GEOENVIRONMENTAL DESK STUDY REPORT

Hoyland Lowe
Hoyland

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CONFIDENTIALITY STATEMENT

This report is addressed to and may be relied upon by the following:

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DOCUMENT HISTORY

VERSION	PURPOSE/DESCRIPTION	DATE
1	Final – For issue to Client	September 2018
2	Final – For Issue to Client, Planning Layout plan updated	September 2018

EXECUTIVE SUMMARY

Site Address	**Hoyland Lowe, Hoyland**
NGR	Approximate NGR 435860, 400550.
Current Site Use & Proposed Development	The site is currently undeveloped and occupied by agricultural fields which are used for grazing. It is proposed to develop the site for housing.
Site History	The earliest available historical plans show the site to be open fields. A pump house is present in the western part of the site, former buildings are shown in the south east part of the site and two wells are shown adjacent to the southern boundary of the site. Part of the site has also been subject to opencast coal mining, this was backfilled and restored in the mid 1950's.
Site Setting	**Geology** – Infilled ground, comprising backfilled opencast workings, are shown across the centre of the site and to the north-east of the outcrop of the Barnsley Coal Seam. The infilled ground extends to the north and north-west, beyond the site boundary. No superficial deposits are shown to be present on the site. The underlying bedrock is shown to comprise the Pennine Middle Coal Measures Formation, which comprises interbedded mudstone, siltstone and sandstone, with bands of named sandstone units. Two coal seams are shown to outcrop on the site. • The Barnsley Coal seam (2.39m to 2.64m thick) is shown in the southern part of the site. • The Kents Thin Coal seam (0.86m to 2.26m thick) is shown to outcrop adjacent to the north-eastern boundary of the site. **Mining** – The property is in a surface area that could be affected by underground mining in 15 seams of coal at 60m to 440m depth, and last worked in 1977. The site is within the boundary of an opencast site from which coal has been removed by opencast methods. The Rockingham 2 area (former opencast) underlies the north west part of the site. The BGS Geology plan SE30SE and Coal Authority abandonment plans show further areas of backfilled opencast to extend across the north-western boundary and into the site. **Hydrogeology** – The underlying bedrock is classified as a Secondary A Aquifer. There are no active groundwater abstraction licences within 1km of the site. There are no potable water extraction licences within 2 km of the site. The site does not lie within an Environment Agency (EA) Groundwater Source Protection Zone. **Hydrology** – There are three Inland Rivers in the north west part of the site. There are four active licenced discharge consents to surface water within 500m. There are no surface water abstraction licences within 2km of the site. **Flooding** – Information on the EA website and presented in the GS report indicates that the site does not lie within 250m of an EA Zone 2 or a Zone 3 floodplain. Landfill – There are no active or historical landfill sites within 500m of the site. Historical mapping records ground workings and a refuse heap immediately north of the site. **Radon Risks** – The site is within a Radon Affected Area, as between 1 and 3% of properties are above the Action Level. No radon protective measures will be required.
Environmental Risk Assessment	Based on the history of the site, the following potential sources of contamination may be present: • Made ground associated with former buildings in the south east part of the site. • Made ground associated with historical opencasting, backfilling and restoration. • Hazardous gases associated with the made ground. The site has been assessed in accordance with a proposed residential end use. Based on this end use and the known history of the site, the following potential pollutant linkages may be present: • Development and maintenance workers could come into contact with made ground containing elevated concentrations of potential contaminants and associated hazardous gases. • Site end users could come into contact with made ground containing elevated concentrations of potential contaminants, e.g. eating home grown produce from gardens. They could also be exposed to hazardous gases associated with the made ground. • The underlying Secondary A Aquifer (bedrock) could become contaminated due to the leaching and migration of potential contaminants from the made ground into groundwater. • The Inland Rivers in the north west of the site could become contaminated due to the leaching and migration of potential contaminants from the made ground into surface water. • Buildings and services could be affected by potentially aggressive contaminants in the soils; and • Planting in garden and landscape areas could be affected by phytotoxic elements within the soils. These are based on current site conditions and do not consider exposure pathways following any remediation of the site. If the site can be shown to pose no "significant harm" or pollution to controlled waters, then the site can be considered to be uncontaminated. Based on the potential pollutant linkages present on the site, the site should be considered to be low to moderate risk with respect to contamination.
Preliminary Engineering Assessment	**Mining** – The Coal Authority report states that the property is within the boundary of an opencast site from which coal has been extracted by opencast methods. The RSK plans and geological plans show the extent of the former opencasted areas. The extent of the opencast workings and the depth and condition of any shallow coal seams. In particular those within the southern part of the site within the proposed residential area, should be assessed as part of an intrusive ground investigation.

	Foundations **Outside the footprint of the backfilled opencast** - Ground conditions are likely to comprise weathered Coal Measures strata comprising mudstone and siltstone with bands of sandstone. If suitable founding strata is present at shallow depth then a shallow foundation solution, e.g. strip foundations, will be suitable for the proposed development. However, if the underlying natural strata is unsuitable, i.e. too weak or compressible, then consideration could be given to the adoption of deeper trench fill foundations. **Within the backfilled opencast** – Ground conditions are likely to comprise uncompacted colliery spoil to depths of between 20m and 30m. It should be assumed that the made ground within the backfilled opencast will be unsuitable for the support of structural loads due to variations in material properties and low strength. If shallow spread foundations were to be used, the ground would become overstressed, leading to significant settlements. Due to the nature and documented thickness of the uncompacted backfill, it is considered unlikely that traditional ground improvement options, e.g. vibro-stone columns or piles would be viable for the proposed development. In order to assess the viability of the proposed development, an assessment should be made of the long-term settlement characteristics of the full thickness of the opencast backfill and constraints imposed by features such as buried highwalls. **Ground Floor Construction** - For a residential development, in accordance with NHBC guidance, where the made ground is in excess of 600mm thick, it is recommended that a suspended beam and block floor slab is utilised. **Groundwater** - It may be expected that shallow perched groundwater will be encountered within the shallow made ground and natural strata. The presence of groundwater will need to be assessed as part of any ground investigation. **Obstructions** - Based on the history of the site, the presence of significant obstructions within the made ground should be expected, particularly within the footprint of the backfilled opencast. **Excavations** - Excavations through any made ground and shallow natural ground may be unstable and temporary side support is likely to be required. The stability of the made ground and natural strata will need to be assessed as part of any ground investigation. **Roads, Pavements and Hardstanding Surfaces** - At this stage it is recommended that a conservative bearing value for the sub-grade is used, until the nature of the sub-grade can be physically assessed. **Chemical Attack on Buried Concrete** - Samples of made and natural ground should be obtained and submitted to the laboratory for testing in order to assess the sulphate content and acidity and hence the concrete class required for buried concrete to the latest standard.
Further Work Required	In order to assess the potential environmental and geotechnical constraints for future development, it is recommended that the following investigative works should be carried out: - Trial pits to examine the shallow ground conditions and to obtain soil samples. Soakaway testing may also be required in selected trial pits. - Cable percussive boreholes with in situ tests to provide geotechnical information in order to assess the nature of the subsurface and confirm the depth and distribution of any made ground. These boreholes will facilitate the installation of gas and groundwater monitoring wells and allow soil samples to be obtained from greater depth. - Rotary boreholes will be required to assess the potential for mining instability beneath the site. - Chemical analysis of soil and water samples in order to determine the concentrations of potential contamination on the site. - Geotechnical testing to classify materials and inform foundation design and chemical testing to assess the nature and extent of any contamination on the site and determine the Aggressive Chemical Environment for Concrete classification. - Monitoring of gas and groundwater wells for hazardous gases, methane, carbon dioxide, and oxygen and flow rate to the requirements of the Local Authority.
This sheet is intended as a summary only of the assessment of the site in relation to ground condition. It does not provide a definitive engineering analysis.	

1.0 INTRODUCTION

1.1 Instruction

JPG (Leeds) Limited has been instructed by Avant Homes (Yorkshire) to carry out a geoenvironmental desk study for a proposed residential development on land at Hoyland.

1.2 Objectives

The main objective of the geoenvironmental desk study is to identify potential geotechnical and environmental issues that may represent constraints to the proposed development of the site.

1.3 Scope of Works

The scope of works for the desk study included the following:

- Site inspection and description.
- Review of any previous reports provided.
- Review of contemporary and historical Ordnance Survey publications.
- Consultations with regulatory authorities where appropriate.
- Review of geological publications (including hydrology, hydrogeology and soil survey publications where appropriate).
- Obtain a Coal Authority Mining Report.
- Obtain available Coal Authority Abandonment Plans.
- Review of the radon status of the site.
- An environmental database search.
- Outline environmental risk assessment.
- Preliminary engineering recommendations with respect to mining, foundations, ground floor and pavement design.
- Recommendations for further work where appropriate.
- Presentation of the findings in a tabular non-technical summary.

1.4 Location

The site is located to the north east of Junction 36 of the M1 motorway, on the north side of Hoyland Road and Hawshaw Lane, approximately 1.5km northwest of Hoyland town centre. The approximate centre of the site is located at NGR 435860, 400550. A site location plan is given as Figure 1 in Appendix A.

1.5 Site Description and Topography

The site has an irregular shape and covers an area of approximately 11.06ha.

Access to the site is from the east through a wooden gate off Hawshaw Lane.

The site comprises two large fields and one smaller field. These are separated by fences and hedges.

The large field in the east of the site generally slopes steeply to the south west with local undulations.

The southern part of the large field in the west slopes towards the northwest; the northern part of this field slopes towards the south west.

The smallest field, which is situated in the southern portion of the site, it is flat but topographically higher than the surrounding area.

An old greenhouse and farm machinery surrounded by dense overgrown vegetation are present in the south east part of the site adjacent to the southern boundary.

Electrical pylons oriented south west to north east form the boundary between the proposed residential development (to the south east of the pylons) and the land to the northwest which will accommodate the proposed surface water attenuation pond.

The site is bound by open fields/restored former opencast to the north and east and residential development to the south and west.

An aerial photograph of the site is presented as Figure 2 and selected photographs of the site are contained in Appendix B.

1.6 Development Proposals

It is proposed to develop the eastern and southwest parts of the site with housing and associated access roads. A surface water attenuation pond will be located in the northwest part of the site, this part of the site will not be developed with housing.

1.7 Previous Reports

A previous desk study report for a larger site of which the subject site forms part, has been prepared by JPG; which is referenced below:

- JPG (Leeds) Limited. Geoenvironmental Desk Study Report. Hoyland Lowe, Hoyland. Report Ref: APN/DS/5003-1.v1. Dated December 2016 for CRM Land and Developments.

1.8 Limitations

The general limitations to the nature of the investigation are outlined in Appendix G.

2.0 SITE HISTORY

Historical plans for the site were obtained from GroundSure (GS). These have been reviewed in order to establish any former uses of the site and identify any potentially contaminative historical uses, or potential geotechnical constraints to the proposed development.

A summary of the relevant map information is presented in Table 2.0 and copies of relevant plans are presented in Appendix C.

Table 2.0 – Summary of Relevant Historical Map Information

Date(s) & Scale	Feature
1855 1:10,560	**The site comprises numerous fields separated by boundaries, trees are shown along these boundaries. A small circular feature is shown in the southern part of the site and a well is shown midway along the south eastern boundary of the site. Several buildings are shown adjacent to the southern boundary in the south east part of the site.** The site is bound by residential properties and Hoyland Lane/Hawshaw Lane to the south. The site is bound on all other sides by open fields. Scattered residential properties are shown beyond the site to the south.
1891 - 1894 1:10,560	**The small circular feature is no longer shown in the southern part of the site. Another small circular feature is shown in the centre of the site. A second well is also shown in the southern part of the site adjacent to the southern boundary.** Beyond the site, residential properties are shown to the south west of the site at Hoyland Common. Rockingham Colliery is shown approximately 450m beyond the site to the north west and Rockingham Gasworks are shown approximately 750m to the west of the site.
1893 LS 1_2 1:2,500	**No significant changes are shown on the site.** Several features associated with Rockingham Colliery are shown, these include two mine shafts, one air vent and three long coke ovens.
1903 1:10,560	**The trees and wells are no longer shown on the site, no other significant changes are shown.** Additional housing is shown to the south west of the site at Hoyland Common.
1929 1:10,560	**No significant changes are shown on the site.** Further housing is shown in Hoyland Common, immediately to the south of the site and allotment gardens are shown immediately to the west of the site.
1938 1:10,560	**No significant changes are shown on or beyond the site.**
1948 1:10,560	**No significant changes are shown on the site.** Several embankments/earthworks are shown approximately 250m to the north west of the site, immediately south of Rockingham Colliery. Further housing is also shown to the south of the site at Hoyland Common.
1951-1956 1:10,560	**No significant changes are shown on the site.** Opencast mining is shown immediately north of the site (the extent of the opencast mining is not clear as no changes are shown to the field boundaries or topographical contours).
1955-1956 LS 2_1 1:2,500	**The number of buildings adjacent to the southern boundary in the south east part of the site have reduced.**
1965-1966 1:10,560	**Fewer field boundaries are shown on the site and several drains are shown crossing the site. A small rectangular structure is shown in the north west of the site adjacent to the south west boundary of the site (this is later shown to be a pump house).** Beyond the site, a spoil heap associated with Rockingham Colliery is shown approximately 250m to the north west.
1977-1980 1:10,000	**Fewer field boundaries are shown on the site. The spoil heap to the north of the site is now shown to extend to the south and encroaches onto the northern boundary of the site.** Beyond the site, a factory is shown adjacent to the site, midway along the south east boundary. Slurry ponds are shown approximately 150m to the north west of the site and junction 36 of the M1 motorway is shown approximately 650m to the west of the site. Further development is shown to the south of the site at Hoyland Common.
1987-1992 1:10,000	**No significant changes are shown on the site.** The spoil heap to the north west has decreased in size and no longer encroaches onto the site.
2002 1:10,000	**The drains are no longer shown to cross the site.** Beyond the site, the tip to the north is no longer shown, this area is shown to comprise fields. The A6195 dual carriageway, oriented south west to north east is shown approximately 300m to the north west of the site.
2010 and 2014 1:10,000	**No significant changes are shown on or beyond the site.**

3.0 SITE SETTING

3.1 Geology

The GroundSure (GS) report and the following geological publications have been consulted:

- British Geological Survey. Sheet 87. Barnsley. 1:50,000 Scale. Bedrock and Superficial Geology. Dated 2008.
- British Geological Survey. Sheet SE30SE. Wombwell. 1:10,000 Scale. Bedrock and Superficial Deposits. Dated 2005.

Infilled ground, comprising backfilled opencast workings, are shown across the centre of the site and to the north-east of the outcrop of the Barnsley Coal Seam. The infilled ground extends to the north and northwest, beyond the site boundary.

No superficial deposits are shown to be present on the site.

The underlying bedrock is shown to comprise the Pennine Middle Coal Measures Formation, which comprises interbedded mudstone, siltstone and sandstone, with bands of named sandstone units.

Close to the north-eastern boundary of the site, the Kents Rock (sandstone) is shown to underlie the site. The Barnsley Rock (sandstone) is shown to underlie the south-western part of the site.

The strata are generally orientated north west to south east and are recorded to dip at approximately six degrees to the east.

The north-west to south-east trending Wentworth Fault crosses the centre of the site. A second, north-west to south-east trending unnamed fault (opencast plans indicate this to be the Elsecar Fault) crosses the site close to its north-eastern boundary. Both faults downthrow towards the north east.

Two coal seams are shown to outcrop on the site.

- The Barnsley Coal seam (2.39m to 2.64m thick) is shown in the southern part of the site.
- The Kents Thin Coal seam (0.86m to 2.26m thick) is shown to outcrop adjacent to the north-eastern boundary of the site, and terminates against the unnamed fault.

Historical borehole information has been obtained from the BGS. There are records for one borehole on the site, and a second just beyond the north-western boundary. The boreholes record the strata between the Silkstone Coal seam and the Whinmoor Coal seam, which occur at depth beneath the site.

Copies of historic exploratory borehole logs are contained in Appendix D.

3.2 Mining

A Coal Mining Report has been obtained from the Coal Authority, which states the following:

- *The property is in a surface area that could be affected by underground mining in 15 seams of coal at 60m to 440m depth, and last worked in 1977. Any movement in the ground due to coal mining activity should have stopped.*
- *In addition, the property is in an area where the Coal Authority believe there is coal at or close to the surface. This coal may have been worked at some time in the past. The potential presence of coal workings at or close to the surface should be considered prior to any site works or future development activity.*
- *The property is not within a surface area that could be affected by present underground mining.*
- *The property is not in an area where the Coal Authority has plans to grant or has granted a licence to remove coal using underground methods.*
- *However, reserves of coal exist in the local area which could be worked at some time in the future.*
- *No notices have been given under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.*
- *There are no known coal mine entries within, or within 20 metres of, the boundary of the property.*
- *There may however be mine entries/additional mine entries in the local area which the Coal Authority has no knowledge of.*
- *The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.*
- *The property is within the boundary of an opencast site from which coal has been removed by opencast methods.*
- *The property does not lie within 200m of the boundary of an opencast site from which coal is being removed by opencast methods.*
- *There are no licence requests outstanding to remove coal by opencast methods within 800 metres of the boundary.*
- *The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.*
- *A damage notice or claim for alleged subsidence damage was made in October 1995 for 114 Hoyland Road, Hoyland Common, Barnsley, South Yorkshire, S74 0AS. However, the claim was rejected.*
- *A damage notice or claim for alleged subsidence damage was made in December 1994 for 124 Hoyland Road, Hoyland Common Hoyland, Barnsley, South Yorkshire, S74 0AS. However, the claim was rejected.*
- *There are a further two claim(s) within 50 metres of the property boundary that do not match the property address.*
- *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.*

- *The Coal Authority has no record of a mine gas emission requiring action.*
- *The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.*

A copy of the Coal Mining report is presented in Appendix E.

Copies of plans produced by RSK for the adjacent Rockingham Opencast Site have been obtained, these are referenced below:

- RSK. Rockingham. Site Boundary Plan. Job No. 321393. Drawing No. 321393-R1(01)D002A. Dated 11.06.13. Figure 2, Revison A for Harworth Estates.
- RSK. Rockingham. Worked Areas for Coal Seams. Job No. 321393. Drawing No. 321393-R01(01)D003A. Dated 12.07.13. Figure 3, Revison A for Harworth Estates.
- RSK. Rockingham. Unnamed (1AQ) Basal Seam. Job No. 321393. Drawing No. 321393-R1(01)D004A. Dated 12.07.13. Figure 4, Revison A for Harworth Estates.
- RSK. Rockingham. Contours of Approximate Backfill Thickness. Job No. 321393. Drawing No. 321393-R02(00)D003A. Dated 01.10.13. Figure 3, Revison A for Harworth Estates.

The Rockingham 2 area (former opencast), which underlies the northwest part of the site is shown to have been backfilled with no compaction recorded. The thickness of the backfill is shown to range between 20m and 65m.

The BGS Geology plan SE30SE, shows further areas of backfilled opencast to extend across the north-western boundary and into the site.

The extent and depth of the opencast workings are controlled by the faults which cross the site, a summary of the worked seams is provided below:

- The Kents Thin coal seam, which outcrops adjacent to the north-eastern boundary, is recorded to have been worked. However, any shallow workings associated with the Kents Thin is likely to impact land to the north-east of the site.
- To the west of the unnamed fault (Elsecar Fault), the following seams in stratigraphic order are recorded to have been worked, Barnsley Rider Upper A, Barnsely Rider Lower A, Barnsley AVX (outcrops on site), Dunsil Rider Upper 2AU, Dunsil Rider Lower 1AU, Dunsil AU, Swallow Wood Rider 1AR, Swallow Wood Ar and Unnamed 1AQ.
- Underground workings have also been recorded in the Barnsley seam, beyond the opencast areas, and also in the following seams which underlie the base of the opencast: Lidgett, Flockton Thick, Flockton Thin, Top Fenton, Low Fenton, Parkgate, Thorncliffe and Silkstone.

A plan showing the extent of the recorded opencast areas is presented as Figure 4 in Appendix A.

Abandonment plans for the Barnsley Seam, which is shallowest seam underlying the site (and is likely to be the only seam within influencing depth of the surface of the site) are provided in Appendix F.

The GS report states that localised small-scale underground mining for iron ore may have occurred and that the potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered.

3.3 Hydrogeology

The bedrock underlying the site is classified as a Secondary A Aquifer. These are described as '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'.

There are no active groundwater abstraction licences within 1km of the site.

There are no potable water extraction licences within 2km of the site.

There are no groundwater Source Protection Zones within 500m of the site.

3.4 Hydrology

There are three watercourses classified as 'Inland Rivers' in the northwest part of the site. These are within the catchment of the Rother and the Don.

There are four active licenced discharge consents to surface water within 500m of the site. These are detailed in Table 3.4.1, below.

Table 3.4.1. Records of Licensed Discharge Consents within 500m of the study site

Distance (m) and direction from the site	NGR	Site Address	Effluent type	Receiving Water	Status
7m, West	435610, 400570	Tinker Lane Sewage Pumping Stn, Tinker Lane, Wombwell, Barnsley	Sewage Discharges – Pumping station – Water Company	Short Wood Dike	Modified - (WRA 91 Sched 10 – as Amended by Env Act 1995)
7m, West	435610, 400570	Tinker Lane Sewage Pumping Stn, Tinker Lane, Wombwell, Barnsley	Sewage Discharges - Sewer Storm Overflow – Water Company	Short Wood Dike	Modified - (WRA 91 Sched 10 – as Amended by Env Act 1995)
335m, West	435272, 400542	G.B. Trucks Services Ltd, Cross Keys Works, Cross Keys Lane, Hoyland, Barnsley, S74 0QA	Sewage Discharges - Final/Treated Effluent - Not Water Company	Short Wood Dike	Undetermined 1961 Application
380m, South West	435400, 400200	Valley Farm, Hutton Bonville, Northallerton	Sewage Discharges - Final/Treated Effluent - Not Water Company	River Wiske	New Consent (WRA 91, S88 & Sched 10 as Amended by Env Act 1995)

There are no surface water abstraction licences within 2km of the site.

Information on the EA website and presented in the GS report indicates that the site does not lie within 250m of an EA Zone 2 or a Zone 3 floodplain. In addition, the site is at a very low risk of flooding from Rivers and the Sea.

The BGS have indicated that the site lies within an area which is susceptible to flooding due to groundwater. This classification is based on the limited geological information available to the BGS for the site at the present time. The susceptibility and the risk of groundwater flooding occurring at the site should be assessed based on site specific information.

It is likely that a flood risk assessment will be required by the Local Authority as part of any planning application for the site.

3.5 Pollution Incidents

There are no Environment Agency List 1 recorded pollution incidents within 500m of the site.

There are two Environment Agency List 2 recorded pollution incidents within 500m of the site. Both of these recorded minor or no impact to water, land or air.

3.6 Landfill and Waste

The GS report includes information on active and former landfill sites supplied by the Environment Agency, BGS, DoE, Local Authority and historical mapping.

There are no active or historical landfill sites within 500m of the site.

Historical mapping records ground workings and a refuse heap located immediately to the north of the site.

There are no waste treatment, transfer or disposal sites within 500m of the site.

3.7 Environmental Permits, Incidents and Registers

There are no records of historic Integrated Pollution Control (IPC) authorisations within 500m of the site.

There are no records of any Part A(1) or Integrated Pollution Prevention Control (IPPC) authorised activities within 500m of the site.

There are no records of any Part A(2) permitted activities within 500m of the site.

There are two records of active Part B permitted activities within 500m of the site. These are summarised in Table 3.7.1, below.

Table 3.7.1 – Part B Permitted Activities within 500m of the study site

Distance (m) and direction from the site	Address	Process	Enforcement
331m, SW	Mr A Mitha, Hoyland Common Service Station, Sheffield Road, Hoyland Common, S74 0DP.	Unloading of petrol into storage at service stations.	No Enforcement Notified.
340m, SW	Cross Keys Garage (Barnsley) Ltd, Sheffield Road, Hoyland Common, S74 0PY.	Unloading of petrol into storage at service stations.	No Enforcement Notified.

There are no records of Water Industry Referral (potentially harmful discharges to the public sewer) within 500m of the site.

There are no Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the site.

There are no records of List 1 or List 2 Dangerous Substances Inventory Sites within 500m of the site.

There are no current records of Category 3 or 4 Radioactive Substances Licences within 500m of the site.

There are no recorded Control of Major Accidents Hazard (COMAH) or Notification of Installations Handling Hazardous Substances (NIHHS) sites within 500m of the site.

There are no sites determined as contaminated Land under Part IIA EPA 1990 within 500m of the site.

3.8 Radon Risks

The property is in a Radon Affected Area, as between 1 and 3% of properties are above the Action Level. No radon protective measures will be required.

3.9 Additional Information

There are no historical petrol stations or fuel sites within 500m of the site.

There are two active petrol stations within 500m of the site. These are located approximately 341m south of the site and 369m south west of the site at MRH Hoyland Common and Cross Keys Garage respectively.

There is a Yorkshire Water pumping station adjacent to the western boundary of the site.

4.0 ENVIRONMENTAL RISK ASSESSMENT

4.1 Introduction

The presence of contaminated materials on a site is generally only of concern if an actual or potentially unacceptable risk exists. Within the context of current UK legislation i.e. Part 2A of the Environmental Protection Act 1990, implemented through Section 57 of the Environment Act 1995, the interpretation of a "significant risk" is termed to be one where:

- Significant harm is being caused, or there is a significant possibility of such harm being caused, (where harm is defined as harm to health of living organisms or other interference with the ecological systems of which they form a part and, in the case of man, includes harm to his property); and/or
- Pollution of controlled waters is being caused.

The potential for harm to occur requires three conditions to be satisfied:

- Presence of substances (potential contaminants/pollutants) that may cause harm (Sources).
- The presence of a receptor which may be harmed, e.g. the water environment or humans, buildings, fauna and flora (Receptors).
- The existence of a linkage between the Source and the Receptor (The Pathway).

In order to assess the contamination risk at the site, the above rationale has been applied and is discussed in the context of Contamination Sources and Potential Pollutant Linkages.

4.2 Potential Sources

The central southern part of the site has been subject to opencasting and was restored in the mid 1950's. The land to the north of the site has also been subject to opencasting and restoration.

Based on the history of the site, the following potential sources of contamination may be present:

- Made ground associated with former buildings in the south east part of the site.
- Made ground associated with historical opencasting, backfilling and restoration.
- Hazardous gases associated with the made ground.

Potential contaminants which could be present on the site are listed below:

- Metals, metalloids and their compounds.
- Inorganic compounds, e.g. arsenic.
- Organic compounds, e.g. Poly Aromatic Hydrocarbons (PAH).

- Asbestos.
- Hazardous gases.

4.3 Potential Pathways

The site has been assessed in accordance with the proposed redevelopment of the site for a residential end use with plant uptake, the following potential exposure pathways will require consideration, both during the redevelopment works and on completion of the construction:

- Ingestion and dermal contact with contaminated soil and groundwater.
- Inhalation of hazardous gases.
- Leaching/migration of contaminants from soil into groundwater via groundwater flow.
- Leaching/migration of contaminants from soil into surface water via surface water flow.
- Permeation of water supply pipes and other services by organic and aggressive contaminants.
- Uptake of contaminants by planting in garden and landscape areas.

4.4 Potential Receptors

The potential receptors considered are:

- Development workers and future maintenance workers involved in excavations, e.g. foundations or where services are being installed or repaired following development.
- Site end users (i.e. residents).
- The underlying Secondary A Aquifer (bedrock).
- The Inland Rivers in the north west of the site.
- Buildings and services.
- Planting in garden and landscape areas.

4.5 Pollutant Linkage Assessment

A potential pollutant linkage assessment has been completed and is summarised in the Conceptual Site Model which is presented as Figure 3 in Appendix A. This is based on the proposed redevelopment of the site for a residential end use.

On the basis of the proposed end use and known history of the site, the following potential pollutant linkages may be present:

- Development and maintenance workers could come into contact with made ground containing elevated concentrations of potential contaminants and associated hazardous gases.
- Site end users could come into contact with made ground containing elevated concentrations of potential contaminants, e.g. eating home grown produce from gardens. They could also be exposed to hazardous gases associated with the made ground.
- The underlying Secondary A Aquifer (bedrock) could become contaminated due to the leaching and migration of potential contaminants from the made ground into groundwater.
- The Inland Rivers in the northwest of the site could become contaminated due to the leaching and migration of potential contaminants from the made ground into surface water.
- Buildings and services could be affected by potentially aggressive contaminants in the soils; and
- Planting in garden and landscape areas could be affected by phytotoxic elements within the soils.

These are based on current site conditions and do not consider exposure pathways following any remediation of the site.

If the site can be shown to pose no "significant harm" or pollution to controlled waters, then the site can be considered to be uncontaminated.

4.6 Risk Classification

Based on the potential pollutant linkages present on the site, the site should be considered to be **low to moderate risk with respect to contamination**. This designation will be largely dependent on the nature of any made ground and potential presence of any significantly elevated concentrations of potential contaminants or hazardous gases.

In order to fully assess and classify the risks to human health, controlled waters and buildings/services, a Phase 2 Intrusive Investigation, including chemical testing of soils and groundwater and gas monitoring will be required.

5.0 PRELIMINARY ENGINEERING ASSESSMENT

5.1 Development Proposals

It is proposed to re-develop the eastern and south west parts of the site with housing and associated access roads. A surface water attenuation pond will be located in the northwest part of the site, this part of the site will not be developed with housing.

5.2 Mining

The Coal Authority report states that the property is within the boundary of an opencast site from which coal has been extracted by opencast methods.

The RSK plans and geological plans show the extent of the former opencasted areas.

The extent of the opencast workings and the depth and condition of any shallow coal seams. In particular those within the southern part of the site within the proposed residential area, should be assessed as part of an intrusive ground investigation.

5.3 Foundations

Outside the Footprint of the Backfilled Opencast
Ground conditions are likely to comprise weathered Coal Measures strata comprising mudstone and siltstone with bands of sandstone.

The selection of foundation type for the proposed development will be governed by the thickness of any made ground and the strength and settlement characteristics of the underlying natural strata, which will need to be assessed.

If suitable founding strata is present at shallow depth then a shallow foundation solution, e.g. strip foundations, will be suitable for the proposed development.

However, if the underlying natural strata is unsuitable, i.e. too weak or compressible, then consideration could be given to the adoption of deeper trench fill foundations.

If further poor ground is encountered, then consideration could be given to ground treatment options, e.g. vibro-stone columns or piles.

Within the Backfilled Opencast (Adjacent to the Proposed Development)
Ground conditions are likely to comprise uncompacted colliery spoil to depths of between 20m and 30m.

It should be assumed that the made ground within the backfilled opencast will be unsuitable for the support of structural loads due to variations in material properties and low strength. If shallow spread foundations were to be used, the ground would become overstressed, leading to significant settlements.

Due to the nature and documented thickness of the uncompacted backfill, i.e. 20m to 30m, it is considered unlikely that traditional ground improvement options, e.g. vibro-stone columns or piles would be viable for the proposed development.

In order to assess the viability of the proposed development, an assessment should be made of the long term settlement characteristics of the full thickness of the opencast backfill and constraints imposed by features such as buried highwalls.

5.4 Ground Floor Construction

For a residential development, in accordance with NHBC guidance, where the made ground is in excess of 600mm thick, it is recommended that a suspended beam and block floor slab is utilised.

5.5 Groundwater

It may be expected that shallow perched groundwater will be encountered within the shallow made ground and natural strata. The presence of groundwater will need to be assessed as part of any ground investigation.

5.6 Obstructions

Based on the history of the site, the presence of significant obstructions within the made ground should be expected, particularly within the footprint of the backfilled opencast.

5.7 Excavations

Excavations through any made ground and shallow natural ground may be unstable and temporary side support is likely to be required. The stability of the made ground and natural strata will need to be assessed as part of any ground investigation.

5.8 Roads, Pavements and Hardstanding Surfaces

At this stage it is recommended that a conservative bearing value for the sub-grade is used, until the nature of the sub-grade can be physically assessed.

5.9 Chemical Attack on Buried Concrete

Samples of made and natural ground should be obtained and submitted to the laboratory for testing in order to assess the sulphate content and acidity and hence the concrete class required for buried concrete to the latest standard.

6.0 FURTHER INVESTIGATIONS

On the basis that the proposed development will be restricted to the land outside the footprint of the restored opencast, and in order to assess the potential environmental and geotechnical constraints for future development. It is recommended that the following investigative works should be carried out:

- Trial pits to examine the shallow ground conditions and to obtain soil samples. Soakaway testing may also be required in selected trial pits.
- Cable percussive boreholes with in situ tests to provide geotechnical information in order to assess the nature of the subsurface and confirm the depth and distribution of any made ground. These boreholes will facilitate the installation of gas and groundwater monitoring wells and allow soil samples to be obtained from greater depth.
- Rotary boreholes will be required to assess the potential for mining instability beneath the site.
- Chemical analysis of soil and water samples in order to determine the concentrations of potential contamination on the site.
- Geotechnical testing to classify materials and inform foundation design and chemical testing to assess the nature and extent of any contamination on the site and determine the Aggressive Chemical Environment for Concrete classification.
- Monitoring of gas and groundwater wells for hazardous gases, methane, carbon dioxide, and oxygen and flow rate to the requirements of the Local Authority.

R Mew

R Mew
BSc MSc FGS
For and on behalf of JPG (Leeds) Limited

September 2018

Appendix A Figures/Drawings

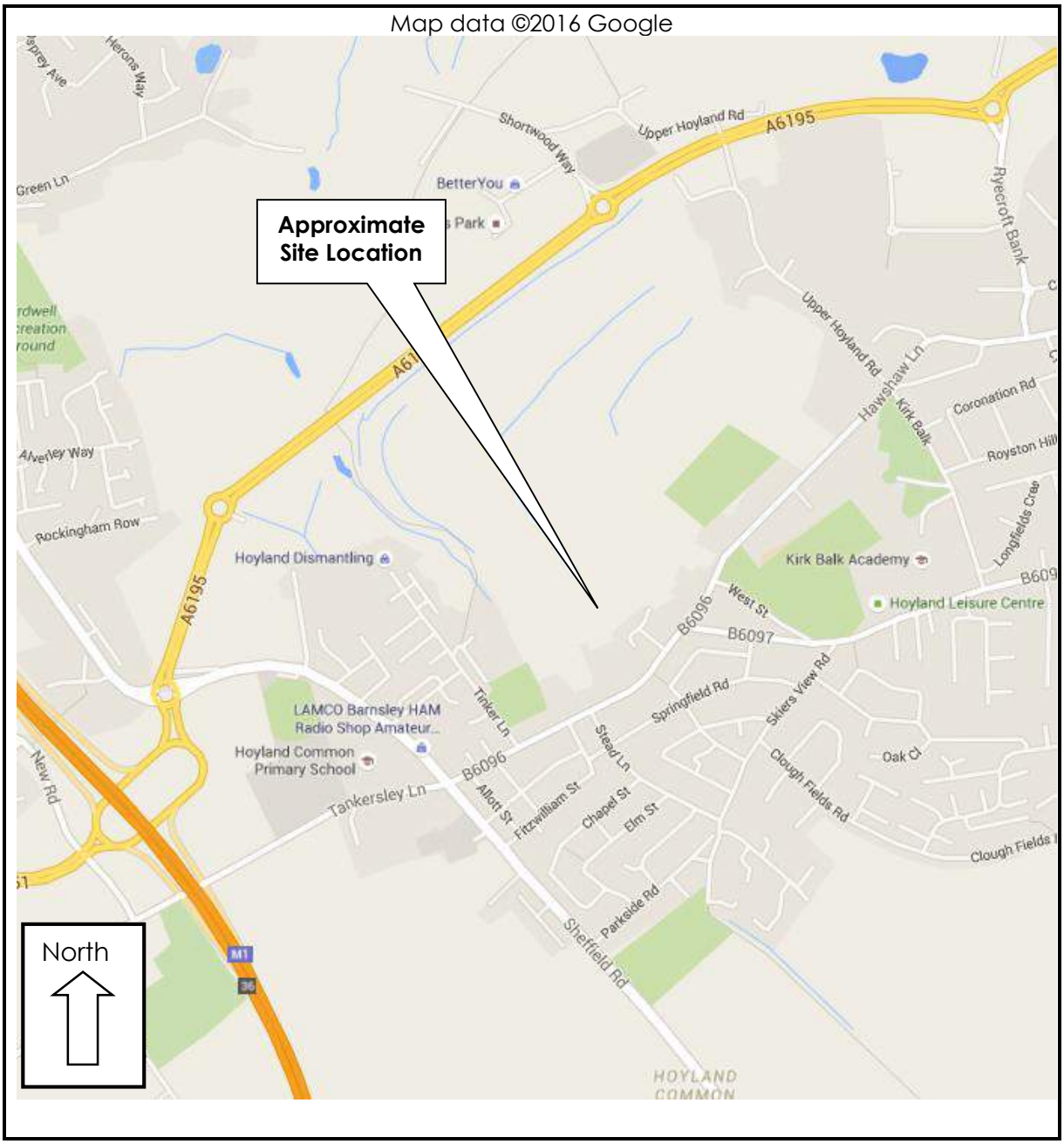


Figure 1 – Site Location Plan	
Site	**Hoyland Lowe, Hoyland**
Client	**Avant Homes (Yorkshire)**
Job Number	**5003-4**
Scale	**NTS**

Figure 2 – Aerial Photograph	
Site	**Hoyland Lowe, Hoyland**
Client	**Avant Homes (Yorkshire)**
Job Number	**5003-4**
Scale	**NTS**

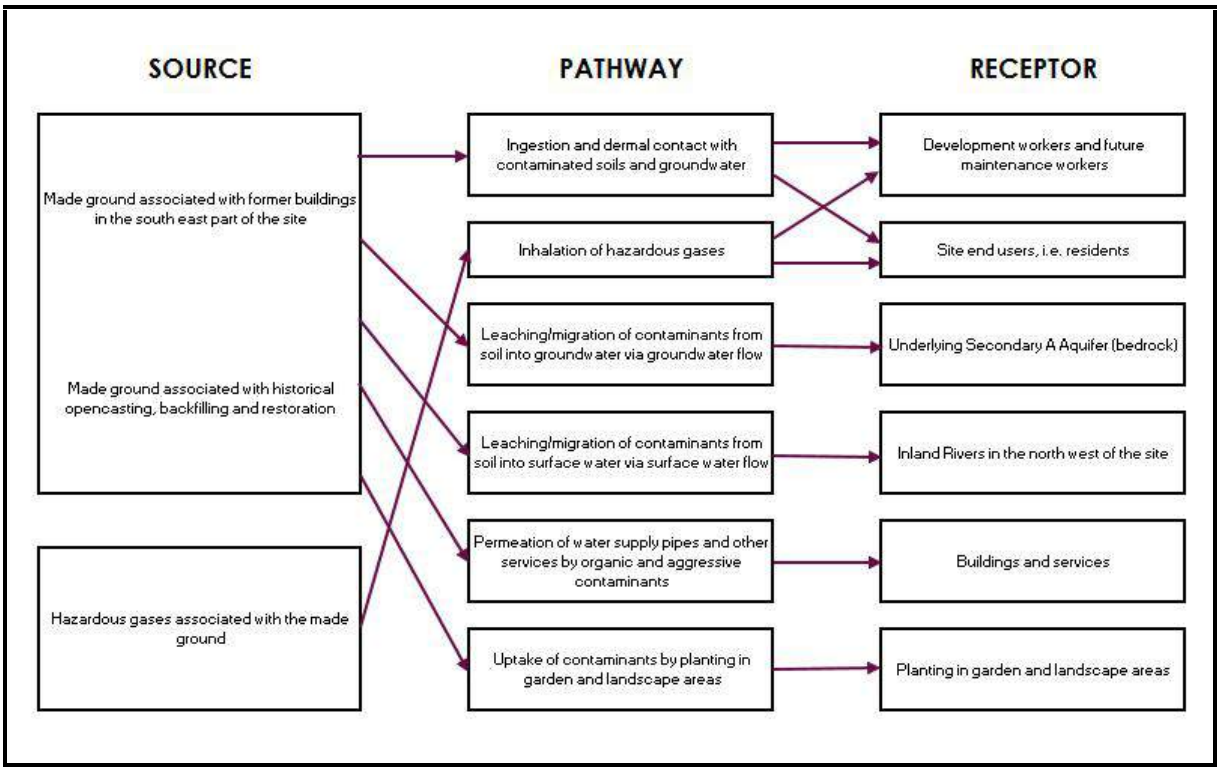
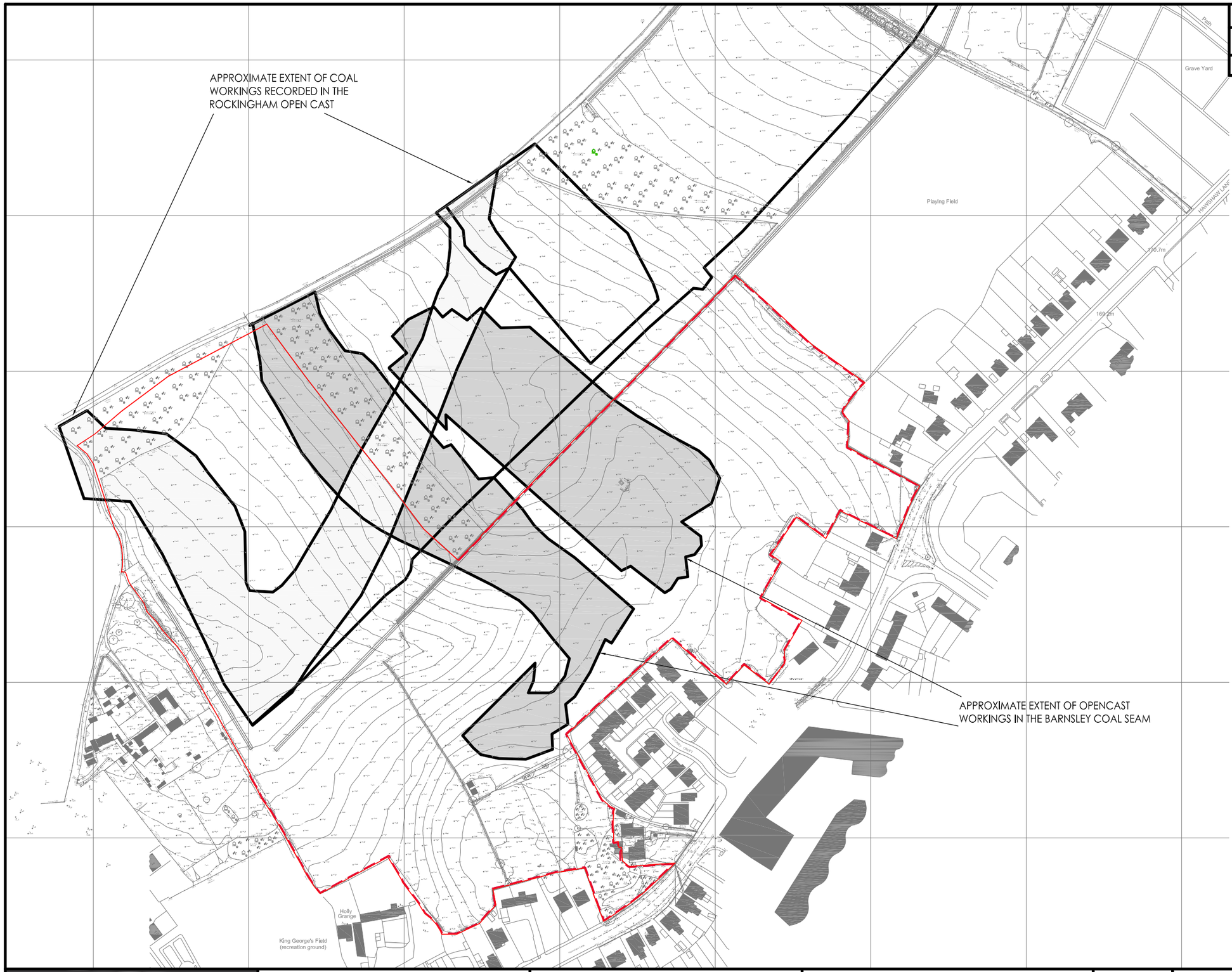


Figure 3 – Conceptual Site Model	
Site	**Hoyland Lowe, Hoyland**
Client	**Avant Homes (Yorkshire)**
Job Number	**5003-4**
Scale	**NTS**

DO NOT SCALE

NOTES



REV	DESCRIPTION	DATE	BY
A	SITE BOUNDARY REVISED	26/09/18	JAC

JPG
www.jpg.group
Leeds: 0113 263 1155 | London: 020 7947 4148

Job Title
HOYLAND SK5

Drawing Title
FIGURE4: APPROXIMATE EXTENT OF BACKFIELD OPENCAST WORKIGS

Architect

Checked	Date	Scale		Drawn
	07.09.2018	1:2500	A3	SH

Drawing No 5003-SK6 A