APPLiED GEOLOGY

PHASE I COAL MINING RISK ASSESSMENT FOR HOYLAND COMMON, BARNSLEY, M1 JUNCTION 36

nqa ISO 9001 QUALITY MANAGEMENT
UKAS MANAGEMENT SYSTEMS 015
AGS
Constructionline Gold Member
CHAS Accredited Contractor CHAS.co.uk
Avetta

REPORT STATUS SHEET

Client:	Newlands Developments
Report Title:	Phase I Coal Mining Risk Assessment at Hoyland Common, Barnsley, M1 Junction 36
Report Number:	AG3080-19-AJ77
Report Status:	Validated Issue 1
Date:	January 2020



		Date	Signed for and on behalf of Applied Geology Limited
Report Author	P Shelton BSc PhD CEng MIMMM FGS	31/01/2020	
Checked & Authorised	S Day BSc (Hons) MSc CGeol FGS SiLC Director	31/01/2020	

CONTENTS

1.0 INTRODUCTION 1
1.1 Brief 1
1.2 Scope of Coal Mining Risk Assessment 1
1.3 Sources of Information 1
2.0 SITE DESCRIPTION AND PROPOSALS 2
2.1 Site Description 2
2.2 Site Proposals 4
3.0 SUMMARY OF DESK STUDY DATA 5
3.1 Site History 5
3.2 Published Geology 8
3.3 Coal Authority Interactive Map and Consultant's Report 13
3.4 Coal Mine Abandonment Plans 17
4.0 IDENTIFICATION AND ASSESSMENT OF SITE-SPECIFIC COAL MINING RISKS 18
4.1 Summary of Risk Assessment 18
4.2 Recorded Underground Shallow Mine Workings 19
4.3 Unrecorded Underground Shallow Mine Workings 19
4.4 Recorded Mine Entries 20
4.5 Un-recorded Mine Entries 21
4.6 Surface Mining (Opencast Workings) 21
5.0 SUMMARY OF MINING LEGACY 21
6.0 CONCLUSIONS AND PROPOSED MITIGATION STRATEGY 22

GENERAL NOTES

APPENDICES

APPENDIX A **DRAWINGS**
- Site Location Plan, Dwg No AG3080-19-01
- Proposed Borehole Location Plan, Dwg No. AG3080-19-03
- Geological Conceptual Site Model, Figure 1
- Topographic Survey Drawing Extract
- Proposed Site Plan, pHp Architects Drawing Ref. 4400-029-P4 19-12-19

APPENDIX B **DESK STUDY DATA**
- Coal Authority Consultants Mining Report, Ref. 51002186288001
- Coal Authority Mine Abandonment Plans
- Selected BGS Archive Boreholes
- Extracts from selected OS Historical Maps
- Extracts from BGS Internal Report IR/06/135
- Extracts from BGS Geological Sheet Memoir (Sheet 87)
- Extracts from Midland Institute of Mining, Civil, and Mechanical Engineering 'Sections of Strata' 1914 Publication
- Extracts from SYMAS Report Ref. PJ/M3687/5

1.0 INTRODUCTION

1.1 Brief

An area of land between the M1 motorway and Sheffield Road to the west of Hoyland Common near Barnsley (the site) is to be redeveloped by Newlands Developments (the Client). The proposals for the site comprise the reprofiling of the current land surface to enable site development for industrial/employment use, the most significant of which will be the construction of a single large distribution warehouse, along with a new link road and associated infrastructure, parking, and landscaping.

Applied Geology was appointed by Newlands Developments to undertake a Phase 1 Coal Mining Risk Assessment (CMRA) to support a future planning application.

1.2 Scope of Coal Mining Risk Assessment

The site is located within an area designated by the Coal Authority (CA) as being of Development High Risk as a result of historic coal mining legacy. As a result, this CMRA is required to identify the historic coal mining risks and direct the Client as to their causes and ways that these can be mitigated permitting future beneficial development.

In particular, the CMRA has been prepared to:

- present a desk-based review of all available information on the coal mining issues that are relevant to the application site;
- use that information to identify and assess the risks to the proposed development from coal mining legacy, including the cumulative impact of issues;
- set out appropriate mitigation measures to address the coal mining legacy issues affecting the site, including any necessary remedial works and/or demonstrate how coal mining issues have influenced the proposed development;
- demonstrate to the Local Planning Authority that the application site is, or can be made, safe and stable to meet the requirements of National Planning Policy Framework with regard to development on unstable land.

1.3 Sources of Information

The scope of works undertaken by Applied Geology included a review of the following:

- Coal Authority Consultants Mining Report (Ref.51002186288001, dated 24th October 2019);
- Ordnance Survey Historical Maps;
- British Geological Survey (BGS) - published information and on-line borehole database, including:
  - 1:10,000 Geological Map of SE30SE;
  - 1:10,000 Geological Map of SK39NE;
  - Memoir for Sheet 87 Barnsley;

  - The Pennine Lower and Middle Coal Measures Formations of the Barnsley district. BGS Internal Report IR/06/135;
  - BGS Archive borehole records.
- Coal Authority Interactive Map;
- Coal Authority Abandonment Plans (Ref. 5843, 10651, NE169, NE433, NE583, OC142 and OC238);
- Midland Institute of Mining, Civil, and Mechanical Engineering 'Sections of Strata of the Coal Measures of Yorkshire', 1914;
- Barnsley Metropolitan Borough Council Planning Portal;
- CIRIA SP32 'Construction over Abandoned Mine Workings', 2002;
- CIRIA C758D 'Abandoned Mine Workings Manual', 2019.

A site walkover was undertaken by Applied Geology on 30th October 2019.

2.0 SITE DESCRIPTION AND PROPOSALS

2.1 Site Description

The site is located immediately southeast of Junction 36 of the M1 motorway just west of the village of Hoyland Common, approx. 6km south of Barnsley in South Yorkshire. The Ordnance Survey grid reference for the centre of the site is approximately 435500, 399700 as shown on the Site Location Plan in Appendix A.

The site is irregular in plan shape with maximum extents of 1.3km (NW-SE) and 750m (SW-NE) covering an area of approximately 44.5 hectares (110 acres). Site levels vary between approximately 150.5mOD towards the centre of the site and 117mOD in the southeast corner. From the high point of the site, ground levels slope down towards the southeast; however, the northern half of the site in gently sloping/undulating, varying between approximately 140mOD and 150mOD. A copy of the existing topographic survey drawing is included in Appendix A.

A site inspection/walkover was undertaken by Applied Geology on 30th October 2019. Access to the site was gained via Tankersley Lane, Sheffield Road and a private road to the southwest corner of the site. At the time of inspection, the site comprised open fields including arable, pasture and very recently ploughed fields. Apart from a few stables for horses, no buildings were present on site. Tankersley Lane crosses the site running ENE-WSW in the northern part of the site. Towards the south of the site, high voltage ENE-WSW aligned electricity cables supported on large pylons cross the site. A further smaller overhead electricity cable crosses the extreme northwest corner of the site.

For reasons relating to coal mining history and proposed development, the whole site has been divided into three separate zones designated Zones A to C consecutively. The boundaries are shown below as are detailed site descriptions.

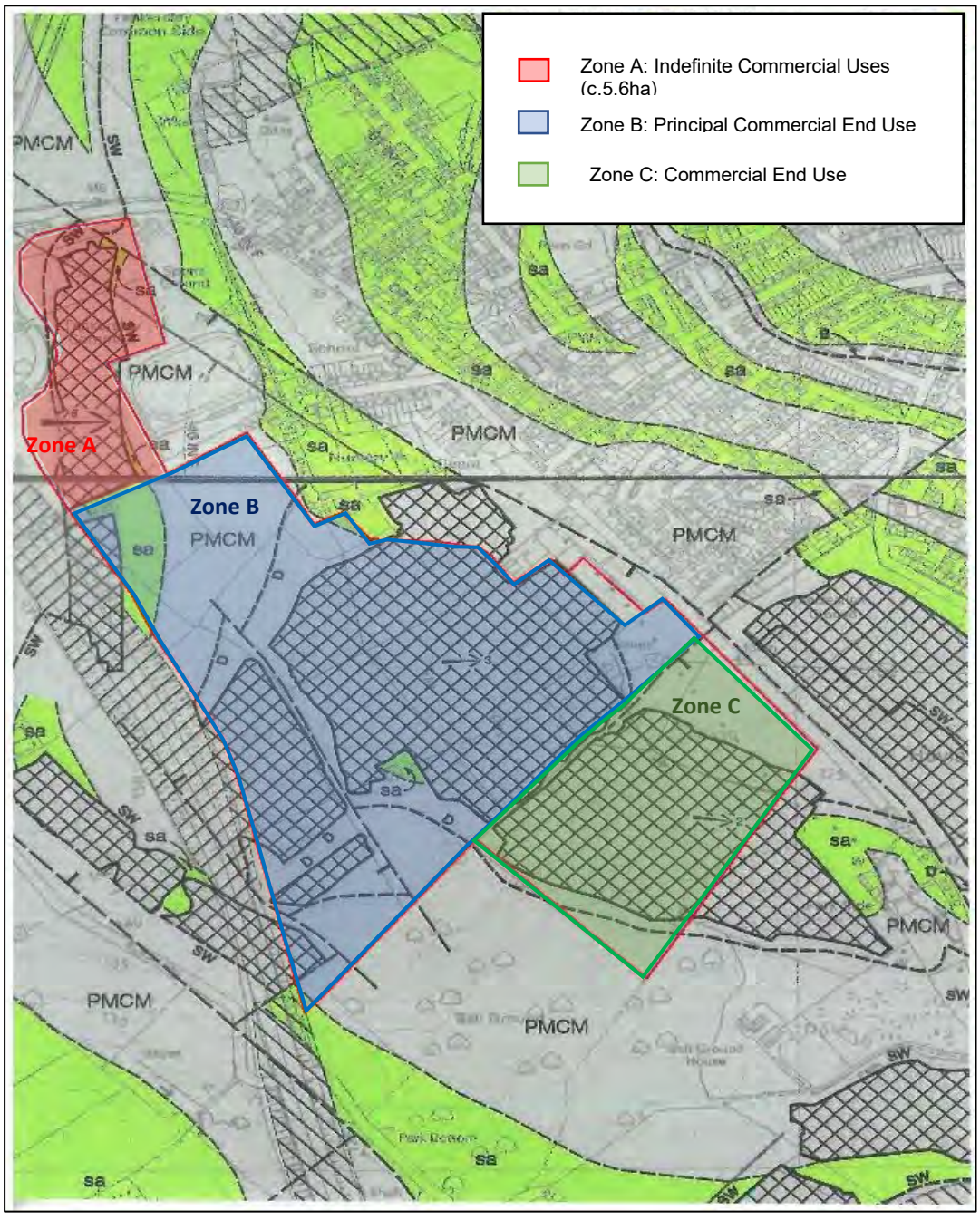
Zone A

Zone A is located at the northern end of the proposed development. It occupies an area of approximately 5.6ha and is some 375m long from N-S and 125m wide (average) from W-E. Ground elevations rise from about 140m aOD at the western side to about 148m aOD along the eastern side.

To the north, the site is bounded by the motorway (M1) and trunk road (A61) interchanges including the Birdswell Roundabout, and to the south by Tankersley Lane. The M1 junction infrastructure forms the western boundary and field hedges for the eastern boundary.

At the time of the site visit, the site was recently ploughed agricultural fields. There are no permanent structures, but a small, broken hedge runs W-E through the northern half along with an overhead power line in the extreme northwest corner.

A small industrial unit is located immediately east of the north eastern corner of the site. The fields immediately to the east are used as outdoor sports facilities. Further east are the margins of Hoyland Common, which include mainly residential and some commercial usage.



Zone B

Zone B is the largest sub-division of the full site and occupies an area of approximately 22.1ha and is some 650m from NNW-SSE and 400m (average) from WSW-ENE. Ground elevations fall from a high point of about 150m aOD in the western – central section, to about 145m aOD towards the north, about 140m aOD to the east and more steeply to between about 131m and 135m aOD to the south.

The site is bounded to the north by Tankersley Lane, and to the west by the M1 Motorway. To the east are small agricultural fields, farm buildings and allotment gardens, a small road known as Green Lane runs for approximately150m adjacent to the north eastern boundary leading to Pheasant Cottage. To the south are more agricultural fields and a zone of mature woodland known as 'Bell Ground'.

At the time of the site visit, the site was working agricultural pasture and arable land. There are no permanent structures other than animal shelters, but several mature hedge/field boundaries cross the site, including a dry-stone wall running west-east. Major high voltage power cables cross the southern section of Zone B, supported by large pylons.

Zone C

Zone C forms the south-eastern section of the full proposed development and occupies an area of approximately 11.6ha. It is very roughly rectangular being between about 265m and 325m from NNW-SSE and about 400m from WSW-ENE. Ground elevations fall, sometimes steeply, from a maximum of about 140m aOD at the northern corner to about 117.5m at the southern corner.

The site is divided into two agricultural arable enclosures by a hedged field boundary that crosses the north-central section of the site. A small stream/ditch (marked as issues on some old maps) crosses through the north-eastern field and follows the hedge to the south eastern site boundary. No permanent structures are present within Zone C, but the high voltage overhead power cables described in Zone B also cross Zone C and includes one supporting pylon.

Zone C is bounded by Zone B to the northwest, Sheffield Road to the northeast, more agricultural land to the southeast and by mature woodland, known as 'Bell Ground' to the southwest.

2.2 Site Proposals

Significant re-profiling of the site is to be undertaken to create level development platforms. The main part of the site (Zone B) is to be redeveloped for a single large distribution warehouse with associated loading bays, lorry park and staff car park. The land to the north of Tankersley Lane (Zone A) is to be prepared for a series of light industrial units and a large area of land in the southeast of the site (Zone C) is also to be prepared for future light industrial development. A new link road is to run through the site linking these developments with Sheffield Road at the easternmost part of the site and the existing roundabout to the north of the site. A balancing pond may be constructed towards the southern site boundary at a topographic low area. The proposed layout is shown on pHp Architects Drawing Ref. 4400-029 P4 dated 29/12/2019, a copy of which is presented in Appendix A.

3.0 SUMMARY OF DESK STUDY DATA

3.1 Site History

Since the early 19th Century the history of the site within the full proposed development area has been dominated by agriculture and mining; while the immediate surrounding areas have seen the gradual enlargement of Hoyland Common as a largely residential village to the east and the construction of the M1 Motorway and Junction 36 highway infrastructure to the west and north.

The following review of historical Ordnance Survey (OS) maps (see Appendix B) also refers to the various phases of opencast coal mining within the development area and immediate surroundings, which are not shown on the OS mapping.

1850 – 1891

The earliest available OS mapping of 1850 shows Sheffield Road and Tankersley Lane in their present-day positions, except for minor realignments resulting from the construction of the M1 Junction 36 and motorway crossing respectively.

Land north of Tankersley Lane, incorporating Zone A, is described as Tankersley Common. Some agricultural field boundaries have remained unchanged. A set of buildings named 'Hangman Stone' are shown some 175m west of the northern end of Zone A.

To the south of Tankersley Lane, Zones B and C are shown as enclosed agricultural fields. Only a few of the field boundaries are recognisable on current mapping. Many of the original field boundaries are shown to include marker 'stones'. A feature labelled as 'Old Park Wall' is shown to cross Zone B, running from Tankersley Rectory and St Peter's Church (c.275m to the west) to a farmhouse (later called Pheasant Cottage), which lies at the end of Green Lane.

There is no significant development on either side of Sheffield Road shown on the 1850 plan and Hoyland Common is shown as general farmland.

Zone C is shown as agricultural farmland.

Approximately 250m to 300m north of the Sheffield Road the Barnsley and Sheffield Branch of the Yorkshire Railway runs from SW to NE. This railway linked the Wharncliffe Silkstone Colliery (c. 1.1km west of Zone B) to Rockingham Colliery (c. 500m north of Zone A). Wharncliffe Silkstone Colliery opened in 1860 (closed in 1967), while Rockingham Colliery opened in 1873 (closed in 1979). Records also show that Lidgett Colliery (c.700m SE of Zone C) operated between 1870 and 1911. High Boyd Colliery (c.3km NE of Zone A) is shown on the 1850 mapping but is marked as a clay pit and brickworks on later sheets.

Another railway line, marked as the 'Tankersley Park Railway, is shown in 1850 to run from Bullwood (c.300m west of the southern end of Zone B), south of Zones B and C through the southern end of Bell Ground, to join the Thorncliffe and Elsecar Railway. Other researches have shown that this served the numerous ironstone workings that were still active during most of the 19th Century and collectively known as Swallow Wood Mine. While this mine may have exploited the Swallow Wood coal seam, which outcrops nearby (see Section 3.2), it is most well known for mining the Tankersley Ironstone seam, which is at a depth of about 120mbgl. It is reported that

the shafts to exploit this seam were sunk in about 1820. The Swallow Wood Mine is shown on the plans of 1850 and 1855 to cover a broad 'U' shaped strip of ground beginning at Bullwood and running to the south of Zone B, through Bell Ground and then just to the south of Zone C. The area is filled with numerous shafts, bell pits and waste dumps all supposedly associated with ironstone working. However, it seems unlikely that all of the shafts and bell pits extend the full depth to the Tankersley Ironstone and must therefore have also exploited coal at a much shallower depth.



Extract from OS Sheet 1891 showing areas of mining

1891 – 1938

OS mapping during this period shows a few changes within the development boundary. The feature previously marked as Old Park Wall is now referred to as a footpath. The 1891 plan shows two wells between 20m and 40m south of Green Lane within Zone B, while a third well, in the centre of Zone B, is shown on the 1929 mapping. The spring that emerges in Zone C is shown for the first time in 1929.

Off-site, Rockingham Colliery to the north is shown to be well established on the northern side of the railway along with an associated water reservoir on the southern

side. Rockingham Gas Works is shown c. 300m NW of Zone A alongside Birdwell Quarry.

Hoyland Common is shown to have become established as a small village, mainly on the eastern side of Sheffield Road but with a school on the western side and some 220m east of Zone A.

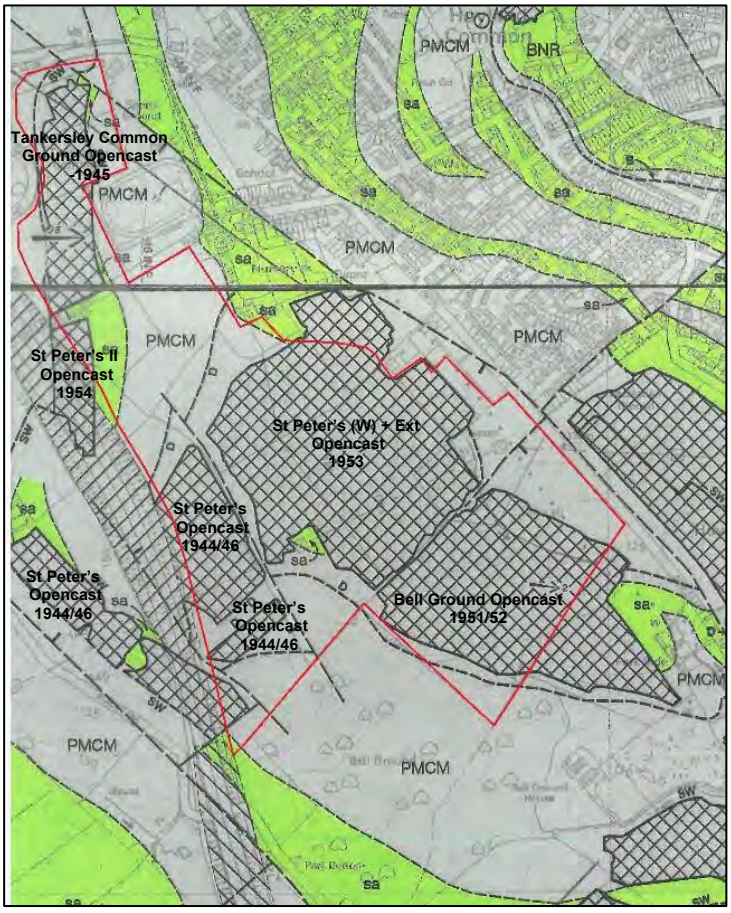
Immediately east of the northern end of Zone A, the area currently used as sports pitches is marked as a cricket ground. A miners' welfare centre is shown at Bullwood, south of St Peter's Church.

Two wells and a small pond are shown close to the old ironstone workings at Bullwood in 1893, along with a spring just east of Bell Ground, close to Bell Ground Cottage. A pond is also shown at Park Bottom, c.15m south of Zone C.

Several air shafts are shown between Lidgett Colliery and the western side of Bell Ground; Lidgett Colliery closed in 1911. Other air shafts are recorded close to Wharncliffe Silkstone Colliery and at Birdswell; although these are well outside influencing distance of the development.

1938 – 1968

This time period showed significant earthworks affecting c.75% of the proposed development area in the form of opencast coal mining. The positions and sequence of the various opencasts are shown below, while their geological context and significance are discussed in later sections of this report.



Extract from BGS Sheets SE30SE & SK39NE
Showing areas of opencast mining

Opencast Name	Date Start	Date Finish	Coal Seam(s)	Comment / CA Plan Ref
Tankersley Common	-	1945	Swallow Wood	Zone A / OC142
St Peter's	30 Dec 1944	6 Mar 1946	Dunsil Swallow Wood	Zone B Taken in three separate areas / NE433
Bell Ground	15 Oct 1951	15 May 1952	Unidentified Dunsil	Zone C / NE169
St Peter's (W) + Ext	6 Oct 1952	10 Sept 1953	Dunsil	Zone B Taken in two stages / NE433
St Peter's (II)	21 Apr 1954	28 Aug 1954	Swallow Wood	Zone B / NE433

Other opencast coal mining operations were being undertaken in the wider area at this time.

As part of the overall opencast operations, a temporary overhead cableway was erected along the western sides of Zones A and B running approximately N-S, which was presumably delivering coal from outlying areas for treatment at Rockingham Colliery. The cableway is not shown on OS mapping after 1965. The 1965 sheet does however show a set of overhead high-voltage power transmission cables crossing Zones B and C from W to E supported on pylons, one in each of Zones B and C.

To the north of the proposed development area, mining waste tips around Rockingham Colliery is shown to have expanded significantly, particularly south of the railway. Rockingham gas work is shown to have closed by 1951, with the site being re-developed as the NCD Central Workshop. The Birdwell Quarry is shown as disused from this time.

Hoyland Common, to the east of the site, is shown to continue expanding with mainly residential construction including two rows of houses on the northern and southern sides of Tankersley Lane east of Zone B. Allotment gardens have been established on the western side of Sheffield Road along with a garage and associated workshop c.100m south of Tankersley Lane.

1968 – 2020

The M1 Motorway to the west of the proposed development was opened in June 1968, including Junction 36 and was first shown on the OS mapping of 1973. The associated Birdwell Roundabout is shown to have been completed by 2002. The motorway construction included the construction of a bridge crossing for Tankersley Lane and the positioning of a new pylon, in Zone B, for the support of the high voltage transmission cables.

This period saw the peak and then decline of local coal mining, with Rockingham Colliery closing in 1979. This was followed by the closure and dismantling of the railway that previously ran from Wharncliffe Colliery (closed in 1967) and south of Rockingham Colliery.

Following the completion of the motorway and Junction 36 highway infrastructure there have been no significant developments affecting the proposed development area.

3.2 Published Geology

Published geological sources, principally BGS, have been used to establish the geological context of the ground conditions beneath the proposed development.

3.2.1 Superficial Strata and Made Ground

BGS sources show that significant thicknesses of natural superficial deposits are not expected beneath the site.

Although the site has not been subject to any built development, significant thicknesses of disturbed ground are expected beneath as much as 75% of the surface area. These have resulted from historic opencast coal mining operations undertaken during the 1940's and 1950's.

For the most part, this Made Ground is expected to comprise reworked natural strata (mainly clays, mudstones, siltstones and sandstones) derived from excavation and replacement of overburden after the removal of coal. While this form of mining and restoration is unlikely to result in the creation of residual voids, it will not have been compacted to an engineering specification.

The thickness of Made Ground will vary considerably depending on the depth of the targeted coal seams. Fortunately, detailed records of excavations were kept by the NCB Opencast Executive, which was the organisation that oversaw the operations. Copies of relevant plans showing the completion records of the various stages of opencast mining have been obtained from the CA Mining Heritage Centre in Mansfield and are reproduced in Appendix B. These records show maximum Made Ground thicknesses within the proposed development area as follows:

- Zone A: 9.0m
- Zone B: 12.5m
- Zone C: 15.0m.

It can be seen that the maximum Made Ground thickness can be expected to increase from NW to SE. However, it is emphasised that in each Zone there will be areas of no Made Ground.

3.2.2 Solid Strata

Solid strata are expected to belong to the Pennine Middle Coal Measures, which is of Carboniferous age. These strata generally comprise cyclical sequences of mudstones, siltstones and sandstones with thin coal seams.

Although the sequence of strata expected in the area is well understood and well documented, it is recognised by the BGS that errors and some confusion of seam name allocation has occurred historically in some records at a local level – see for instance BGS Internal Report IR/06/135.

The strata sequence expected to immediately underly the proposed Hoyland Common site at depths likely to influence this CMRA ranges between the Lidgett Coal seam and the Barnsley Coal seam. The significant coal seams between these two horizons (from bottom up) are the Haigh Moor Coal, the Swallow Wood Coal and the Dunsil Coal. Significant sandstone horizons are the Haigh Moor Rock and Birdwell Rock.

General descriptions of significant horizons are given below.

Several coal seams are reported to be present at the Lidgett Coal level, of which the thickest is normally taken to be the defining layer. At Rockingham Colliery (to the north of the site), the shaft section shows the Lidgett at a depth of 88mbgl, where it consists of a top leaf (0.64m thick) and bottom leaf (0.18m thick) separated by shale (0.43m thick); giving a total seam thickness of 1.25m. At Lidgett Colliery (to the south of the site), the shaft section shows the Lidgett at a depth of approximately 66mbgl, where it consists of a top leaf (0.66m thick) and a bottom leaf (0.23m thick) separated by black shale (0.15m thick) giving a total seam thickness of 1.04m.

Lidgett Coal Seam

Rockingham Colliery			**Lidgett Colliery**	
Stratum	Thickness		Stratum	Thickness
Coal	0.64m		Coal	0.66m
Shale	0.43m		Black Shale	0.15m
Coal	0.18m		Coal	0.23m
Total	1.25m		Total	1.04m

The Haigh Moor Coal is the subject of some confusion locally. The BGS (IR/06/135) confirm that originally the Haigh Moor and Swallow Wood Coals were believed to be one and the same in this area and it seems to be the case that an abandonment plan produced by Rockingham Colliery of the “Haigh Moor” seam in December 1931(CA Ref:10651 – Appendix B) has erroneously attributed the Haigh Moor name to mine workings, when they are actually in the Swallow Wood. This is confirmed by the conjectured seam outcrops shown on the plan, which are now accepted to be the Swallow Wood Coal. The BGS memoir states that it is generally considered that the true Haigh Moor Coal splits and thins south of Barnsley with some leaves being washed out by the Haigh Moor Rock.

The shaft sections at Rockingham and Lidgett Collieries do not reference the Haigh Moor Coal. As a result of the above and for the purposes of this CMRA, it will be assumed that the Haigh Moor coal seam is not present beneath the proposed development.

No reliable information is available regarding the Haigh Moor Rock.

The Birdwell Rock is a local thick development of sandstone found at Birdwell (Birdwell Quarry) and recorded as being about 24m thick at Rockingham Colliery, where it occurs just below the Swallow Wood Coal seam.

Like the Lidgett Coal, the Swallow Wood Coal is often encountered as two or three leaves. It is also often marked by band(s) of ironstone nodules. At Tankersley Common Opencast, the Swallow Wood seam is recorded to be 0.84m thick. At Rockingham Colliery, the shaft section shows the Swallow Wood at a depth of about 21mbgl, where it consists of a top leaf (0.08m thick) and bottom leaf (0.74m thick) separated by claystone (clod) (0.13m thick); giving a total seam thickness of 1.25m. the Swallow Wood is not recorded at Lidgett Colliery. However, sections have been recorded at St Peter’s II Opencast, which show a top leaf (0.25m thick) and bottom leaf (0.58m thick) separated by shale (0.10m thick); giving a total seam thickness of 0.93m.

The separation distance between the Lidgett and Swallow Wood at Rockingham Colliery is 66.25m

Swallow Wood Coal Seam

Rockingham Colliery			St Peter's Opencast	
Stratum	Thickness		Stratum	Thickness
Coal	0.08m		Coal	0.25m
Clod	0.13m		Shale	0.10m
Coal	0.74m		Coal	0.58m
Total	0.95m		Total	0.93m

Geological Sheets SK39NE and SE30SE show that the Swallow Wood seam outcrops at the proposed development site. A composite extract from these plans is included in Appendix B. It shows that the recorded outcrop originally ran approximately N-S along the western edge of Zone A. This outcrop has moved eastwards as a result of the opencast operations at Tankersley Common Opencast.

The original outcrop then moved to the west of the site boundary and the motorway south of Tankersley Lane by up to 200m before trending NW-SE and cutting the lower corner of Zone B. Current outcrop positions of the Swallow Wood seam have been affected, locally, by opencast operations and natural faulting, but are well understood and recorded.

The highest significant coal seam in the sequence is the Dunsil Coal (the Barnsley Coal is not present at the site). The BGS (IR/06/135) reports that this seam often splits south of Barnsley and that opencast operators often term one or both leaves as the Harley Coal. This is the case with the various phases of the St Peter's Opencast operations – see extracts from CA Opencast Plans NE169 and NE433 in Appendix B. Notwithstanding this, this CMRA will refer to the seam above the Swallow Wood as the Dunsil Coal.

Plan NE433 includes detailed sections through the Dunsil seam at St Peter's (W) + Ext and St Peter's Opencast (both in Zone B), which are summarised below. At Bell Ground Opencast (Zone C), Plan NE169, the Dunsil is shown to be 0.64m thick.

Dunsil Coal Seam

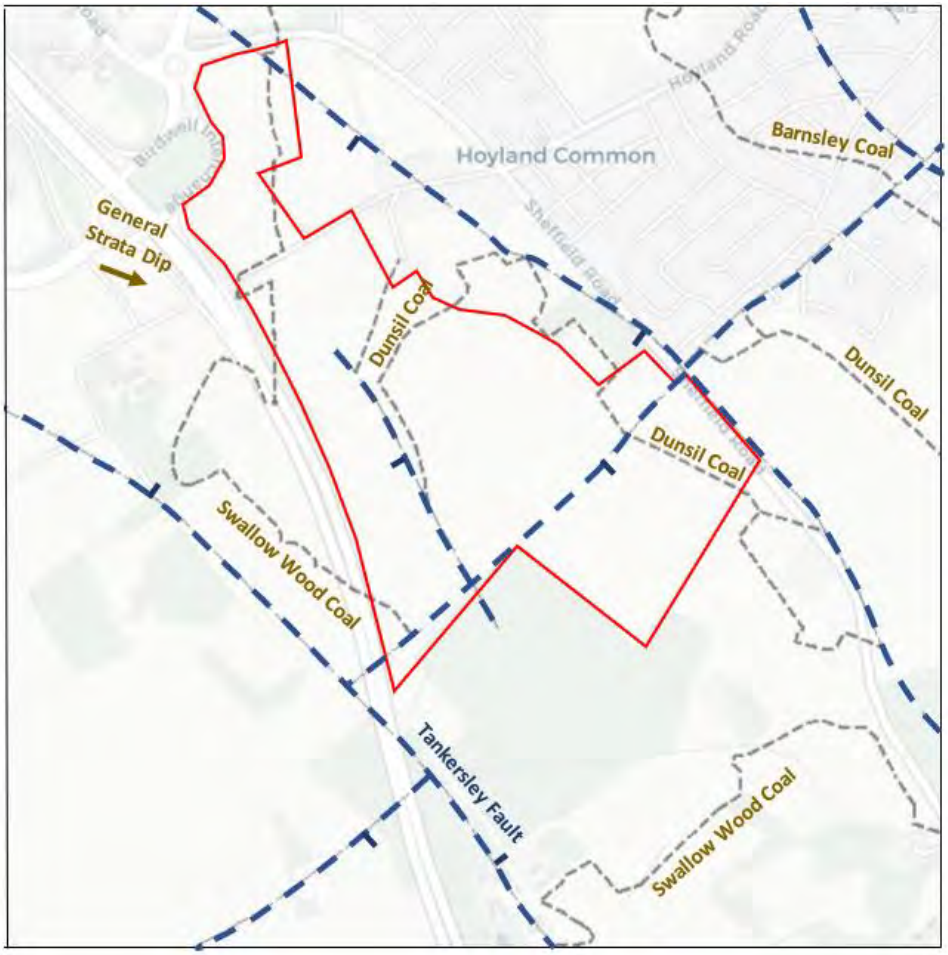
St Peter's (W) + Ext			St Peter's Opencast	
Stratum	Thickness		Stratum	Thickness
Coal	0.38m		Coal	0.46m
Grey Mudstone	0.63m		Shale	0.33m
Coal	0.18m		Coal	0.28m
Total	1.19m		Total	1.07m

Geological Sheets SK39NE and SE30SE show that the original outcrop of the Dunsil Coal ran through the centre of Zone B, trending roughly NW-SE, then through the western edge of Zone C. But as with the Swallow Wood seam, although the current outcrop position at the site has been affected by opencast operations and natural faulting, it is well understood and documented.

There is no recorded separation distance between the Swallow Wood and Dunsil Coal seams, but this will be discussed further in later sections of this report.

3.2.3 Faulting

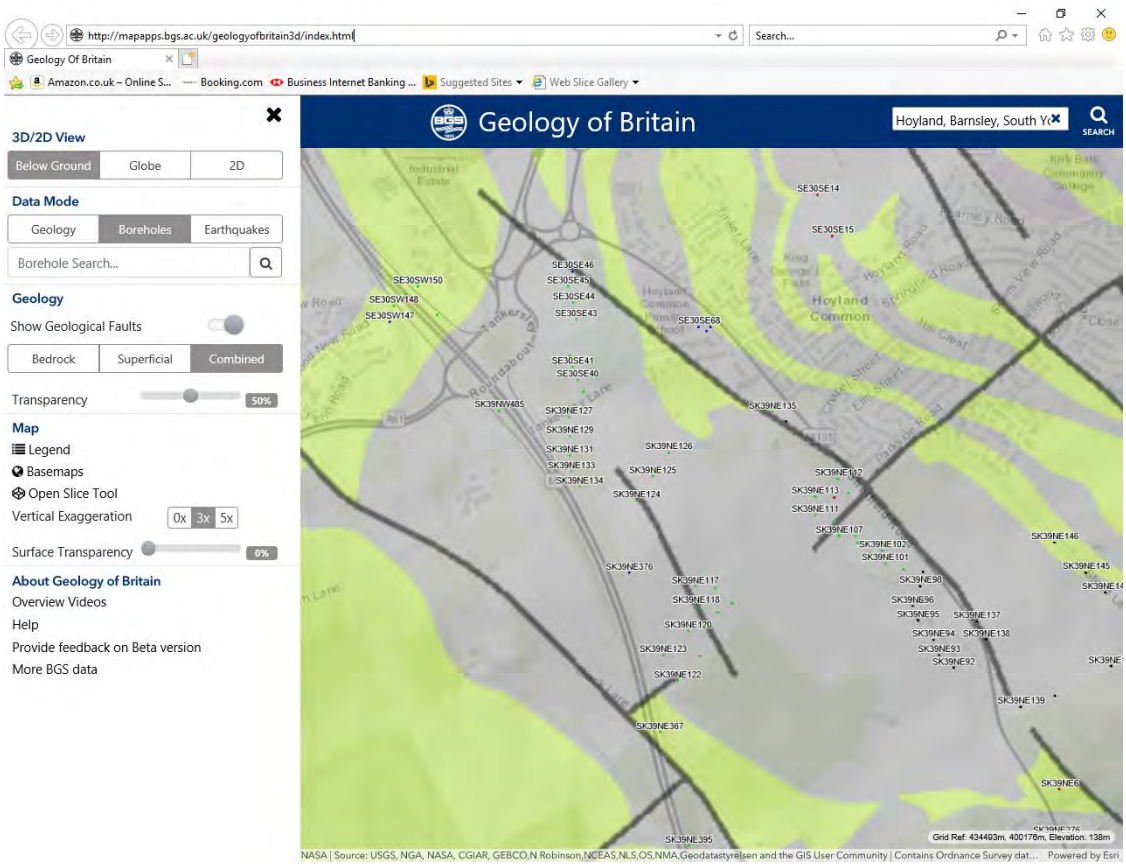
A number of faults displace strata beneath the site. The larger of these are shown below, along with the conjectured displacements of the shallow coal seams.



The most significant and only 'named' fault is the Tankersley Fault, which trends NW-SE to the southwest of the proposed development, downthrowing to the northeast. An un-named fault follows a similar trend on the north eastern side of the site, downthrows to the southwest. These form a shallow trough, in which most of the proposed development lies. Other, more minor, faults run parallel and perpendicular to these. The NE-SW fault shown above is recorded in the abandonment plan for the Lidgett Coal seam (CA NE586_43) as a swarm of faults with small throws of a few hundreds of mm to a few metres. Other small faults of similar orientations are also shown beneath Zone B, but these are of little significance to this study. Fault throws of similar magnitude can be determined from base of Dunsil Coal measurements shown on CA NE433 plan of the St Peter's Opencasts.

3.2.4 Historic Borehole Records

BGS online records of historical boreholes have been reviewed and relevant archive records obtained. The most useful of these were drilled on behalf of Michael D Joyce Associate during 1989. Many records are available within the proposed development boundary, as shown below, and a selection of these are reproduced in Appendix B. Most historical records date from times after the opencast mining and therefore help with the definition of coal extraction limits and highwalls. They also provide valuable information on coal depths, thicknesses and coal seam identification.



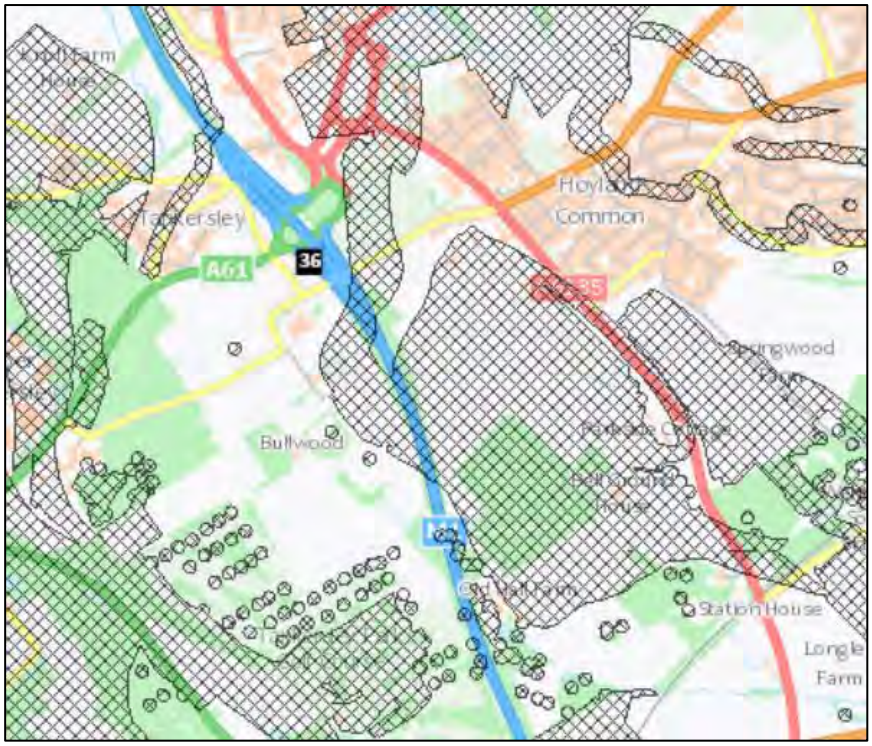
However, notwithstanding the above, none of the available boreholes contain definitive sections including the Swallow Wood seam and the Dunsil seam, from which a vertical separation depth could be derived.

3.3 Coal Authority Interactive Map and Consultant's Report

Consultation of the Coal Authority's/Law Society's Coal Mining Searches Directory indicates that the site lies in an area, for which a standard mining report is required for new development. A copy of the CA Consultants Coal Mining Report (ref: 51002186288001, dated 24th October 2019), is presented in Appendix B.

Reference to the CA Interactive Map shows that most of the site falls within a Development High Risk Area (HDRA). This means that the local authority is required to refer any planning application to the CA, and that the CA will require the preparation of this CMRA to assess the risks posed by historical coal mining legacy.

An extract from the CA Interactive website below, shows that most of Zone A, all but a strip of land at the northern end of Zone B and all of Zone C fall within the HDRA. Closer examination shows that its boundaries, particularly at the northern end of the site, relate to the original (pre-opencast) outcrops of the Swallow Wood and Dunsil Coal seams. Because there are no recorded workings in these seams beneath the site, the 'risk' stems from the possibility of there being unrecorded mine workings at shallow depth (between outcrop and say 25mbgl). However, it is known that these outcrop positions have changed as a result of open cast coal mining.



Extract from Coal Authority Interactive Mapping

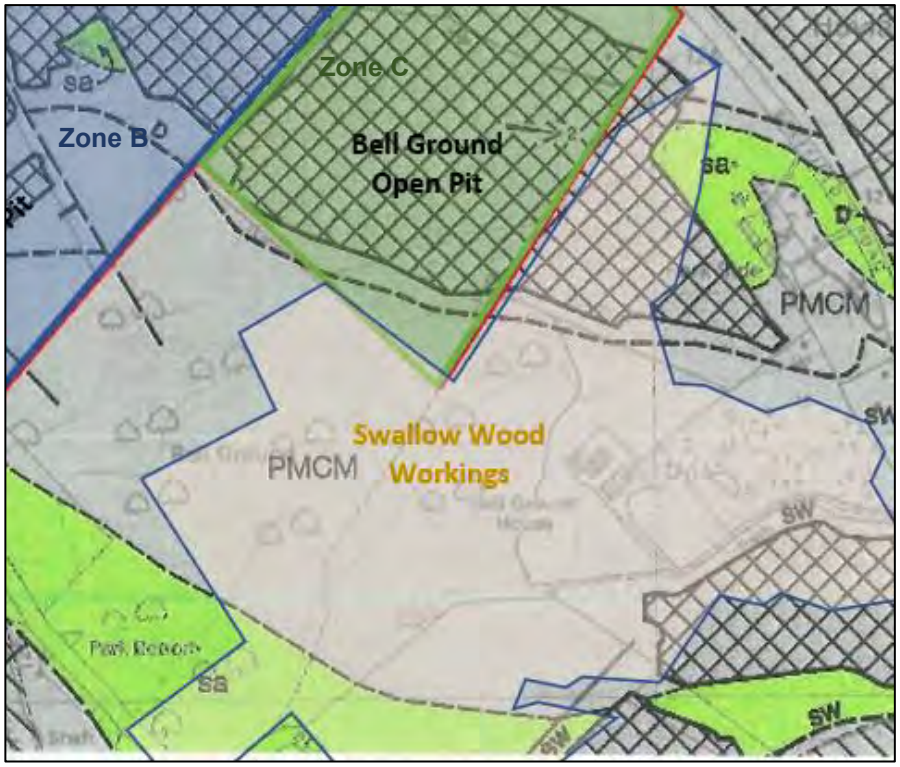
This CMRA will use the available historical and geological data to redefine the boundaries of areas at risk from coal related hazards relating to unrecorded shallow coal mining.

Basic information on underground mining is provided by the CA Consultants Report (*ibid*). The extent of local coal mining history is demonstrated by the fact that at least ten separate coal seams have been mined from at least six different collieries. A general summary is presented below.

Seam	Colliery	Depth m	Date Last Worked	Comment
Swallow Wood	Unnamed	23	1857	Possibly Swallow Wood Mine
Lidgett	Lidgett	64	1943	Also, Rockingham
Top Fenton	Wharncliffe	113	1940	Also, Rockingham
Tankersley Ironstone	Tankersley	127	1879	
Flockton Thick	Unnamed	128	1958	
Middleton Main	Unknown	156	1895	Also, Rockingham
Low Fenton	Rockingham	185	1961	
Parkgate	Unnamed	199	1875	
Silkstone	Tankersley	223	1900	
Whinmoor	Tankersley	268	1925	

The Interactive mapping shows areas where historic coal mine workings are known to exist at shallow depth. At Hoyland Common, such workings are known to relate to the recorded underground extraction of the Swallow Wood Coal (just off-site to the south, southeast and southwest). The original data coming from CA Abandonment Plan 10651 – see Appendix B.

Significantly, these recorded workings terminate at their northern side at identifiable ground surface field boundaries indicating that this is because of land ownership and mineral extraction rights rather than geological constraints. What is not known is, had the adjacent landowner of Zone C independently extracted the Swallow Wood Coal without reporting it?

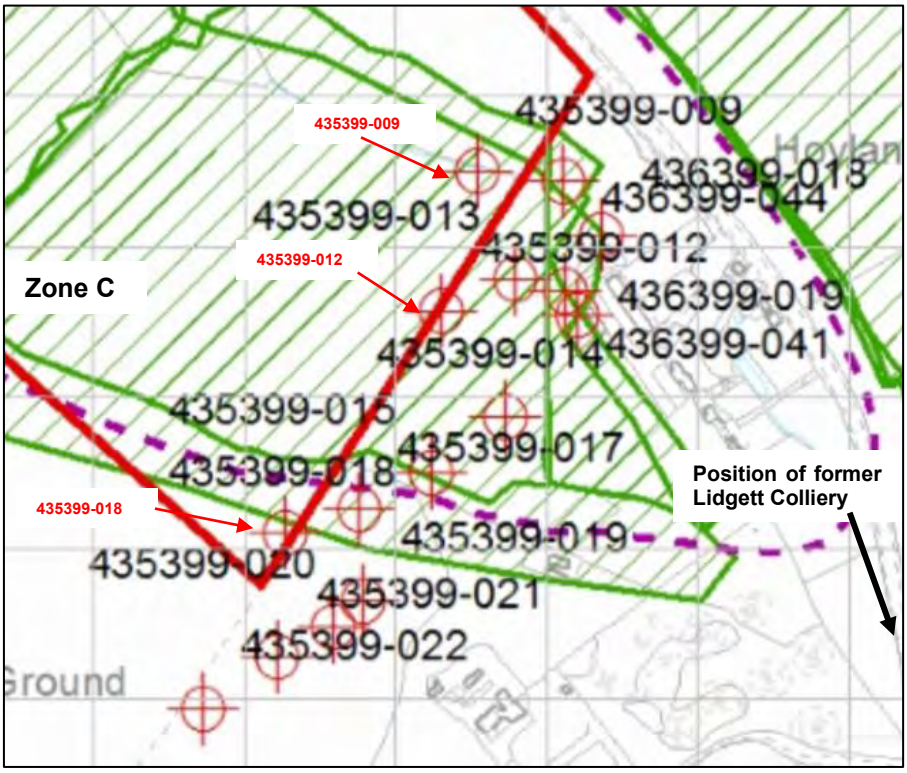


The Interactive mapping and CA Consultants report both show the positions of recorded mine entries (shafts or adits) within influencing distance of the site – see below. These are all shafts, and most relate either to the pre-1850 bell pit ironstone workings or access and ventilation shafts associated with Lidgett Colliery. A summary of known information relating to those within and closest to Zone C is also provided below.

CA Reference	Coordinates	Mineral	Treatment/Comments
435399-009	435955 399549	Ironstone	No treatment records, possibly extracted by Bell Ground Opencast
435399-012	435932 399457	Ironstone	No treatment records, possibly extracted by Bell Ground Opencast
435399-018	435829 399310	Ironstone	No treatment records. Located outside Bell Ground opencast.

It can be seen that at least the top 10m to 15m of shafts 435399-009 and -012 (and potentially all if shallow bell pits) will have been excavated as part of the Bell Ground Opencast operations, although it is noted that the Bell Ground abandonment plan reports that no mine workings were intercepted during the opencast works.

While excavation by opencast has reduced the potential risks, it has not eliminated them, as the opencast backfill does not constitute solid strata cover as required by the CA.



Extract from CA Consultants Report (ref: 51002186288001)

Recorded shaft 435399-018 is also shown to be related to former ironstone workings. Unlike the shafts referred to above, -018 is located just outside the recorded limit of the Bell Ground Opencast workings. If this location is correct, it is not considered likely that the potential risk to development from this shaft has been mitigated.

While other shafts are recorded within 50m of the Zone C boundary, it is not considered that these constitute a risk to the proposed development.

Other data contained within the CA report can be summarised as follows:

- there are no managed tips within 500 metres of the enquiry boundary;
- there have been no site investigations or remediation works recorded within 50m of the enquiry boundary *(although we know some site investigation has occurred from the BGS website)*;
- the CA 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;
- there have been no reports of mine gas incidents within 500 metres of the enquiry boundary;
- there are no mine water treatment schemes in the vicinity of the site

There has been one claim regarding coal mining subsidence within 50m of the property boundary. It is not known how this was resolved, but it is not considered that this constitutes any risk to the proposed development.

3.4 Coal Mine Abandonment Plans

The Coal Authority archives were searched and copies of seven mine abandonment plans were obtained (numerous others were available but were for seams worked at significant depths below the site). Reference to these plans have been made above in the text and copies are included in Appendix B. A summary of the pertinent information contained on the plans is provided below.

CA Ref:	Title	Date	Relevant Information
5843	Plan of Abandoned Mine Workings in Lidgett Seam	-	• Only half of the plan is available; • section of Lidgett seam; • extent of workings below site; • depth greater than 60mbgl; • positions of shafts SE of Zone C.
10651	Plan of Abandoned Mine Workings in Haigh Moor Seam	1931	• Seam named in error, should be Swallow Wood; • underground workings south of Bell Ground and Zone C; • position of shafts; • reference to Swallow Wood Mine
NE169	Bell Ground Opencast	1955	• Seam is named Harley, but called Dunsil in CMRA; • extent of OC workings in Dunsil and Unnamed seams; • depths of opencast workings; • section of Dunsil and Unnamed seams; • positive statement that abandoned workings were not found.
NE433	St Peter's I, II, W&Ext Opencast	1960	• Upper seam is named Harley, but called Dunsil in CMRA; • extent of OC workings in Swallow Wood and Dunsil seams; • depths of opencast workings; • section of Swallow Wood and Dunsil seams; • seam outcrops and faults.
NE583	Tankersley Drift Mine – Lidgett Seam	1961	• Section of Lidgett seam; • extent of workings below site – in agreement with CA Plan 5843; • depth greater than 60mbgl; • positions of drifts off-site.
OC142	Tankersley Common Opencast Abandonment Plan	1945	• Relates to Swallow Wood OC workings beneath Zone A; • extent of OC workings in Swallow Wood and Dunsil seams; • depths of opencast workings; • section of Swallow Wood seam.
OC238	St Peter's Opencast	1946	• Upper seam is named Harley, but called Dunsil in CMRA; • extent of OC workings in Swallow Wood and Dunsil seams – in agreement with CA Plan NE433; • depths of opencast workings; • seam outcrops and faults.

4.0 IDENTIFICATION AND ASSESSMENT OF SITE-SPECIFIC COAL MINING RISKS

4.1 Summary of Risk Assessment

Based on available data, the table below summarises the potential risks associated with mining legacy for the proposed development site.

Coal Mining Issue	Zone	Yes	No	Risk Assessment
Recorded underground shallow mine workings	A		No	Negligible
	B		No	Negligible
	C	Yes		Low Risk: Potential influence of recorded workings in the Swallow Wood seam at the SE border .
Unrecorded underground shallow mine workings	A	Yes		Low Risk: Possible workings in Swallow Wood seam beyond opencast highwall. Dunsil absent.
	B	Yes		Dunsil Coal – Negligible Swallow Wood – Significant risk. Present at shallow depth, known to have been worked in early 19th C just off-site.
	C	Yes		Dunsil Coal – Negligible Swallow Wood – Significant risk. Present at shallow depth, known to have been worked in early 19th C just off-site.
Recorded Mine entries (shafts and adits)	A		No	Negligible
	B		No	Negligible
	C	Yes		Minor risks along the south eastern boundary
Unrecorded Mine entries (shafts and adits)	A	Yes		Very low risk in former mining areas
	B	Yes		Very low risk in former mining areas
	C	Yes		Very low risk in former mining areas
Mining geology (faults and fissures)	A		No	Negligible
	B		No	Negligible
	C		No	Negligible
Record of past mine gas emissions	A		No	Negligible
	B		No	Negligible
	C		No	Negligible
Recorded mining surface hazard	A		No	Negligible
	B		No	Negligible
	C		No	Negligible
Surface mining (opencast workings)	A	Yes		Variable settlement across highwalls
	B	Yes		Variable settlement across highwalls
	C	Yes		Variable settlement across highwalls

The risk of former underground mine workings resulting in residual mining settlement/subsidence is a function of a number of factors. These include the depth and original thickness of the seam, the extracted thickness, the method and extent of extraction, the nature of the roof materials and the thickness of overlying solid and superficial strata. Instability at the surface can arise when voids within and above mined horizons collapse and migrate to the surface, creating either a relatively narrow crown hole or a wider area of general subsidence. The potential for crown holes is significantly reduced where there are no significant voids following abandonment of workings, such as long wall mining which allows progressive controlled collapse as mining advances. The zone of influence of areas of subsidence is also related to the depth in relation to the size of the void, where this exceeds a certain ratio and where the nature of the materials above the worked horizon is competent such as a thick band of sandstone.

As a basic rule of thumb, where the thickness of rock cover is less than ten times the seam or workings thickness (e.g. roadways can be thicker than a seam) there is potential for void migration at surface to occur.

4.2 Recorded Underground Shallow Mine Workings

Mine workings are recorded in the Lidgett Coal seam beneath all parts of the site. However, the depth of workings has been shown to be more than 60m beneath all Zones. It is considered that there is sufficient thickness of solid strata between the workings and ground surface to mitigate against the risk of void migration. No further mitigation is required. Recorded workings in coal and ironstone seams below the Lidgett are therefore also considered to present a negligible risk to surface instability.

Workings in the Swallow Wood seam, which is above the Lidgett, are recorded on CA Plan 10651 produced by Rockingham Colliery (incorrectly shown as the Haigh Moor Coal). The workings are shown to abut against the field boundaries that form the south eastern and south western boundaries of Zone C. Although not technically directly beneath, it could be argued that the southern margins of Zone C are within the potential area of influence from these workings. Targeted drilling should be undertaken to intercept the known workings and establish thickness of cover close to the Zone C boundary.

4.3 Unrecorded Underground Shallow Mine Workings

Unrecorded shallow mine workings in the Swallow Wood seam presents the most significant risk at the site.

At Zone A it is known that the Tankersley Common Opencast has removed the majority of the Swallow Wood Coal, but a remnant remains to the east of the highwall and west of the eastern zone boundary. This is a relatively thin strip of land between 0m and 20m wide and will be mainly occupied by an access road as part of the proposed development.

Opencast records (CA OC142 – Appendix B) and historical borehole records indicate that the Swallow Wood seam is to be expected at depth of between 7m and 11mbgl. Clearly, should unrecorded workings be present they would present a risk to ground surface stability. However, it is noted that none of the 8no. borehole records indicate disturbed coal and the CA record of the opencast operations makes no comment on whether old workings were encountered. This risk is therefore considered to be low. Mitigation works should include some rotary drilling to look for workings while undertaking investigations of highwall positions.

The Dunsil seam is not present in Zone A.

At Zone B, small blocks of the Swallow Wood seam have been extracted by the St Peter's Opencast operations, but most of this work took place outside the western site boundary. Within Zone B, more than half of the land surface has been subject to opencast mining that has just extracted the ground down to the Dunsil seam.

Unfortunately, it has not been possible to establish with any accuracy, the separation depth between the Swallow Wood and Dunsil coal seams. Within the opencast areas, the vertical separation distance would effectively be the thickness of solid strata cover. Although there is plenty of level data for both seams in areas of opencast

workings, and for the Swallow Wood from the shaft section at Rockingham, the critical link between the two has not been established. From working sections drawn through the site it is estimated that the vertical separation is probably between about 23m and 28m, but this depends on the actual throw of faults, which has not been established. Further investigation is required to provide further information on this.

If this estimate is correct, then where the Dunsil is known to have been present i.e. beneath areas of Dunsil opencast, then there will be sufficient cover for an excavation thickness of up to 2.3m (using the 'rule-of-thumb' of ten times extraction thickness of solid strata). It is considered very unlikely that early 18th Century mining operations in the relatively thin Swallow Wood seam (c.1m combined thickness of both leaves) would be more than 2.3m. However, in areas where the Dunsil is not present, for instance between Tankersley Lane and the St Peter's opencasts, then the thickness of cover will reduce, and the risk will rise. It is noted that this could include up to a third of the length of the proposed distribution warehouse. This risk is considered to be significant, and should be investigated by rotary drilling.

Very little of the Dunsil seam remains in Zone B with most having been removed by opencast. There are no records of the opencast workings encountering abandoned underground workings. It is considered that the risk from unrecorded underground workings in the Dunsil seam to be negligible. No further mining related investigation is required.

To the south and west of Zone C it is known that the Swallow Wood has been mined. It is possible that these workings do extend beneath Zone C as unrecorded workings. However, the same criterion of risk from unrecorded workings in the Swallow Wood apply here as for Zone B, ie. if the separation distance between the Dunsil and Swallow Wood is between 23m and 28m as expected, then sufficient solid cover should exist to prevent ground surface instability. However, this should be established through further rotary drilling.

A strip of land, approximately 100m to 200m wide exists to the northeast of the Bell Ground Opencast and inside Zone C where the Dunsil coal has not been worked by opencast. This area would be at risk of surface instability if workings existed in the Dunsil seam. However, the abandonment plan for the Bell Ground Opencast (see CA Plan NE169) positively states that no old workings were encountered. It is therefore concluded that this risk can be considered to be negligible. No further investigation is considered necessary in this regard.

4.4 Recorded Mine Entries

There is no risk from recorded mine entries at Zones A and B.

Three recorded mine entries exist just within, or very close to the south eastern boundary of Zone C. It is known that two of the shafts (refs 435399-09 and -012) are located within the area of the former Bell Ground Opencast. If the shafts extend beneath the base of the opencast, then the risk is not mitigated, however, if they were shallow bell pits, then it is possible that they have been excavated during the opencast operations.

The precise nature and layout of development in Zone C is unknown at this time, although it is known that only ground filling will occur in this area. Given their location, history of opencast working and proposed future filling it is considered unlikely that

the positions of the old bell pits will be identified physically. It is considered that further investigation could be undertaken at a later date once the development plans for this area are available. It is considered that the reliability of the position co-ordinates for these shafts is quite high and probably better than the 8m precision recommended by CIRIA (2019).

The third shaft (ref 435399-18) lies outside the Bell Ground Opencast and like the two shafts referred to above, is believed to be associated with ironstone workings. There is no record of treatment. As this shaft should be identifiable at shallow depth below ground level, it is considered that the reliability of the shaft co-ordinates is sufficiently accurate for this shaft to be located by excavation at reasonable cost during the forthcoming Phase 2 investigations.

4.5 Un-recorded Mine Entries

The proposed development sites coal mining context is such that there will always be a low risk of unrecorded mine entries being present. At this stage, it is considered that a watching brief should be undertaken during all excavation and ground works within the development. Any anomalous features that may indicate historic mine entries should be investigated and recorded by a competent person.

4.6 Surface Mining (Opencast Workings)

The proposed development area has been subject to considerable historic opencast mining, with as much as 75% of the land area having been affected. Opencast operations do not result in a residual risk to ground instability. However, variations in backfilling compaction can result in variable and unpredictable settlement when new foundation loads are applied. This is particularly the case at highwalls where sudden variations in thickness of Made Ground can occur. Fortunately, there are good records of the positions and depths of the opencast operations and these should be consulted when establishing a development layout. Where development cannot avoid these highwalls then they should be investigated by intrusive investigation to confirm exact locations.

Future development earthworks in Zone B will involve areas of significant ‘cut’. These operations can be used to reduce the risks posed by remnant opencast highwalls.

5.0 SUMMARY OF MINING LEGACY

This CMRA has accumulated geological and historical mining data from many sources to form a significant body of information. This has confirmed that mining beneath and in the close vicinity of the proposed development area dates back to close to the beginning of the 19th Century and has continued up until the closure of Rockingham Colliery in 1979. The following summarises this history and forms the basis of a conceptual model of the ground conditions at the site at the present day and where the historical mining legacy presents risks of varying degree for the proposed development. This conceptual model can then be used to direct further investigations, which will help to mitigate against these risks.

Pre 1850	Ironstone mining south of Zone C between Bullwood, through Bell Ground to the Sheffield Road. Characterised by numerous bell pits/shafts. The workings have been collectively known as Swallow Wood Mine. Mining is recorded to have taken place in the Tankersley Ironstone seam at a depth of c.127mbgl. It is considered unlikely that all of the pits were sunk to this depth and it is likely that most actually

		exploited a band(s) of ironstone nodules known to exist above the Swallow Wood Coal seam.
1824	1858	Recorded workings in the Swallow Wood seam from shafts associated with Swallow Wood Mine south of Bell Ground. Workings were at a depth of between about 20m and 30mbgl. Workings began in the southeast working up dip towards the northwest.
1870	1911	Mining continued in the Bell Ground area with the opening of Lidgett Colliery to exploit the Lidgett Coal seam at a depth of about 60mbgl. Recorded workings are available that show that most of the proposed development area was undermined.
1860	1967	Underground mining from Wharncliffe Silkstone Colliery west of the site. Workings are recorded from deep coal seams beneath the site.
1873	1979	Underground mining from Rockingham Colliery north of the site. Workings are recorded from deep coal seams beneath the site.
1944	1946	St Peter's Opencast (western border of Zone B) – Swallow Wood and Dunsil seams.
	1945	Tankersley Common Opencast (Zone A) – Swallow Wood workings.
1951	1952	Bell ground Opencast (Zone C) – Dunsil seam.
	1953	St Peter's (W) + Ext (Zone B) – Dunsil seam.
	1954	St Peter's II (western border of Zone B) – Swallow Wood seam.

The conceptual model for the site is shown in Appendix A This is based on a schematic cross section running through the proposed development area from WNW-ESE and shows the regions of potential mining related risk.

6.0 CONCLUSIONS AND PROPOSED MITIGATION STRATEGY

This CMRA has revealed a long and diverse mining heritage at the proposed development site at Hoyland Common. This has included ironstone mining dating back to the beginning of the 19th Century and possibly earlier. Coal mining has included recorded coal mining at shallow depth at the southern margins, deeper underground mining from at least ten seams beneath the site, along with extensive opencast mining, which has affected some 75% of the whole site area.

The full development site is large and development plans vary in different areas. As a result, the full site has been divided into three Zones A, B and C. These run from north to south. Zone A is located north of Tankersley Lane and is expected to be developed for light commercial end use and to contain the main access road from Sheffield Road. Zone B is the largest zone and contains the most advanced development proposal for a large distribution warehouse (370m x 75m). Zone C is located at the southern end of the site and no definite development plans have yet been produced.

The CMRA has identified risks associated with the historical mining legacy, which can be summarised as follows:

- Recorded underground shallow mine workings in Zone C are considered to present a low risk from an extension of recorded workings in the Swallow Wood seam beyond the recorded limit beneath the site. *Mitigation should include targeted rotary drilling close to the boundary between Zone C and Bell*

Ground as part of the forthcoming Phase 2 ground investigation, potentially followed by rotary probe drilling at a later date (depending on findings).

- The risk of unrecorded mine workings in the Dunsil seam is considered to be negligible. *No further mitigation required*.
- The Swallow Wood seam is present beneath most of the site, except where it has been extracted by opencast mining (Tankersley Common Opencast, part of St Peter's Opencast and St Peter's II Opencast. The Swallow Wood seam has recorded shallow mine workings to the south beneath Bell Ground. Although opencast working plans do not record finding any, there is the potential for unrecorded workings to exist beneath the site. *The level of risk posed by this potential will be established during the forthcoming Phase 2 ground investigations.*
- It has not been possible to establish the separation depth between the Dunsil and Swallow Wood seams, although estimates place this as between about 23m and 28m. If this can be confirmed, then it can be shown that there is sufficient solid cover (ten times maximum extraction thickness) to mitigate against the risk of surface instability resulting from void migration in all areas of the site where the Dunsil is either still present or where it has been removed by opencast (opencast workings did not excavate ground below the floor of the Dunsil). *Mitigation should include undertaking some rotary cored boreholes at selected locations to confirm the separation depth between the Dunsil and Swallow Wood seams, as well as to investigate for the effects of unrecorded mine workings*.
- If the Swallow Wood seam has been mined (no evidence of this has been found by historic borehole drilling or opencast mining to date), then the risk of surface instability increases in the areas between the outcrops of the Dunsil and Swallow Wood, where the depth of cover will be less than the separation depth discussed above. *Mitigation should include investigations for evidence of abandoned workings, particularly beneath the footprints of known built development.*
- The risks from recorded mine entries in Zones A and B are considered to be negligible. *No mitigation required*.
- There are three recorded shafts in or very close to the boundary of Zone C.
- Two of these shafts (453399-009 and -012) are in areas that have been mined by opencast to the Dunsil seam. It is not believed that this has mitigated the risk since restored backfill is not considered to constitute solid cover. However, given the uncertainty regarding development in this area, *it is considered that there may be future potential to mitigate this risk by appropriate development layout or further investigation could be undertaken once development layouts are known. It is considered that there is no current requirement to find and treat these shafts at this stage.*
- It is believed that the third shaft (435399-018) has not been affected by opencast mining. *It is considered that it would be possible to investigate for this shaft by excavation at reasonable cost during the forthcoming intrusive investigations.*
- The opencast mining will have left highwalls at their margins with sudden large variations in thickness of Made Ground. While these do not constitute a risk to ground surface stability, variations in backfilling compaction can result in

variable and unpredictable settlement when new foundation loads are applied. This can be a particular problem for large warehouses (as is proposed) that apply high racking loads to floor slabs, which themselves require strict tolerances on level to accommodate remotely operated stacking and retrieval systems. *Mitigation should include trenching to confirm the recorded positions of highwalls along with subsequent ground treatment to reduce sudden changes in ground stiffness. The reduction in ground surface elevation through 'cut' will reduce the impact of some of the opencast highwalls.*

It is intended to begin intrusive investigations at the site during January 2020 and investigation positions and methodologies have been selected to gain further geological information based on the above recommendations.

The proposed investigation exploratory hole location plan is included in Appendix A.

On completion of the intrusive investigations this CMRA will be updated and resubmitted. At this stage it is not possible to say whether large scale ground stabilisation works will be required, but if these are required then the updated CMRA would form the basis for the preparation of a stabilisation and/or ground improvement specification.

Applied Geology Limited
Unit 23
Abbey Park
Stareton
Kenilworth
Warwickshire
CV8 2LY

Tel: 02476 511822

GENERAL NOTES

A) The assessment made in this report is based on the site terrain and ground conditions revealed by the various field investigations undertaken and also any other relevant data for the site including previous site investigation reports (if available) and desk study data. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available. It must be recognised that many of the Environmental Searches obtained during the course of the desk study are often lengthy. Applied Geology have, where appropriate and in the interests of simplicity, only reproduced the summary of the searches within the report. A full copy of all the search data is held at the Applied Geology office and is available for inspection if required.

B) Where any data supplied by the Client or other external source, including that from previous site investigations, has been used it has been assumed that the information is correct. No responsibility can be accepted by Applied Geology for inaccuracies within this data.

C) Whilst the report may express an opinion on possible configurations of strata between or beyond the exploratory locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy.

D) Comments on groundwater (and landfill gas) conditions are based on observations made during the course of the present and past investigations or with reference to published data unless otherwise stated. It should be noted, however, that groundwater (and landfill gas) levels vary due to seasonal (or atmospheric conditions) or other effects.

E) The copyright of this report and other plans and documents prepared by Applied Geology is owned by Applied Geology and no such report, plan or document may be reproduced, published or adapted without the written consent of Applied Geology. Complete copies of the report may, however, be made and distributed by the Client as an expedient in dealing with matters related to its submission.

F) This report is prepared and written in the context of the proposals stated in the introduction to the report and should not be used in a differing context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission. Therefore with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to Applied Geology for re-assessment and if necessary, re-appraisal.

G) The survey was conducted and this report was prepared for the sole internal use and reliance of the Client. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Applied Geology. If an unauthorised third party comes into possession of this report they rely on it at their peril and Applied Geology owes them no duty of care and skill.

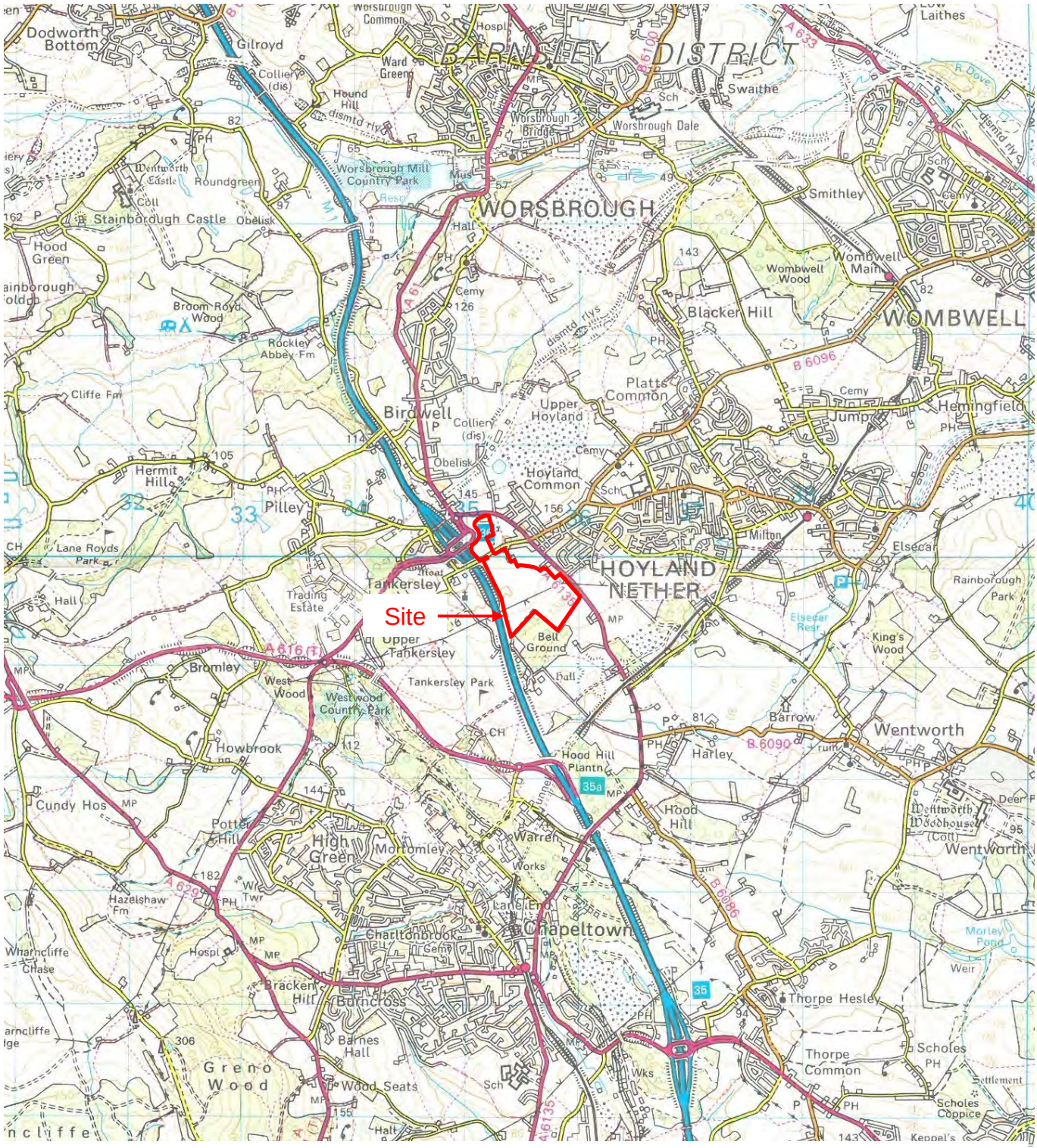
H) Ground conditions should be monitored during the construction of the works and the recommendations of the report re-evaluated in the light of this data by the supervising geotechnical or geo-environmental engineers.

I) Unless specifically stated, the investigation has not taken into account the possible effects of mineral extraction.

J) The economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, depends on very many factors in addition to geotechnical considerations and hence its evaluation is outside the scope of this report.

K) Applied Geology operates as a Consultancy and does not operate it's own laboratory for soil testing, this work being sub contracted to known and respected, generally UKAS accredited, laboratories. Applied Geology can therefore not be held responsible for the testing carried out.

APPENDIX A



Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationery Office, Crown Copyright* LICENCE No: 100055022

APPLiED GEOLOGY

Unit 23
Abbey Park
Stareton
Kenilworth
CV8 2LY

Tel: 02476 511822
email: admin@appliedgeology.co.uk

Client: newlands developments

Project: HOYLAND COMMON, BARNSLEY
M1 JUNCTION 36

Drawn By:	Checked By:	Paper Size:
JS	SD	A4

Scale:	Date:	NGR:
NTS	08.01.2020	435491 399728

Title: SITE LOCATION PLAN

Drawing No:	Revision:
AG3080-19-01	0

KEY:

- TP1001 — Trial Pit
- TT2001 — Trial Trench to locate high wall
- RS3001 — Rotary (sonic) Borehole
- RC4001 — Dynamic / Sample and Rotary Cored Borehole

APPLiED GEOLOGY

Unit 23
Abbey Park
Stareton
Kenilworth
CV8 2LY

Tel: 02476 511822
Fax: 02476 697682
email: admin@appliedgeology.co.uk

Client: newlands developments

Project:

HOYLAND COMMON, BARNSLEY
M1 JUNCTION 36

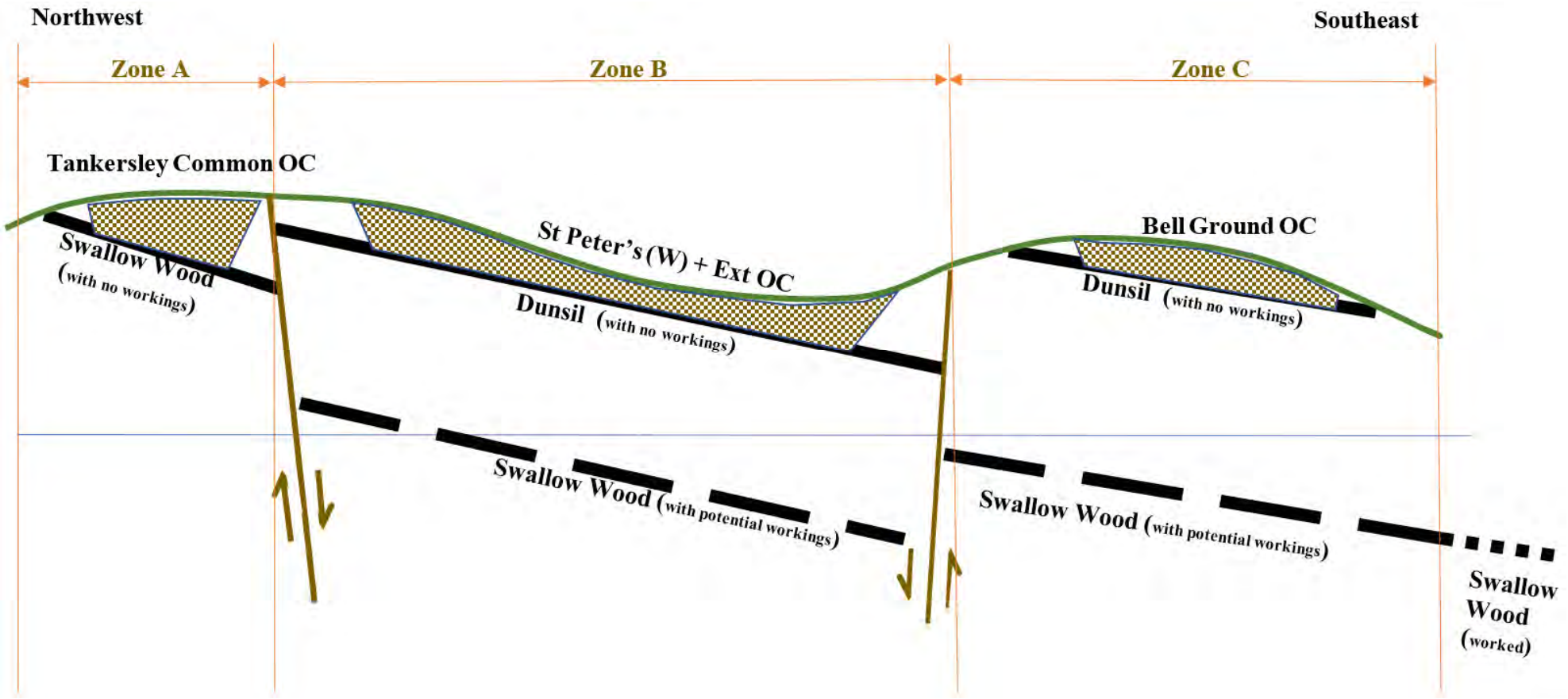
Title:

PROPOSED EXPLORATORY HOLE
LOCATION PLAN ON EXISTING
TOPOGRAPHIC SURVEY

Drawn By:	Checked By:	Paper Size:
JS	SD	A1

Scale:	Date:
1:2000	19.11.2019

Drawing No:	Revision:
AG3080-19-03	0



APPLiED GEOLOGY

Unit 23
Abbey Park
Stareton
Kenilworth
CV8 2LY

Tel: 02476 511 822
email: admin@appliedgeology.co.uk

Client: Newlands Developments

Project: Hoyland Common, Barnsley, M1 Junction 36

Title: Geological Conceptual Site Model

Figure 1


N

EXG ISLAND

Proposed Road Access from Island

HOYLAND COMMON

Warehouse
370m x 75m

Emergency Access

Plot Development Area
22.10ha (54.61ac)

Proposed Junction

Exit

Entry

Overhead Electricity Cables
No Building Zone hatched Blue

12.69ha (31.36ac)
remaining plot

APPLICATION RED LINE AREA
46.20ha / 114.16ac

Tankersley

Bull Wood

Bell Ground

Hoyland Common

A6195 - Sheffield Road

Birdwell Roundabout

M1 J36

SCHEDULE OF ACCOMODATION GIA

	m²	ft²
Warehouse	27,750	298,700
Office (ground)	1,164	12,529
Office (first)	1,164	12,529
Office (2nd fl, viewing etc)	465	5,000
Toilets/Comms (north end)	80	861
VMU	703	7,565
Gatehouse Type A	147	1,582
Gatehouse Type B1	24.5	264
Gatehouse Type B2	24.5	264
TOTAL	31,522	339,294

Car Parking (incl dis)	650 spaces
HGV Parking (excl doors)	608 spaces
Tractor Parking (inc Rigid Lorry 7.5t Parking, Shunter Parking, Recycle, Collection Trailers)	150 spaces
Motorcycle Parking	30 spaces
Bicycle Parking	60 spaces
Haunch Height	12.5 m
Dock Levellers	163 No.
Compactors	3 No.
Level Access Doors (Unit)	7 No.
Level Access (VMU)	3 No.

Revision:

P1	first issue	06dec2019 PL
P2	area table adjusted	10dec2019 PL
P3	HGV spaces added to North end	13dec2019 PL
P4	Overhead cables No Build zone noted	19dec2019 PL

0 50m 100m SCALE 1:2500

N

Hoyland Common
Barnsley M1 J36

newlands developments

pHp Architects
www.peter-haddon.com

Site Plan

Drawing Status:	Preliminary
CAD Reference:	4400
Drawn:	PL
Date:	dec2019
Scale @A1:	1/2500

Project No:	Drawing No:	Rev:
4400	029	P4

This drawing, the works and concepts depicted are copyright of the consultant and may not be reproduced or made use of, either directly or indirectly without express written consent. All heights, levels, sizes and dimensions to be checked on site before any work is put to hand.

APPENDIX B

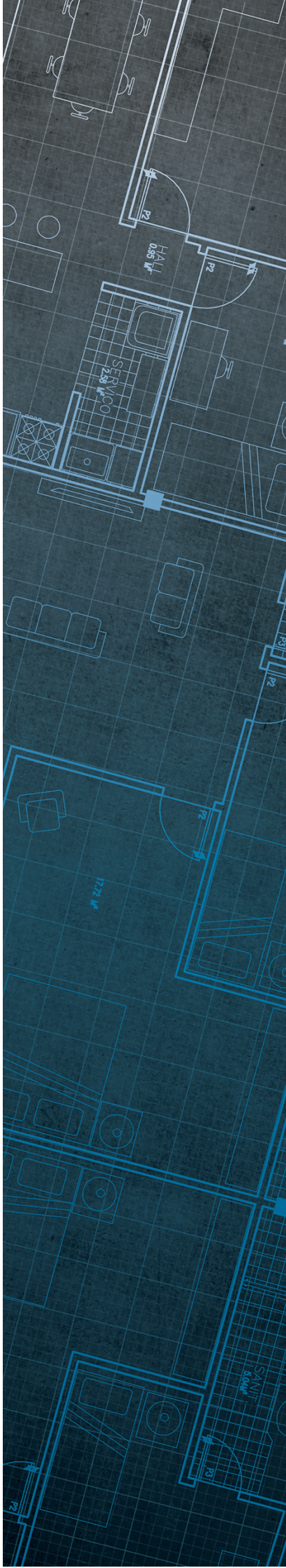
The Coal Authority

Consultants

Coal Mining Report

Hoyland Common
Barnsley
South Yorkshire
S74 0DW

Date of enquiry:	**24 October 2019**
Date enquiry received:	**24 October 2019**
Issue date:	**24 October 2019**
Our reference:	**51002186288001**
Your reference:	**AG3080-19**



Consultants

Coal Mining Report

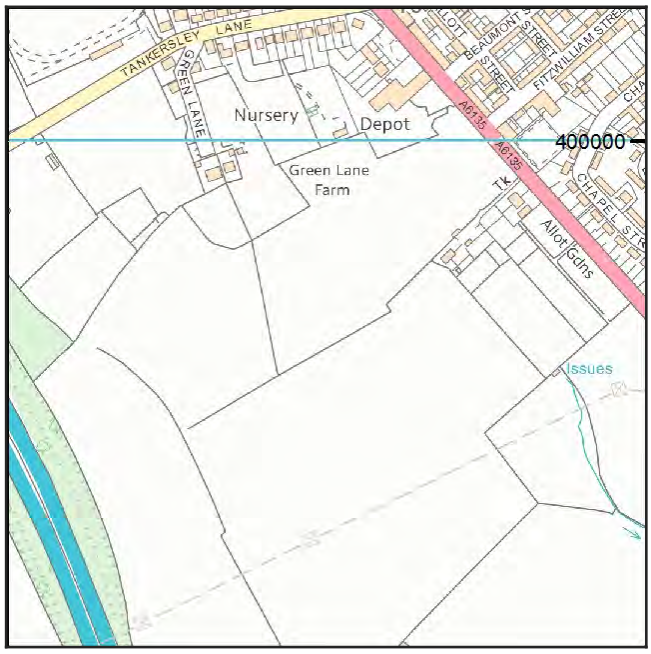
This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

Applied Geology Ltd

Enquiry address

Hoyland Common
Barnsley
South Yorkshire
S74 0DW



Approximate position of property

Reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2018. All rights reserved.

Ordnance Survey Licence number: 100020315

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

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
UNAMED	SWALLOW WOOD	Coal	6IYW	23	Beneath Property	1.4	North-East	94	1857
unnamed	LIDGETT	Coal	64R7	61	Beneath Property	3.2	North-East	75	1908
ROCKINGHAM	LIDGETT	Coal	64RA	64	Beneath Property	3.8	North-East	66	1943
LIDGETT	LIDGETT	Coal	6IYY	65	Beneath Property	3.0	South-East	80	1899
unnamed	LIDGETT	Coal	64R8	76	Beneath Property	3.2	North-East	75	1907
LIDGETT	LIDGETT	Coal	4IVR	88	Beneath Property	1.5	North-West	70	1883
WHARNCLIFFE	TOP FENTON	Coal	6IZ5	113	South-West	4.8	North-East	140	1940
TANKERSLEY	TANKERSLEY	Ironstone	A0GO	127	Beneath Property			152	1879
TANKERSLEY	PARKGATE	Coal	6XRC	127	South-West	3.5	East	160	1895
unnamed	FLOCKTON THICK	Coal	6IZ3	128	Beneath Property	3.8	East	117	1958
unnamed	FLOCKTON THICK	Coal	64RC	131	Beneath Property	4.3	North-East	119	1958
TANKERSLEY	TANKERSLEY	Ironstone	A0GN	150	Beneath Property			152	1879
unnamed	MIDDLETON MAIN	Coal	6620	156	South-West	4.8	North-East	76	1895
ROCKINGHAM	TOP FENTON	Coal	6IZ6	179	Beneath Property	3.5	East	97	1943
ROCKINGHAM	LOW FENTON	Coal	6XRG	180	Beneath Property	3.2	East	130	1961
unnamed	TOP FENTON	Coal	64RH	181	Beneath Property	3.5	North-East	109	1928
ROCKINGTON	LOW FENTON	Coal	64RL	185	Beneath Property	3.8	North-East	132	1961
ROCKINGHAM	LOW FENTON	Coal	64RK	186	Beneath Property	3.4	North-East	137	1948
SKIERS SPRING	LOW FENTON	Coal	4IW1	190	Beneath Property	3.0	North-East	106	1972
unnamed	TOP FENTON	Coal	6IZ7	190	Beneath Property	3.6	North-East	91	1930
ROCKINGHAM	LOW FENTON	Coal	6XRH	193	Beneath Property	4.1	North-East	130	1950
SKIERS SPRING	TOP FENTON	Coal	4IVW	193	Beneath Property	0.9	East	91	1936

Copyright © 2019 The Coal Authority

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
BARLEY HALL	LOW FENTON	Coal	6XRI	196	South-East	0.9	East	112	1964
unnamed	PARKGATE	Coal	6XRD	199	Beneath Property	3.5	East	145	1875
unnamed	PARKGATE	Coal	64RO	201	Beneath Property	3.0	East	152	1897
unnamed	PARKGATE	Coal	64PM	205	Beneath Property	2.3	East	152	1885
SKIERS SPRING	LOW FENTON	Coal	4IW0	208	South-East	1.6	North	104	1959
unnamed	PARKGATE	Coal	6XRE	214	Beneath Property	4.0	North-East	140	1910
SKIERS SPRING	PARKGATE	Coal	4RRP	218	Beneath Property	1.9	East	145	1911
TANKERSLEY	SILKSTONE	Coal	6IZD	223	Beneath Property	4.5	East	180	1900
unnamed	MIDDLETON MAIN	Coal	661Z	228	Beneath Property	3.9	East	76	1910
unnamed	MIDDLETON MAIN	Coal	64RU	229	Beneath Property	5.1	North-East	102	1898
SKIERS SPRING	TOP FENTON	Coal	4IVX	229	North-East	1.4	North-East	90	1926
unnamed	MIDDLETON MAIN	Coal	64RT	231	Beneath Property	3.7	North-East	102	1904
ROCKINGHAM	MIDDLETON MAIN	Coal	4IW3	233	Beneath Property	2.9	North-East	76	1914
unnamed	MIDDLETON MAIN	Coal	661X	240	Beneath Property	4.1	North-East	76	1898
unnamed	MIDDLETON MAIN	Coal	661Y	242	Beneath Property	0.7	South-East	65	1913
unnamed	MIDDLETON MAIN	Coal	661W	253	Beneath Property	1.9	East	76	1899
TANKERSIDE	WHINMOOR	Coal	6XM0	268	Beneath Property	4.4	North-East	91	1925
UNAMED	SILKSTONE	Coal	64SB	282	Beneath Property	3.5	North-East	180	1918
unnamed	SILKSTONE	Coal	6IZE	282	Beneath Property	3.5	East	180	1907
unnamed	SILKSTONE	Coal	64S4	286	Beneath Property	3.8	East	180	1897
unnamed	SILKSTONE	Coal	6IZF	295	Beneath Property	3.4	East	180	1900
SKIERS SPRING	SILKSTONE	Coal	4RRR	322	Beneath Property	1.6	North-East	86	1906
unnamed	WHINMOOR	Coal	64RY	323	Beneath Property	3.8	East	91	1949
WHARNCLIFFE	WHINMOOR	Coal	6XM1	337	Beneath Property	3.2	East	91	1943
WHARNCLIFFE	WHINMOOR	Coal	6XM2	346	Beneath Property	2.9	East	100	1948

Copyright © 2019 The Coal Authority

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	435399-009	435955 399549		Ironstone	
Shaft	435399-012	435932 399457		Ironstone	
Shaft	435399-013	435980 399478		Ironstone	
Shaft	435399-014	435973 399387		Ironstone	
Shaft	435399-015	435925 399351		Ironstone	
Shaft	435399-017	435877 399326		Ironstone	
Shaft	435399-018	435829 399310		Ironstone	
Shaft	435399-019	435879 399265		Ironstone	
Shaft	435399-020	435860 399248		Ironstone	
Shaft	435399-021	435823 399229		Ironstone	
Shaft	435399-022	435773 399194		Ironstone	
Shaft	436399-018	436037 399508	has been filled and mounded to an unknown specification	Coal	
Shaft	436399-019	436022 399454	has been filled and monded to an unknown specification	Coal	
Shaft	436399-041	436014 399470		Coal	
Shaft	436399-044	436012 399543		Coal	

Copyright © 2019 The Coal Authority

Abandoned mine plan catalogue numbers

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

OC238	NE433	17828
NE814	NE855	9356
SY5	NE853	8641

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

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
DUNSIL	Coal	Yes	Within	N/A	97
DUNSIL	Coal	Yes	Within	N/A	120
DUNSIL	Coal	Yes	Within	N/A	216
SWALLOW WOOD	Coal	Yes	Within	N/A	123
SWALLOW WOOD	Coal	Yes	Within	N/A	173
SWALLOW WOOD	Coal	Yes	Within	N/A	356

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.

Copyright © 2019 The Coal Authority

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
There are 1 claim(s) within 50 metres of the property boundary that do not match the property address. These are shown on the enquiry boundary plot.

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.

If further subsidence damage claims information is required, please visit www.groundstability.com.

See Section 4 for further information.

Mine gas
None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes
None recorded within 500 metres of the enquiry boundary.

Copyright © 2019 The Coal Authority

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 a notice to withdraw support was given in 1946.

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.

Copyright © 2019 The Coal Authority

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.

Coal mining subsidence

The site is within an area of previous interest. It is close to where the Coal Authority or licensed mine operator has investigated and where necessary remediated issues relating to coal mining subsidence.

The site requires further investigation and may influence your risk assessment. We recommend that you order the appropriate **Coal Authority Subsidence Claims Report**, which will include more information about the hazard.

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.

Copyright © 2019 The Coal Authority

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.

Copyright © 2019 The Coal Authority

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.

Copyright © 2019 The Coal Authority

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.

Copyright © 2019 The Coal Authority

This page left intentionally blank

Copyright © 2019 The Coal Authority

VAT receipt

Issued by	The Coal Authority 200 Lichfield Lane Mansfield Nottinghamshire NG18 4RG
Tax point date	24 October 2019
Issued to	APPLIED GEOLOGY LTD UNIT 23 ABBEY PARK STARETON KENILWORTH WARWICKSHIRE CV8 2LY
Property search for	HOYLAND COMMON BARNSLEY SOUTH YORKSHIRE S74 0DW
Reference number	51002186288001
Date of issue	24 October 2019
Cost	£255.13
VAT @ 20%	£51.03
Total received	£306.16
VAT registration	598 5850 68

Copyright © 2019 The Coal Authority

The Coal Authority

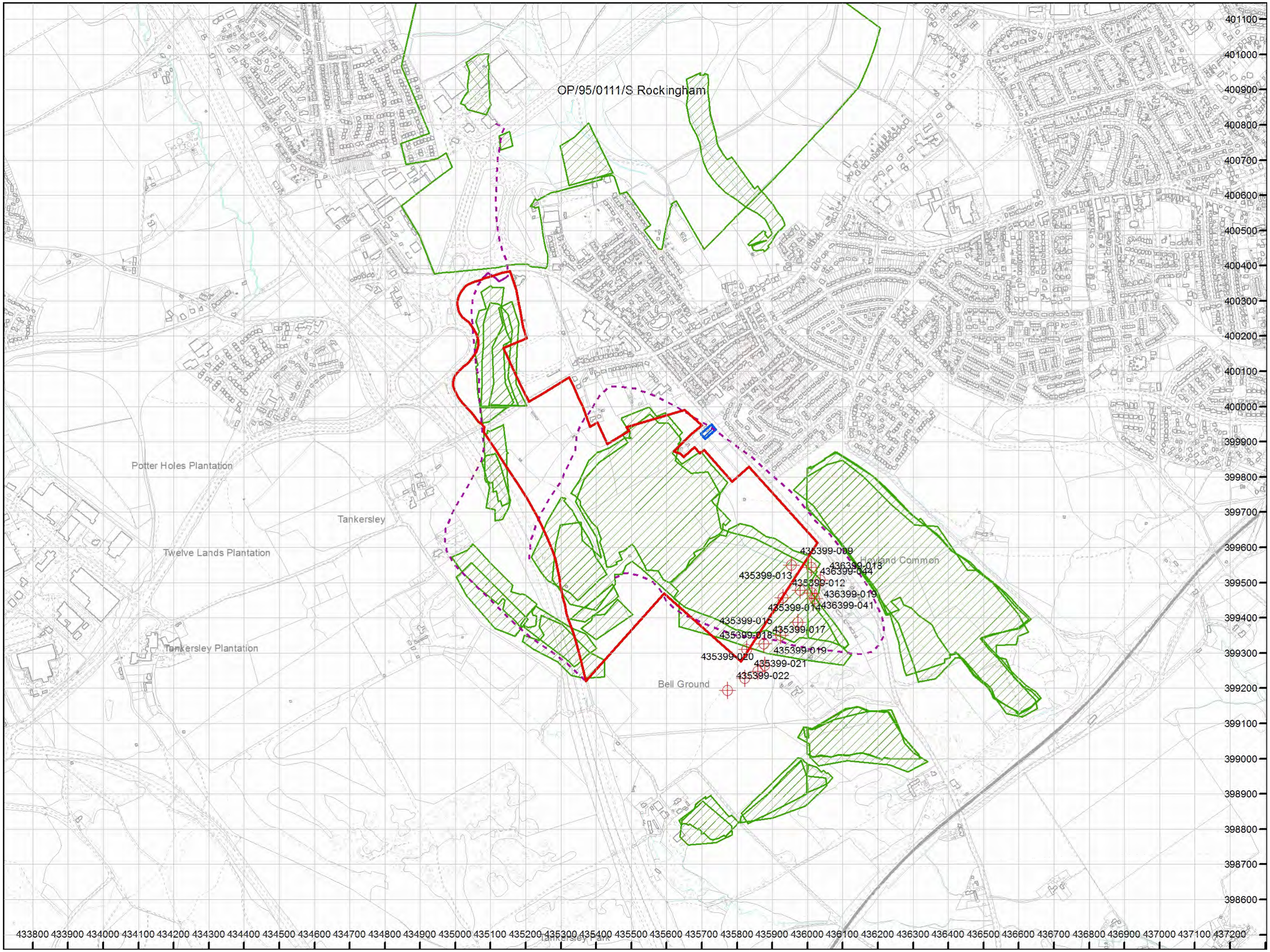
Summary of findings

Reproduced by permission of Ordnance Survey on behalf of HMSO.
© Crown copyright and database right 2018. All rights reserved.
Ordnance Survey Licence number: 100020315

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

Key

- Approximate position of the enquiry boundary shown
- Disused mine shaft
- Outcrop (Proven)
- Outcrop (Conjectured)
- Opencast mine licence area
- Unlicensed opencast site
- Coal claim



How to contact us
0345 762 6848 (UK)
+44 (0)1623 637 000 (International)
www.groundstability.com