

**PHASE 1
GEOTECHNICAL AND GEO-ENVIRONMENTAL
SITE INVESTIGATION**

**CLOUGH HOUSE, LEEDS ROAD,
BIRSTALL, BATLEY**

**FOR
ROSIE CARR**



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14 January 2020

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Site Photographs

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1.0 EXECUTIVE SUMMARY

1. The nearly one hectare site is located north of Leeds Road in the east of Birstall, around 9.5 km south west of Leeds city centre. The site currently comprises Clough House and two outbuildings in the centre of the site with soft landscaping to the north and south. Localised areas of macadam and concrete hardstanding exist in the centre and south of the site.
2. Historically a railway cutting crossed through the north of the site, trending roughly east to west, which was backfilled prior to 1986. Anecdotal evidence suggests the northern half of the site was utilised as a pig farm prior to the 1990s, which comprised various large buildings and a tank. A well and pump are expected in the central east and west of the site, respectively.
3. The highest point is in the north western corner at around 151 m AOD sloping down to Leeds Road at around 144 m AOD, with a small relatively level plateau surrounding Clough House. An approximate gradient of 1 in 24 is calculated from north to south across the site.
4. The geological map indicates the majority of the site to be underlain by undifferentiated shales and mudstones of the Pennine Middle Coal Measures Formation and a band of sandstone (Emley Rock) crosses the centre of the site.
5. The area surrounding the site is highly faulted and three faults are recorded to cross the site at surface.
6. Two coal seams are recorded to outcrop onsite. Shallow coal workings may be present and a rotary investigation is considered necessary to confirm if drilling and grouting is required, although this is considered unlikely.
7. No radon precautions are required. Deep made is expected onsite, as well as possible backfilled features and possible shallow coal mining. Three areas of infilled ground and five areas of potentially infilled land relating to water are recorded within 250 m. A gas monitoring programme is recommended, and at this stage that Amber 1 precautions be allowed for across 80% of plots and Amber 2 for around 20%.
8. Made ground is expected across the northern half of the site and is expected to reach significant depth within the former railway cutting, and as a result of the cellar below Clough House and former buildings. Natural weathered mudstone (clay), shale (clay) and sandstone (sand) are expected at shallow depth below the site.
9. Shallow groundwater is not expected below the site.

10. Strip or trench fill foundations are expected to be the most appropriate foundation solution across the majority of the site, taken through any made ground into undisturbed non-desiccated natural ground at a minimum depth of 900 mm in clay soil or 600 to 750 mm in granular soils. No plots appear to be located within the former railway cutting, if plots are proposed here in the future piles would likely be required.
11. The stability of trenches may be poor in made ground, especially if perched groundwater is encountered. Obstructions, such as old foundations and slabs as a result of former infrastructure are expected below the site.
12. Soakaways may be viable in a small portion of the site.
13. A capping layer, with a minimum thickness of 600 mm, including 100 mm of topsoil, over made ground should be allowed for in gardens and landscaped areas in the northern half of the site.
14. At this stage we recommend DS-2 AC-2 sulphate precautions be allowed for below ground concrete in contact with made ground, and protective water supply pipes in made ground.
15. Before more definite information regarding the properties of the ground and any contamination present can be given, an intrusive ground investigation will be required.

2.0 INTRODUCTION

2.1 Terms of Reference

This report presents the findings of a Phase 1 geotechnical and geo-environmental site investigation carried out by Eastwood & Partners (Consulting Engineers) Limited for, and on the instructions of Rosie Carr. Any other parties using the information in this report do so at their own risk and any duty of care is excluded.

2.2 Context

Eastwood & Partners are not aware of any previous investigations having been undertaken on the site.

2.3 Aims and Objectives

The aims and objectives of this investigation were as follows:

- To assimilate and review information extracted from published documentation to derive an outline conceptual model identifying potential contaminants, pathways and receptors, as well as possible linkages between these;
- To detail the expected ground conditions and their geotechnical properties enabling outline foundation proposals to be made for the proposed residential development; and
- To outline proposals for a Phase 2 intrusive investigation, the purpose of which would be to obtain information to test the conceptual model and assess the risks to receptors as well as to confirm the foundation proposals.

2.4 Scope of Investigation

This document constitutes the findings of the Phase 1 investigation. This involved a review of information extracted from published documentation. Information regarding the current and former land uses both on and surrounding the site, as well as the environmental sensitivity of the location as determined by factors including geology, hydrogeology and hydrology have been examined.

Information analysed has been obtained from a variety of sources and included the following:

- A Landmark Envirocheck;
- The British Geological Survey online viewer, geological maps and associated memoirs;
- The Coal Authority online viewer;
- A Consultants Coal Mining Report; and

- A site walkover.

2.5 Limitations of Investigation

This report is based on the assumption that the site will be developed with housing of conventional construction, with private gardens and areas of public open space. It is assumed site levels will remain relatively unchanged. If this is not the case, then the advice given in this report may not be appropriate.

Where assessments of site areas affected in particular ways are given, these are approximate. All information, comments and opinions given in this report are based on the documentary information examined. This report considers the ground and groundwater and does not cover any buildings or their fabric or the constituents of any existing hardstanding. Risks to ecological receptors, such as bats, have not been considered.

3.0 THE SITE

3.1 Description

The approximately 0.9 hectare site is located directly north of Leeds Road in the east of Birstall, around 9.5 km south west of Leeds city centre. It is roughly rectangular in shape on plan and is centred around grid reference 423390, 426680.

The site slopes gently from around 151 m in the north western corner down to around 144 m at the southern boundary. An approximate gradient of 1 in 24 is calculated north to south across the site, although localised steeper slopes were observed. A relatively level plateau was noted around Clough House and the ground level around the outbuildings was noted to be around 0.5 m lower than Moat Hill Farm Drive directly west of the boundary.

The majority of the site has comprised a private residence, Clough House, since 1864 which is still present in the centre of the site today. Anecdotal evidence suggests a cellar underlies around a third of the house footprint. Two outbuildings, which formed part of a former pig farm, remain to the north of the main house.

Minimal development has occurred in the southern half of the site. It is currently primarily surfaced with soft landscaping and a looped macadam entrance extends from Leeds Road up to the front of the main house. Localised hardstanding is also present between Clough House and the outbuildings to the north.

Tree stumps line the edge of the looped entrance in the south of the site and aerial imagery from 2015 shows mature trees to line the southern site boundary which were not observed during the walkover. Sporadic trees remain in the south west and central east of the site.

An enclosed garden is present to the east of the house, bound by a stone wall to the north and a hedgerow to the south.

Photographs from the walkover are included in the Appendix.

3.2 History

Historical Ordnance Survey maps have been reviewed in the Envirocheck to assess the previous use of the site and surrounding area. The maps, together with the Envirocheck, can be found in the Appendix.

3.2.1 The Site

The earliest Ordnance Survey map available to view, dated 1854, shows Clough House in the central west of the site with two smaller outbuildings to the north. A possible boundary fence or wall

curves from the rear of the house across the site to the eastern boundary. A field boundary segregates a small portion in the north from the remainder of the site, this area appears to be part of a larger agricultural field extending north. Various trees are shown in the southern half of the site, along the western boundary and along the field boundary in the north.

The more detailed (1:2,500 scale) map dated 1893 to 1894 indicates a pump is located between Clough House and one of the outbuildings in the west of the site. A well is also located along the eastern boundary.

Part of a railway cutting (Heaton Lodge & Wortley Line) is shown to cross the northern edge of the site, sloping down to the north, by 1907 to 1908. The well in the east of the site is no longer mapped at this time.

By 1922 the pump is no longer mapped. The number of trees in the south of the site has been reduced, leaving a row lining the southern boundary and along the circular track leading to the house.

The easternmost outbuilding has been demolished by 1933.

At least six large rectangular buildings have been constructed between Clough House and the top of the railway cutting by 1971. The remaining outbuilding has been replaced and incorporated into this new development. Anecdotal evidence suggests these buildings could have been related to pig farming. Tanks are shown adjacent to one of these larger buildings close to the western boundary. A smaller building is constructed in the central east of the site, south of the fence/wall line. The railway directly north of the site has been labelled as dismantled, the cutting remains in place.

The cutting in the north of the site is no longer mapped by 1986 indicating landscaping or backfilling may have taken place.

The majority of the larger buildings in the northern half of the site, suspected to be associated with pig farming, are demolished by 1990. Two buildings remain in this area until 1991 when an additional building is constructed adjacent to the western boundary. The smaller building in the east of the site has been demolished.

No significant changes are then noted on subsequent maps, or on aerial photography dated between 2002 and 2019, although a large marquee is identified in the north of the site on the 2015 aerial photograph.

3.2.2 The Surrounding Area

The earliest map, dated 1854, generally shows the surrounding area to comprise agricultural land. Leeds Road is shown in its current day location parallel to the southern site boundary. A row of

housing is mapped directly east of the site along Leeds Road and a cluster of buildings, labelled as Moat Hill, are shown directly west of the site. A railway line is shown to trend roughly north to south approximately 300 m east of the site. Several coal pits are mapped between 230 and 500 m north east of the site. The town centre of Birstall is around 750 m south west and a large sandstone quarry (Brown Hill Quarry) is located around 675 m south west. Boggard Colliery and associated coal pits are mapped between 550 and 600 m south east of the site and Birstall Colliery is around 350 m north west.

Boggard and Birstall Collieries are no longer mapped by 1894 to 1895. The coal pits to the north east of the site are no longer shown, replaced instead by an unnamed colliery which appears to have expanded to within 350 m of the site boundary. Old shafts are mapped around 400 m east of the boundary. Buildings are shown to line Leeds Road coming within 110 m of the western site boundary. A pond and a well are mapped 140 and 160 m east of the site, respectively.

The 1908 map shows the colliery to the north east as Howden Clough Colliery. Several associated railway sidings are shown to branch off the main train line extending within 300 m of the boundary. Brownhill Quarry is labelled as disused. A new air shaft has been excavated east of some old shafts, approximately 650 m east of the boundary.

Howden Clough Colliery has expanded west by 1932. The well located beyond the pond to the east of the site is no longer mapped. Two rows of housing have been constructed directly west of the site boundary. The air shaft is no longer mapped.

Howden Clough Colliery is labelled as disused by 1955; the associated railway sidings have been demolished but the buildings and colliery spoil are still present.

Residential properties are constructed directly east of the northern half of the site by 1971 and the majority of the surrounding area to the south and west has been built up connecting to Birstall. The railway line to the north of the site has been dismantled, and is labelled as a path/track. The railway to the east of the site has also been dismantled. The infrastructure associated with Howden Clough Colliery has been dismantled and a depot has been constructed in its footprint.

The section of the embankment which crossed within the northern site boundary has been potentially infilled together with a stretch to the east and west of the site by 1986.

An industrial estate has been constructed in the location of the former railway line to the north of the site and beyond by 1991. A possible drain is shown around 100 m north east of the site, later labelled as a drain and flood tank.

No other significant developments are noted on subsequent maps.

3.3 Geology

The geological map for the area, 232 NE (1:10,560 scale) shows the centre of the site to be underlain by sandstone of the Pennine Middle Coal Measures Formation. The local geological memoir for the area (Geology of Huddersfield and Halifax) refers to this sandstone unit as Emley Rock.

Undifferentiated shales or mudstones of the Pennine Middle Coal Measures Formation are present in the north and south of the site.

No superficial deposits are shown to overlie the site.

A fault is shown to cross the southern half of the site at surface, orientated roughly east to west and downthrown to the south. An inferred fault is shown to cross the north western tip of the site, orientated north east to south west and downthrown to the south east. A further fault is recorded within the Middleton coal at depth across the southern tip of the site.

Within the area to the south of the faults and in the fault blocks east and west of the site, the strata are recorded to dip to the north east between 1 and 3°. There is no available data for the strata within the fault block surrounding the site therefore the dip and direction of the beds is unknown.

The Adwalton Stone Coal is inferred to outcrop across the southern third of the site, orientated roughly north east to south west and is expected to be present below the site at shallow depth. A second seam, the Adwalton Black Bed is stratigraphically older and was observed at outcrop in the former railway cutting in the north of the site.

3.4 Hydrogeology

The Envirocheck identifies the underlying bedrock as a Secondary A Aquifer. The Environment Agency defines these 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.

The site is not situated within a Groundwater Source Protection Zone.

There are no groundwater abstractions located within 250 m of the site.

3.5 Hydrology

According to the Envirocheck, the nearest surface water feature is located 101 m north east. This is expected to relate to a short section of drain, approximately 78 m long, which is labelled as part of a flood tank on an industrial estate.

3.6 Coal Mining

The historical map review identified several collieries and coal pits surrounding the site. Howden Clough Colliery was the longest operating colliery in closest proximity to the site, located around 350 m north east between 1908 and 1955.

The geological map for the area shows the Adwalton Stone Coal inferred to outcrop across the southern third of the site and is the shallowest expected seam below the site. The local memoir notes this seam is also referred to as the Flockton Thick Coal and the Carbonicola band sits just above it. In this geographical area the coal consists of three divisions, a bed of stone coal at the top (0.15 to 0.4 m), resting on the 'Middle Bed' (0.12 to 0.35 m), which is separated from the 'Low bed' (0.25 to 0.45 m) by a 0.02 to 0.22 m thick dirt parting. Records indicate the seam has mainly been worked from bell pits or pits around Flockton.

The second shallowest seam expected below the site is the Adwalton Black Bed which has been observed at outcrop in the former railway cutting in the north of the site. The seam is expected at shallow depth below the site excluding the area within the railway cutting in the north. The local geological memoir notes this seam is also referred to as the Flockton Thin Coal. The seam is recorded to be of good quality with a dull lustre in the north east, and is of significant thickness. Therefore, it has been largely worked and little remains. The seam has a local recorded thickness of 0.86 m, with a thin dirt parting about 0.1 m from the top.

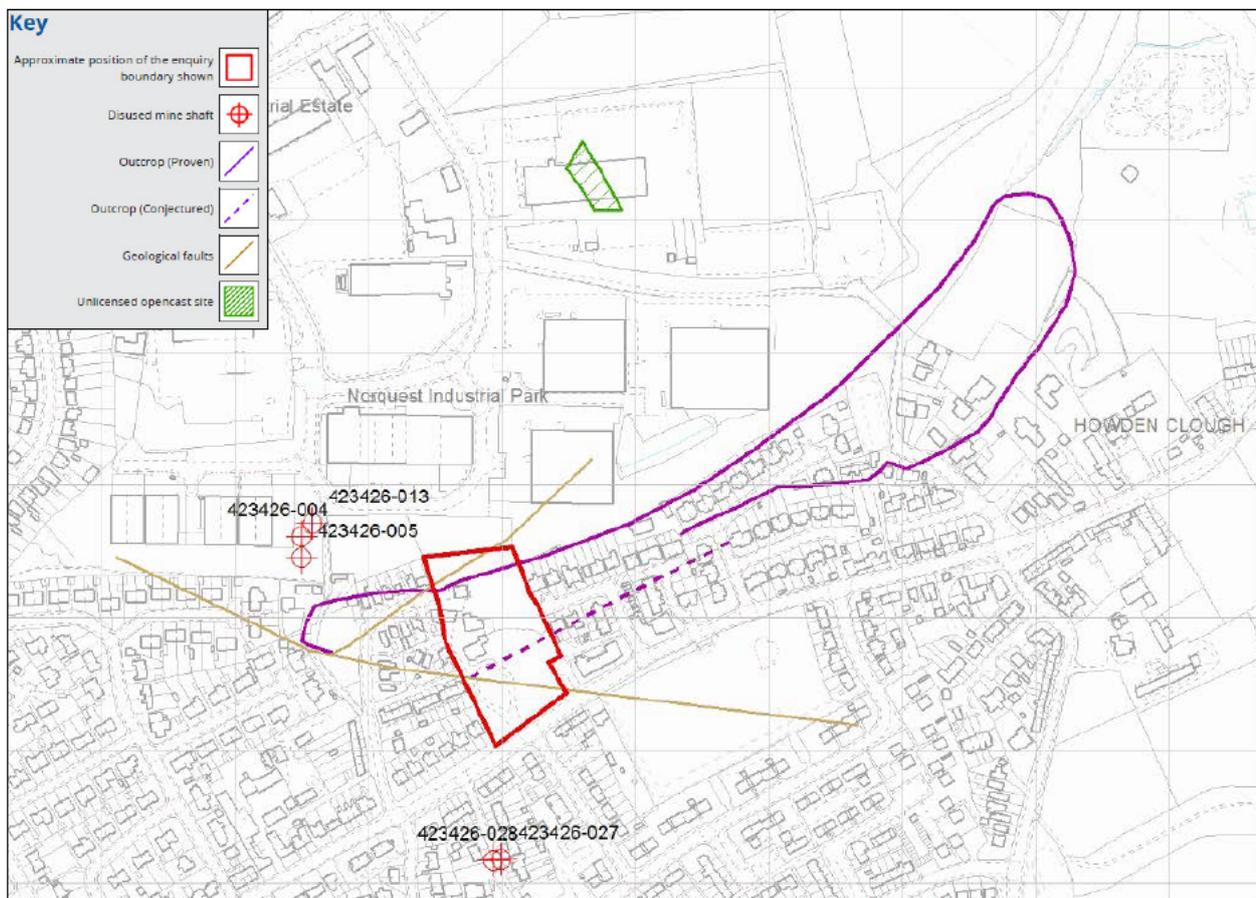
Stratigraphically, the next shallowest coal beneath the site is the Brown Metal Coals, also referred to as the Old Hard Coals, and in areas is split into three leaves. The geological memoir states the split between the shallower 1st and 2nd coals occurs east of a line through Howden Clough therefore the parting between these coals is not expected to be significant below the site. In the area around Adwalton, around 1.7 km north of the site, the coal is recorded to vary between 1.6 and 1.7 m thick with 0.35 to 0.45 m of dirt. Due to the high degree of faulting in the surrounding area there is no visible outcrop to estimate the depth to the seams and the overlying Birstall Rock is known to vary significantly in thickness. None of the borehole records available online or the annotations on the geological map in the vicinity of the site record the presence of the Brown Metal Coals which could indicate they are were not widely extracted in the region.

Coal Authority Mining Report

The Envirocheck indicates the site is located in an area which may be affected by coal mining activity. A Coal Authority Consultants Mining Report has therefore been obtained, a copy of which is in the Appendix.

The Coal Authority states the site is within the likely zone of influence from subsurface workings in four seams of coal between 36 and 233 m depth. The seams are named as the Flockton Thin (Adwalton Black Bed), Middleton Main, Whinmoor and Black Bed, last worked in 1927.

Unrecorded shallow workings are considered likely. This is most likely associated with the Adwalton Stone Coal (Flockton Thick) and Adwalton Black Bed (Flockton Thin) which are both shown to outcrop on the site. Both seams are considered to be workable; the Adwalton Stone Coal outcrop has a bearing of 241° and the Adwalton Black Bed of 91° which are displayed on the summary of findings map, an extract of which is below.



Two faults are recorded to cross the site according to the Coal Authority; their approximate positions have also been outlined on the above plan in yellow.

Five known mine entries are located within close proximity to the site, their positions are shown on the plan above. The possibility of unrecorded entries cannot be discounted.

The Coal Authority has no record of any future underground mining and there are no current coal mining licenses within 200 m of the site boundary.

There are no records of any mine gas emissions requiring action.

The Coal Authority has not received any damage notices or claims for the site, or any property within 50 m of the boundary, relating to subsidence since 31 October 1994. No Section 46 notices have been given stating the land is at risk of coal mining related subsidence.

The site is not in an area where a notice to withdraw support has been given.

It is possible that while creating the railway cutting the Adwalton Black Coal was extracted from outcrop below the site. Extraction of the Adwalton Stone coal could also have been undertaken prior to the construction of Clough House, possibly via bell pits. Therefore, the presence of shallow workings cannot be fully discounted at this stage.

Due to the outcropping coal seams on, and in the vicinity of the site (north and north west), it is considered shallow coal workings may be present below the site. According to the Coal Authority Online Viewer there are probable shallow coal workings below the site and it is situated within a development high risk area. It is therefore considered prudent to undertake a borehole investigation to confirm the depth to, thickness and condition of the shallow coal seams below the site and to determine if any remedial works are required.

3.7 Ground Gas

The site is not located within a radon affected area according to the Envirocheck, therefore no radon protective measures are required.

Shallow coal workings may be present beneath the site; consequently there could be a risk of mine gas generation.

Made ground is expected across the northern half of the site as a result of past development. However, it is only expected to extend to significant depth (greater than 2 m) within the footprint of the former railway cutting which was backfilled prior to 1986. The existing Clough House is expected to have a cellar which spans around a third of the footprint of the property, therefore should this structure be removed, consideration should be given to the suitability of the backfill material used.

A pump and a well were identified to be onsite during the historical map review. If either of these have been backfilled they are a potential source of ground gas. However, any ground gas generated would not be expected to affect a significant lateral area due to the anticipated small size of these features.

Other onsite sources of ground gas could be localised hotspots of contamination. Tanks are shown on historical maps in the north of the site from 1971 until their removal prior to 1990. Due to the reported former use of the site as a pig farm, these would be expected to be water tanks. However,

if they were fuel tanks, hydrocarbon impacted ground is a possibility and volatile hydrocarbons may pose a risk to the development.

The Envirocheck states there is one recorded historical landfill located within 250 m of the site and it is located within the site boundary. The license is for Moat Hill Farm and specifically covers the railway cutting which used to pass through the north of the site. Deposited waste included inert, industrial and commercial waste. Records state material was inputted from December 1978 to December 1988.

Records state there are three areas of potentially infilled land relating to non-water features within 250 m of the boundary. These are located between 212 and 235 m north and north east of the site and are all thought to be related to former coal pits shown on historical mapping.

There are five recorded potentially infilled areas of ground relating to water within 250 m of the site. The location of each feature has been identified on historical maps and the table below outlines the location and date of each feature.

Location (m)	Feature	Date of Potential Backfill
116 W	Pond at Moat Hill Farm	C. 1976
131 E	Possible pond	C. 1956
145 E	Pond	C. 1956
197 S	Pond	C. 1971
209 NE	Pond	C. 1956

These are not expected to present a significant risk of gas generation and migration.

A programme of gas monitoring will however, be required to assess the gassing regime at the site and determine the level of protection measures, if any, required for the proposed development.

3.8 Pollution Incidents to Controlled Waters

The Envirocheck holds one record for a pollution incident relating to controlled waters within 250 m of the site. The incident occurred on 2 July 1989, 160 m north west of the site, at the Mouth / Scotia Beck. It involved a foul sewer and the release of unknown chemicals into a freshwater stream/river. It was classified as a Category 2 Significant Incident. No easy pathway exists between the incident location and the site and due to the length of time elapsed since the incident any resulting contamination from this event is not considered to pose a significant risk.

3.9 Discharge Consents

According to the Envirocheck there are no discharge consents within 500 m of the site.

3.10 Flooding

The Envirocheck shows that the site is not within the floodplain of any rivers or seas and there is no significant risk of surface water flooding. There is however, limited potential for groundwater flooding to occur across the site.

3.11 Soil Geochemistry

The Envirocheck estimates the following concentrations of arsenic, cadmium, chromium, nickel and lead to be present in the natural soil at the site:

Contaminant	Estimated Concentration (mg/kg)	Assessment Value (mg/kg)
Arsenic	25 to 35	37
Cadmium	<1.8	11
Chromium	60 to 120	910
Lead	<100	200
Nickel	15 to 45	180

None of the contaminant concentrations are expected to be elevated within the natural ground.

4.0 EXPECTED GROUND CONDITIONS

4.1 Surface Covering

The majority of the site is surfaced with soft landscaping, therefore topsoil is expected from surface with localised areas of hardstanding (concrete and macadam). Three buildings, including Clough House, are located in the central west of the site.

4.2 Made Ground

Made ground is anticipated to be present across the majority of the northern half of the site, and is expected to extend to significant depth below a third of the house footprint as a result of the cellar, in the former railway embankment and potentially below former buildings.

Historically, a pump and a well are recorded to have been present onsite, these could have been backfilled resulting in a significant depth of made ground locally.

4.3 Natural Ground

Beneath the surface cover and made ground, the natural ground is expected to consist of clay over mudstone and shale, with a band of sand over sandstone across the centre of the site.

Shallow coal may be encountered below the site.

4.4 Groundwater

Shallow groundwater is not expected to be present below the site.

Made ground is expected across the site and perched groundwater may be encountered.