

A photograph of a stream bed with rocks and green algae, partially covered by a green mesh net. The text "Preliminary Geoenvironmental Investigation" is overlaid in white.

Preliminary Geoenvironmental Investigation

Land at Barugh Green For Countryside Properties

Report no: 3407/1B

Date: August 2020



BARUGH GREEN SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	3407	Site area/ha	4.9
Client:	Countryside Properties	NGR:	SE 318 078
Site:	Barugh Green	Nearest postcode:	S75 1JY

The site is located off Barugh Green Road, approximately 3km northwest of Barnsley town centre, and currently comprises grassed fields used as grazing pasture.

Lithos were commissioned by Countryside Properties to provide a preliminary geoenvironmental appraisal of the site. It is understood that the site is to be redeveloped with housing; a proposed layout has been prepared.

Lithos' investigation included an inspection of historical and geological maps and information provided by the BGS, Landmark and the Coal Authority. 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	About 2.6 ha in the west was subject to opencast mining in the early 1950s.
Hazardous gas	There are known areas of landfilling within 250m, and the south and west of the site are underlain by areas of deep opencast backfill. Gas monitoring and risk assessment will be required.
Mining & quarrying	The majority of this site (south and west) is located within a Coal Mining Development High Risk Area. There are no known shallow mineworkings, but unrecorded workings may be present both in the east and beneath the base of the opencast in the centre and west. Extensive opencast workings (Craven I) of the Swallow Wood and the Thin coals, are shown in the west of the site (c. 2.6ha; 55% of the site's total area), extending beyond the western boundary. Further opencast workings (Craven II) to the south of the site are shown to encroach within the southern boundary (c. 340m ² ; <1%). Opencast backfill is expected to be a maximum of 11m deep; deepest in the north-east.
Flooding & drainage	The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low. Given the presence of deep opencast backfill, soakaways will not provide a viable solution for the disposal of surface water.
Anticipated ground conditions	Beyond the opencast area: residual soils (completely weathered bedrock) - firm or stiff gravelly clay/clayey gravel. Within the opencast area: deep made ground (up to c. 11m) of variable composition which is likely to include oversize material.
Anticipated contamination	It is considered likely that some (probably minor) ground contamination will be present in the opencast backfill.
Anticipated foundation solutions	Beyond the opencast area: plots can be founded on traditional strip/trench-fill foundations. Within the opencast area: Fill thicknesses mean that consideration can be given to a piled foundation solution and/or reinforced strip footing. If piled foundations are adopted for plots underlain by opencast backfill there should be a reduced need for further significant geotechnical analysis / modelling. Conversely, if reinforced strips (or rafts) are preferred, more rigorous assessment will be required.
Recommendations for ground investigation	An appropriate ground investigation strategy has been designed. However, the proposed scope should be reviewed in light of the preferred foundation solution (shallow reinforced strips or piles) and more rigorous geotechnical review.

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APPENDICES

Appendix A – General notes

01	Environmental setting
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Appendix B – Drawings

Drawing	Revision	Title
3407/1	-	Site location plan
3407/2	A	Proposed layout
3407/3	-	Site features
3407/4	-	Site photos
3407/5	-	Preliminary conceptual site model
3407/6	-	Exploratory hole location plan
3407/7	-	Published geology & coal outcrops
3407/8	-	Craven I & II opencast abandonment plan
3407/9	-	Flockton Thick Coal abandonment plan

Appendix C - Commission

Appendix D – Historical OS plans*

Appendix E – Search responses*

From	Date	Content
Landmark	2 nd April 2019	Envirocheck report
Coal Authority	2 nd April 2019	Mining report

* Some of this data is not included within the paper or PDF copies of this report; by request, it can be provided on a CD.

FOREWORD (preliminary geoenvironmental investigation report)

This report has been prepared for the sole use and reliance of the Client named on page 1 and cannot be relied upon by any other parties without the express written authorisation of Lithos Consulting Limited (Lithos). Any unauthorized third party relies on this report at their own risk and the authors owe them no duty of care.

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 sheets of paper in the hard copy to a minimum, some information (e.g. full copy of the Landmark/Groundsure Report) is only included within the "electronic", PDF Report on the accompanying CD.

The findings and opinions conveyed in any Desk Study section of the report (including review of any third party reports) are based on information obtained from the sources listed, which Lithos understands are reliable. Reasonable skill, care and diligence has been applied in examining the information obtained. However, Lithos accept no responsibility for inaccuracies in the data supplied or for opinions based on any such inaccurate data.

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

PRELIMINARY GEOENVIRONMENTAL INVESTIGATION OF LAND AT BARUGH GREEN

1 INTRODUCTION

1.1 The commission and brief

- 1.1.1 Lithos Consulting were commissioned by Countryside Properties to carry out a preliminary investigation of land at Barugh Green.
- 1.1.2 Lithos have previously issued an Exploratory Investigation Report (dated April 2019). The information contained in Exploratory Investigation has been incorporated within this Report.
- 1.1.3 This document is a revision of the Geoenvironmental Appraisal (Report 3407/1A) issued by Lithos in April 2020; Report 3407/1A is now superseded. This document now takes account of an updated planning layout which has been provided by Countryside with the only significant revisions being made to Drawing 3407/2 and Section 1.2.
- 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 the 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, and the Landmark Information Group, and the Coal Authority. 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 site with 140 storey domestic dwellings, associated gardens, POS and adoptable roads and sewers.
- 1.2.2 A site layout has been provided by Countryside Properties (Drawing reference SKY-004-PL-PL-01, rev. D, dated April 2020) which is reproduced as Drawing No. 3407/2 in Appendix B to this report.

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 3407/1 presented in Appendix B to this report. Site details are summarised in the table below.

Detail	Remarks
Location	3 km northwest of Barnsley town centre
NGR	SE 318 078
Area	4.9 ha (12.1 acres)
Known services	Two sets of overhead electric cables (11kV) cross the southeast trending northeast-southwest

2.2 Site features

- 2.2.1 Lithos completed a walkover survey of the site on 10th April 2019.
- 2.2.2 The site is accessed through a locked gate off Barugh Green Road in the northwest corner and currently comprises a northern grassed field and the northern extent of an adjoining field to the south, used as grazing pasture.
- 2.2.3 A drainage ditch runs along the northern boundary adjacent to Barugh Green Road. An area of waterlogged, boggy ground was noted in the centre north.
- 2.2.4 Hedgerows and (semi)mature trees form the northern, western and southern boundaries of the northern field, with gaps in the southern hedgerow allowing access to the southern field.
- 2.2.5 Existing salient features, at the time of the walkover are presented on Drawing 3407/3 in Appendix B to this report and summarised in the table below.

Feature	Remarks
Current access	Off Barugh Green Road
Topography	Gently falls towards the northeast corner
Approximate areas	49,000m ² grass
Nature of boundaries	North & west – hedgerow and trees East – post & wire fence South – no physical boundary
Surrounding land uses	North – Barugh Green Road with industrial units beyond East – Claycliffe Avenue with housing beyond. South & west – open fields

- 2.2.6 A selection of site photographs is included on Drawing 3407/4.

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	Site	Surrounding land
1855	Open fields with stream crossing northwest corner southwest-northeast	Unnamed road immediately beyond northern boundary Open fields in all directions
1894	No significant changes	Houses immediately northwest and northeast Red Brook Bleach Works 150m east
1906		Bleach works relabelled Linen Works
1933		Chemical works and Barugh Coke & By-product Works 250m northeast
1938		Barugh Green Road beyond northern boundary Residential development immediately beyond eastern boundary off Claycliffe Avenue and Mawfield Road
1956	Overhead electric cable cross southeast corner trending northeast-southwest	Continued expansion of residential area to the east
1966	Stream no longer shown crossing northwest Drain shown running northeast-southwest across centre of site	Large area to the west and south labelled Opencast Workings Linen works, chemical works and Barugh Coke & By-product Works no longer shown Area 150m northeast shown as refuse tip
1970	No significant changes	Engineering works and garage shown immediately beyond Barugh Green Road to the north
1973	Drain and electric cables no longer shown crossing site	Areas to the south and west no longer shown as opencast workings Tip to the northeast shown to be disused
1993	No significant changes	Expansion of works to the north with Industrial Estate shown beyond Area of former tip 150m northeast labelled as Disused Workings
2006		No significant changes
2019	Drain labelled on northern boundary	Significant expansion of industrial estate to the north

- 3.3 Although none of the OS maps indicate opencast mining has taken place on site, it falls within the wider area of the Craven I and II opencasts (see Section 4.2).

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

Issue	Data reviewed	
Geology	1:50,000 BGS map (Sheet 87) 1:10,000 BGS map (Sheet SE30NW)	Drift – None mapped although 'worked-out opencast coal-seam area (backfilled)' shown in centre and west. Solid – Pennine Middle Coal Measures (mudstone, siltstone & sandstone). Shallowest coal seam – Gawber Coal outcrops in the far east with the Swallow Wood Coal at about 15m depth. Further details in Section 4.3 below Strata Dip – Gentle (5°) to the northeast. Faults – none mapped beneath site.
Mining & Quarrying	Coal Authority BGS maps	Further details in Section 4.2 below
Quarrying	Historical OS plans	
Radon	Public Health England	The site lies in an area where between 1% and 3% of homes are estimated to be above the action level.
Hydrogeology	Environment Agency Envirocheck Report	Source Protection Zone? No. Aquifer Secondary A (Solid). Groundwater abstractions? None within 1km. Soil leaching potential - Medium. Pollution incidents? None at or significant to site.
Hydrology		Nearest watercourse(s) – drainage ditch on the northern boundary which flows east. Water quality – Site located within Dearne catchment area from Cawthorne Dyke to Lundwood STW currently rated as ecologically moderate and chemically good. Pollution incidents? None at or significant to site. Abstractions? None within 1km. Discharge consents? Nearest 190m east for storm sewage effluent.
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 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).

4.2 Coal & mining

- 4.2.1 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.
- 4.2.2 The majority of the site (south & west) lies within a High Risk Area - an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc.
- 4.2.3 The remainder of the site lies within a Low Risk Area - within the defined coalfield, but no known defined risks have been recorded by the CA; there may still be unrecorded issues.
- 4.2.4 The 1:10000 BGS map (SE30NW) suggests that the following coal seams underlie the site at shallow depth.

Seam name(s)	Approximate thickness/m	Approximate depth below Gawber/m*	Remarks
Gawber Coal	0.7	-	Outcrops in the far east, and only underlies land in the far east (c. 500m ²).
Thin coal		10	Outcrops in the centre, and underlies land in the eastern half (c. 2.3ha).
Swallow Wood Coal	1.2	15	Outcrops to the west, and underlies the entire site
Top Haigh Moor	1.2	45	This deep seam lies about 30m* below the Swallow Wood, with strata between the two seams likely to comprise Haigh Moor Rock (sandstone)

- 4.2.5 Approximate outcrops are shown on Drawing 3407/7.
- 4.2.6 It should be noted that seam outcrops plotted on geological maps have been known to be inaccurate by distances in excess of 100m.
- 4.2.7 A CA mining report states that:
- The site is underlain by underground coal workings in 3 seams, the shallowest seam, the Flockton Thick, was worked from Dodworth Colliery at around 70m to 125m depth below the site with an extraction thickness of 0.7m. Last worked in 1959.
 - There are no recorded mine entries within 100 metres of the enquiry boundary.
 - No faults, fissures or breaklines recorded
 - No mines gas recorded within 500 metres of the enquiry boundary
 - No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence
 - The property is in an area where notices to withdraw support were given in 1956, 1977 and 1987.
 - The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support

Unrecorded shallow workings

- 4.2.8 The mining reports suggests there are no known shallow workings (i.e. at less than 30m depth). In addition, abandonment plans obtained from the Coal Authority for former opencasts within the site (see Section 4.2.25) suggest old mineworkings were not encountered during operations.
- 4.2.9 However, it should be noted that it did not become a statutory requirement to maintain and preserve plans of abandoned mines until the Mine (Coal) Regulations Act of 1872 and consequently there may be mineworkings beneath the site for which the Coal Authority have no records.
- 4.2.10 Coal has been mined in Yorkshire for centuries; the first mining probably took place in the fifteenth century. Early mining methods included drifts or adits from outcrop. Where mining extended further from the crop, bell pits were often sunk, and as the coal got deeper still, shafts were used to access gallery workings (pillar & stall).
- 4.2.11 The shafts associated with bell pits are typically only about 1.2m in diameter, and the bell pit itself was typically 5m to 10m in diameter (bell pit size would have been constrained by roof stability). Consequently, bell pits are often closely spaced; the most intensive concentration of shafts recorded to date (66 per acre) was at the Middleton Broom Opencast site.
- 4.2.12 As coal was removed during bell pitting, the unsupported strata above assumed an inverted slope of stability, generating a bee-hive shape around the base of the shaft which forms the characteristic vertical section. The depth limit of bell pit mining is almost certainly 15m, and this is considered a deep bell pit; the vast majority were probably less than half this depth.
- 4.2.13 At greater depths, pillar and stall workings appear to have been the preferred method, and such workings were often accessed via a single shaft. Consequently, shafts associated with such workings are more widely spaced; but rarely exceeded one quarter of a mile (400m) shaft to shaft, due to problems with ventilation and underground haulage. It was customary to view the life expectancy of an individual pit as about three to five years and at any one time several new pits would be sinking to replace those currently operating.
- 4.2.14 Up until the last decades of the eighteenth century, coal mining almost always represented a short-term interruption to ongoing use of land for agricultural. The right to sink shafts and extract coal was usually conditional upon restoration of the surface after coal extraction was complete. This not only involved filling the shaft, but also required that any subsequent settlement of shaft fill material did not result in depressions in the field surface. Consequently, it was usual to fill the shaft and heap excess arisings into a dome over the shaft eye. Over subsequent years, the dome supplied material to compensate for settlement of the shaft fill. In the normal course of events, at the conclusion of the recovery period, any remaining spoil accumulations above ground level would have been planed off to leave a relatively stable, level surface where the shaft had been.
- 4.2.15 In general plan, gallery workings consisted of a series of parallel, rectangular working chambers separated by long piers or pillars of coal, colloquially referred to as benks or banks. The major axis of the galleries was generally up the dip although strike working was not uncommon.

- 4.2.16 Although the broad direction of the stalls was adhered to, there tended to be considerable wandering in the alignment of the pillars, which followed the natural partings provided by the cleat of the coal. There is no sense of the disciplined influence of a surveyed pre-plan, but rather it would appear that the skill of individual miners conditioned the degree to which the workings approached formal regularity. The fact that some pillars drifted into adjacent stalls implies a lack of formal control of progress. It may be that the intermittent cross headings that penetrated laterally through the pillars were intended to provide a check upon the extent to which parallel headings were being preserved.
- 4.2.17 Usually, the length of the stall extended for up to 10m but some were extremely attenuated, occasionally running uninterrupted for 15m or more. There was considerable variation in the width of the stalls, ranging between 2m and 6m and an even more noticeable variation in the width of the pillars. The most substantial pillars were about 2.5m in width but many were reduced to less than 0.5m in width. It is possible that this reduction in pillar width was a result of robbing.
- 4.2.18 Timber props supported the roof where the stall span was greater than about 2m. Prop withdrawal on closure of a mine does not seem to have been prevalent.
- 4.2.19 From the late 18th century onwards, packing of mineworkings became common practice. Packing of workings (known as 'goaf' packing) was done using unwanted materials associated with mining of the target seam (e.g. dirt partings, dark mudstone, clay, poor quality coal etc). This material was 'packed' by hand into the stalls (voids) from which the coal had been removed, as mining of 'fresh' coal progressed.
- 4.2.20 As mining continued, the 'roof' of the stall often lost support and would sag/subside, coming to rest on, and compressing, the packed material. This process was done systematically, meaning that the vast majority (if not all) of the stalls were fully packed come the end of mining. However, a small area around the shaft (also known as a 'shaft porch'), tramways and waterways (used to drain workings towards a pumping shaft) would not be packed. Tramways and waterways are linear and of limited width (unlike 'open' stalls), making them very difficult to target during an intrusive investigation.
- 4.2.21 Compression of the packed materials, and the fact that they comprise re-worked Coal Measures rock, make such former mineworkings very difficult to identify in rotary open probholes (and possibly even in a cored boreholes).
- 4.2.22 Bell pits may be present at Barugh Green. If they are, given the likely depth constraints discussed above, it seems likely they will be limited to workings in the Thin and Swallow Wood seams beneath about 2.5 ha (6 acres) of land in the north and east.
- 4.2.23 Given the absence of loose superficial deposits, it is considered unlikely that mine entries at would have been lined.

Recorded mineworkings

- 4.2.24 The shallowest recorded mineworkings beneath this site are in the **Flockton Thick** seam (c. 0.7m thick) at a depth of about 125m bgl. An abandonment plan has been obtained for these workings; see Drawing 3407/9.

Opencast workings

4.2.25 Extensive opencast workings (Craven I) of the **Swallow Wood** Coal and the **Thin** Coal, are shown in the west of the site on CA plans, extending beyond the western boundary. Further opencast workings (Craven II) to the south of the site are shown to encroach within the southern boundary.

4.2.26 A summary of each opencast site is provided in the table below:

Opencast Site	Seams Worked	Dates of Working	Completion of re-soiling & handing back to agriculture	Total Area Worked/ Coal Removed	Approximate area of site underlain by opencast backfill
Craven I	Swallow Wood Thin Coal (far north-east)	10 th July 1950 to 20 th Nov 1951	July 1952	11.9 ha (29.3 acres) 80,697 tons	2.6 ha (c. 55%)
Craven II	Low Haigh Moor Top Haigh Moor Swallow Wood Thin Coal Gawber (far east)	29 th April 1957 to 7 th Feb 1963	Not provided	33.1 ha (81.9 acres) 775,929 tons	340m ² (<1%)

4.2.27 The abandonment plans include base contours for each seam worked (at 10' intervals) and occasional original ground levels; review of these suggest that excavation in:

- Craven I (within the area of current interest) were typically around 6m to 10m deep, and
- Craven II (area underlying the far south-east of the proposed development) are likely less than 5m deep (but deepening quickly to the south, beyond the site's southern boundary).

4.2.28 Abandonment plan NE.498 includes a vertical section (copied on Drawing 3407/8) which is summarised below.

Seam name(s)	Approximate thickness/m	Approximate depth below Gawber/m	Remarks	Coal quality
Gawber Coal	0.91	-	Comprises two beds of coal (each 0.25m thick), separated by a 0.4m dirt parting.	Top leaf: Good Bottom leaf: Moderate (high sulphur content)
Thin coal	0.34	7	Underlain by 0.6m of Fireclay.	Excellent
Swallow Wood Coal	0.91	15	Comprises two beds of coal (0.2m & 0.4m thick), separated by a 0.3m dirt parting.	Top leaf: Excellent Bottom leaf: Good, but numerous pockets of pyrites
Top Haigh Moor	1.12	29	Comprises three beds of coal (0.36m, 0.2m, & 0.25m thick), separated by two thin dirt parting. Underlain by 0.3m of Fireclay.	Top leaf: Moderate Middle leaf: Inferior, with high ash. Bottom leaf: Good
Low Haigh Moor	0.89	37	Comprises two beds of coal (0.25m & 0.4m thick), separated by a 0.25m dirt parting.	Top leaf: Good Bottom leaf: Good

4.2.29 Given the dip of underlying strata, existing topography and information in the table above, the Swallow Wood Coal is anticipated to lie at depths of between c. 6m in the centre-west and c. 15m in the northeast.

- 4.2.30 The Craven I opencast did not extend across the entire site to the eastern boundary and therefore the maximum depth of backfill is likely to be less than 15m deep. Indeed, the abandonment plan suggests the excavation was 11.5m deep at its lowest point.
- 4.2.31 The vertical section summarised above is considered to be more accurate/reliable than the more generic information provided on the 1:10000 BGS map (SE30NW). The most notable difference between the two is that the Top Haigh Moor is shallower than indicated on the BGS map legend.
- 4.2.32 Consequently, any unrecorded mineworkings within the Top Haigh Moor seam are likely to be around 15m below the base of the opencast (i.e. c. 25m depth), compared to 30m as indicated on the geological map stratigraphic column.
- 4.2.33 Depths in the above table are based on ground levels prior to opencast works, ground levels post remediation are not known as no current topographical survey has been provided, but they are likely to be similar to original levels.
- 4.2.34 High walls associated with the opencast workings are shown in the north and centre of the site (Craven I), with the high wall associated of Craven II shown just within the southern site boundary. The location, height and slope angle of the high walls will have implications for any proposed layout and foundations of proposed plots.
- 4.2.35 Abandonment plans showing the extent of opencast obtained from the CA are reproduced as Drawing 3407/8 in Appendix B to this report. These plans provide a record of the mine prior to backfilling and are therefore likely to provide a good approximation of the extent of operations, as well as the location of any high walls present.
- 4.2.36 Whilst areas beyond the opencast backfill are indicated by the CA to be Low Risk, and there are no known workings, the possibility of unrecorded workings cannot be entirely discounted, and an intrusive mining investigation would be prudent.

4.3 Mineral safeguarded areas

- 4.3.1 The site is underlain by coal and might therefore be considered by the Local Authority to lie within a Mineral Safeguarding Area (MSA).
- 4.3.2 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.
- 4.3.3 Specialist guidance on Mineral Safeguarding "A Guide to Mineral Safeguarding in England" has been produced by The Coal Authority and the British Geological Survey.
- 4.3.4 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.
- 4.3.5 NPPF Paragraph 144 notes that when determining planning applications, local planning authorities should give weight to the benefits of the mineral extraction.

- 4.3.6 As a consequence of the NPPF, and the presence of coal beneath the site, the Local Authority may require Countryside Properties to consider the opportunity to recover (extract) the coal.
- 4.3.7 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.
- 4.3.8 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

4.4 Landfills

- 4.4.1 Known areas of landfill in the vicinity are summarised below:

Location	NGR (proximity to site)	Remarks	Source of data
Cannon Way	SE 317 080 (100m northwest)	Accepted inert waste although dates of input are not known. Currently developed with retail units.	Envirocheck Report Environment Agency
South Yorkshire Industrial Estate	SE 321 079 (120m east)	Accepted inert and commercial waste between 1983 and 1990. Currently developed with retail units.	
Wilthorpe Road	SE 322 078 (240m east)	Accepted inert waste between 1983 and 1999. Currently developed with residential properties.	

4.5 Hazardous gas

Methane & carbon dioxide

- 4.5.1 The site could be affected by sources of hazardous gas generation as it is:
- Located within 250m of known former landfill sites
 - Anticipated to be underlain by significant areas of deep opencast backfill
- 4.5.2 Consequently, monitoring is recommended in order to determine appropriate gas protection measures for the proposed dwellings.

Radon

- 4.5.3 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%).
- 4.5.4 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.
- 4.5.5 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.

4.6 Land contamination - Part IIA & planning

- 4.6.1 Local Authorities have responsibilities with respect to land contamination in the context both of Part IIA of the Environmental Protection Act 1990, and Planning.
- 4.6.2 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

- 4.6.3 As of 27th March 2012, Planning Policy Statement (PPS23) was replaced by the National Planning Policy Framework (NPPF). The NPPF (updated in July 2018) includes the following with respect to contamination and site investigation:
- 4.6.4 'Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.
- 4.6.5 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'.
- 4.6.6 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 - 2017, Code of Practice for the Investigation of Potentially Contaminated Sites)'.

This site

- 4.6.7 The underlying Coal Measures bedrock is classified as a Secondary A Aquifer. The nearest surface watercourse is a drainage ditch on the northern boundary which flows in an easterly direction. Therefore, the site's environmental setting is considered to be moderate sensitivity.
- 4.6.8 With respect to human health, the proposed end use (residential) is also sensitive.
- 4.6.9 Whilst current use of the site is considered unlikely to have given rise to any significant ground and groundwater contamination, former use as an opencast mine may well have.
- 4.6.10 However, it is considered that the site should be suitable for the proposed use subject to implementation of appropriate preparatory works.

5 EXPLORATORY INVESTIGATION FINDINGS

5.1 General

- 5.1.1 Lithos have previously undertaken an exploratory investigation to confirm the extent of the opencast backfill and identify high walls, as detailed in Report (Ref 3407/1, dated April 2019).
- 5.1.2 The ground investigation comprised the excavation of 7 trial pits and 3 trial trenches, locations of which are shown on Drawing 3407/6 in Appendix B. The trial trenches identified high walls dipping at around 40° to 50° from vertical and roughly correspond with the positions indicated on the Coal Authority abandonment plans.
- 5.1.3 Trial pits advanced beyond the areas of opencast encountered residual soils (stiff gravelly clay/clayey gravel) and shallow bedrock (c. 1.5m depth).
- 5.1.4 Trial pits advanced within the areas of opencast identified opencast backfill (gravelly clay/clayey gravel of mudstone, sandstone, coal etc) to greater than 3.5m depth. In addition, a concrete obstruction and boulders up to 0.6m across were encountered within the opencast backfill.

6 POTENTIAL ISSUES ASSOCIATED WITH DEEP OPENCAST BACKFILL

6.1 General

- 6.1.1 At this stage, and subject to the findings of the detailed geotechnical assessment outlined above, it is considered likely that the presence of deep opencast backfill beneath this site will have implications for:
- Foundations – likely piled, but possibly rafts/reinforced strips following ground improvement (see Sections 6.3, 6.4 & 8.4).
 - Drainage – likely need for placement at maximum possible gradients using flexible connections to prevent any backfalls should differential settlement of the fill occur. Potential need for piling of manholes
 - New utilities – should be constructed of flexible materials. Electricity and communications cabling should also be laid with sufficient 'slack' to accommodate a degree of movement. The use of flexible joints is recommended where possible, particularly where service connections extend across a rigid/flexible structure interface (e.g. from a piled foundation into a garden area)
 - Highways - a specification will need to be agreed with the adopting authority, but reinforcement of the road construction over highwalls will probably be required (see Section 8.5).
- 6.1.2 The foundation solution should allow for the consequences of recovery of internal groundwater levels within the opencast backfill. Precautions may also be required to avoid detrimental effects from surface water infiltration. The location and detailing of drains and other trenches, and the provision of hardstanding aprons, requires attention to prevent extraneous waters deteriorating the fill.
- 6.1.3 However, in the context of land that has been subject to opencast coal extraction, this site can be considered relatively low risk given the limited depths of fill (c. 11m) anticipated. Fill thicknesses mean that consideration can be given to a piled foundation solution and/or reinforced strip footing.
- 6.1.4 If piled foundations are adopted for plots underlain by opencast backfill there should be a reduced need for further significant geotechnical analysis / modelling, although specialist piling contractors will require more data (i.e. cable percussion boreholes, possibly with rotary core follow-on).

6.1.5 Conversely, if reinforced strips (or rafts) are preferred, significant further investigation and assessment will be required. This should commence with a review of the data obtained during Lithos' earlier exploratory investigation, and case study data relating to other deep backfill sites, to enable preliminary estimates of anticipated settlement.

6.1.6 Current UK guidance, CIRIA C758D¹, provides information and guidance for engineers and geologists with respect to the design of: mining investigations; foundations; and remedial measures.

6.2 Geotechnical characteristics

6.2.1 Geotechnical characteristics of opencast backfill are related to the nature of the excavated overburden, how it becomes mixed, how it is placed, and any compaction applied.

6.2.2 All opencast backfill is subject to some settlement caused by self-weight which is partly governed by initial thickness. The characteristics of each backfill will be unique and its potential capabilities, at the time of development, depend on many factors, some of which are:

- the period since backfilling was completed.
- future groundwater impacts:
 - current and predicted levels compared to pre-excavation level
 - exposure to infiltrating water and presence of perched levels
 - current water quality and its potential for change within the backfill.
- potential hazards:
 - concealed lagoons/washings
 - loose or destabilised highwall margins
 - heat generation and spontaneous combustion

6.2.3 The prevailing condition of any opencast backfill will depend on the interval since completion, this affecting the extent of internal degradation and rearrangement. At the time of development, the influencing factors will have combined to (usually) reduce to two key engineering concerns:

- The present state of compression of the materials, upon which future settlement is a consequence.
- Any continuing groundwater impacts

6.2.4 It is considered likely that fill here was placed without mechanical compaction in relatively thick layers (likely >1m), and without any screening to remove oversize boulders etc. Such material poses a risk to development due both to the potential for significant differential settlement, and long-term 'creep' settlement.

6.2.5 Significant post-restoration settlements can occur over many decades although fortunately, the opencast backfill here (Craven I) is more than 65 years old.

6.2.6 However, it is more difficult to assess creep in older backfills, since monitoring would need to continue for a long time (say 3 to 5+ years). For younger fills (say <10 years old), skip load tests of 6 to 18 months duration can yield meaningful results.

6.2.7 Settlement of deep made ground is initially (first 5 years or so) predominantly associated with inundation (caused by changes in the water table depth and/or surface water infiltration).

¹ CIRIA C758D:2019. Abandoned mine workings manual

- 6.2.8 Consolidation settlement is associated with a reduction in volume caused by expulsion of water from soil pores and transfer of load from excess porewater pressure to soil particles. Consolidation of the colliery spoil in opencast backfill under self-weight largely occurs during placement.
- 6.2.9 Creep compression occurs as the particles of fill become more closely packed, under conditions of constant effective stress (arising from self-weight of the fill). Although the movements caused by creep are relatively small, often it is these long-term movements that are of most interest to foundation performance. Many coarse fills show a linear relationship between settlement and the logarithm of the time that has elapsed since the fill was placed (i.e. settlement that occurs during the first 10 years is similar to that from years 10 to 100).
- 6.2.10 Where development on deep fill takes place, in addition to any ongoing creep associated with self-weight, settlement is caused by the imposed foundation loads. This leads to some immediate compression and consolidation within stressed zones.
- 6.2.11 The strength/density of the backfill materials is likely to vary over relatively short distances, and this could lead to significant differential settlements across small areas.

6.3 Foundations (shallow)

- 6.3.1 Determination of an appropriate foundation solution requires input from specialist geotechnical and structural engineers capable of assessing the risks and designing accordingly.
- 6.3.2 For shallow foundation solutions, assessments can be complex, involving characterisation of the ground, optimising building size, structural performance criteria and an assessment of the mechanisms involved.
- 6.3.3 The first of these includes determination of realistic bulk material properties, groundwater influences and future stability matters. An appropriate ground improvement process or full or partial depth re-engineering can then be decided upon.
- 6.3.4 For low-rise buildings, a partial depth replacement with a specified engineered fill of thickness related to purpose may be an option. However, long-term movements of the untreated thicknesses/ extents are of concern. In predicting these, cognisance should be taken of the nature of surface mining operations, phasing of restoration works, time delay periods and the predicted, as well as prevailing, hydrogeological regimes. The effects of ageing will also be relevant for the treated thickness.
- 6.3.5 As well as the direct performance of the improved ground under foundation loads it is the long-term settlement of the whole backfill 'column' or mass that requires careful analysis. All backfill, whether engineered or non-engineered, is subject to self-weight settlement.
- 6.3.6 Given the potential for ongoing settlement, further investigation will likely be required to assess the need for ground improvement in order to reduce settlements to tolerable levels. However, at this stage, and assuming that ongoing creep settlements are not considered prohibitive, some form of ground improvement may be necessary.

6.3.7 Options might include:

- Surcharge - a ground treatment method in which consolidation is achieved by temporary loading of the ground, usually via placement of mounds of material, several metres high above the backfill.
- Excavation of the uppermost 3m to 4m of quarry backfill and replaced in engineered layers.
- Dynamic deep compaction (DDC) can be used to densify the fill in-situ; possibly in conjunction with (b), from the base of the excavation prior to replacement of engineered fill. With DDC the ground is subjected to repeated surface tamping using a heavy weight. This weight is dropped a set number of times on a grid pattern over the site to form a pass. The imprints formed at each drop position are infilled with granular material after each pass. A blanket of imported stone is required where in-situ near surface materials are unsuitable. Dependant on soil types and condition, two to five passes can be required on a site, and treatment depth would likely be in the order of 10m.

6.3.8 Some further ground investigation and/or settlement monitoring might then include some/all of:

- Installation of extensometers.
- Installation of a grid of survey stations, and subsequent surveying to determine whether ground levels are changing.
- Zone tests via construction of a shallow test pad.

6.3.9 When dependable ground treatment has taken place for light structures, generally it will be preferable to use suitably reinforced strip footings (rather than pad), with independent floor slabs or rafts, in order to reduce bearing pressures.

6.4 Foundations (piled)

6.4.1 Given the limited depths of fill (c. 11m) anticipated, consideration can be given to a piled foundation solution. However, the plot layout should give consideration to the location of opencast high walls (see Section 8.4).

6.4.2 With respect to a piled foundation solution, it cannot be assumed that the properties of opencast backfill are consistent from place to place and they may affect each pile, or pile group, differently. For a site where the excavation was taken through beds of massive strata, there may be a significant boulder content that could be obstructive to piling.

6.4.3 Settlement of an opencast backfill is a serious concern for piling because of the 'down-drag' (negative skin friction) it can create. The settlement process can be lengthy and may alter in magnitude and rate, dependent on the extent and duration of any inundation.

6.4.4 Groundwater recovery can also cause significant effective stress changes and it is important to be able to predict the final level of groundwater recovery.

6.4.5 For piles that will have secure end-bearing, the matter of large backfill settlements creates the possibility that pile caps may become exposed if transitional precautions for the surrounding concourse area are not taken.

6.5 Unrecorded workings beneath the opencast backfill

- 6.5.1 The Top Haigh Moor coal (c. 1.2m thick) is expected to lie about 15m below the base of the opencast. There are no recorded mineworkings in this seam, but the possibility of unrecorded workings cannot yet be discounted.
- 6.5.2 Whilst there might be in excess of 10 times rock cover above any mineworkings in the Top Haigh Moor, the presence of workings below pile toes can become a concern, especially for end-bearing pile groups. Piling over shallow mineworkings (even after grouting) is not common practice.
- 6.5.3 Founding piles above a system of **untreated** workings is not recommended because collapsed workings are rarely in a permanently stable condition and so have some form of residual settlement potential. Thus, either creep settlement, strata relaxation or collapse migration remain intermittent subsidence possibilities.
- 6.5.4 CIRIA C758D provide advice:
- 6.5.5 If workings occur within 20m of surface it would be unusual to find a satisfactorily thick and rigid founding stratum for highly-loaded piles above, and sufficiently isolated from, the workings. When loadings are light (e.g. for houses), a suitable horizon might be available, but often piles will need to penetrate the workings to found in a stable stratum adequately below the disrupted floor of the workings.
- 6.5.6 Whatever the depth of workings, even if they are thought to be fully filled or the roof strata to be rigid, piles should not be terminated immediately above an untreated worked horizon because this could concentrate load on a potentially unstable stratum which may initiate eventual collapse.
- 6.5.7 The objective of a conventionally spaced, over-site grout treatment grid is to ensure against surface settlements. It will not adequately serve below ground support for individual piles. Grid separations exceeding 3m in partially collapsed or back-stowed workings are prone to uneven grout distribution and leaving isolated untreated areas or discrete void pockets.
- 6.5.8 It should be recognised that pressurised grout treatments (even if enhanced) are unlikely to achieve full closure or permeation of randomly distributed or occluded voids, especially if water-filled. This consequence of earthworks treatments is well known, but also it is industry wisdom that grout acceptance maximises at about 90-95% of voidage).
- 6.5.9 When there is a continuing risk of subsidence or residual movements, piles should be taken into competent strata below any seam floor disruption and heave consequential on the workings. Ground treatments should be scheduled to mitigate both installation effects and future settlements.
- 6.5.10 Piling above workings might be possible where sufficiently reliable strata (e.g. a substantial massive and competent bed of sandstone) are present to enable a detachment zone to be defined, or created by enhanced ground treatment. The thickness of this zone will depend on the pile installation method and the size and loading of the pile group.
- 6.5.11 When a prospective horizon is present, the following key issues, should be examined before deciding if the proposal is viable:
- depths, dip and thickness of the subsidence restricting horizon
 - geotechnical and geomechanical properties of the restricting horizon
 - separation between pile toe level and the restricting horizon (ie the detachment zone)
 - establishing that past collapses have arrested at the restricting horizon
 - specific connectivity arrangements at pile heads/caps.

6.5.12 To enable piles to found at a higher level than a significantly stressed worked seam, bulk filling of open workings or grout treatment should be carried out beforehand as standard practice. If grouting, a more comprehensive treatment regime than for spread foundations will be required to produce reliable higher strength characteristics in the intensely stressed zones. These strengths should be specified via the grout mix and validated afterwards.

6.6 High walls

6.6.1 It is generally considered wise not to build over high walls and such areas are usually reserved for non-critical uses such as landscaping. Utility routes in the vicinity of high walls need careful selection.

6.6.2 However, building in the crest region might be possible if split foundation types are used to reach undisturbed natural ground.

6.6.3 It will be necessary to ensure the construction of a reliable rock socket at the high wall. This could be problematic if there are concerns about slope strata integrity (which can occur where a fault has determined the extraction boundary).

6.6.4 Furthermore, if there are unrecorded workings in the Swallow Wood or Thin coals these could influence surface stability in the vicinity of the highwall where there could be less than 10 times competent rock cover.

6.6.5 Away from the crest, and over the buried slope, it should be expected that foundations not on natural ground will tilt, due to differential settlement. The zone of potential unacceptably large tilt of foundations will be dependent upon:

- the angle of the opencast slope
- depth below development level at which the crest is buried
- depth below development level to the toe of the slope
- the mass modulus of the fill/made ground.

7 GROUND INVESTIGATION DESIGN

7.1 Anticipated ground conditions & potential issues

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

Anticipated condition	Remarks
Made ground	Deep made ground (up to c. 11m) of variable composition anticipated within areas of former opencast which is likely to include oversize material and obstructions
Natural soils	Topsoil over residual soils (gravelly clay/clayey gravel) from weathering of bedrock
Bedrock	Mudstone, siltstone and sandstone at shallow depth beyond areas of former opencast with bedrock at c. 6m to 11m depth 'inside' opencast area
Mineworkings	Possible unrecorded workings at shallow depth beyond areas of former opencast
Groundwater	Perched water likely present in made ground with 'true' groundwater likely at depth in bedrock

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

Type of issue	Specific issue	Remarks
Potential on-site contamination sources	1. naturally occurring contaminants 2. farming related activities 3. opencast backfill	1. metals in topsoil 2. see Section 7.2.2 below 3. backfill material may include asbestos and be potentially combustible
Potential off-site contamination sources	1. landfill	1. generation and migration of hazardous gas
Potential geotechnical hazards	1. relict buried obstructions 2. deep made ground 3. opencast high walls 4. shallow workings	1. opencast backfill likely to contain oversize material 2. unsuitable founding stratum 3. layout should take account of high walls to ensure plots do not span these 4. Possible unrecorded workings leading to surface instability
Other potential constraints	1. overhead utilities	1. overhead electric (11kV) cables

7.2 Preliminary conceptual site model

7.2.1 A preliminary conceptual site model, presented as Drawing No 3407/5 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 6.1 inclusive of this report.

7.2.2 Historical plans show that the site has been occupied by arable farmland which is not considered likely to have caused significant ground contamination. Nonetheless, activities such as slurry spreading, the discharge of chemicals to ground, and unregulated burial have all occurred on farmland.

7.2.3 Potential pollutants associated with farming activity might include any of the following:

Agricultural activity	Potential contaminant
Sewage farming, slurry spreading	Methane, metals, nitrates, oxygen depletion
Plant & animal protection	Pesticides & herbicides
Soil conditioners	Metals, sulphates, PAH
Field sports	Lead shot
Waste burial, land levelling, backfilling ponds/quarries	Methane, metals, PAH etc
Naturally occurring contaminants	Arsenic, metals

7.2.4 In addition to the above, opencast mining has taken place in the west and far south of the site. Potential pollutants associated with this operation and the backfilled waste may include:

- Metals and asbestos
- PAH
- Sulphates

7.2.5 Potential pollutant linkages are shown on the preliminary conceptual site model.

7.3 Ground investigation design & strategy

7.3.1 The preliminary conceptual site model has been used as a basis for design of an appropriate main phase of ground investigation (following the initial, exploratory investigation outlined in Section 5). However, the scope outlined below should be reviewed in light of the preferred foundation solution (shallow reinforced strips or piles) and more rigorous geotechnical review; see Section 6.

7.3.2 The scope of the main phase of investigation is summarised below.

Exploratory holes	Purpose
Twenty trial pits	To determine the general nature of soils underlying the site, including the: • nature, distribution and thickness of made ground • nature, degree and extent of contamination • proportion of undesirable elements e.g. biodegradable matter, foundations etc • suitability of the ground for founding structures and highways
Five cable percussion boreholes	To retrieve geotechnical data from depth
Twenty-five probeholes	To check for the presence of voids or broken ground associated with possible unrecorded shallow mine workings
Fifteen probeholes & five boreholes	To install monitoring wells across the site in order to: • monitor for hazardous gas • determine groundwater levels and assess flow direction

7.3.3 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 7.1 above. A nominal 40m grid spacing should be appropriate, with additional exploratory locations scheduled as necessary in light of the ground conditions actually encountered.

7.3.4 Parts of the site were noted to be wet and soft during the site walkover. If ground investigation is not undertaken during drier summer months, it may be necessary to use a tracked excavator.

- 7.3.5 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.
- 7.3.6 The investigation should be undertaken in general accordance with:
- BS5930:2015 "Code of practice for site investigation"
 - BS10175:2017 "Code of practice for the identification of potentially contaminated sites"
 - "Technical Aspects of Site Investigation" – EA R&D Technical Report P5-065/TR (2000)
 - "Development of appropriate soil sampling strategies for land contamination" – EA R&D Technical Report P5-066/TR (2001)
- 7.3.7 About 5 cable percussion boreholes should be advanced to the base of the opencast backfill (depths of around 11m), to refusal in underlying bedrock, in order to retrieve geotechnical data from depth, and also allow the installation of gas/groundwater monitoring wells.
- 7.3.8 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.
- 7.3.9 The ability to use temporary steel casing to line the borehole, during drilling of 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).
- 7.3.10 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.
- 7.3.11 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.
- 7.3.12 Given the anticipated nature and thickness made ground here, piles (if chosen as the preferred foundation solution for plots located on opencast backfill) are likely to be end-bearing in bedrock. In accordance with BS 8004:2015 and EC7, piling contractors may request that boreholes be extended a minimum 5m into competent bedrock using rotary coring techniques. Countryside Properties should liaise with their preferred piling contractor(s) in advance of commissioning this investigation and inform Lithos whether or not rotary coring is required.
- 7.3.13 The in-situ shear strengths of any cohesive soils encountered should be determined by use of a hand-held shear vane.
- 7.3.14 Deep made ground is anticipated, and consequently soakaways will not provide a viable solution for the disposal of surface water.
- 7.3.15 Routine geotechnical soils analysis (moisture content, Atterberg limits, pH, water soluble sulphate) should be scheduled on about 40 samples, with some compaction testing on samples of made ground to assess suitability for use in earthworks ground improvement.
- 7.3.16 Whilst it is highly unlikely that Phenoxo Acetic Acid Herbicides (PAAH pesticides) will be detected by soil sampling, it would be prudent to confirm this via analysis of 3 topsoil samples.

7.3.17 Potential contaminants associated with the former use of the site include:

- Inorganics (metals, asbestos, sulphates)
- Organics (PAHs)

7.3.18 Appropriate chemical analyses based on the findings of this Report should be allowed for. This is likely to comprise 30 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.

7.3.19 Approximately 25 probeholes should be sufficient to determine whether or not old mineworkings are present in the underlying shallow coal seams. If present, 25 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) above across the site. 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.

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

7.3.21 Given the proximity of surrounding housing (within 50m of much of the general site area), and in accordance with CA requirements it will be necessary to advance probeholes using water as the flushing medium (as reinforced by recent CA guidance on managing the risk of hazardous gas).

7.3.22 Monitoring wells should be installed in about 15 shallower probeholes. The generation potential of potential gas sources (opencast backfill and adjacent landfills) is considered likely to be Low. Therefore, in accordance with CIRIA Report C665, it would be prudent to initially allow for 9 visits over a 6 month period. A hazardous gas risk assessment should be issued on completion of monitoring.

7.3.23 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.

8 CONCLUSIONS & RECOMMENDATIONS

8.1 General

- 8.1.1 The site comprises c. 4.9 hectares of land located in Barugh Green, about 3km northwest of Barnsley town centre. The site has essentially remained undeveloped but the west and far south were subject to opencast mining between 1950 and 1963.
- 8.1.2 It is understood that Countryside Properties are considering acquisition of the site with a view to redevelopment with housing.
- 8.1.3 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.

8.2 Mining and quarrying

- 8.2.1 The majority of this site (south and west) 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).
- 8.2.2 The remainder of the site is located within a Low Risk Area (within the defined coalfield, but no known defined risks have been recorded by the Coal Authority; there may still be unrecorded issues).
- 8.2.3 Extensive opencast workings (Craven I) of the Swallow Wood and the Thin coals, are shown in the west of the site on CA plans, extending beyond the western boundary. Further opencast workings (Craven II) to the south of the site are shown to encroach within the southern boundary.
- 8.2.4 A summary of each opencast site is provided in the table below:

Opencast Site	Seams Worked	Dates of Working	Approximate area of site underlain by opencast backfill
Craven I	Swallow Wood Thin Coal (far north-east)	10 th July 1950 to 20 th Nov 1951	2.6 ha (c. 55%)
Craven II	Low Haigh Moor Top Haigh Moor Swallow Wood Thin Coal Gawber (far east)	29 th April 1957 to 7 th Feb 1963	340m ² (<1%)

- 8.2.5 Based on information obtained from the Coal Authority and trial trenching undertaken by Lithos, a maximum opencast depth of 11m and a high wall slope of 40° to 50° has been identified. However, further investigation is required to confirm these initial findings.
- 8.2.6 Although there are no known shallow mineworkings beneath the site, unrecorded workings may be present both in the east and beneath the base of the opencast in the centre and west.
- 8.2.7 It is possible that unrecorded "shallow" shafts (possibly bell pits) may be present in the east (beyond areas of opencast), and 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.

- 8.2.8 If bell pits are present, given the depth constraints discussed in Section 4.2, it seems likely they will be limited to areas beyond the areas of former opencast mining; perhaps about 45% of the total site area.
- 8.2.9 Given the absence of loose superficial deposits, it is considered unlikely that such mine entries would have been lined.
- 8.2.10 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 Countryside Properties may choose to do this.
- 8.2.11 However, where build over a shaft(s) (including bell pits) is proposed, Countryside Properties will need to discuss proposed treatment (which is likely to include both grouting of the shaft backfill, and a cap at rockhead) and bespoke foundation design, by a suitably qualified structural engineer, with the Coal Authority. A Permit to Enter or Disturb Coal Authority Mining Interests will be required prior to construction of any shaft cap.
- 8.2.12 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.
- 8.2.13 If old mineworkings are present in the Thin and/or Swallow Wood coals, 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

8.3 Hazardous gas

- 8.3.1 The site is in an area where between 1% and 3% of homes are estimated to be above the radon action level. Therefore, radon protection measures are not required. However, in light of Public Health England advice, the Developer might consider providing all new dwellings with basic radon protection measures.
- 8.3.2 There are known areas of landfilling within 250m, and the south and west of the site are underlain by areas of deep opencast backfill. Any unrecorded shafts/bell pits may act as a pathway for hazardous gas to migrate to the surface.
- 8.3.3 Consequently, the site is considered to be at potential risk from migrating landfill gas and gas generated onsite within the opencast backfill. As such, wells should be installed in boreholes to allow subsequent monitoring for hazardous gas in order to determine appropriate gas protection measures for the proposed dwellings.

8.4 Foundations

- 8.4.1 At present, insufficient 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.
- 8.4.2 The published geological data and exploratory investigation previously undertaken suggests that northeast is underlain by weathered Coal Measures with competent sandstone bedrock at shallow depth (<3m).

- 8.4.3 The centre and west (c. 2.6 ha) and far southeast (< 0.1ha) are underlain by Opencast Backfill (gravelly clay/clayey gravel of mudstone, sandstone, coal etc), the depth of which is unknown but based on abandonment plans (see Section 4.2) is likely to be around 11m.

Beyond opencast workings

- 8.4.4 Ground 'beyond' the areas of Opencast Backfill generally comprises natural soils with localised shallow made ground, likely associated with wider landscaping post backfilling. At this stage, it is likely that plots situated beyond the former opencast workings will be founded on traditional strip/trench-fill foundations.
- 8.4.5 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.
- 8.4.6 If shallow mineworkings are present beyond the opencast and require treatment (i.e. consolidation by drilling & grouting), then reinforced strips/rafts might be required following treatment (depending on the depth of the mineworkings).

Within opencast workings

- 8.4.7 In the context of land that has been subject to opencast coal extraction, this site can be considered relatively low risk given the limited depths of fill (c. 11m) anticipated. Fill thicknesses mean that consideration can be given to both a piled foundation solution and/or reinforced strip footing.
- 8.4.8 If **piled** foundations are adopted for plots underlain by opencast backfill there should be a reduced need for further significant geotechnical analysis / modelling, although specialist piling contractors will require more data (i.e. cable percussion boreholes, possibly with rotary core follow-on).
- 8.4.9 However, it should be noted that the Top Haigh Moor coal (c. 1.2m thick) is expected to lie about 15m below the base of the opencast. There are no recorded mineworkings in this seam, but the possibility of unrecorded workings cannot yet be discounted.
- 8.4.10 Founding piles above a system of untreated workings is not recommended because collapsed workings are rarely in a permanently stable condition and so have some form of residual settlement potential. Consequently, intrusive investigation should include rotary probing to establish whether or not there are any unrecorded mineworkings below the opencast.
- 8.4.11 Conversely, if **reinforced strips** (or rafts) are preferred, significant further investigation and assessment will be required. This should commence with a review of the data obtained during Lithos' earlier exploratory investigation, and case study data relating to other deep backfill sites, to enable preliminary estimates of anticipated settlement.
- 8.4.12 Determination of an appropriate foundation solution requires input from specialist geotechnical and structural engineers capable of assessing the risks and designing accordingly.
- 8.4.13 For shallow foundation solutions, assessments can be complex, involving characterisation of the ground, optimising building size, structural performance criteria and an assessment of the mechanisms involved.

Adjacent to high walls

- 8.4.14 It is generally considered wise not to build over high walls and such areas are usually reserved for landscaping. However, building in the crest region might be possible if split foundation types are used to reach undisturbed natural ground.
- 8.4.15 It will be necessary to ensure the construction of a reliable rock socket at the high wall. This could be problematic if there are concerns about slope strata integrity (which can occur where a fault has determined the extraction boundary).
- 8.4.16 Furthermore, if there are unrecorded workings in the Swallow Wood or Thin coals these could influence surface stability in the vicinity of the highwall where there could be less than 10 times competent rock cover
- 8.4.17 Any plot layout for this site should take account of the known high walls. Most notably, the foundations of plots just beyond the area of deep backfill should ideally be placed below a line drawn up at 45° from the base of the high wall.
- 8.4.18 Plots in the vicinity of steep high walls should ideally be set-back at least 3m from the high wall and founded entirely on bedrock.

8.5 Highways and external works

- 8.5.1 It is understood that limited underbuild may be required at the site with some retaining walls up to 1m in height.
- 8.5.2 Beyond the opencast backfill, natural soils should yield a CBR of at least 3%. This value should be verified prior to or during construction.
- 8.5.3 Within the former opencast ground improvement will be required; likely excavation of the uppermost 2m of colliery spoil and replacement in engineered layers. A specification will need to be agreed with the adopting authority, but at this stage, where any new highway spans an opencast 'high-wall', precautions to protect highway and drainage infrastructure from damage due to differential settlement will likely comprise:
- Excavation of colliery spoil over the full width of the adoptable highway to at least 1.0m below deepest sewer invert
 - Reinforcement of the excavation base, 5m either side of the high wall, with two layers of Tensor Triax TX160 (or equivalent) geogrid sandwiched within at least 300mm of suitable aggregate

8.6 Soakaways & drainage

- 8.6.1 Given the presence of deep opencast backfill, soakaways will not provide a viable solution for the disposal of surface water.
- 8.6.2 Alternative SUDS options (see CIRIA C697:2007 for further details) include:
- Swales – linear grassed features in which surface water can be stored or conveyed.
 - Pervious Pavements – provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate into subsurface storage, with subsequent controlled discharge. Pavement could be porous (water able to infiltrate across entire surface material; e.g. reinforced grass), or permeable (water infiltrates via joints between concrete blocks).
 - Ponds – designed to have permanent pool of water, but with capacity to provide temporary storage controlled discharge.

- 8.6.3 Yorkshire Water have published a guide² for developers and designers outlining their design requirements for surface water attenuation assets.
- 8.6.4 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.
- 8.6.5 Appropriate design usually comprises a fall across the short axis (to centre of basin), and then along the long axis (possibly inclusive of a pipe in gravel trench) to the outfall.
- 8.6.6 The guide also discusses required access to flow control chambers, large diameter (i.e. >900mm) surface water storage pipes, and surface water storage tanks.

8.7 Contamination

- 8.7.1 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.
- 8.7.2 Based on observations made during the site walkover, and given site's former and recent uses, deep made ground is anticipated in the south and west, and it is considered likely that some (probably minor) ground contamination will be present in shallow soils.
- 8.7.3 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.

8.8 Potential development constraints

- 8.8.1 Deep opencast backfill and high walls present a potential development constraint. Ideally, buildings should not span any high wall. The final layout should consider the location of high walls, with areas of POS located over the opencast wherever possible to reduce the abnormalities associated with piled foundations etc.
- 8.8.2 The overhead electric cables present a potential development constraint unless they can be relocated. Additional enquiries are required to ascertain the feasibility of such diversionary works and the particular easement required by each service undertaker if they remain in-situ.

² Design Requirements for Surface Water Attenuation Assets, February 2017.

8.9 Further investigation

8.9.1 Whilst the site is considered suitable for its current and proposed use, the proposed change in use will require intrusive investigation. This could include:

- Machine-excavated trial pits to determine near surface ground conditions including depth to bedrock, the location and gradient of high walls, the presence of obstructions, groundwater and stability
- Cable percussion boreholes to enable the retrieval of geotechnical data from depth within the area of backfilled opencast
- Geotechnical soils analysis with grading and compaction testing assess suitability of made ground for use in earthworks ground improvement, 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 land use
- Rotary probeholes to confirm depths and seam thicknesses in order to assess risks associated with possible old mineworkings and surface stability
- Gas monitoring and risk assessment

8.9.2 An appropriate ground investigation strategy is presented in Section 5.2. However, the proposed scope should be reviewed in light of the preferred foundation solution (shallow reinforced strips or piles) and more rigorous geotechnical review.

Appendix A

General Notes

General

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

Geology, mining & quarrying

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

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

Landfills

Lithos obtain data from Landmark or Groundsure, the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site. Historical OS plans are also inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Radon

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

In order to assess potential risks associated with radon gas, Lithos refer to BRE Report BR211¹, and the 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 2010². 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 2007³. 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 and Target Levels should also be applied to non-domestic buildings with public occupancy exceeding 2,000 hours per year and to all schools.

Hydrogeology

Lithos obtain information from the Environment Agency (EA), and Landmark or Groundsure with respect to:

- Groundwater quality
- Recorded pollution incidents
- Licensed groundwater abstractions

From April 2010 the EA's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply), but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey. The maps are split into two different types of aquifer designation:

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

The maps display the following aquifer designations:

Principal aquifers: These are layers of rock or superficial deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

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

- Secondary A - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
- Secondary B - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers
- Secondary undifferentiated - In most cases, this is because the rock type in question has previously been designated as both a minor and non-aquifer in different locations due to the variable characteristics.

¹ BRE Report BR211, 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

Lithos obtain information from the Environment Agency 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



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CLIENT

COUNTRYSIDE
PROPERTIES

JOB TITLE

BARUGH GREEN

DRAWING TITLE

SITE LOCATION
PLAN

DRAWN

LEW

DATE

17 04 19

CHECKED

ASw

DATE

17 04 19

STATUS

FOR COMMENT ☐

DRAFT ☐

FOR APPROVAL ☐

FINAL ☒

SCALE

1:25,000

SHEET

A4

DRAWING NO.

3407/1

REVISION



NOTES

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REPRODUCED FROM COUNTRYSIDE PROPERTIES DRAWING 'BARUGH GREEN ROAD, BARNLEY - PLANNING LAYOUT' REF. SKY-004-PL-PL-01, REV. D, DATED APRIL 2020

A	UPDATED WITH NEW PROPOSED DEVELOPMENT LAYOUT	19/08/2020
REV.	DESCRIPTION	DATE



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CLIENT

COUNTRYSIDE PROPERTIES

JOB TITLE

BARUGH GREEN

DRAWING TITLE

PROPOSED SITE LAYOUT

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CHECKED	ASw	DATE	19/08/2020	FOR APPROVAL	DRAFT	☐
				FINAL		☒

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NOTES

- GRASS & OVERGROWN AREAS
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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CLIENT

COUNTRYSIDE PROPERTIES

JOB TITLE

BARUGH GREEN

DRAWING TITLE

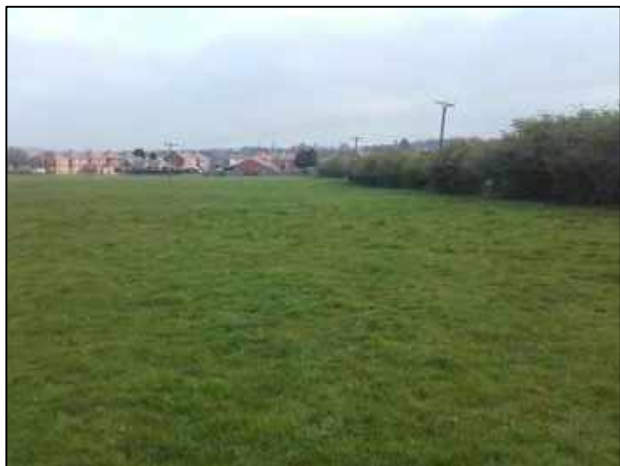
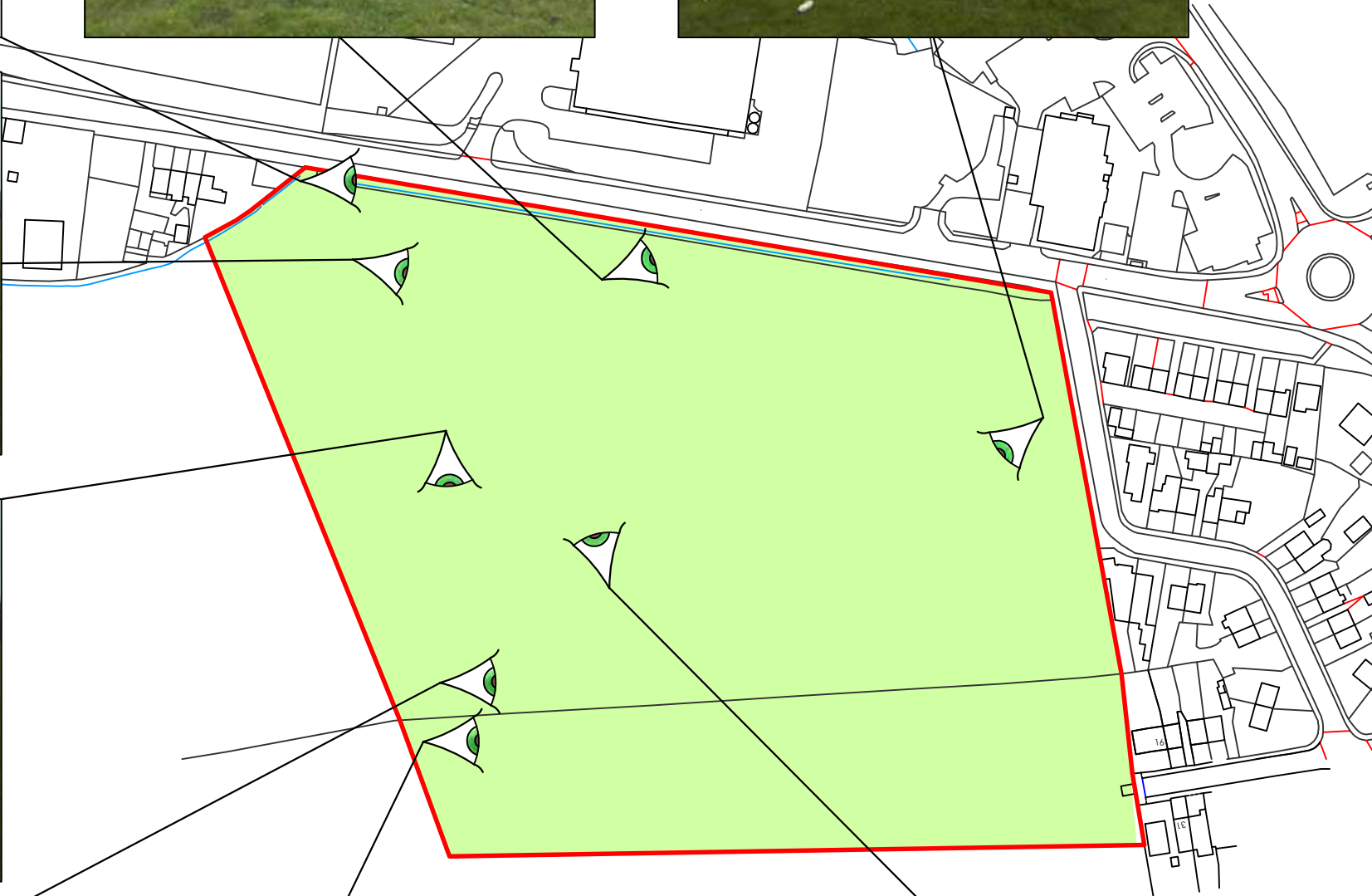
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- NOTES
- GRASS & OVERGROWN AREAS
 - APPROXIMATE SITE BOUNDARY
 - LOCATION & ORIENTATION OF PHOTOGRAPH



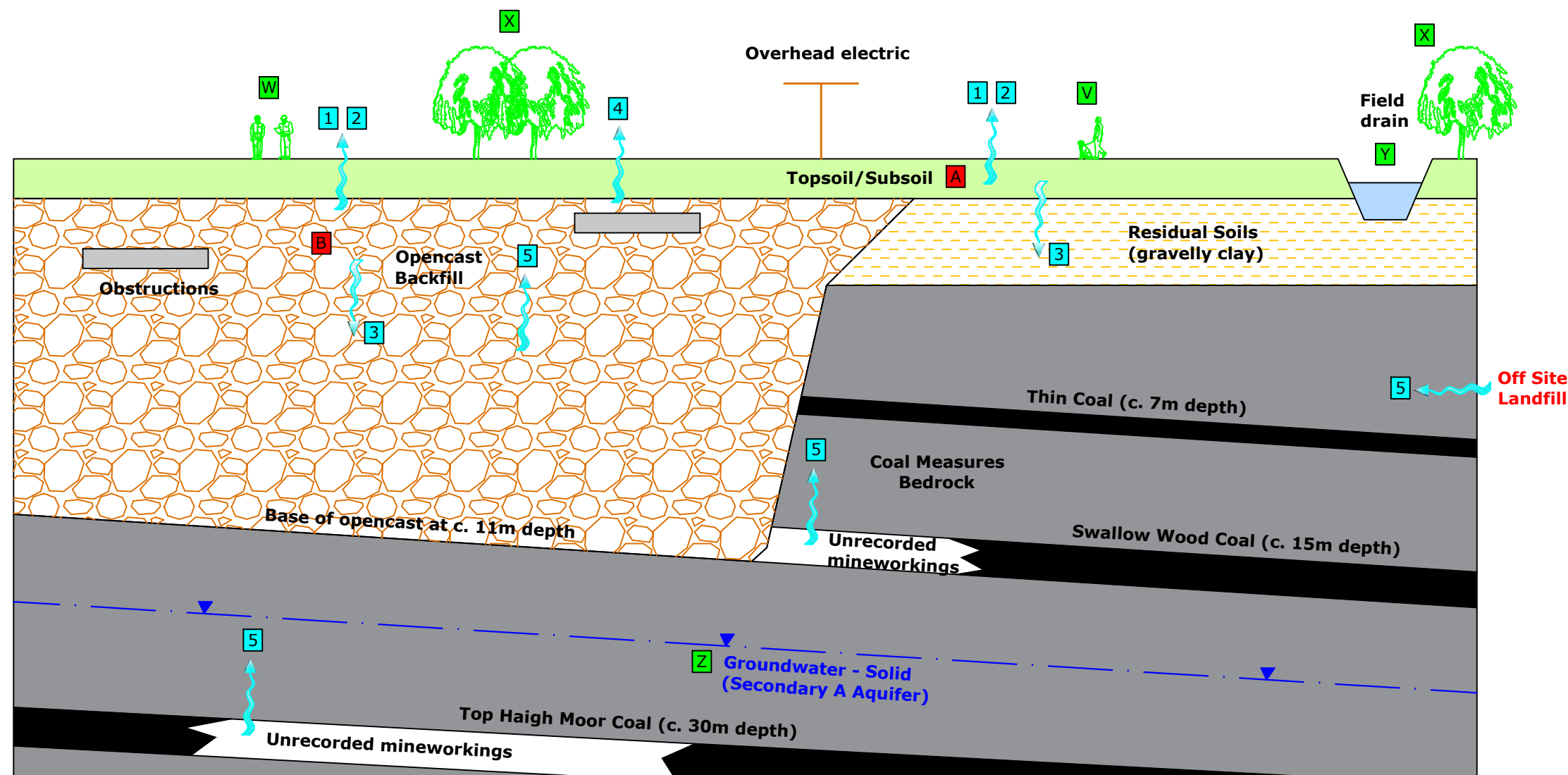
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Tel 01937 545330

COUNTRYSIDE
PROPERTIES

BARUGH GREEN

SITE PHOTOGRAPHS

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CHECKED	ASw	DATE	09 03 20	FOR APPROVAL	DRAFT	☐
				FINAL		☒
SCALE	NOT TO SCALE	SHEET	A3	DRAWING NO.	3407/4	REVISION



Off Site
Landfill

SOURCES	
A	NATURALLY OCCURRING CONTAMINANTS (INORGANICS)
B	FARMING RELATED ACTIVITIES (INORGANICS & ORGANICS)
C	OPENCAST BACKFILL (INORGANICS & ORGANICS)

PATHWAYS	
1	DERMAL CONTACT
2	INGESTION/INHALATION
3	LEACHING OF CONTAMINANTS
4	UPTAKE BY PLANTS
5	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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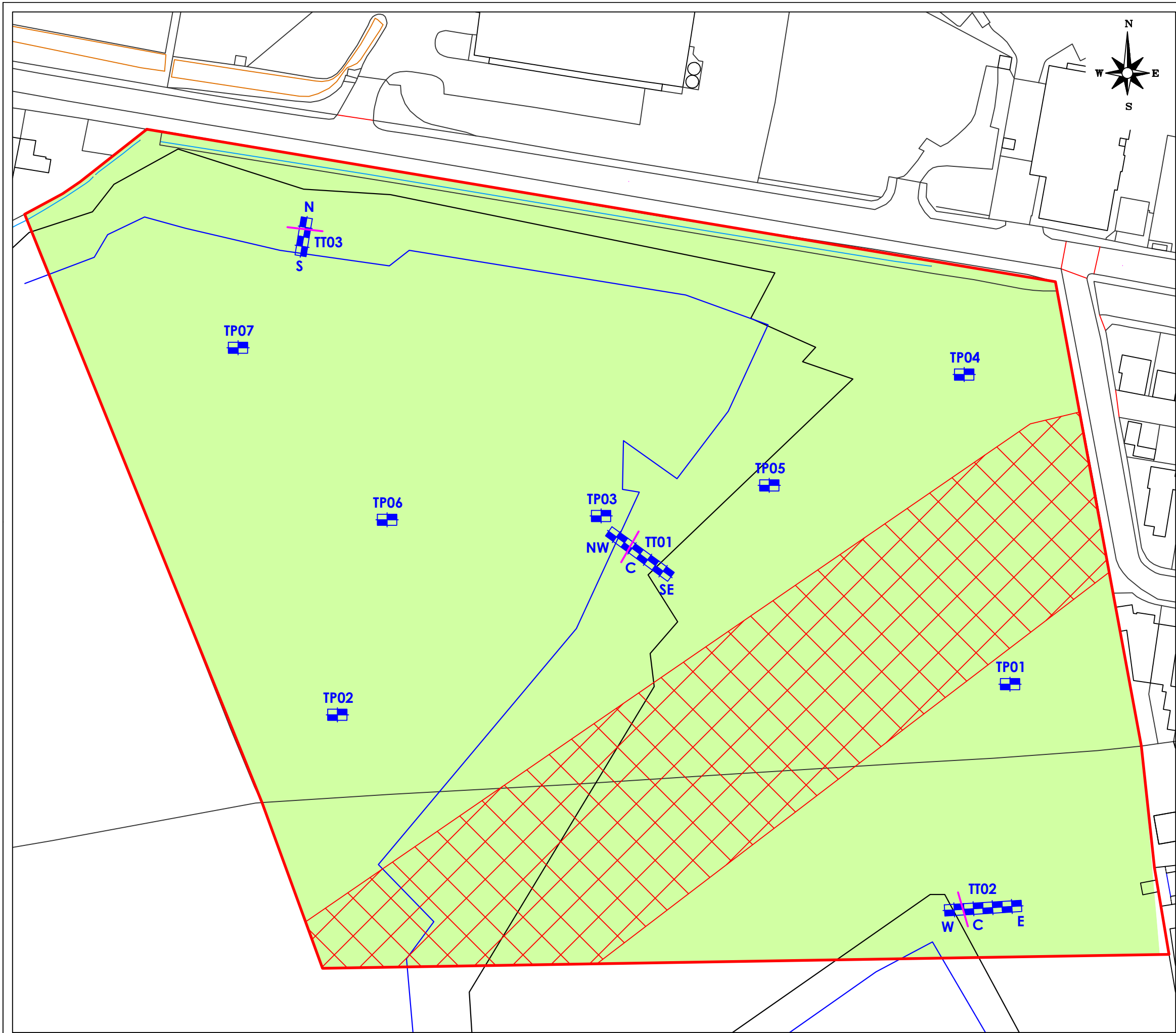
CLIENT
COUNTRYSIDE PROPERTIES

JOB TITLE
BARUGH GREEN

DRAWING TITLE
PRELIMINARY CONCEPTUAL SITE MODEL

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CHECKED		DATE		FOR APPROVAL ☐	
ASw		23 03 20		DRAFT ☐	
				FINAL ☒	

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	3407/5	



NOTES

- GRASS & OVERGROWN AREAS
- INACCESSIBLE DUE TO LIVE OVERHEAD SERVICES
- TRIAL PIT LOCATION
- TRIAL TRENCH LOCATION
- APPROXIMATE HIGHWALL (CA REPORT)
- APPROXIMATE HIGHWALL (ABANDONMENT PLAN)
- ENCOUNTERED HIGHWALL

NOTE THAT TRIAL PIT/TRENCH & HIGHWALL POSITIONS HAVE BEEN LOCATED USING HAND-HELD GPS (ACCURATE TO 3 METRES) AND SHOULD THEREFORE NOT BE RELIED UPON FOR CONSTRUCTION PURPOSES.

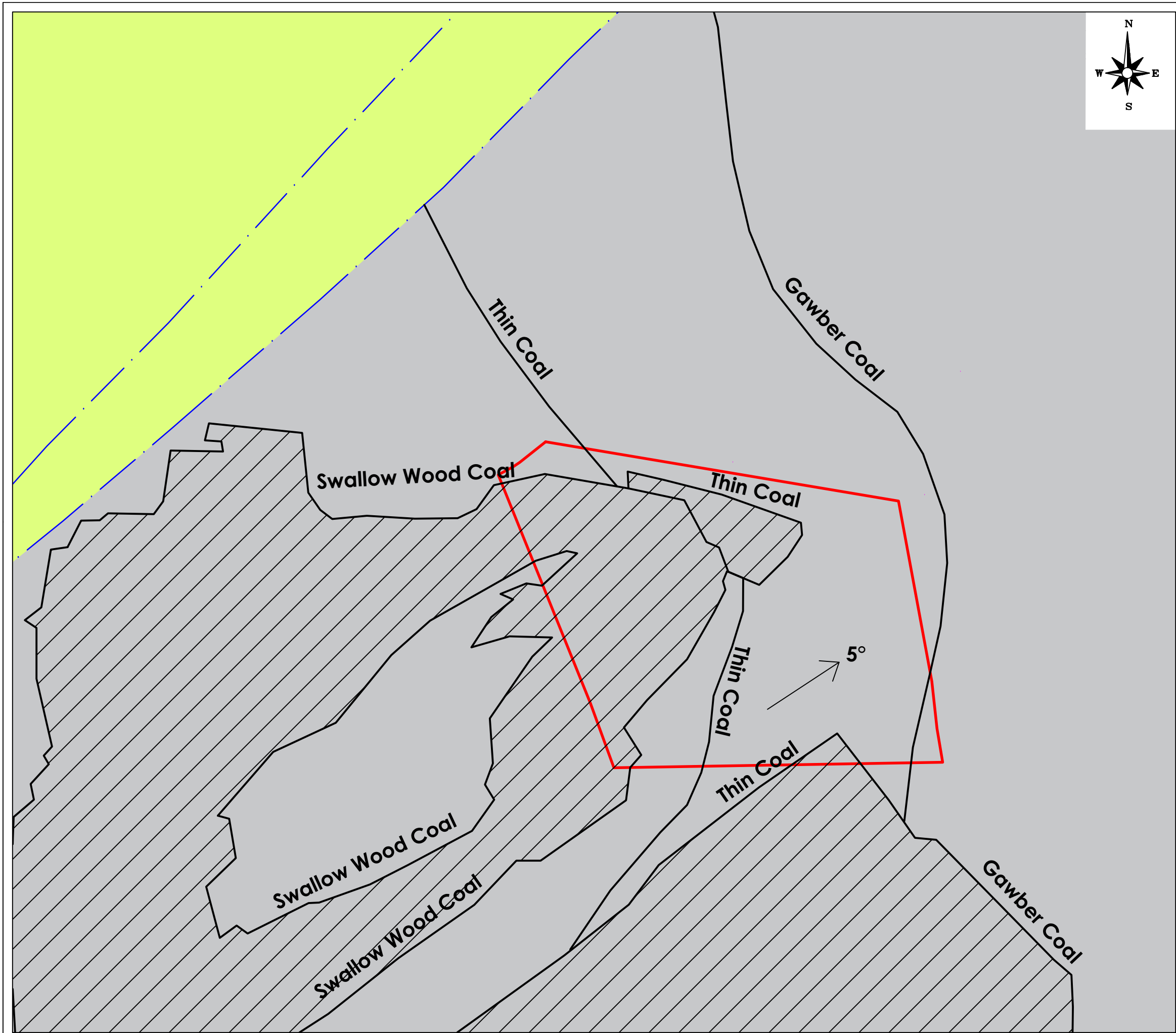
APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE
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CLIENT			
COUNTRYSIDE PROPERTIES			
JOB TITLE			
BARUGH GREEN			
DRAWING TITLE			
EXPLORATORY HOLE LOCATIONS			
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CHECKED	ASw	DATE	17 04 19
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		FOR APPROVAL ☐	
		DRAFT ☐	
		FINAL ☒	
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DRAWING NO.		3407/6	
		REVISION	



NOTES		
	PENNINE MIDDLE COAL MEASURES (MUDSTONE, SILTSTONE & SANDSTONE)	
	HIGH MOOR ROCK (SANDSTONE)	
	WORKED GROUND (BACKFILLED OPENCAST)	
	COAL OUTCROP	
	GEOLOGICAL FAULT	
	DIP DIRECTION	
	APPROXIMATE SITE BOUNDARY	
REV.	DESCRIPTION	DATE



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

CLIENT

COUNTRYSIDE
PROPERTIES

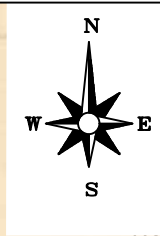
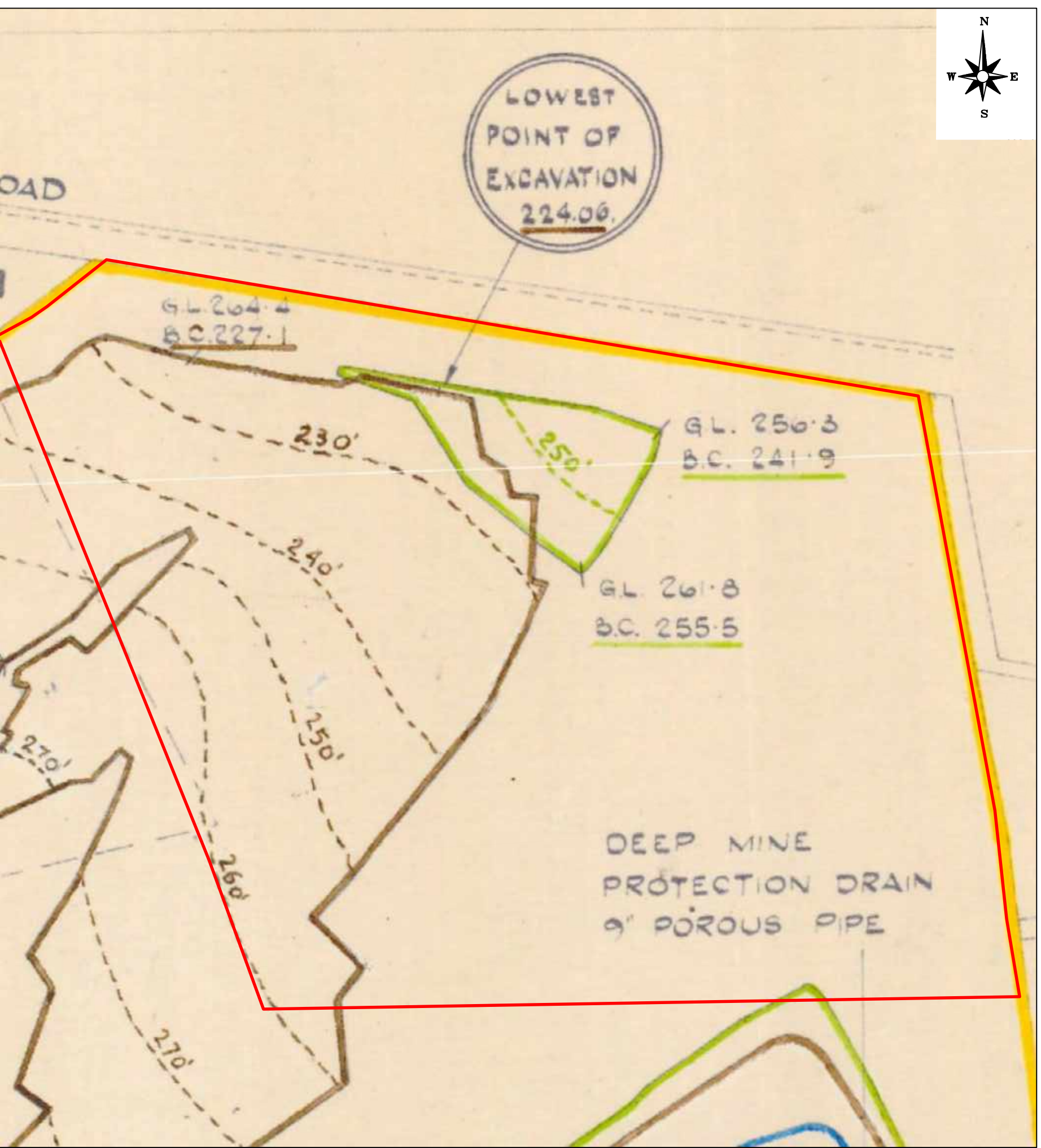
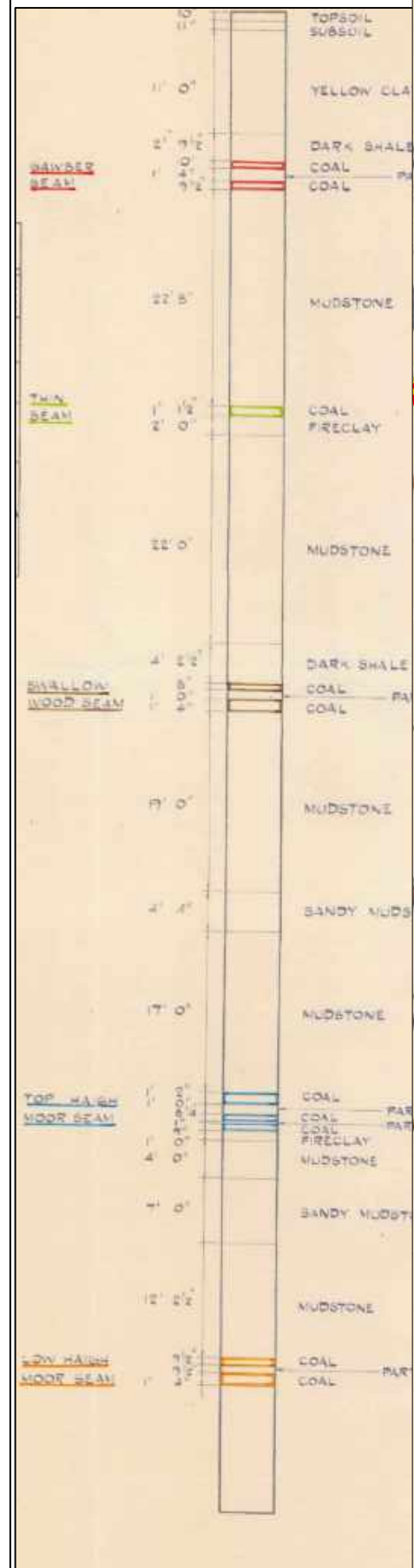
JOB TITLE

BARUGH GREEN

DRAWING TITLE

PUBLISHED GEOLOGY & COAL
OUTCROPS

DRAWN	LEW	DATE	23 04 19	STATUS	FOR COMMENT	☐
CHECKED	ASw	DATE	23 04 19	FOR APPROVAL	DRAFT	☐
				FINAL		☒
SCALE	1:1000	SHEET	A3	DRAWING NO.	3407/7	REVISION



NOTES

THIN	SWALLOW WOOD
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APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE
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info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

CLIENT

COUNTRYSIDE PROPERTIES

JOB TITLE

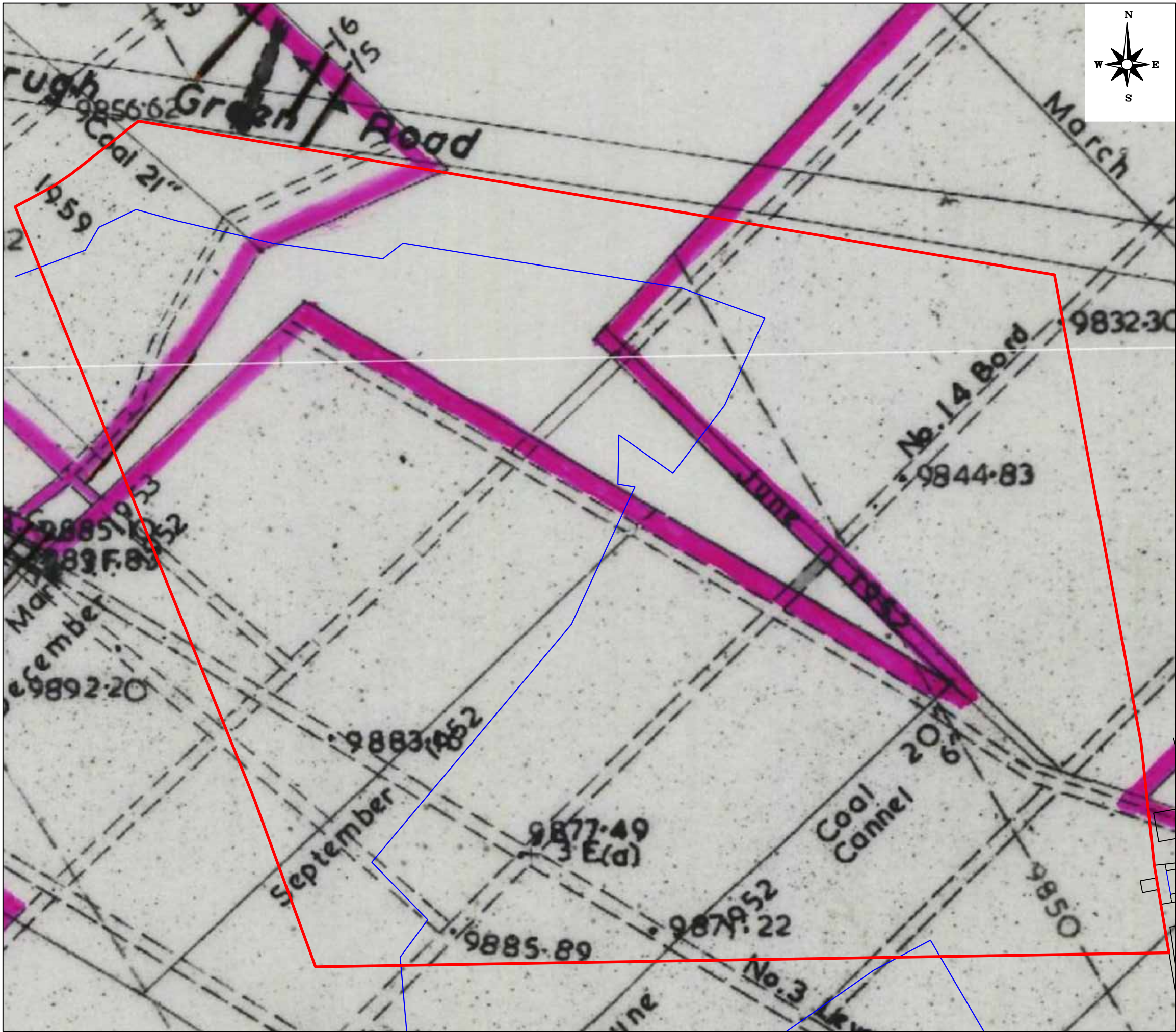
BARUGH GREEN

DRAWING TITLE

CRAVEN I & II OPENCASE ABANDONMENT PLAN

DRAWN	LEW	DATE	17 04 19	STATUS	FOR COMMENT	☐
CHECKED	ASw	DATE	17 04 19	FOR APPROVAL	DRAFT	☐
				FINAL		☒

SCALE	1:1250	SHEET	A3	DRAWING NO.	3407/8	REVISION	
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NOTES		
APPROXIMATE LINE OF HIGHWALL (ABANDONMENT PLAN) APPROXIMATE SITE BOUNDARY		
REV.	DESCRIPTION	DATE



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

CLIENT		
COUNTRYSIDE PROPERTIES		
JOB TITLE		
BARUGH GREEN		
DRAWING TITLE		
FLOCKTON THICK COAL ABANDONMENT PLAN		
DRAWN	DATE	STATUS FOR COMMENT ☐ FOR APPROVAL ☐ DRAFT ☒ FINAL ☐
CHECKED	DATE	
LEW	17 04 19	
ASw	17 04 19	
SCALE	SHEET	DRAWING NO.
1:1000	A3	3407/9

Appendix C

Commission

008/3407/Reg

19th February 2020



Registered in England 07068066

Mr A Clarke
Countryside Properties
3200 Thorpe Park
Century Way
Leeds
LS15 8ZB

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330
www.lithos.co.uk

Dear Adam

Barugh Green

Further to your recent invitation, please find attached our proposal for undertaking a site investigation on the above land. We understand that your proposed development will include traditional 2 storey domestic dwellings with associated gardens, POS and adoptable roads and sewers; a feasibility layout showing 121 units has been provided.

As you know we have already completed some initial research and an exploratory days' pitting; key findings of which are summarised below:

- The shallowest recorded mineworkings beneath this site are in the Flockton Thick seam (c. 0.7m thick at c. 125m bgl). However, the possibility of unrecorded shallow workings cannot be discounted, and if present would have significant implications for the proposed development.
- The western half and far southeast of the site are located within Coal Mining Development High Risk Areas due to previous opencast operations. Opencast backfill within the area of current interest is only expected to be around 5m to 10m deep.
- Trial trenching suggests the highwall locations roughly correspond to those shown on CA abandonment plans.
- The presence of deep opencast backfill has implications for foundations, drainage, new utilities & highways.

Given the depth of the fill and its age, and following discussion with Surepath (our specialist geotechnical sub-consultant), we do not expect settlement to be critical except over high walls (and internal walls if present – none are indicated). This assumes though that the fill is not atypical in composition or density. We need to establish the nature of the fill, as even if piles are used the surrounding development will settle relative to the houses.

Consequently, the ground investigation proposed here includes cable percussion boreholes with some with some classification testing and SPTs. Rotary probeholes are also proposed in order to check for the presence of shallow mineworkings, both beneath & beyond areas of known opencast.

This proposal also allows for a brief independent site appraisal by **Surepath**, to supplement Lithos' desk study, including:

- A review of our GI report and site photographs / plans
- Appraisal of the geometry of the quarry based on the available data
- Appraisal of the nature of the backfill and its properties
- Assessment of the likely sources of backfill movement and the likely range of settlements that the backfilled area could be subject to
- Discussion of the findings and the main development implications



Preliminary assessment will enable us to provide an order of magnitude of likely movements for your consideration and discussion with the NHBC etc.

If indications are that settlements could be important (this is not anticipated) then additional testing / monitoring could be required.

Our site investigation will be undertaken in accordance with UK good practice (as outlined in BS5930, BS10175, CLR11 etc). Our Report may not be fully compliant with Eurocode 7 (EC7) and will not purport to be a Ground Investigation Report, nor a Geotechnical Design Report as defined by EC7. Our ground appraisal is intended to assist others as they proceed with design of the proposed development.

This proposal allows for the following works:

Desk study: We already have environmental search data and historical maps (obtained from Landmark or Groundsure), and a Consultant's mining report from the Coal Authority.

We will complete a more detailed review of this data in order to draft a "traditional desk study" (to date only a letter report has been issued).

Fieldwork: We have allowed for a further 2 day's trial pitting (to 'tighten' the existing grid), the drilling of 5 cable percussion boreholes, and the drilling of c. 25 rotary probeholes. All trial pits and boreholes will be supervised and logged by an experienced geoenvironmental engineer.

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

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

Based on anticipated ground, **soakaways** will not provide a satisfactory solution for surface water drainage, and no allowance has been made for soakaway testing.

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

The cable percussion **boreholes** will be advanced to depths of c. 10m or refusal in bedrock, whichever is the deeper, and are primarily intended to enable the retrieval of geotechnical data from depth within the opencast backfill where piled foundations are anticipated.

However, boreholes will also allow the installation of gas wells (50mm ID, HDPE pipework with bentonite seals and a gravel filter pack). Well headworks will comprise a 100mm diameter steel security helmet which will extend about 300mm above ground level (if required, the position of each helmet could be "marked" with a 1.5m high fence post to reduce the likelihood of damage by farm machinery).

SPTs will be undertaken at approximate 1m intervals as the boreholes are advanced. SPTs allow assessment of the in-situ density of granular soils, enabling determination of allowable bearing capacity and thereby definitive foundation advice.

The borehole will be cased-off during drilling to at least rock head, in order to reduce the possibility of groundwater ingress, mis-sampling etc.

This investigation should yield sufficient data to enable a foundation zoning plan, and possibly a detailed Foundation Schedule. However, if ground conditions are found to be more variable than anticipated, a 'tighter' grid of pits will be necessary prior to preparation of a detailed Foundation

Schedule. This proposal does not allow for the preparation of a detailed Foundation Schedule, but we will provide a quote on completion of the site investigation if requested.

The site is underlain by several coal seams, and therefore we have allowed for the drilling of c. 25 **rotary probeholes** to check for the presence of mineworkings. This drilling should be sufficient to determine whether old mineworkings are present and pose a significant risk to surface stability of the site. 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.

It will be necessary to submit an application (with the associated fee) to the Coal Authority (CA) for 'Permission to enter CA mining interests'; and we have allowed for this. Given the proximity of surrounding housing (within 50m of some of the general site area), and in accordance with CA requirements we have had to assume that the probeholes will need to be advanced using water as the flushing medium (as reinforced by recent CA guidance on managing the risk of hazardous gas). Our drilling sub-contractor will need to locate the wash outs close to the site, and procure a standpipe and licence from Yorkshire Water.

With reference to the control, management and disposal of surplus water and flush arising from the works, (and in order to avoid additional costs associated with the provision of a telehandler to transfer a weir tank between boreholes, and the provision of a pump to transfer surplus water from the weir tank to an approved disposal point), we have made provision for a sand bag bund at the foot of the drilling mast, at each borehole to contain the majority of the drill cuttings. However, we have assumed that potentially discoloured surplus water will be allowed to flow and settle into the field.

We have also assumed that it will be possible to park plant overnight within the farmyard, where it will be more secure.

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

Given the presence of deep opencast backfill, we have allowed for the installation of wells in c. 15 boreholes and monitoring for hazardous **gas** (and any shallow groundwater).

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

Testing: This will comprise routine **geotechnical** soils analysis, including 40 moisture content & Atterberg limits, and 40 pH & water-soluble sulphate. We will also schedule 12 compaction tests on samples of made ground to assess suitability for use in earthworks ground improvement.

This site is underlain by opencast backfill which is likely to be subject to re-engineering prior to the construction of new estate roads. Consequently, there is no merit in obtaining CBR values at this stage.

Appropriate **chemical analyses**, based on our knowledge of the site's history, have been allowed for; this will comprise 30 samples for a suite including heavy metals, speciated PAH, and banded TPH (with supplementary speciation as/where appropriate). In the event that ground contamination is more significant or different to that anticipated, it might be necessary to carry out additional chemical testing.

Within in our proposal we have allowed for the screening (ID) of 30 samples for asbestos. In the event that positive IDs are reported, it is likely that we will need to schedule further analysis (asbestos quantification), in order to determine the significance of the results. Asbestos quantification is currently a relatively expensive test and consequently we have not allowed for it at this stage. We will inform you immediately after receipt of results if we consider asbestos quantification is required.

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

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

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

A completed copy of the **YW** Contaminated Land Assessment Form will be included in an Appendix to our Report.

A copy of the final report will be issued to the relevant regulatory authorities on receipt of written instruction from yourselves.

Invoicing: The attached proposal provides a breakdown of the costs associated with this project. This breakdown is for information only and the proposal can be regarded as a lump sum price of **£** plus VAT. Variation will only occur in the event that a given item is not undertaken or that substantial additional works are recommended, in which case we will inform you immediately, provide costs for the required works, and seek your prior consent.

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

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

- 1st milestone invoice (Items A) on issue of the Desk Study report
- 2nd milestone invoice (Items B to E) within 5 days of fieldwork completion, with exploratory hole logs and an interim letter report outlining our initial findings
- 3rd milestone invoice (Item F to I) on issue of the final SI report
- 4th and final invoice (Item J) after completion of the gas monitoring/issue of the supplementary letter report

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

Details of welfare will be included within the Method Statements, however, this investigation is expected to be completed within 5 working days and therefore it is not considered reasonably practicable to provide formal welfare facilities, and our proposal makes no allowance for so doing. However, we have allowed for mobilisation and use of a welfare van.

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

Most developers have copies of the necessary utility plans (including electricity, gas, water, drainage & telecom), and it would be appreciated if you could forward these prior to the proposed fieldworks.

However, if you do not have the necessary plans, Lithos will obtain them direct from each of the utility companies.

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

Further work: In addition to the investigation outlined above, further work that might be required, in light of initial findings and EA feedback, could include:

- Further cable percussion boreholes within the opencast backfill.
- In accordance with BS 8004:2015 and EC7, if piled foundations are anticipated, piling contractors may request that boreholes be extended a minimum 5m into competent bedrock using rotary coring techniques.
- Preparation of a Remediation Statement.
- Installation of extensometers.
- Installation of a grid of survey stations, and subsequent surveying to determine whether ground levels are changing.
- Zone tests via construction of a shallow test pad.

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

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

Yours sincerely

A handwritten signature in black ink, appearing to read "Mark Perrin".

Mark Perrin
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" shall mean these Terms (entitled "Terms and Conditions for the Appointment of Lithos Consulting"), the Proposal, any document recording the Client's unequivocal acceptance of the Proposal and any other documents or parts of other documents expressly referred to in any of the foregoing;

"Client" shall mean the party for whom the Services are being provided by Lithos;

"Documents" shall mean all documents of any kind and includes plans, drawings, reports, programmes, specifications, Bills of Quantities, calculations, letters, e-mails, faxes, memoranda, films and photographs (including negatives), or any other form of record prepared or provided or received by, or on behalf of Lithos, and whether in paper form or stored electronically or on disk, or otherwise;

"Lithos" shall mean Lithos Consulting Limited whose registered office is at Parkhill, Walton Road, Wetherby, West Yorkshire, LS22 5DZ.

"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;

"Parties" shall mean the Client and Lithos

"Project" shall mean the project described in the Proposal and any enquiry from the Client on which Lithos has based its Proposal;

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

"Terms" means these terms entitled "Lithos Consulting Terms of Appointment".

- 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 The Client agrees to engage Lithos and Lithos agrees to provide the Services in accordance with the provisions of the Agreement.

3 OBLIGATIONS OF LITHOS

- 3.1 Lithos shall perform the Services using the reasonable standard of skill and care normally exercised by similar professional Environmental firms in performing similar services under similar conditions.
- 3.2 Lithos shall use all reasonable endeavours to perform the Services in accordance with all relevant environmental and safety legislation.

4 OBLIGATIONS OF THE CLIENT

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

5 INTELLECTUAL PROPERTY

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

6 TITLE

- 6.1 Lithos shall transfer only such title or rights in respect of the Documents as it has, and if any part is purchased from a third party Lithos shall transfer only such title or rights as that party had and has transferred to Lithos.
- 6.2 Title in the Documents shall remain with and shall not pass to the Client until the amount due under the invoice(s) (including interest and costs) has been paid in full.
- 6.3 Until title passes, the Client shall hold the Documents as bailee for Lithos and shall store or mark them so that they can at all times be identified as the property of Lithos.
- 6.4 At any time before title passes (save and except where payment is not due), but only after prior consultation with the Client, Lithos may without any liability to the Client repossess and use or sell all or any of part of the Documents and by doing so terminate the right of the Client to use, sell or otherwise deal in the Documents.
- 6.5 Lithos may maintain an action for the price of the Documents notwithstanding that title in them has not passed to the Client.

7 CONFIDENTIALITY AND DATA PROTECTION

- 7.1 Lithos undertakes not to divulge or disclose to any third party without the written consent of the Client information which is designated confidential by the Client or which can reasonably be considered to be confidential and arises during the performance of the Services unless required to do so by law or necessary in the proper performance of its duties in relation to the Project, or in order to make full frank and proper disclosure to its insurers or intended insurers, or to obtain legal or accounting advice.
- 7.2 Subject to the above and Lithos' Privacy Policy which can be found on www.lithos.co.uk, Lithos shall be permitted to use information related to the Services it provides in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

8 THIRD PARTIES

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

9 INSURANCE

- 9.1 Lithos warrants to the Client that there is in force a policy of Professional Indemnity insurance covering its liabilities for negligence under this Agreement, with a limit of indemnity of £5,000,000 (FIVE MILLION POUNDS) any one claim, save for pollution and contamination claims and asbestos claims both of which carry £2,000,000 (TWO MILLION) in the aggregate cover. This policy is annually renewable and whilst renewal is not automatic, Lithos agrees to use reasonable endeavours to maintain such insurance at all times until six years from the date of the completion (or termination) of the Services under the Agreement, provided such insurance is available at commercially reasonable rates having regard, inter alia, to premiums required and policy terms obtainable.
- 9.2 If for any period such insurance is not available at commercially reasonable rates, Lithos shall forthwith inform the Client and shall obtain in respect of such period such reduced level of Professional Indemnity insurance as is available and as would be fair and reasonable in the circumstances for Lithos to obtain.

10 LIMITATIONS ON LIABILITY

- 10.1 Unless otherwise agreed in writing, Lithos' liability under or in connection with the Agreement whether in contract, tort, negligence, breach of statutory duty or otherwise (other than in respect of personal injury or death) shall be limited to and shall not exceed the lesser of either five million pounds in the aggregate (unless it is a pollution, contamination or asbestos claim in which case it is two million pounds in the aggregate) or 10 times the total value of invoices issued to the Client for consultancy work instructed under the Agreement.
- 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 Lithos after the expiry of a period of six years from the date of the completion (or termination) of the Services under the Agreement.
- 10.3 Whilst Lithos will scan all potential exploratory locations with a Cable Avoidance Tool, Lithos shall not be liable for any damage to underground services, cables, pipes, drains or underground buildings, constructions and the like which were either not marked on site or for which accurate plans were not provided.
- 10.4 Lithos shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by Lithos 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 Lithos has been advised in writing of the same by the Client and has been given the opportunity to rectify the same or where necessary, to design the solution for rectification of any subsequent works carried out by others pursuant to the same.

11 PAYMENT

- 11.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal.
- 11.2 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.
- 11.3 If the Client disputes the amount included for payment in an invoice a written notice must be served on Lithos by the Client not later than 14 days before the final date for payment. If no notice is given the amount due shall be the amount stated in the invoice.
- 11.4 In the event of failure on the part of the Client to pay any monies in accordance with the foregoing payment provisions, Lithos will be entitled to charge interest on any monies owed to it by the Client, such interest to be at a rate of 8% above the base rate of a clearing bank from time to time calculated from the final date for payment to the date of actual payment on a compound basis.

12 DELAY

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

13 TERMINATION

- 13.1 The Agreement may be terminated by either party in the event of the other making a composition or arrangement with its creditors, becoming bankrupt, or being a company, making a proposal for a voluntary arrangement for a composition of debts, or has a provisional liquidator appointed, or has a winding-up order made, or passes a resolution for voluntary winding-up (except for the purposes of a bona fide scheme of amalgamation or reconstruction), or has an administrator or an administrative receiver appointed to the whole or any part of its assets. Notice of termination must be given to the party which is insolvent by the other party.
- 13.2 If for any reason the performance of the Services by Lithos is suspended for a period in excess of three calendar months then Lithos shall be entitled to terminate its appointment in respect of the Services by seven days written notice to the Client.
- 13.3 If the Client shall fail to pay in full any sum due under the terms of the Agreement by the final date for payment for that sum and no effective notice of intention to withhold payment has been issued, Lithos may serve written notice on the Client demanding payment within 14 days of such notice. If the Client shall fail to comply with such notice, Lithos shall be entitled to terminate its employment under the Agreement forthwith.
- 13.4 Any termination of the appointment of Lithos howsoever caused shall be without prejudice to the right of Lithos 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.

14 NOTICES

- 14.1 Any notice provided for in the Agreement shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post to the address of the relevant party as may have been notified by each party to the other or, in the absence of notification, to the address of Lithos set out above or to the registered address of the Client.
- 14.2 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 first class post.

15 ENTIRE AGREEMENT

- 15.1 The Agreement constitutes the complete and entire agreement between the Client and Lithos 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 Lithos in respect of the Services can only be made in contract under the provisions of the Agreement and not otherwise under the law or tort or otherwise.
- 15.2 No amendments, modifications or variation of the Agreement shall be valid unless made in writing and agreed to by both the Client and Lithos; such agreement must be recorded in writing by at least one of the Parties.
- 15.3 Lithos will not be bound by any standard or printed terms or conditions furnished by the Client in any of its documents unless Lithos specifically states in writing separately from such documents that it intends such terms and conditions to apply.

16 DISPUTES AND GOVERNING LAW

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

Lewis Whiteley

From: Lewis Whiteley
Sent: 09 March 2020 16:08
To: Lewis Whiteley

From: Adam Clarke <AdamC@cpplc.com>
Sent: 03 March 2020 13:58
To: Reg <Reg@lithos.co.uk>
Subject: RE: Site Investigation Quote - Barugh Green, Barnsley

Hi Reg

Please proceed with this work.

Please could you arrange for desk study to be issued in advance (possibly incorporating the trial trenching findings as you mentioned) to allow planning submission to be made

Thanks

Adam

Adam Clarke
Development Engineer, Partnerships Yorkshire

Countryside Properties
Aeris, 3200 Century Way, Thorpe Park, Leeds, LS15 8ZB

T: 0113 5324484 | M: 07468 702603 | countrysideproperties.com



From: Reg <Reg@lithos.co.uk>
Sent: 19 February 2020 12:29
To: Adam Clarke <AdamC@cpplc.com>
Subject: Site Investigation Quote - Barugh Green, Barnsley

SI quote as promised.

As discussed, this is a relatively costly job (£), largely due to the need for an intrusive mining investigation and gas risk assessment. We have allowed for c. 20 trial pits, 25 deep rotary probeholes (to check for mineworkings), 15 shallow probeholes (monitoring well installation), and 5 cable percussion backfill (to assess the nature of opencast backfill) plus plenty of soils testing (geotechnical & contaminant) and reporting.

We could issue a Desk Study Report in advance of fieldwork if desired.

If required, we could reduce the scope/cost and/or adopt a more staged approach issue. However, this is a potentially difficult site and consequently, there could be need for other supplementary investigation anyway.

We would expect to be on site within 4 weeks of instruction, with a summary of initial findings issued within 2 to 3 days of fieldwork completion. Our final SI Report should be available within c. 9 weeks of instruction (although a quicker turnaround might be possible).

Any queries, please call.

Regards

Mark Perrin
Director
Lithos Consulting Ltd
M 07703 396 635
DD 01937 545 331



www.lithos.co.uk



From: Adam Clarke <AdamC@cpplc.com>
Sent: 11 February 2020 15:17
To: Reg <Reg@lithos.co.uk>
Subject: Site Investigation Quote - Barugh Green, Barnsley

Hi Reg

As discussed, we're now preparing a planning application for the site at Barugh Green, Barnsley where you carried out the trial trenching previously to locate the opencast highwalls.

Please could you provide a quote for a phase 1 and 2 SI – phase 1 to be issued in advance of phase 2 to achieve planning submission date of end of March.

I attach a copy of our layout.

Thanks

Adam

Adam Clarke
Development Engineer, Partnerships Yorkshire

Countryside Properties
Aeris, 3200 Century Way, Thorpe Park, Leeds, LS15 8ZB

T: 0113 5324484 | M: 07468 702603 | countrysideproperties.com

Appendix D

Historical OS Plans



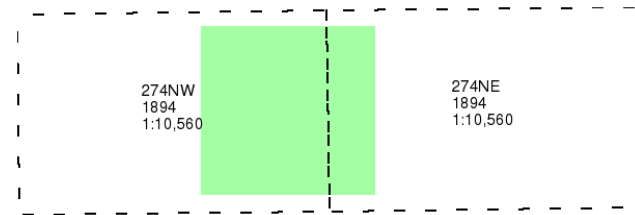
Yorkshire

Published 1894

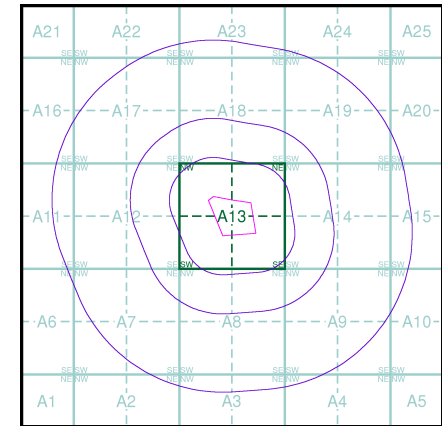
Source map scale - 1:10,560

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 other 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 until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

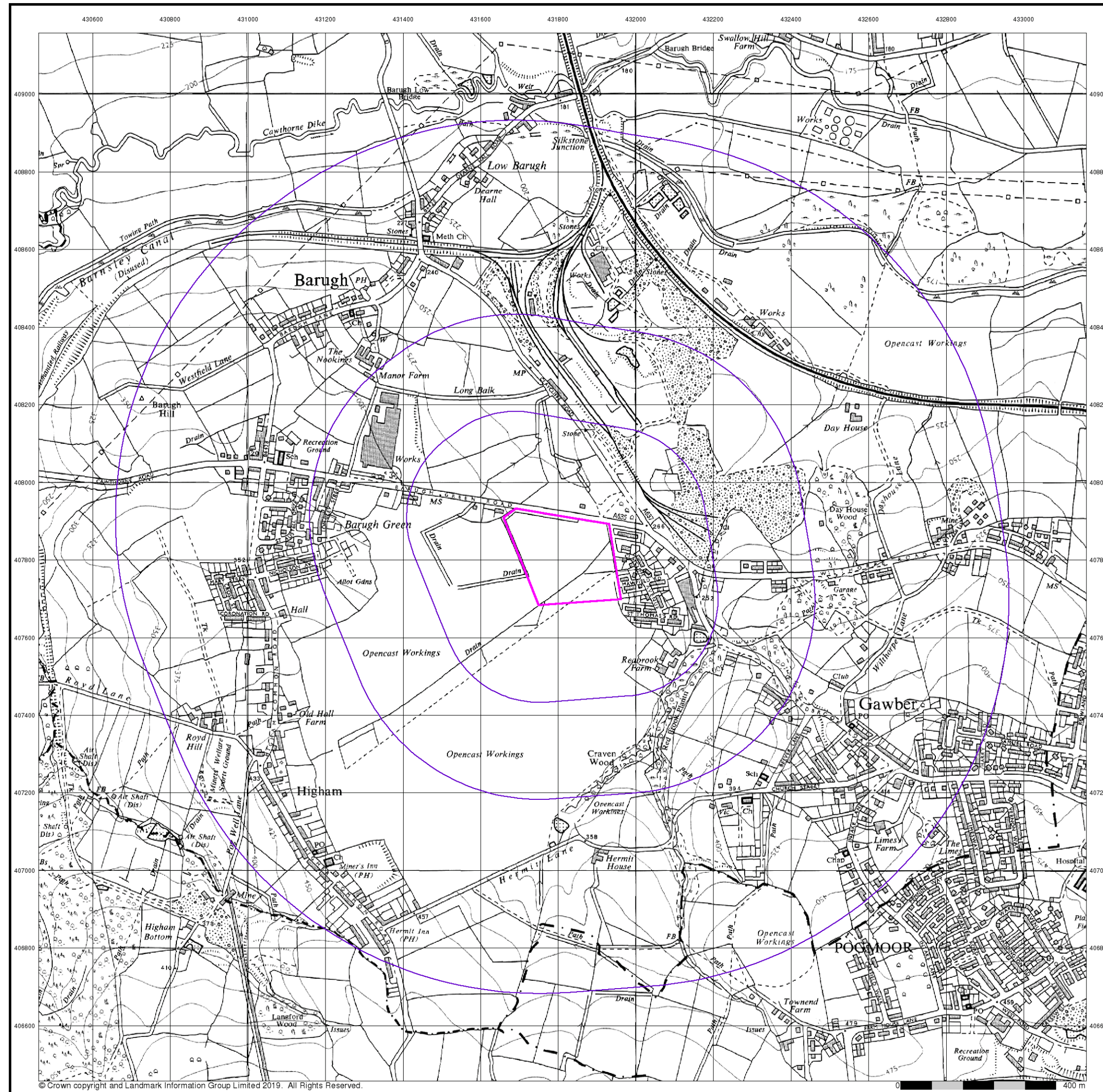
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Customer Ref: PO14383/JW/3407
National Grid Reference: 431820, 407810
Slice: A
Site Area (Ha): 5.43
Search Buffer (m): 1000

Site Details

Barugh Green, S75 1JY

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INFORMATION GROUP

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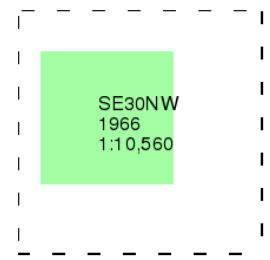
Ordnance Survey Plan

Published 1966

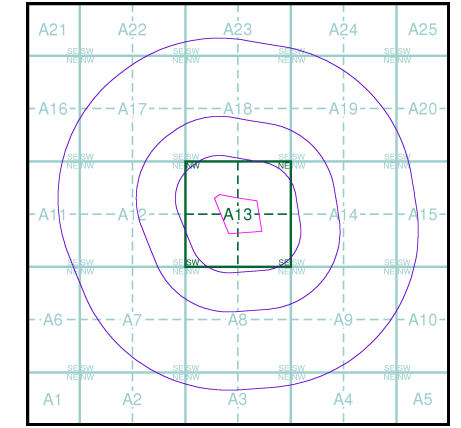
Source map scale - 1:10,000

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 other 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 until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

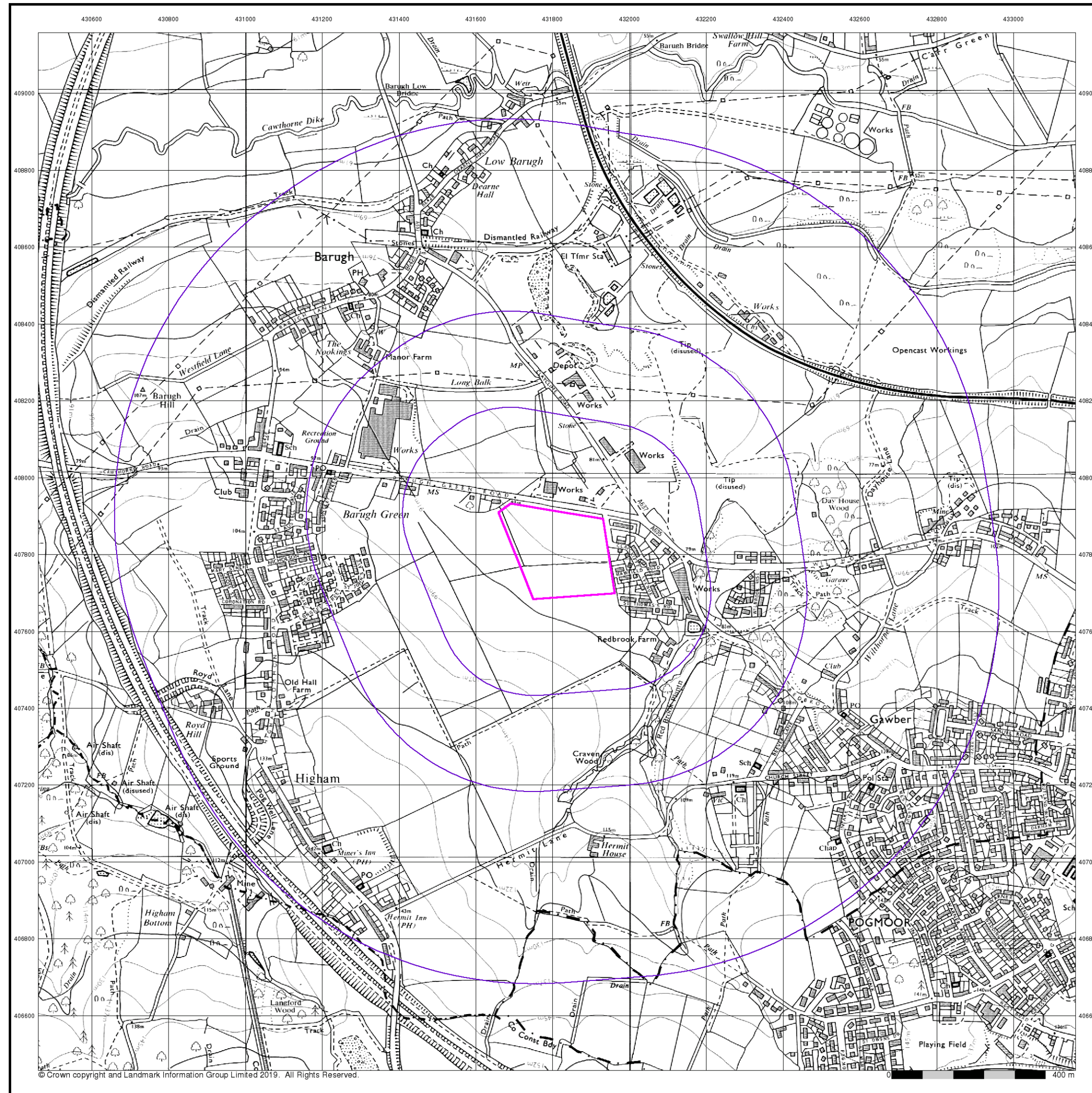
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Customer Ref: PO14383/JW/3407
National Grid Reference: 431820, 407810
Slice: A
Site Area (Ha): 5.43
Search Buffer (m): 1000

Site Details

Barugh Green, S75 1JY



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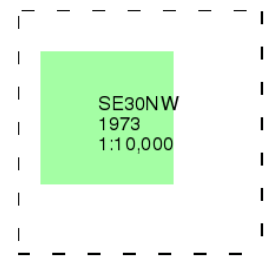
Ordnance Survey Plan

Published 1973

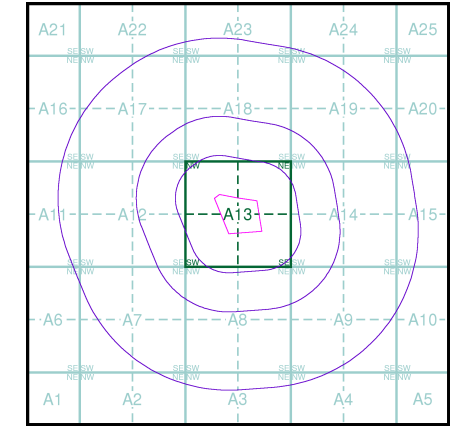
Source map scale - 1:10,000

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 other 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 until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number: 199418449_1_1
Customer Ref: PO14383/JW/3407
National Grid Reference: 431820, 407810
Slice: A
Site Area (Ha): 5.43
Search Buffer (m): 1000

Site Details

Barugh Green, S75 1JY



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

Appendix E

Search Responses & other Correspondence



Envirocheck[®] Report:

Datasheet

Order Details:

Order Number:

199418449_1_1

Customer Reference:

PO14383/JW/3407

National Grid Reference:

431820, 407810

Slice:

A

Site Area (Ha):

5.43

Search Buffer (m):

1000

Site Details:

Barugh Green

S75 1JY

Client Details:

Mr M Perrin

Lithos Consulting Ltd

Parkhill

Walton Road

Wetherby

LS22 5DZ

Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	17
Hazardous Substances	-
Geological	28
Industrial Land Use	35
Sensitive Land Use	54
Data Currency	55
Data Suppliers	60
Useful Contacts	61

Introduction

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

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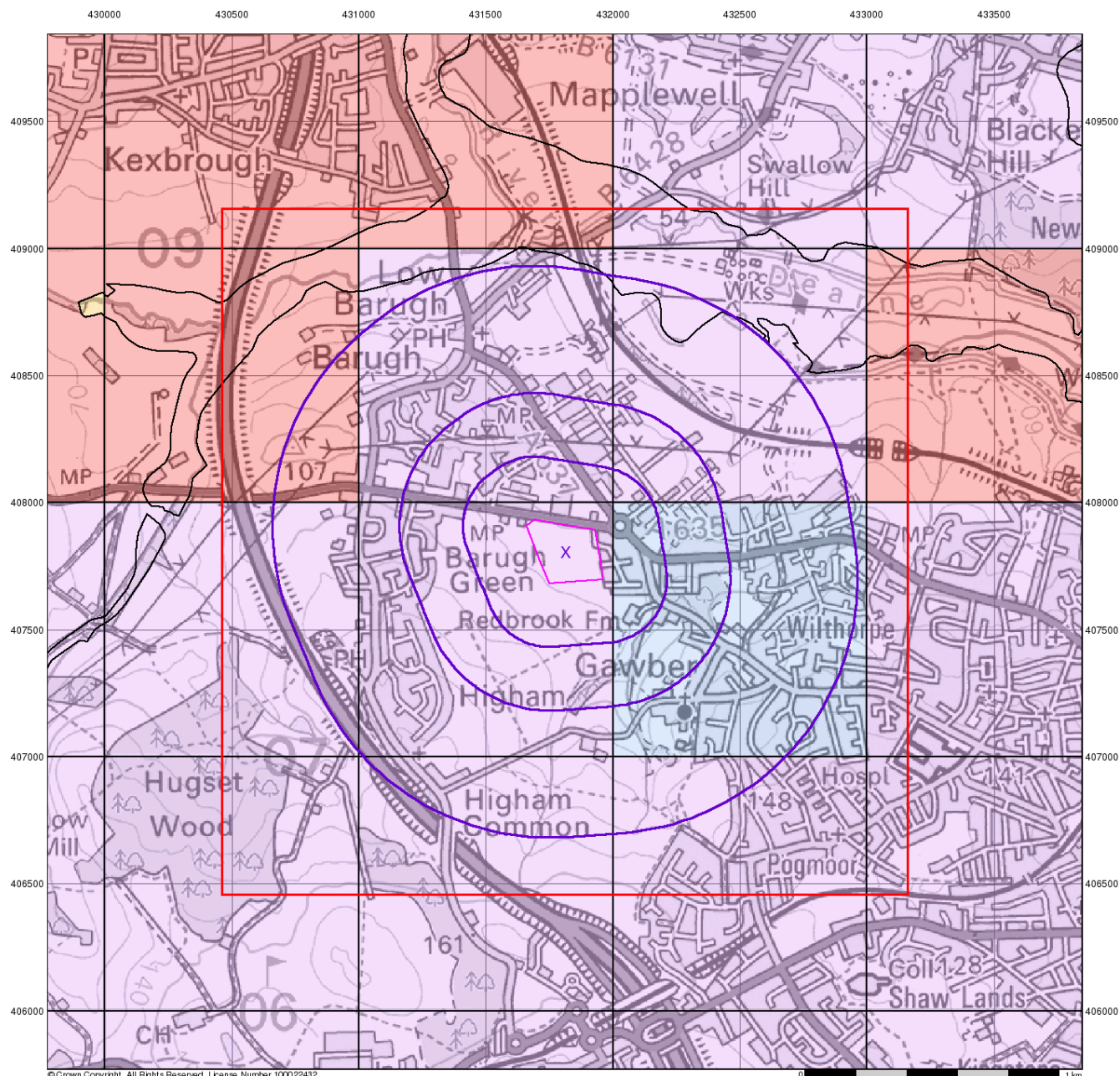
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Report Version v53.0

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 2		3	2	4
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 5		4	6	5
Local Authority Pollution Prevention and Control Enforcements	pg 7			1	1
Nearest Surface Water Feature	pg 7	Yes			
Pollution Incidents to Controlled Waters	pg 7			1	12
Prosecutions Relating to Authorised Processes					
Registered Radioactive Substances	pg 9			1	
River Quality					
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register	pg 10				1
Water Abstractions	pg 10				(*1)
Water Industry Act Referrals					
Groundwater Vulnerability Map	pg 10	Yes	n/a	n/a	n/a
Groundwater Vulnerability - Soluble Rock Risk			n/a	n/a	n/a
Groundwater Vulnerability - Local Information			n/a	n/a	n/a
Bedrock Aquifer Designations	pg 10	Yes	n/a	n/a	n/a
Superficial Aquifer Designations			n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
OS Water Network Lines	pg 10	2	10	16	27

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites	pg 17				1
Historical Landfill Sites	pg 17		3	5	8
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)	pg 20			1	
Local Authority Landfill Coverage	pg 20	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites	pg 20		1	7	6
Potentially Infilled Land (Non-Water)	pg 22		1	3	5
Potentially Infilled Land (Water)	pg 23		3	3	32
Registered Landfill Sites	pg 25			6	1
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					



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Groundwater Vulnerability

General

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

Agency and Hydrological

Bedrock Aquifers

- High Vulnerability, Principal Aquifer
- High Vulnerability, Secondary Aquifer
- Medium Vulnerability, Principal Aquifer
- Medium Vulnerability, Secondary Aquifer
- Low Vulnerability, Principal Aquifer
- Low Vulnerability, Secondary Aquifer

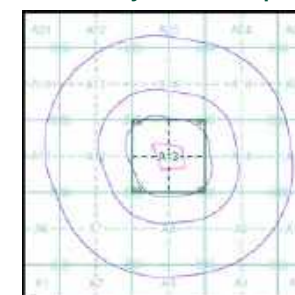
Superficial Aquifers

- High Vulnerability, Principal Aquifer
- High Vulnerability, Secondary Aquifer
- Medium Vulnerability, Principal Aquifer
- Medium Vulnerability, Secondary Aquifer
- Low Vulnerability, Principal Aquifer
- Low Vulnerability, Secondary Aquifer

Unproductive Aquifer

Soluble Rock

Site Sensitivity Context Map - Slice A



Order Details

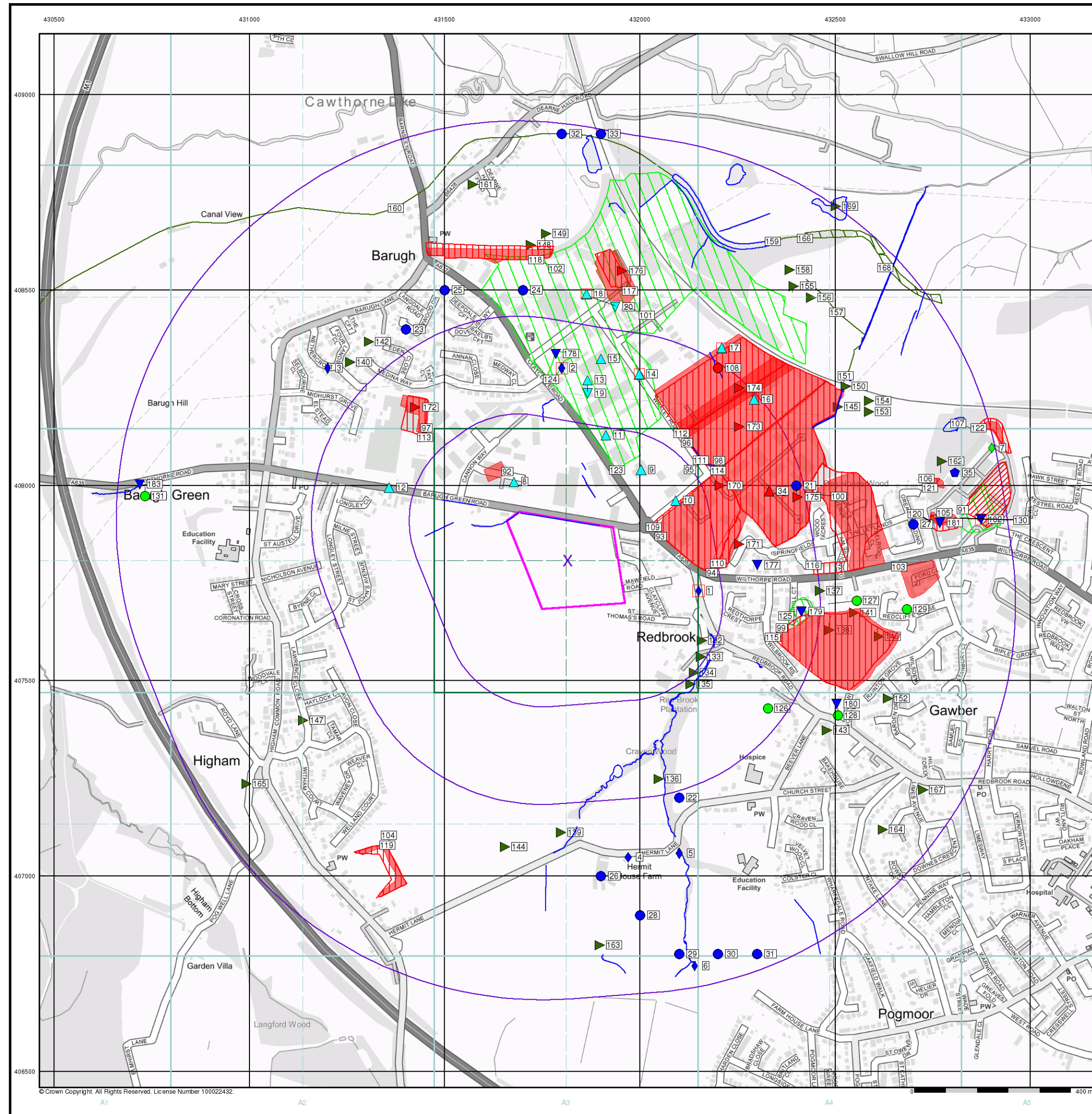
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 Customer Ref: PO14383/JW/3407
 National Grid Reference: 431820, 407810
 Slice: A
 Site Area (Ha): 5.43
 Search Buffer (m): 1000

Site Details

Barugh Green, S75 1JY

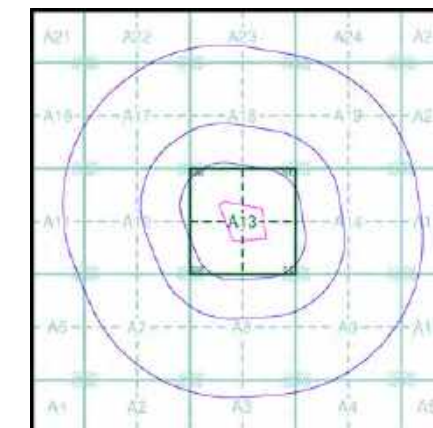
Landmark
 INFORMATION GROUP

Tel: 0844 844 9952
 Fax: 0844 844 9951
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- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point
 - Map ID
 - Several of Type at Location
- Agency and Hydrological**
- Contaminated Land Register Entry or Notice (Location)
 - Contaminated Land Register Entry or Notice
 - Discharge Consent
 - Enforcement or Prohibition Notice
 - Integrated Pollution Control
 - Integrated Pollution Prevention Control
 - Local Authority Integrated Pollution Prevention and Control
 - Local Authority Pollution Prevention and Control
 - Local Authority Pollution Prevention and Control Enforcement
 - Pollution Incident to Controlled Waters
 - Prosecution Relating to Authorised Processes
 - Prosecution Relating to Controlled Waters
 - Registered Radioactive Substance
 - River Network or Water Feature
 - River Quality Sampling Point
 - Substantiated Pollution Incident Register
 - Water Abstraction
 - Water Industry Act Referral
- Waste**
- BGS Recorded Landfill Site (Location)
 - BGS Recorded Landfill Site
 - EA Historic Landfill (Buffered Point)
 - EA Historic Landfill (Polygon)
 - Integrated Pollution Control Registered Waste Site
 - Licensed Waste Management Facility (Landfill Boundary)
 - Licensed Waste Management Facility (Location)
 - Local Authority Recorded Landfill Site (Location)
 - Local Authority Recorded Landfill Site
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Registered Landfill Site (Location)
 - Registered Landfill Site (Point Buffered to 100m)
 - Registered Landfill Site (Point Buffered to 250m)
 - Registered Waste Transfer Site (Location)
 - Registered Waste Transfer Site
 - Registered Waste Treatment or Disposal Site (Location)
 - Registered Waste Treatment or Disposal Site
- Hazardous Substances**
- COMAH Site
 - Explosive Site
 - NIHHS Site
 - Planning Hazardous Substance Consent
 - Planning Hazardous Substance Enforcement
 - BGS Recorded Mineral Site
- Geological**
- BGS Recorded Mineral Site

Site Sensitivity Map - Slice A



Order Details

Order Number: 199418449_1_1
Customer Ref: PO14383/JW/3407
National Grid Reference: 431820, 407810
Slice: A
Site Area (Ha): 5.43
Search Buffer (m): 1000

Site Details

Barugh Green, S75 1JY



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



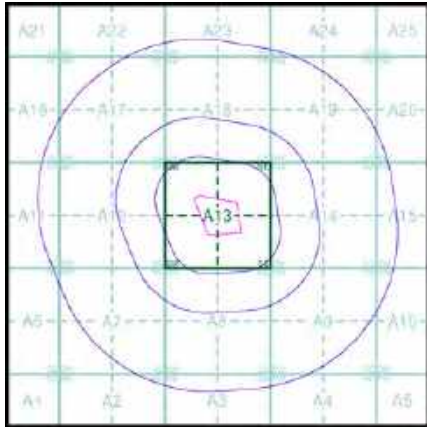
General

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

Agency and Hydrological (Flood)

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

Flood Map - Slice A



Order Details

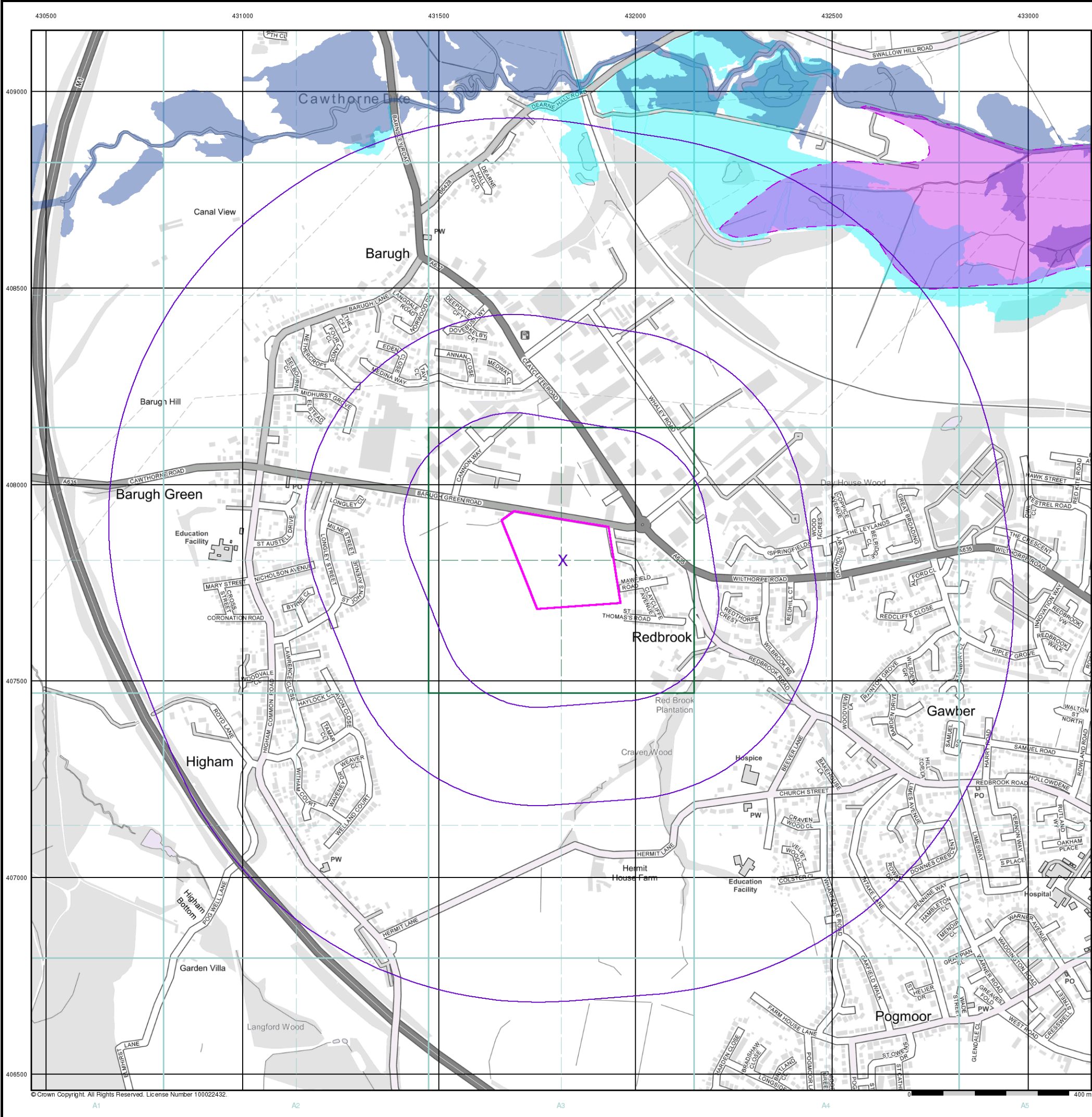
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Site Area (Ha): 5.43
Search Buffer (m): 1000

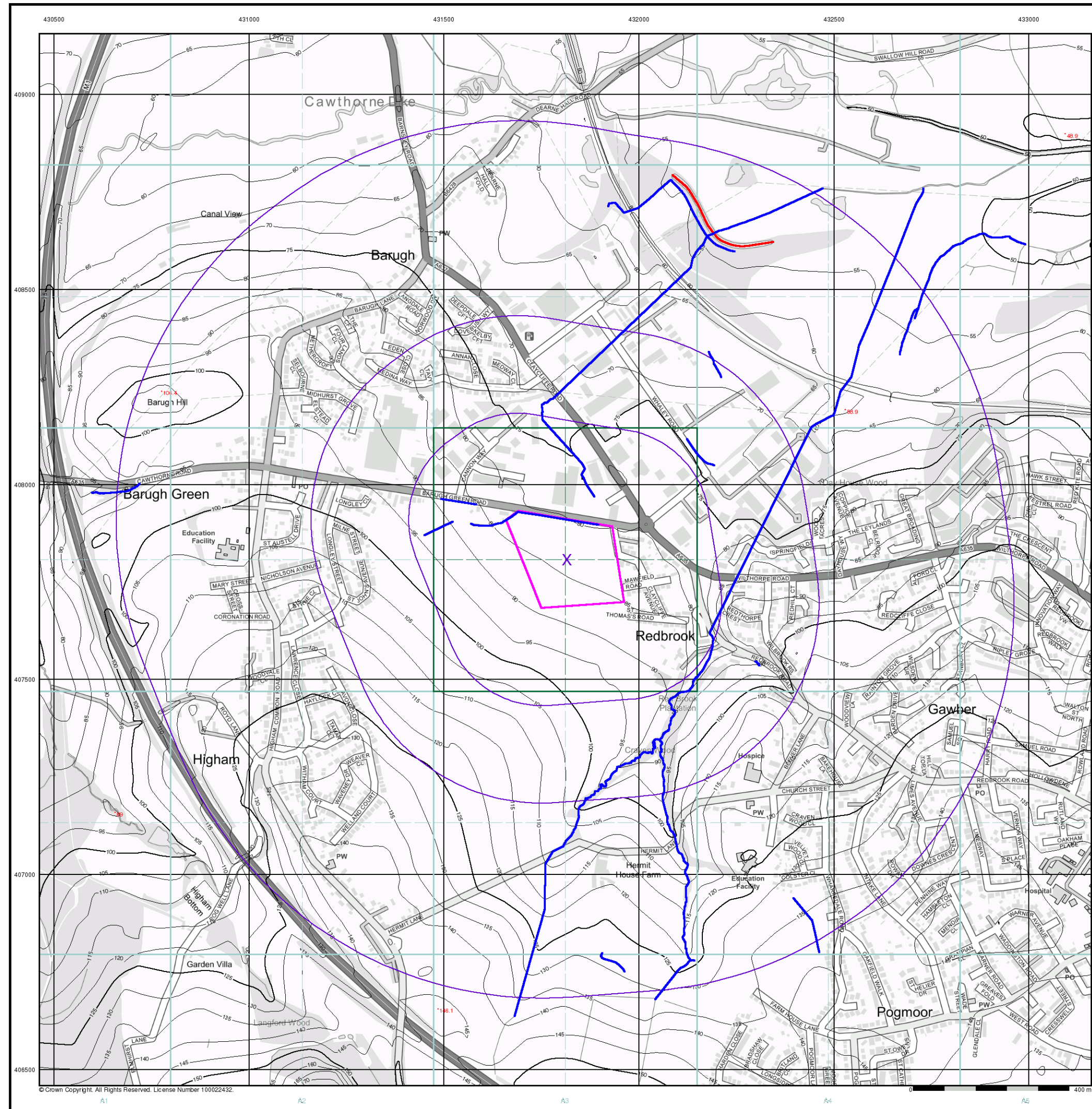
Site Details

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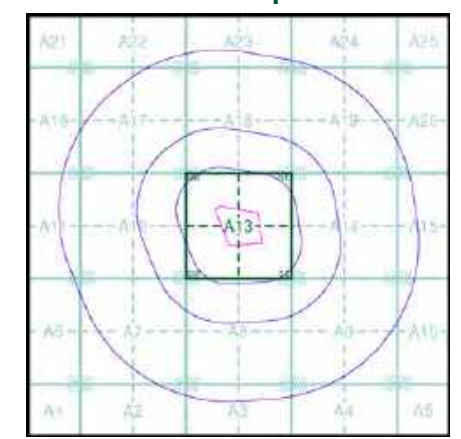


- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point

- OS Water Network Data**
- | | |
|--------------|-------------------------|
| Canal | Drain |
| Reservoir | Other |
| Foreshore | Lake |
| Marsh | Transfer |
| Tidal River | Lock Or Flight Of Locks |
| Inland River | Sea |

- Contours (height in meters)**
- Standard Contour 105 100 95
- Master Contour 105 100 95
- Spot Height 167.3
- MLW Mean Low Water
- MHW Mean High Water

OS Water Network Map - Slice A



Order Details

Order Number: 199418449_1_1
Customer Ref: PO14383/JW/3407
National Grid Reference: 431820, 407810
Slice: A
Site Area (Ha): 5.43
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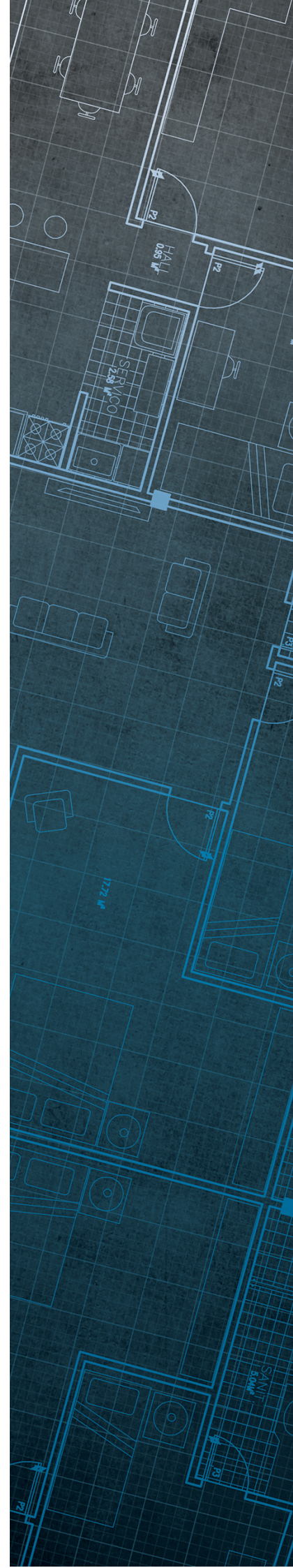


The Coal
Authority

Consultants Coal Mining Report

Barugh Green
S75 1JY

Date of enquiry:	2 April 2019
Date enquiry received:	2 April 2019
Issue date:	2 April 2019
Our reference:	51002073864001
Your reference:	PO14384/JW/3407



Consultants

Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

LITHOS CONSULTING LTD

Enquiry address

Barugh Green
S75 1JY

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.groundstability.com

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
DODWORTH	FLOCKTON THICK	Coal	6NKR	70	Beneath Property	3.8	North-East	68	1952
DODWORTH	FLOCKTON THICK	Coal	6NJR	127	Beneath Property	3.8	North-East	71	1959
DODWORTH	FLOCKTON THICK	Coal	6NFT	128	North	4.2	North-East	56	1960
DODWORTH	FLOCKTON THICK	Coal	6Z6U	133	East	4.1	North-East	76	1950
DODWORTH	TOP FENTON	Coal	6NCR	153	South-West	2.7	North-East	79	1933
DODWORTH	SILKSTONE	Coal	6NHS	253	Beneath Property	3.9	North-East	105	1977
STANHOPE SILKSTONE	SILKSTONE	Coal	6NDS	254	North-West	4.4	North-East	107	1928
STANHOPE SILKSTONE	SILKSTONE	Coal	6NCV	258	North-West	3.9	North-East	107	1928
unnamed	SILKSTONE	Coal	6NFS	267	Beneath Property	4.7	North-East	107	1928
DODWORTH	SILKSTONE	Coal	6NGS	269	Beneath Property	4.0	North-East	105	1979
DODWORTH	SILKSTONE	Coal	6Z70	273	East	4.3	North-East	105	1976
DODWORTH	SILKSTONE	Coal	6NDW	274	North	3.0	North-East	100	1978
DODWORTH	SILKSTONE	Coal	6YNG	279	North-East	3.9	North-East	90	1978
WOOLLEY	WHINMOOR	Coal	6NLS	306	Beneath Property	4.3	North-East	107	1978
WOOLLEY	WHINMOOR	Coal	6NEV	321	North	4.8	North-East	115	1978
WOOLLEY/REDBROOK	WHINMOOR	Coal	6Z72	322	East	4.8	North-East	107	1977
WOOLLEY	WHINMOOR	Coal	Z89	323	Beneath Property	5.2	North-East	107	1980
WOOLLEY	WHINMOOR	Coal	6NFV	327	North	4.4	North-East	115	1979
WOOLLEY/REDBROOK	WHINMOOR	Coal	6Z74	329	North-East	4.7	North-East	117	1979
WOOLLEY/REDBROOK	WHINMOOR	Coal	6YNH	329	North-East	4.4	East	109	1979

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

None recorded within 100 metres of the enquiry boundary.

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

NE3	7196	NE584
NE919	NE1034	NE498
7197	NE762	9534

Our records show we have more plans than those shown above which could affect the enquiry boundary.

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

No outcrops recorded.

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

Please refer to the "Summary of findings" map (on separate sheet) for details of any opencast areas within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

None recorded within 50 metres of the enquiry boundary.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices

The property is in an area where notices to withdraw support were given in 1956, 1977 and 1987.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

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The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

- Approximate position of the enquiry boundary shown 
- Opencast mine licence area 
- Unlicensed opencast site 

How to contact us
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