive investigation (pitting) would be recommended to determine the cause of any anomalies identified by the geophysics.

10.2.6 Whilst the Coal Authority (and NHBC) discourage development over or adjacent to all mine entries, Lithos consider such features to pose a low risk to surface stability where they only extend to relatively shallow workings that require treatment (grouting). Consequently, we would not expect any (previously unrecorded) shallow shafts, encountered during site preparatory works and/or the subsequent construction phase, to result in the need for "no-build" zones and/or revision of the planning-approved layout although Strata may choose to do this.

10.2.7 Any shafts encountered during the development of this site should be made safe by treatment in accordance with an appropriate Specification (Lithos can prepare this) and a Coal Authority Permit to Enter or Disturb Coal Authority Mining Interests.

10.2.8 If old mineworkings are present in the Gawber and/or thin coal seam, and are considered to pose a significant risk to surface stability, mitigation of the risks posed will be required; this could be achieved in one of two ways:

- Extraction of the remaining coal
- Consolidation, via drilling & grouting

10.3 Hazardous gas

10.3.1 The site is in an area where between 1% and 3% of homes lie above the Radon Action Level.

10.3.2 There are known areas of landfill located immediately beyond the western boundary and from 180m beyond the northern boundary. Shallow coal and possible workings are present beneath the site and areas of opencast with deep made ground are present across about 70% of the area.

10.3.3 Consequently, monitoring for gasses and completion of a Hazardous Gas Risk Assessment will be required to inform Strata whether protective gas measures will be required at this site.

10.4 Foundations

10.4.1 At present, no geotechnical ground investigation data is available and consequently it is only possible to estimate the ground conditions. Before firm foundation recommendations can be given, it will be necessary to undertake an appropriate ground investigation. However, tentative recommendations are provided below.

10.4.2 Made ground is not generally considered a suitable founding material (without some form of ground improvement) and foundations should be taken through it, into underlying natural in-situ strata of adequate bearing capacity.

10.4.3 Based on review of all the data available to date, ground conditions are expected to comprise a veneer of Topsoil over competent Residual Soils and Coal Measures Bedrock. However, areas of deep made ground (up to c. 44m) are anticipated.

10.4.4 Residual Soils or Coal Measures Bedrock should provide sufficient bearing capacity to enable the adoption of strip footings for two storey housing. Reinforcement, as a precaution against differential settlement, is recommended only where foundation excavations encounter significant lateral and vertical variations in strata.

10.4.5 If shallow mineworkings underlie the site, and require treatment, NHBC typically require foundations to be at least 300mm thick and reinforced. If the workings are at a depth of less than 5 times the seam thickness, then raft foundations may be required.

10.4.6 If rock is encountered at shallow depth, foundations should be placed entirely on rock and not partially on rock and partially on residual soil. This may, depending on surface gradient, necessitate significant over deepening of foundations.

10.4.7 Within the footprints of former opencasts an alternative foundations will be required. In the absence of ground investigation data it is difficult to provide firm recommendations, however it is expected that foundations could comprise: stiffened strips/rafts constructed on re-engineered made ground or piled foundations socketed into bedrock at the base of the opencasts.

10.4.8 It should be noted that piles should not be seated above underground workings which have been treated by drill and grouting. Consequently, should drill & grout have occurred then piles should be advanced to seat below the workings; this is likely to necessitate pre-boring and poses a potentially significant cost beyond the 'standard' cost of piling.

10.5 Highways

10.5.1 Natural Residual Soils should yield a CBR of at least 3%. This value should be verified prior to or during construction.

10.5.2 Deep made ground is anticipated within the former opencasts and early consultation with the adopting authority, regarding the specification of the highways, is strongly recommended.

10.5.3 Made ground should be assumed to be highly variable in terms of both composition, and strength/density. Consequently, subject to the findings of the ground investigation, where made ground is present its full thickness (up to a maximum of 3m (in line with development platform earthworks) from existing ground level or proposed highway formation, whichever is the lower) should be excavated and either:

- Replaced with suitable aggregate in accordance with Series 600 (Earthworks) of The Highways Agency (HA) "Specification for Highway Works" 1998; or
- Screened, to allow selection of suitable material, before being replaced in engineered layers (in accordance with Series 600). Unsuitable materials include any soft or wet materials, biodegradables including topsoil, wood, scrap metal, frozen material and oversize.

10.6 Highways crossing highwalls

10.6.1 It is anticipated that adoptable highwalls will cross the line of buried highwalls both across the area of the proposed development and along the proposed spine road.

10.6.2 At all locations where highways cross a buried highwall, the following precautions are recommended to protect highway and drainage infrastructure from damage due to differential settlement.

- The made ground should be excavated over the full width of the adoptable highway to at least 1.0m below deepest sewer invert
- The base of the excavation (1.5m below sewer invert) should be reinforced with two layers of Tensar Triax TX160 (or equivalent) geogrid sandwiched within at least 300mm of suitable aggregate (i.e. nominally 75mm aggregate, geogrid, 150mm aggregate, geogrid and then another 75mm aggregate).

10.6.3 A minimum length of 10m either side of any highwalls associated with the former quarry should be treated to the above specification, although the final specification should be agreed with the adopting authority.

10.6.4 If any deep excavation beneath a highway results in sub-formation slopes greater than 1v:5h, the sub-formation should be stepped (max. 0.5m high) and benched (min. 1m wide). Where excavation works exceed 1m in depth, the footprint of earthworks should be extended beyond the highway footprint a minimum of 1m, plus the depth of excavation. The Engineer will keep records of any such work undertaken.

10.6.5 Some refinement of the above advice might be possible after highways design (with consideration of the proposed formation level cf existing ground level), and via inspection (and usually CBR testing) of the proposed formation during site preparatory groundworks.

10.7 External works

10.7.1 Given the topography of the site some regrade is anticipated to create development platforms and terraces, although levels have yet to be finalised.

10.7.2 Careful consideration will need to be given to earthworks design, and implications for slope stability, induced settlement, retaining walls, foundations, highway gradients and drainage

10.7.3 Any digital terrain modelling undertaken, or commissioned, by Strata should consider implications for the foundation recommendations.

10.7.4 When designing retaining walls, consideration should be given 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.

10.8 Soakaways & drainage

10.8.1 Given anticipated ground conditions, soakaways are considered unlikely to provide a viable solution for the disposal of surface water.

10.8.2 Alternative SuDS options (see CIRIA C753[6] for further details) include:

- Swales – linear grassed features in which surface water can be stored or conveyed.
- Basins - a ground depression designed to store surface water that is normally dry, except during and immediately following a rainfall event. There are two types:
  - Infiltration – basin designed to store runoff and infiltrate it gradually into the ground.
  - Detention – an outlet restricts flows, so that the basin fills and provides attenuation.
- Ponds – designed to have permanent pool of water, but with capacity to provide temporary storage-controlled discharge.

10.8.3 Yorkshire Water have published a guide[7] for developers and designers outlining their design requirements for surface water attenuation assets.

10.8.4 With respect to detention basins, which should normally be dry, water table levels should be taken from borehole monitoring wells over 4 consecutive seasons, for at least 3 points in the basin 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.

10.9 Contamination

10.9.1 The site's environmental setting is considered to be of moderate sensitivity. With respect to human health, the proposed end use (residential) is also sensitive.

10.9.2 Based on observations made during the site walkover, and given site's former and recent uses, made ground is anticipated, and it is considered likely that some (probably minor) ground contamination will be present in shallow soils.

10.9.3 Consequently, a ground investigation is required in order to assess the degree and extent of any ground contamination, and enable the preparation of a Remediation Strategy.

10.10 Potential development constraints

10.10.1 The site slops down to the northeast. Some regrade of site levels comprising cut and fill is anticipated to create level development terraces, although to date final levels have not been confirmed.

10.10.2 Some 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.

[6] *CIRIA C753 (2015) – The SuDS Manual.*
[7] *Design Requirements for Surface Water Attenuation Assets, February 2017.*

10.10.3 It would be prudent to allow flexibility in the groundworks programme to take advantage of any prolonged dry/warm weather (typically between May and September) to enable footings to be cast and blockwork brought up to DPC level well in advance of the build programme (i.e. so it is never necessary to dig deep footings in winter/early spring, when the groundwater table is likely to be higher).

10.10.4 Overhead electrical utilities cross the far-north and these present 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.

10.10.5 Areas of former opencast coal extraction are present with made ground of up to 44m depth beneath the proposed development footprint. Deep made ground shall require alternative foundation solutions for plots inside the area of opencast. Further areas of deep (>2.5m) made ground are present outside the former opencast which shall also require alternative foundation solutions.

10.10.6 The former opencasts are bound by buried highwalls and any plots close to/spanning the highwall will require additional consideration and design of their foundations to allow for differential settlement.

10.11 Further investigation

10.11.1 Whilst the site is considered suitable for its current and proposed use, the proposed change in use will require intrusive investigation.

10.11.2 This would include:

- Machine-excavated trial pits to determine near surface ground conditions including depth to bedrock, the presence of obstructions, groundwater and stability.
- Trial trenches to locate buried opencast highwalls.
- Cable percussion and rotary cored boreholes to retrieve geotechnical samples and data from depth.
- Rotary open probeholes to investigate the potential for shallow underground workings and to determine the line and profile of buried highwalls.
- Geotechnical soils analysis with grading and compaction testing to inform the design of appropriate cut & fill earthworks, and to enable foundation recommendations
- Chemical testing on soil and if necessary groundwater, samples to assess the significance of contamination, if any, as a result of former industrial land use
- Gas monitoring and risk assessment

10.11.3 An appropriate ground investigation strategy is presented in Section 9.

Appendix A

General Notes

01 - Environmental setting
Generic notes – geoenvironmental Investigations

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 though 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 BR211[1] and the Public Health England 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 Health Protection Agency (HPA) in 2005 the HPA updated NRPB advice in July 2010[2]. The HPA became part of Public Health England in 2013.

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 NRPB first indicated which parts of the country should be regarded as radon Affected Areas in 1990. A more detailed mapping method was developed by the HPA in conjunction with the British Geological Survey in 2007[3]. 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 Public Health England 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.

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[1] BRE Report BR211 2015: Radon: guidance on protective measures for new buildings.

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

[3] Miles JCH Appleton JD Rees DM Green BMR Adlam KAM and Myers AH (2007). Indicative Atlas of Radon in England and Wales. Chilton HPA-RPD-033.

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.

Appendix B

Drawings

Reproduced from OS Explorer map 1:25,000 scale by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. Crown copyright. All rights reserved. Licence number 100049696.

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

CLIENT	JOB TITLE	DRAWING TITLE
STRATA HOMES	BARNSLEY WEST LAND TRANSFER 2	SITE LOCATION PLAN

DRAWN	DATE
GLM	08/09/2022
CHECKED: AG	DATE: 08/09/2022

STATUS: FOR COMMENT ☐ FOR APPROVAL ☐ DRAFT ☐ FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
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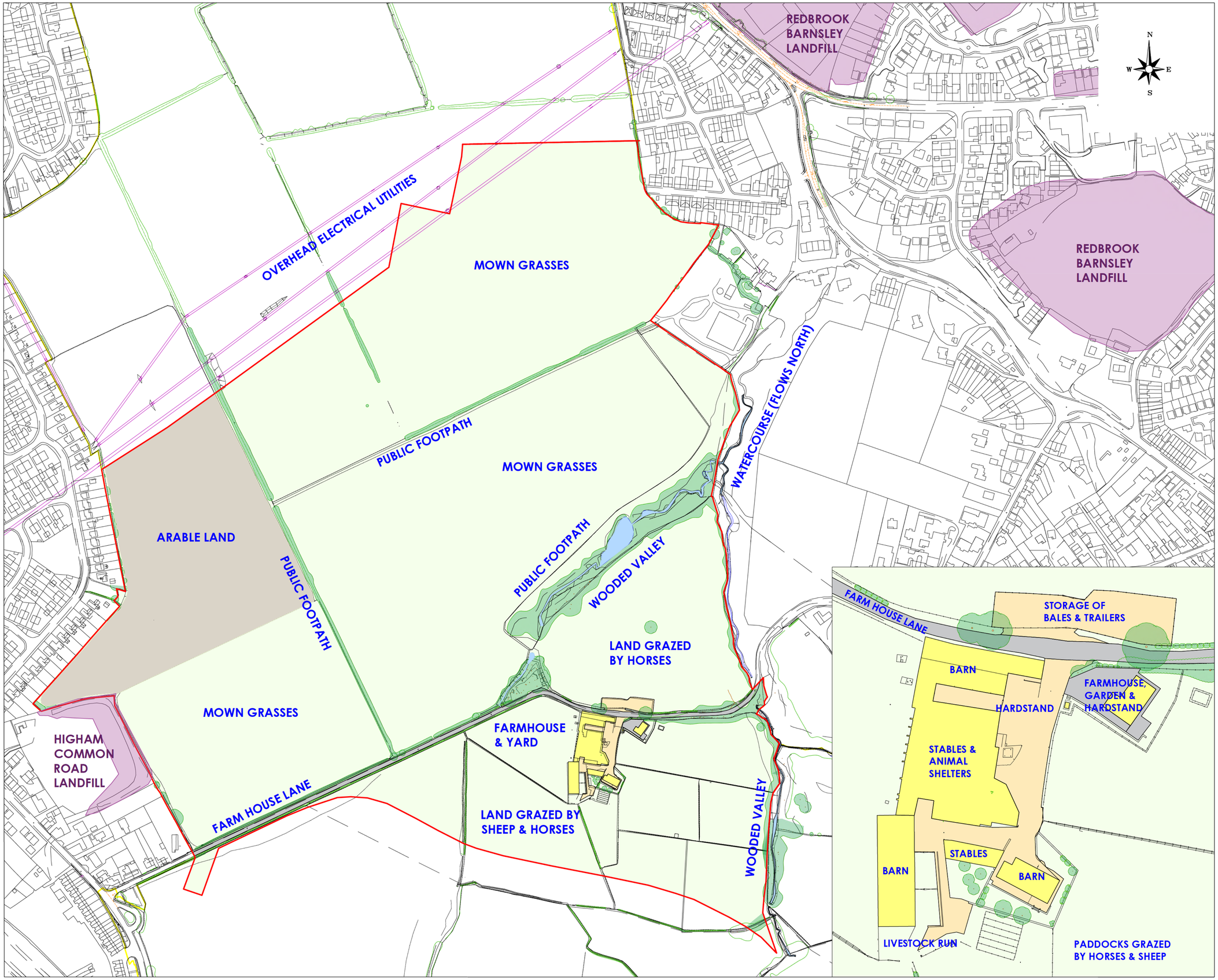

NOTES

- GRASS & OVERGROWN AREAS
- ARABLE FARMLAND
- BUILDING
- MACADAM SURFACING
- HARDSTAND
- SURFACE WATERS
- TREES & WOODLAND
- AREA OF KNOWN LANDFILL
- APPROXIMATE SITE BOUNDARY

REV	DESCRIPTION	DATE

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CLIENT

STRATA HOMES

JOB TITLE

BARNSLEY WEST
LAND TRANSFER 2

DRAWING TITLE

SITE FEATURES

DRAWN	DATE	STATUS
GLM	23/09/2022	FOR COMMENT ☐
		FOR APPROVAL ☐
CHECKED	DATE	DRAFT ☐
AG	23/09/2022	FINAL ☑

SCALE	SHEET	DRAWING NO	REVISION
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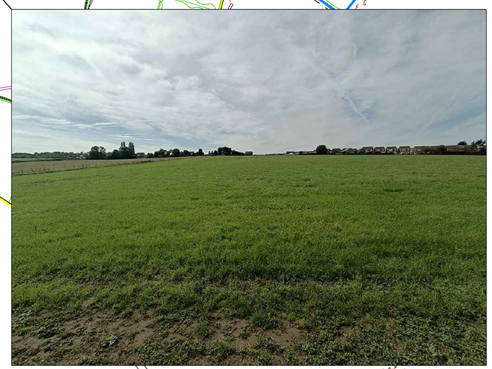

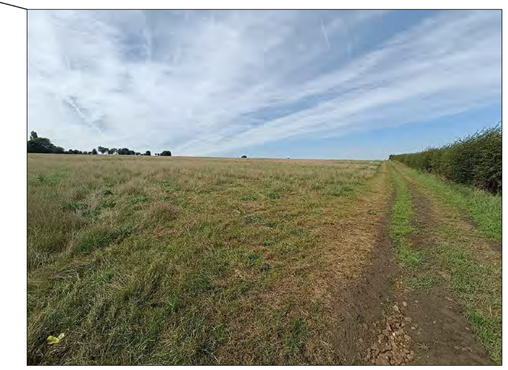

NOTES

- GRASS & OVERGROWN AREAS
- ARABLE FARMLAND
- BUILDING
- MACADAM SURFACING
- HARDSTAND
- SURFACE WATERS
- TREES & WOODLAND
- APPROXIMATE SITE BOUNDARY
- LOCATION & ORIENTATION OF PHOTOGRAPH

REV	DESCRIPTION	DATE

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CLIENT

STRATA HOMES

JOB TITLE

BARNSLEY WEST
LAND TRANSFER 2

DRAWING TITLE

SITE PHOTOGRAPHS

DRAWN	DATE	STATUS
GLM	23/09/2022	FOR COMMENT ☐
		FOR APPROVAL ☐
CHECKED	DATE	DRAFT ☐
AG	23/09/2022	FINAL ☑

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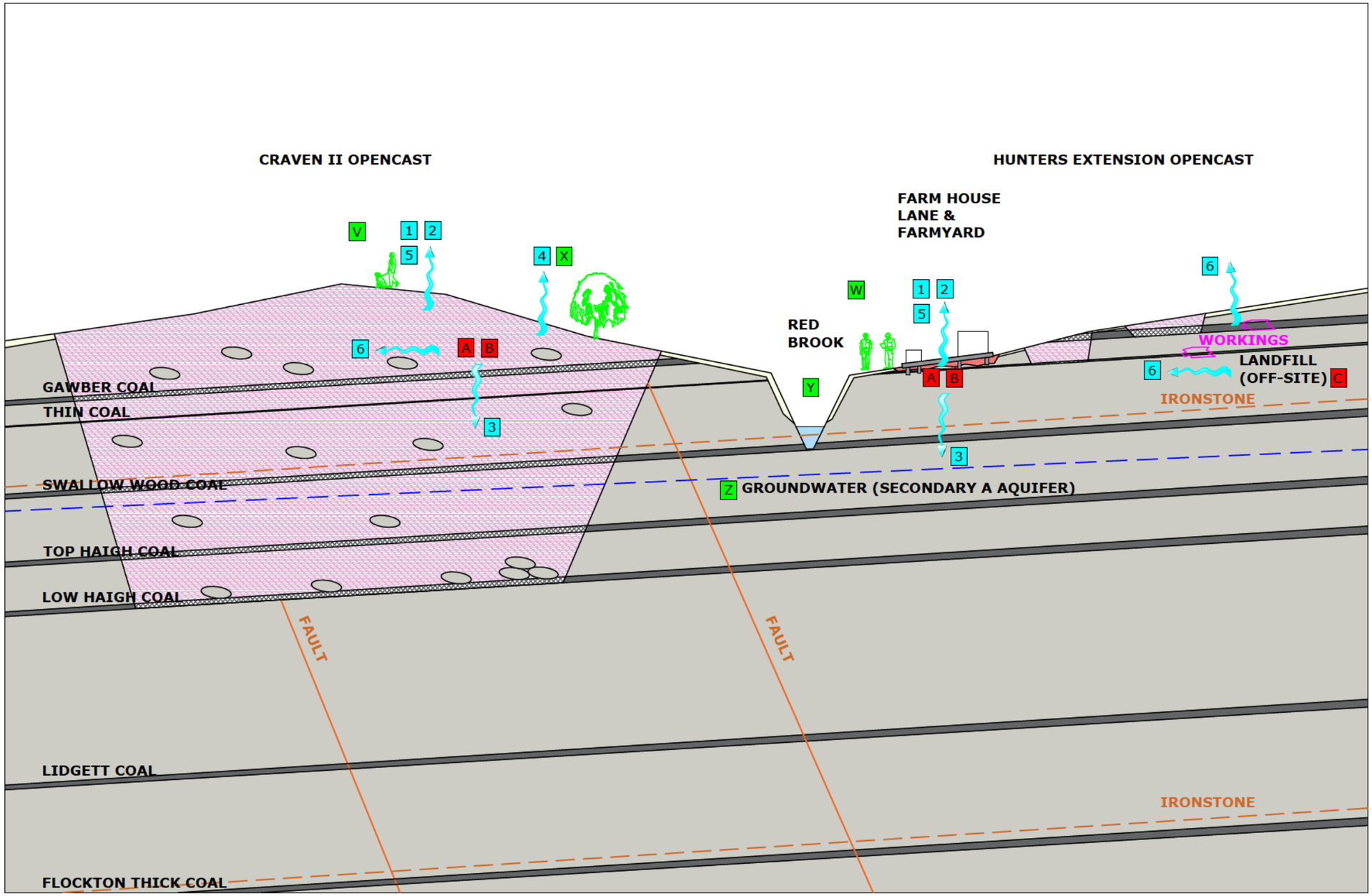

KEY
MADE GROUND
OPENCAST BACKFILL
TOPSOIL
LOWER COAL MEASURES

SOURCES
A MADE GROUND (INORGANICS)
B LEAKAGE/SPILLAGE (ORGANICS)
C LANDFILL (OFF-SITE)

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 SURFACE WATERS
Z GROUNDWATER

NOTES

REV.	DESCRIPTION	DATE

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JOB TITLE
BARNSLEY WEST
LAND TRANSFER 2

DRAWING TITLE
PRELIMINARY CONCEPTUAL SITE MODEL

DRAWN	DATE	STATUS
GLM	26/09/2022	FOR COMMENT ☐
CHECKED: AG	DATE: 26/09/202	FOR APPROVAL ☐
		DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	4561/5	

NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM COAL AUTHORITY ABANDONMENT PLAN REF. NE59 SHOWING OPENCAST WORKINGS AT THE HUNTERS COTTAGE OPENCAST. DATED 1931

REV.	DESCRIPTION	DATE

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CLIENT

STRATA HOMES

JOB TITLE

BARNSLEY WEST
LAND TRANSFER 2

DRAWING TITLE

COAL MINING ABANDONMENT
PLAN REF. NE59

DRAWN	DATE	STATUS
GLM	26/09/2022	FOR COMMENT ☐
		FOR APPROVAL ☐
CHECKED	DATE	DRAFT ☐
AG	26/09/2022	FINAL ☑

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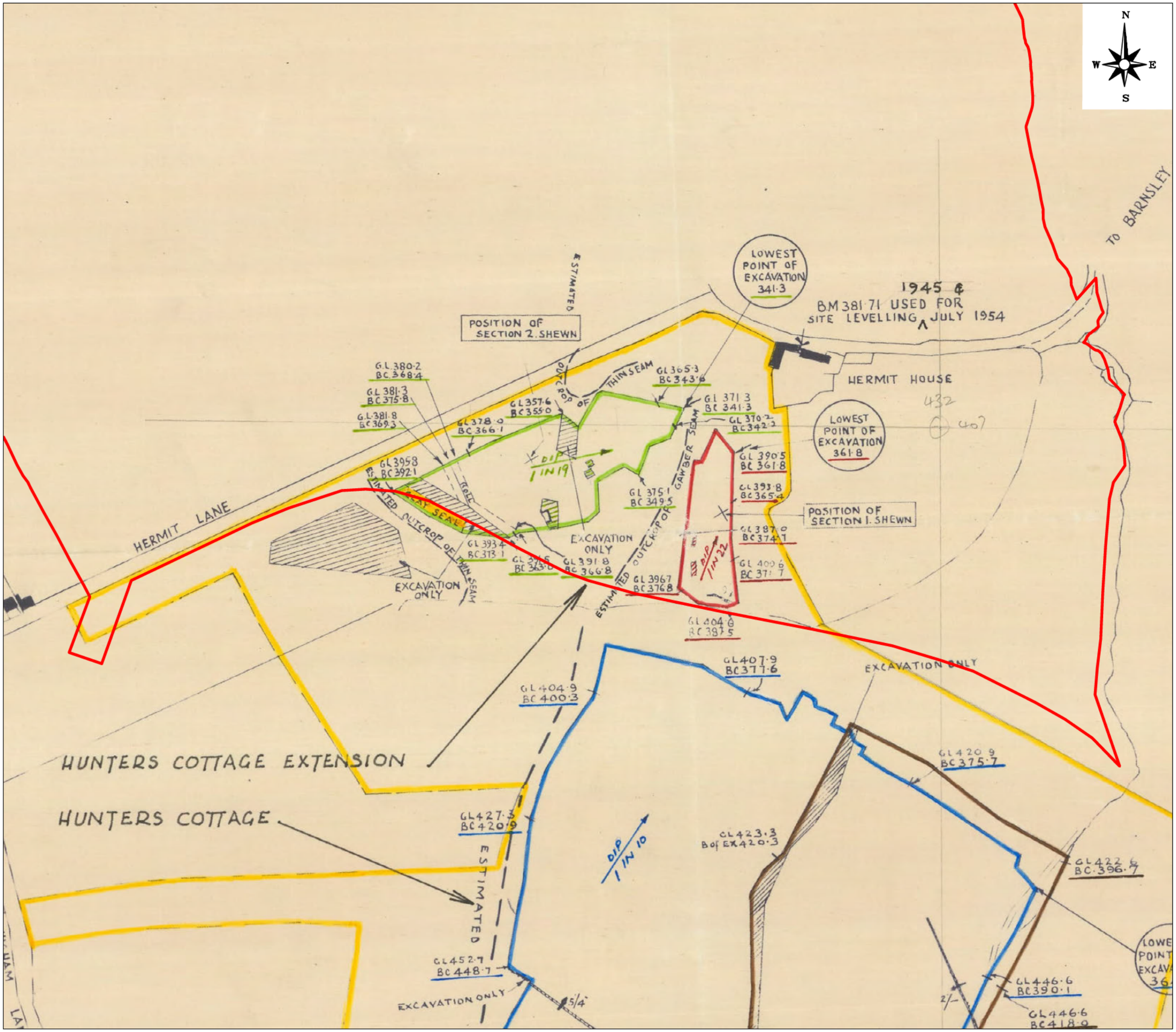

NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM COAL AUTHORITY ABANDONMENT PLAN REF. NE375 SHOWING OPENCAST WORKINGS AT THE HUNTERS COTTAGE & HUNTERS COTTAGE EXTENSION OPENCASTS DATED 1956.

REV.	DESCRIPTION	DATE

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JOB TITLE

BARNSLEY WEST
LAND TRANSFER 2

DRAWING TITLE

COAL MINING ABANDONMENT
PLAN REF. NE375

DRAWN	DATE	STATUS
GLM	26/09/2022	FOR COMMENT ☐
		FOR APPROVAL ☐
CHECKED	DATE	DRAFT ☐
AG	26/09/2022	FINAL ☑

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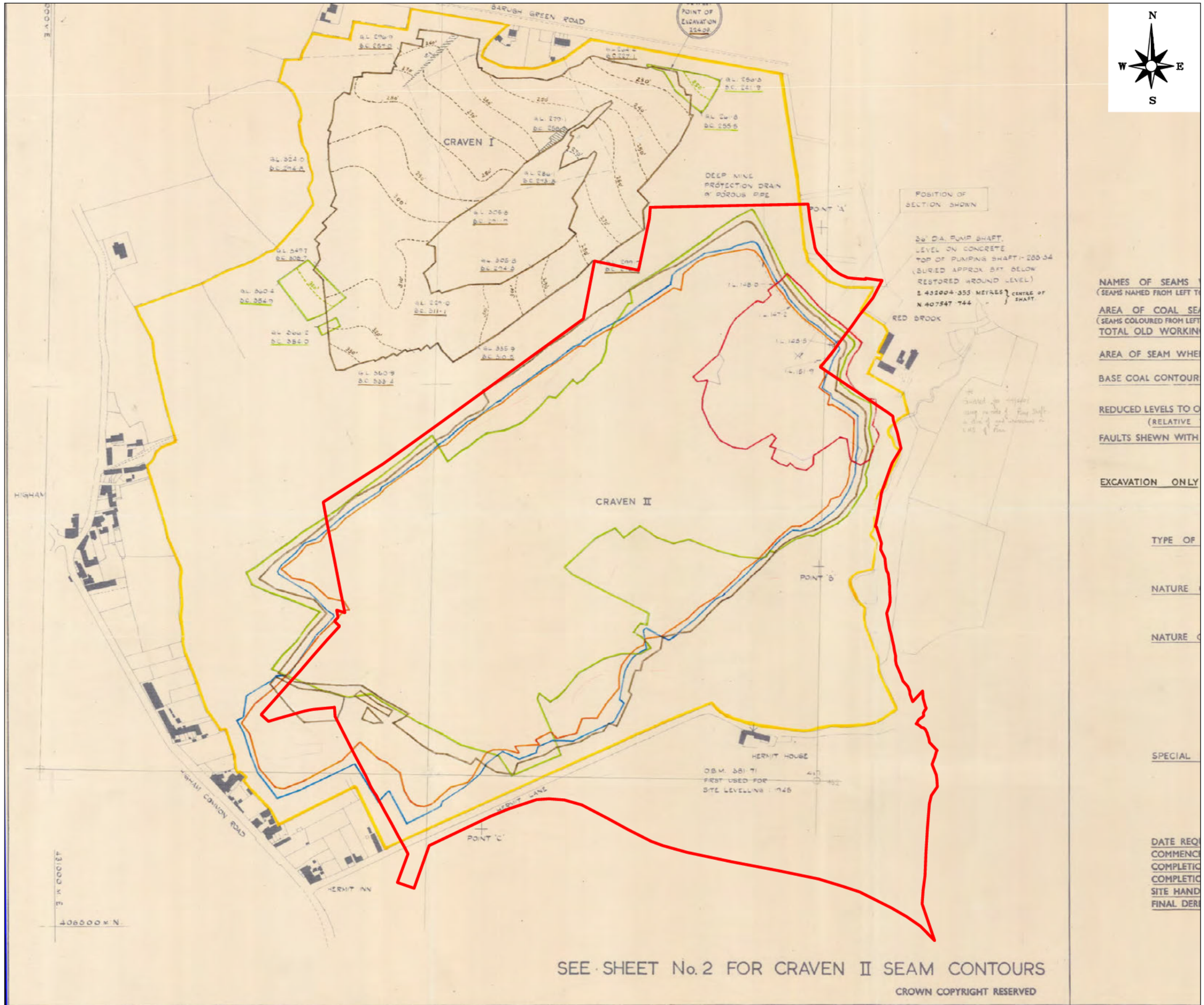

SEE SHEET No. 2 FOR CRAVEN II SEAM CONTOURS

CROWN COPYRIGHT RESERVED

NATIONAL COAL BOARD
OPENCAST EXECUTIVE
86/87 JERMYN STREET

LAND SURVEY BRANCH
DRAWN BY: J. PALMER
DATE: 1ST MAY 1964
CHECKED BY: J. G. R.

NAME OF ZONE
OR CONTRACT

NAME OF SITE
C R A

NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM COAL AUTHORITY ABANDONMENT PLAN REF. NE498 SHEET 1 OF 3 SHOWING OPENCAST WORKINGS AT THE CRAVEN I & CRAVEN II OPENCASTS DATED 1964.

REV.	DESCRIPTION	DATE

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CLIENT
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JOB TITLE
BARNSLEY WEST
LAND TRANSFER 2

DRAWING TITLE
COAL MINING ABANDONMENT
PLAN REF. NE498 SHEET 1 OF 3

DRAWN	DATE	STATUS
GLM	26/09/2022	FOR COMMENT ☐
		FOR APPROVAL ☐
CHECKED	DATE	DRAFT ☐
AG	26/09/2022	FINAL ☑

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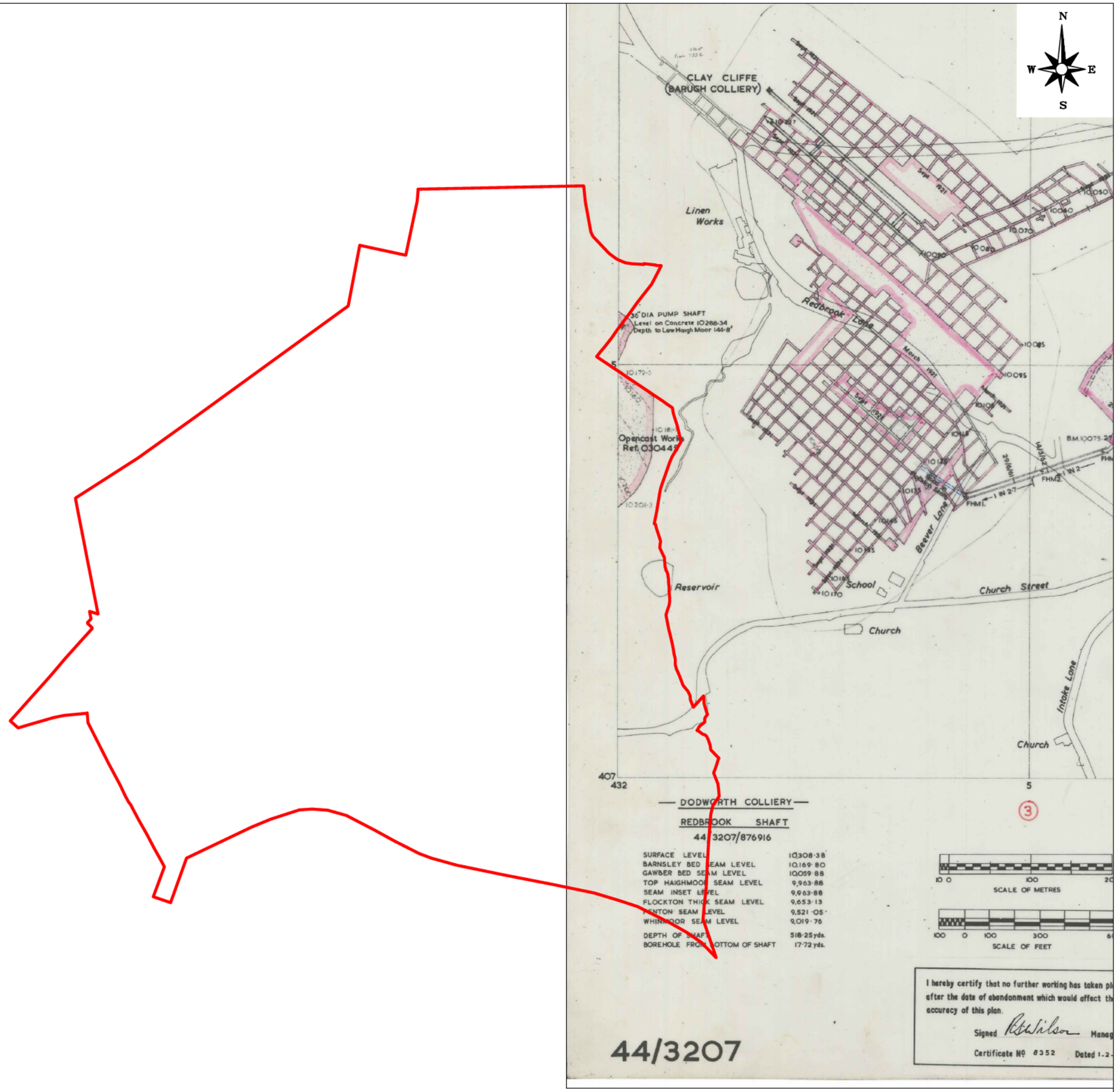

NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM COAL AUTHORITY ABANDONMENT PLAN REF. NE763 SHEET 1 OF 3 SHOWING UNDERGROUND WORKINGS IN THE TOP HAIGH MOOR COAL SEAM FROM DODWORTH COLLIERY DATED 1957.

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

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JOB TITLE

BARNSLEY WEST
LAND TRANSFER 2

DRAWING TITLE

COAL MINING ABANDONMENT PLAN REF. NE763 SHEET 1 OF 3

DRAWN	DATE	STATUS
GLM	26/09/2022	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	26/09/2022	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:5,000	A3	4561/8d	

NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM COAL AUTHORITY ABANDONMENT PLANS REF'S NE584-44006, -443007, -443206 & 443207 SHOWING UNDERGROUND WORKINGS IN THE FLOCKTON THICK COAL SEAM FROM DODWORTH COLLIERY DATED 1960.

REV.	DESCRIPTION	DATE

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CLIENT

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JOB TITLE

BARNSLEY WEST
LAND TRANSFER 2

DRAWING TITLE

COAL MINING ABANDONMENT
PLANS REF. NE584

DRAWN	DATE	STATUS
GLM	26/09/2022	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	26/09/2022	DRAFT ☐
		FINAL ☑

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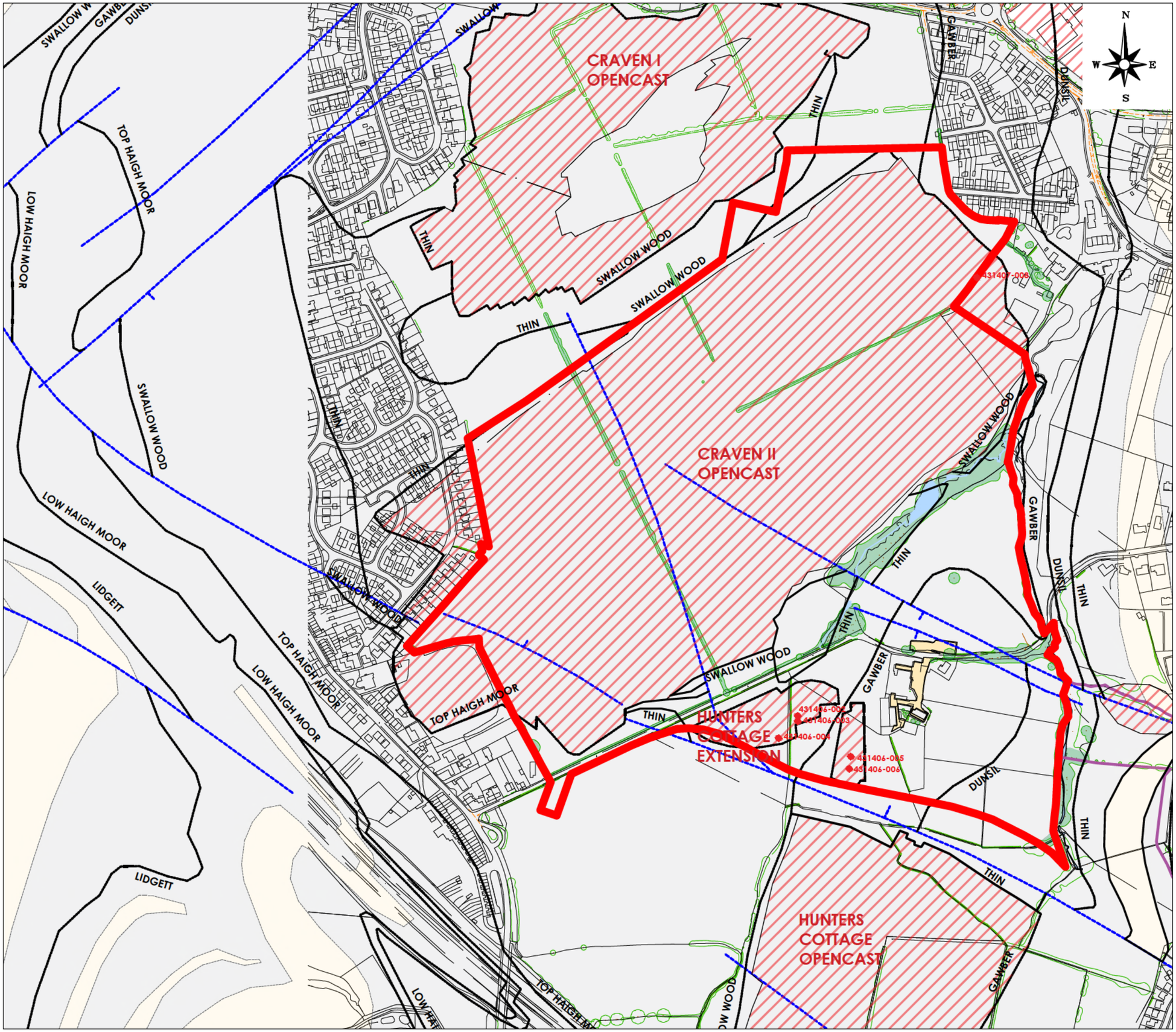

NOTES

- KNOWN MINE ENTRY (BASED ON COAL AUTHORITY CO-ORDINATES)
- AREA OF MADE GROUND
- LOWER COAL MEASURES; INTERBEDDED MUDSTONE, SILTSTONE & SANDSTONE
- LOWER COAL MEASURES; SANDSTONE UNIT
- APPROXIMATE LINE OF FAULT
- APPROXIMATE COAL SEAM OUTCROP
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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Tel 01937 545330

CLIENT

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JOB TITLE

BARNSLEY WEST
LAND TRANSFER 2

DRAWING TITLE

GEOLOGY & MINING FEATURES

DRAWN	DATE	STATUS
GLM	26/09/2022	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	26/09/2022	DRAFT ☐
		FINAL ☑

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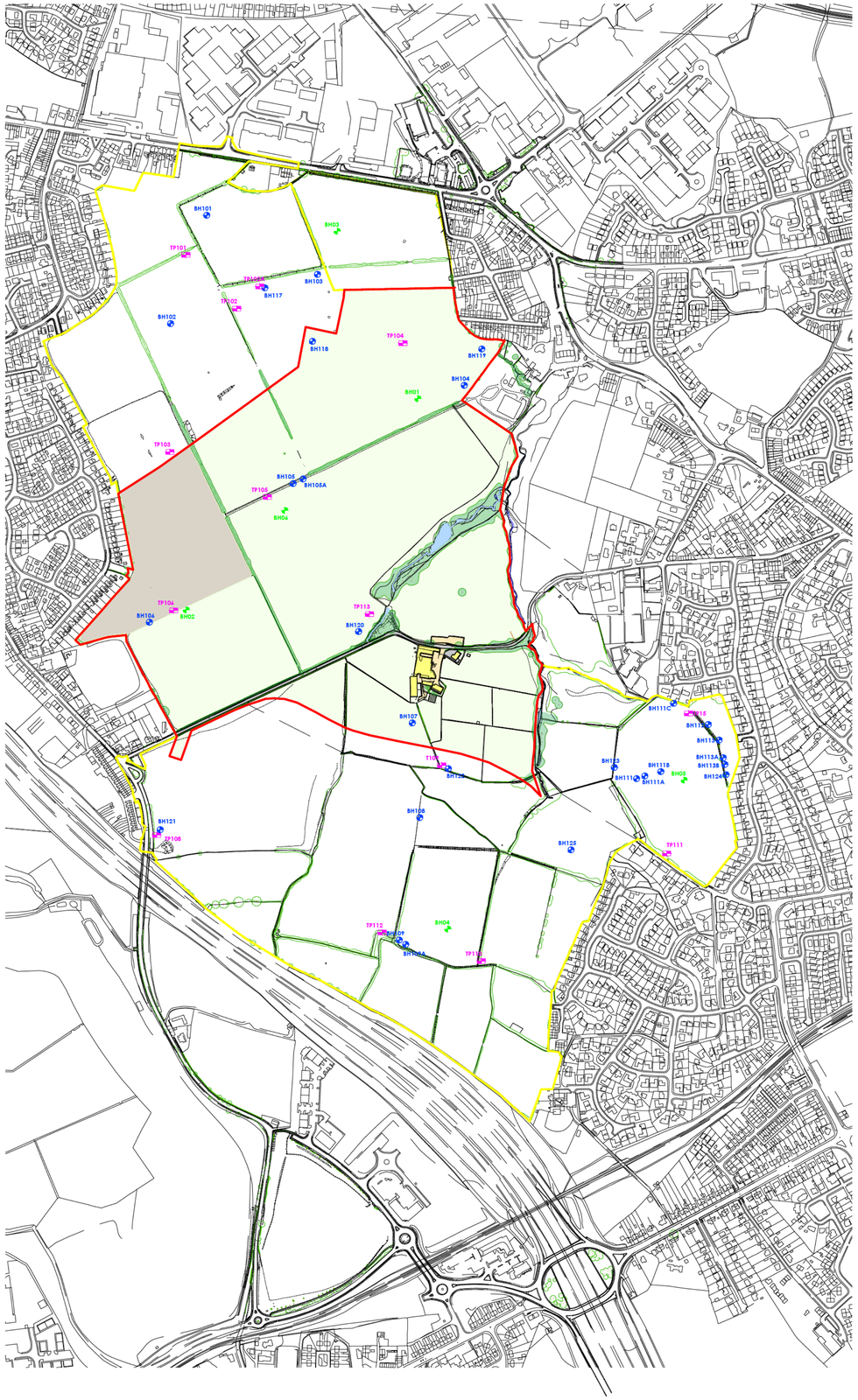

N
W E
S

NOTES

- JPG TRIAL PIT LOCATION
- JPG BOREHOLE LOCATION
- EASTWOODS BOREHOLE LOCATION
- APPROXIMATE WIDER SITE BOUNDARY CONSIDERED IN 3RD PARTY REPORTS
- APPROXIMATE CURRENT SITE BOUNDARY

REV	DESCRIPTION	DATE

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JOB TITLE

BARNSLEY WEST
LAND TRANSFER 2

DRAWING TITLE

3rd PARTY EXPLORATORY HOLE LOCATIONS

DRAWN	DATE	STATUS
GLM	27/09/2022	FOR COMMENT ☐
		FOR APPROVAL ☐
CHECKED	DATE	DRAFT ☐
AG	27/09/2022	FINAL ☑

SCALE	SHEET	DRAWING NO	REVISION
1: 5,000	A1	4561/10	

Appendix C

Commission

032/3104/AG

23rd August 2022

Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330

www.lithos.co.uk

Mr A Bradley
Strata Homes Ltd
Quay Point
Lakeside Blvd
Doncaster
DN4 5PL

Dear Andrew

Barnsley West – Land Transfer 2 & Commercial Area – Desk Study

Further to your recent invitation, please find below our proposal for preparing a geotechnical and environmental desk study appraisal for the above two sites. It is understood that the site consists of two parcels of land, with Land Transfer 2 (residential) approximately 42 hectares, whilst the commercial parcel is approximately 41 hectares. The residential parcel is located to the north of Hermit Lane, and the commercial parcel to the south, both currently used for agricultural purposes.

We understand that your proposed development is going through the planning process, with initial objections raised by the Coal Authority (CA). The two desk studies and subsequent site investigation design should enable the CA to either withdraw their objection or recommend relevant planning conditions be set associated with shallow mining investigations and coal mining risk assessments.

Brief examination of the relevant geological map and the CA interactive viewer suggests:

- Both parcels are underlain by the Pennine Middle Coal Measures
- The majority of Land Transfer 2 (residential) is occupied by the former Craven II opencast, which extracted the Thin, Swallow Wood, Top Haigh Moor and Low Haigh Moor coal seams.
- The former Hunters Cottage Extension opencast also occupies the south eastern part of Land Transfer 2, which extracted the Thin coal.
- The central third of the commercial area is occupied by the former Hunters Cottage opencast, which extracted the Thin, Swallow Wood & Top Haigh Moor coal seams.
- There is the potential for shallow mine workings to exist beyond the footprint of the former opencasts, and also beneath the base.

This site 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), and therefore a mining report will be obtained. Review of the CA's interactive viewer suggests abandonment plans should be available for the former opencast and any known shallow mineworkings beneath the site, we will obtain copies of these plans. There are also around 7 recorded mine entries, and we will also obtain CA data relating to these.

Our report will include a mining risk assessment (desk-based) that should satisfy the Coal Authority.

Environmental search data and historical maps, obtained from Landmark or Groundsure, will be reviewed in order to determine whether any past land uses have had any effect on the proposed development. In addition, we will visit site to review current operations and undertake a walkover survey. Due to the size of each parcel (>40 ha each), the environmental search data & CA report costs are much higher than normal.

Internet data suggests the site lies in an area where the risk of encountering UXO is considered low.

The report will include preliminary recommendations with respect to mining, foundations, contamination and hazardous gas. Our report will be in a format familiar to Barnsley MDC & the CA, and therefore suitable for submission in support of an outline planning application.

If necessary, the report will also include recommendations for an appropriate, intrusive ground investigation, together with a costed proposal.

It is anticipated that a final bound report will be available within 3 to 4 weeks of receiving your written instruction to proceed. Our lump sum fee for provision of these reports is £*** plus VAT for Land Transfer 2 (residential) and £*** plus VAT for the commercial parcel.

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

[redacted]

Adam Gomboc
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 Quantities calculations letters e-mails faxes memoranda films and photographs (including negatives) or any other form of record prepared or provided or received by or on behalf of 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 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 license 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 liabi ities for negligence under this Agreement with a limit of indemnity of £5 000 000 (FIVE MILLION POUNDS) any one claim save for po lution 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 neg igence 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 bu ldings 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 sha l 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

Chris Ryan

Subject: FW: 2021/1090 COal Authority - Desk Study Quote [3104]

From: Adam Gombocz
Sent: 06 September 2022 09:13
To: Andrew Bradley [redacted]
Cc: Angus Niven [redacted] George Morton [redacted]
Subject: RE: 2021/1090 COal Authority - Desk Study Quote [3104]

Morning Andrew,

Thanks for the instruction, we will make a start.

We can undertake the walkover next week (Tuesday) following our site meeting.

The report will take some time to pull together due to the size and complexity, we will aim to issue by the end of September.

Kind regards,

Adam Gombocz
Director
Lithos Consulting Ltd
[redacted]
www.lithos.co.uk

From: Andrew Bradley [redacted]
Sent: 01 September 2022 12:48
To: Adam Gombocz [redacted]
Cc: Angus Niven [redacted]
Subject: RE: 2021/1090 COal Authority - Desk Study Quote [3104]

Adam

Please proceed with the residential parcel study.

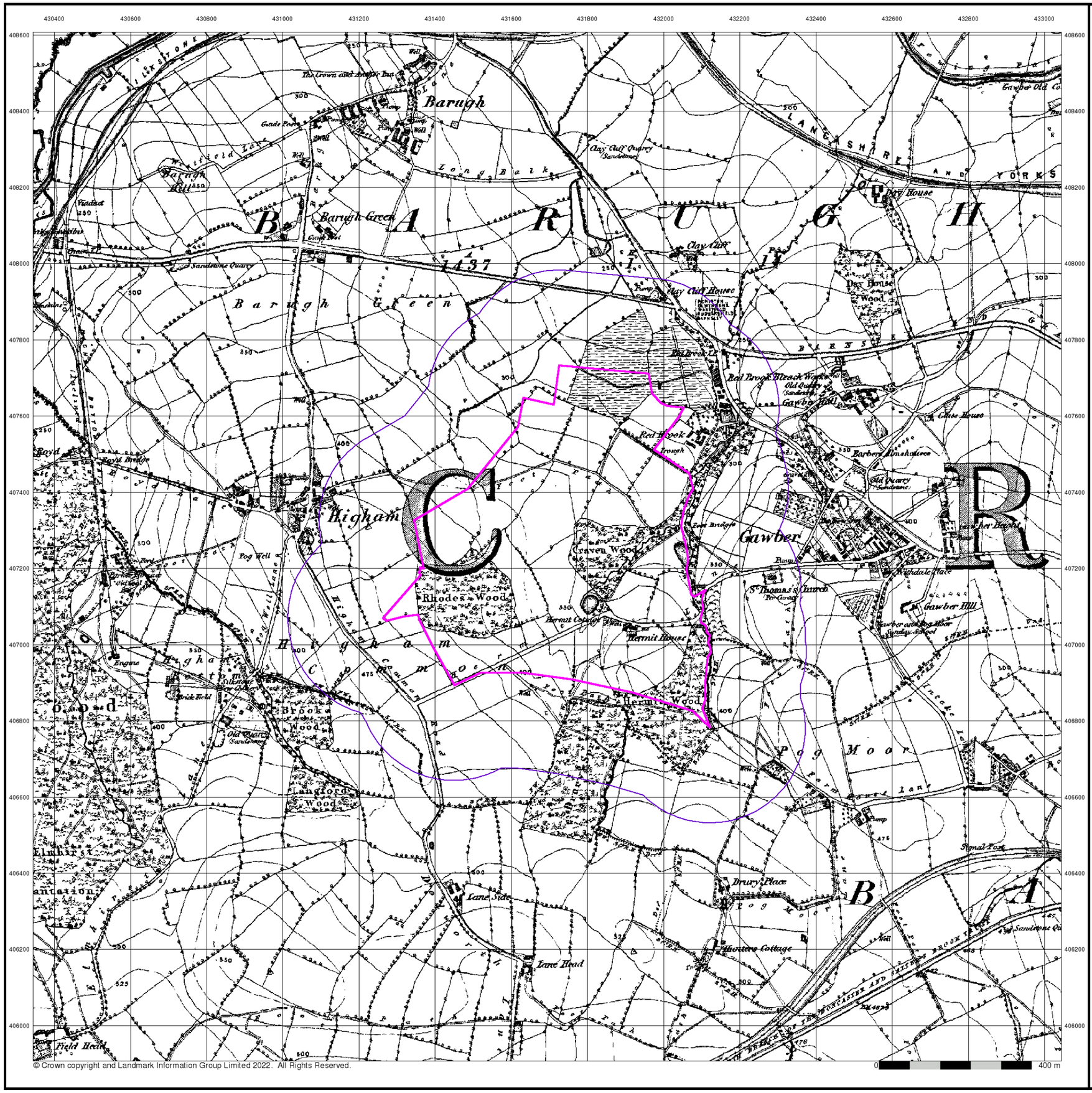
Can you confirm an issue date please?

Many thanks

Andrew

Appendix D

Historical OS Plans



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LITHOS CONSULTING

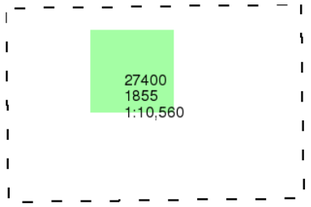
Yorkshire

Published 1855

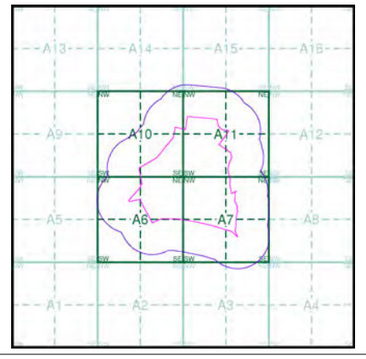
Source map scale - 1:10,560

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; these maps were used to update the 1:10,560 maps. The published date given therefore 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. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and o her strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued un il recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



N

Order Details

Order Number:	301637106_1_1
Customer Ref:	4561
National Grid Reference:	431760, 407230
Slice:	A
Site Area (Ha):	49.34
Search Buffer (m):	250

Site Details

Barnsley West, Land Transfer 2

Landmark INFORMATION GROUP
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