G & M Consulting Ltd

Contaminated Land Appraisals
Brownfield Remediation Solutions
Site Investigation Services
Earthworks Design and Control
Flood Risk Assessments

Cape Site Services Ltd
Unit 2
Rear of Castle Buildings
Carlton Road
Carlton
Barnsley
S71 3HX

15th June 2017

Ref C193/02/GS

Dear Simon,

Ref: Shallow Mining Investigation at 20 Vernon Road, Worsborough, Barnsley, S70 5BD.

1. Introduction

On the instructions of Mr Guy Deighton, Cape Site Services Ltd (Cape) have carried out an intrusive mining investigation on land adjacent to 20 Vernon Road, Worsborough, near Barnsley, South Yorkshire. The proposed development comprises a pair of semi-detached residential dwellings.

The work was carried out following on from a preliminary assessment of coal mining prepared by South Yorkshire Mining Advisory Service (SYMAS), dated 17th March 2017, a copy of which is presented in Attachment A of this report.

This intrusive investigation was undertaken to provide information on the underlying ground conditions and assess the likelihood of historical shallow mine workings affecting the site. G&M Consulting Ltd (G&M) was present on site during part of the fieldwork, and this report presents the findings of the investigation.

The site is located on Vernon Road, Worsborough, approximately 3km south east of Barnsley town centre, South Yorkshire and is centred at National Grid Reference SE 352 038. The site forms part of the former garden to the property at No 20.

The comments and opinions presented in this report are based on the findings of a review of available information and ground conditions encountered during the intrusive investigation work. There may be other conditions prevailing on the site which have not been disclosed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for conditions not revealed by the investigation. Any diagram or opinion of the possible configuration of ground conditions between exploratory holes is conjectural and given for guidance only and confirmation of intermediate ground conditions should be considered if deemed necessary.

2. Geology

Based on a review of the geological map (Sheet No 87 – 1:50,000) the site is shown to be underlain by undifferentiated strata of the Pennine Middle Coal Measures. These comprise an interbedded sequence of sandstone, siltstone and mudstone with seams of coal.

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The Kents Thick coal seam is shown to outcrop approximately 30m to the south-west of the site, generally trending from north-west to south-east. From the sequence of coal seams shown to outcrop on the geological map it can be inferred that the Kents Thick coal dips to the east or north east and would therefore be present beneath the site. No dips are shown in the immediate vicinity of the site; the nearest dip shown is over 1km to the east and is 5°. By assessing the coal outcrops and contours a dip of 4° can be calculated in the vicinity of the site. Given the scale of the geological map this is given for guidance only.

The ground level rises from the coal outcrop up to the site, it is estimated that this rises is at least 5.0m. Assuming a dip of 4° and a horizontal distance of 30m then the coal is likely to underlie the site at a depth of the order of 7.0 m below ground level. Again this should be taken as a rough estimate only.

From the stratigraphical column of the 1:50,000 scale geological map it can be seen that the Kents Thick coal is underlain at depth by the Barnsley coal. This seam is recorded to be up to 3.9m thick. It is at a depth of approximately 60m below the Kents Thick. The SYMAS report shows two shafts south of the site taken to the Barnsley coal at depths of 36m and 37m. These are within the valley and therefore below the level of the site.

According to the geological memoir for the area, the Kents Thick coal ranges from 24 to 39 inches (0.6 m to 1.0 m), and is also locally known as the Mapplewell. It has been recorded worked locally at crop.

3. Mining Risk Assessment

The site has been subject to a preliminary assessment on coal mining prepared by SYMAS; this indicates that the site is underlain by a coal seam at shallow depth (Kent's Thick) and the site is possibly underlain by shallow coal workings. The report recommended the drilling of investigation boreholes to a depth of 15 m below ground level (bgl). This assessment does not, however, give any assessment of the likely depth of the coal, and cannot be considered a mining risk assessment, as defined by the Coal Authority (CA). Following consultation with the CA, the depth of the boreholes was increased to 25 m.

4. Fieldwork

The fieldwork, was carried out on the 25th May 2017. Three rotary open holes, referenced BH1 to BH3 were drilled to a maximum depth of 25 m bgl, to allow logging of the soils and solid strata through examination of flush returns and rate of penetration of the drill bit.

The drilling works were undertaken by Cape using a Beretta T25 tracked rotary drilling rig and carried out under the Terms and Conditions of the CA Permission No 14140, a copy of which is presented in Attachment B of this report.

Drilling was undertaken using water flush. In accordance with the CA permission, the boreholes were monitored for gases during their advancement. The boreholes were backfilled on completion with arising/bentonite.

The locations of the exploratory holes are shown on the location plan presented in Attachment C of this report.

5. Ground Conditions

Surface materials at each of the borehole locations was typically 'fill, topsoil, red brick, concrete and sandstone lumps' (driller's description) to a depth of between 0.5 to 0.8 m bgl. In boreholes BH1 and BH3 this material is underlain by clayey subsoils to 2.7 m bgl (BH1) and 2.3 m bgl (BH3). These subsoils were assessed as being underlain in these two boreholes by a bedrock sequence which comprised mudstones and locally sandstones to between 5.5 m bgl (BH1) and 7.0 m bgl (BH3). In BH1 between 5.5 m and 7.0 m bgl, the driller records mudstone with *'clay mix some odd red brick and coal flakes, soft'* (driller's description).

In borehole BH2 the driller records possible made ground or fill materials comprising brown clay, mudstone and sandstone to 7.0 m bgl.

Below 7.0 m in all of the boreholes mudstone bedrock was encountered to depths of between 12.0 m in BH2 and 12.5 m bgl in BH1.

Loss of water flush was recorded at 12.0 m to 12.5 m BH1, 12.0 m and 13.0 m in BH2 and 12.6 m to 13.5m in BH3, although the driller did recorded solid sandstone over these depth ranges with no broken or voided ground. Further flush losses were recorded in BH1 between 18.5 m and 25.0 m, between 13.0 m and 25.0 m in BH2 and significant flush loss between 14.0 m and 25.0 m in BH3. In all instances the driller recorded *'solid drilling'*, locally however does record *'broken at times'* in BH2 across the depth range of the flush losses.

The exploratory hole records are presented in Attachment C of this report.

During the drilling, monitoring of methane, carbon monoxide, hydrogen sulphide and oxygen was undertaken at the borehole head. No significant concentrations of methane, carbon monoxide or hydrogen sulphide were recorded, as detailed on the attached logs. Oxygen concentrations of between 19.8 % and 20.1% were recorded during the works.

6. Conclusions/Recommendations

In accordance with the requirements of the SYMAS mining assessment, an intrusive mining investigation was carried out, which comprised the drilling of three rotary open hole boreholes on the site. It is understood that the proposed redevelopment of the site is for residential purposes, comprising a pair of semi-detached properties.

The drilling works were carried out in accordance with the CA permission 14140.

Based on a review of the geological maps, including that presented within the above referenced SYMAS report, it is concluded that the Kent's Thick coal seam is likely to be present beneath the site at shallow depth; furthermore the SYMAS assessment indicates that the seam may possibly be worked.

Based on the evidence of the three boreholes drilled it does appear that the site has been affected by shallow mine workings. No intact coal was encountered in any of the boreholes possibly suggesting a high take of coal from the ground, assuming the Kent's Thick seam is located beneath the site at shallow depth. Locally fill/made ground materials were recorded by the driller up to 7 m in thickness in BH2, possibly indicating a mine entry or back fill to localised open casting of the potential coal seam. In BH1 between 5.5 m and 7.0 m bgl, the driller records mudstone with *'clay mix some odd red brick and coal flakes, soft',* which may further indicate working at this location.

Based on the results of the investigation the issues of the mine workings would need to be addressed prior to development of the site. A ground investigation is required to determine the geotechnical properties of the ground; this would then allow an informed assessment of how the mine workings can be dealt with and to allow the most suitable foundation solution to be adopted.

The various foundation options are likely to be piled foundations, if deep made ground is present on the site or raft foundations if natural soils are present beneath the building footprint at shallow depth, with the possibility of ground treatment in the form of drilling and grouting. Given the depth to the Barnsley coal competent ground suitable for piles to terminate in should be present below the Kents Thick coal and outside the zone of influence of the deeper coal.

Rotary probe drilling does not recovery large enough samples to make a geotechnical assessment. The supplementary ground investigation should therefore initially comprise a series of trial pits to investigate if made ground is present to depth on the site, indicating either shafts (bell pits), opencast workings or collapsed ground. If deep made ground is present then a rotary cored borehole should be taken to below the made ground to confirm the competence of the underlying bed rock to aid pile design. The borehole should to a depth of at least 5m below the likely pile depth.

If no deep made ground is present then a decision on whether to treat the ground by drilling and grouting would need to be made prior to construction of a raft foundation. It is likely that the grout take would be low given that no voids were encountered during the intrusive investigation.

We trust this report and the attachments meet with your approval and are sufficient for your present needs. Your client should submit this document to the local authority for their comment/approval prior to undertaking any development work.

Yours sincerely



Graeme Swinbourne
For and on behalf of **G&M Consulting Ltd**

Attachments