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Date: 3rd February 2017

Your ref:

My Ref: SI 0255

FOR THE ATTENTION OF MR R. RICHARDSON

Dear Sir,

**COAL MINING RISK INTERPRETATION REPORT – FOLLOWING THE INTRUSIVE SITE
INVESTIGATION AT LAND OFF GREENFOOT LANE, BARNSELY, SOUTH YORKSHIRE S75
2SY**

I am pleased to supply the following report for the above named project and trust that this satisfies your requirements. Please do not hesitate to contact myself at any time for further clarification or advice.

Yours Sincerely,



M. Lyons
Consultant Mining Engineer
BSci CSci MIMMM

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1. Introduction

Planning permission has been conditionally secured for residential development at the above location subject to the mining legacy risks been fully realised and mitigated from on site. Lyons CMC has now undertaken this work via an intrusive site investigation of 6 boreholes, the location of which is outlined on plan no. 00255/B – as attached and illustrated in appendix 5.2.

2. Scope of the Report

The mining legacy risks for this land are as follows:

- Potential historic shallow coal workings in the Kents Thick coal seam.
- Shallow coal at formation level
- Uncharted mine entries
- Fugitive gas emissions

As such, these risks need to be properly determined to ensure sound stability for the development. A borehole investigation consisting of up to 8 holes was deemed a reasonable level of investigation in the outset regarding potential void migration given the scale and nature of development, along with a watching brief for any signs of a mine entry on adjacent land to the boreholes.

Considering a thickness of the Kents Thick coal seam of around 1200mm (*according to available geological and nearby mining records*), along with the fact that no other workable seam is anticipated at shallow depth, boreholes were decided to be taken to either the base of the coal or to 15m if not encountered.

3. Site Investigation

3.1 Methodology

Prior to the intrusive site investigation a search for utilities was undertaken both via online data providers and physically on site using a Cable Avoidance Tool (CAT) along with hand dug holes to around 0.5m. Boreholes were marked out as illustrated on the attached plan no. 00255/B which is also detailed in appendix 5.2. As part of the mine entry watching brief, the developer/owner had already cleared the site of much rubble which existed on the land with no visible evidence of any uncharted mine entries. The process for the intrusive investigation is outlined in the system chart in appendix 5.5.

An initial investigation utilising a handheld Pneumatic Turmag Drill equipped with scroll rods was deemed appropriate to check the nature of the superficial material and considering that the outcrop of the coal was conjectured through the site centrally; i.e to attempt to identify where the coal was at the surface.

A subsequent borehole investigation would then be undertaken using a small tracked diesel powered percussive drill rig which utilised 750mm long drill rods of 50mm diameter. The works were to be supervised by the Site Engineer (Mr. P. Potter) and overseen by the Principal Engineer Mr. M. Lyons.

3.2 Interpretation of Findings

The initial investigation (Boreholes 1 & 2) using the handheld Turmag Drill and scroll rods provided a good representation of the strata considering the well recovered cuttings within the 'cork-screw' type of rods. A small thickness (150mm to 200mm) of relatively good quality coal was identified at around 3m deep, above which was approximately 2.5m of 'firm clay'. After reviewing the local mining information and nearby shaft section detail (the former Redbrook Colliery for example) no thin coal seams were noticed in close proximity to the Kents Thick Horizon. It was therefore suspected that we had encountered the base of the Kents Thick coal seam which was overlain by more recent drift material, meaning the upper part of the seam had been eroded away.

Considering the above, we focused the subsequent Boreholes further to the east, down dip, with the tracked percussive rig. Borehole logs can be seen in appendix 5.3. The coal seam was encountered (using water-flush techniques) in the region of 1.1m thick at around 5m deep (to the top of the seam); with the exception of borehole 6 which didn't prove the full extent of the coal as the hole had to be abandoned due to the drill rods choking. This borehole (No.6) encountered a small void (around 250mm) approximately 1m above the top of the coal seam, but as drilling was firm both above and below the void it was not considered to be void migration. Only a very slight loss of flush was noticed travelling through the void, which is thought to be a clay parting – particularly considering the existence of a mature 50ft+ Sycamore tree in close proximity to the south-west.

The percussive drilling enhanced the suspected geological scenario from the initial investigation as is illustrated in the Cross Section Sketch in appendix 5.4. Considering the lay of the land (sloping westwards) together with dip of the strata (around 1 in 10 eastwards) the levels appear consistent with this scenario.

4. CONCLUSIONS AND RECOMMENDATIONS

- 1) Providing formation levels are within the top 2m of ground it is unlikely that any removal or blinding off of coal will be required, considering the thickness of recent drift material / firm clay. The risk therefore of discovering the coal seam in the footings of future buildings is considered to have been reduced from 'Moderate-High' to now 'Low'.
- 2) No signs of any mine entries were observed during the investigations; the risk of any uncharted mine entries will be reduced somewhat considering the anticipated geological scenario; never the less a watching brief should still be undertaken during future ground works, particularly in the eastern half of the site adjacent to Greenfoot Lane.
- 3) No fugitive mine gases were encountered and considering the thickness of impermeable clays above the coal in these parts, no gas protection within the design of foundations would be thought necessary (*unless in unlikely outcome that a) coal is encountered in any footings – in which case a methane membrane would be required after removing and blinding off the coal sides, or b) an uncharted mine entry is encountered – in which case the Coal Authority should be notified as owners of the feature to agree the appropriate mitigation strategy*).
- 4) In terms of any mitigation requirement to protect future development from stability concerns due to possibly shallow coal mining we can divide the site into two parts – **Zone A** and **Zone B** - as outlined on plan no. 00255/B (appendix 5.2). Where:

Zone A

The coal seam has now been proved to have 'cropped out' in this zone; i.e. strata beneath this part will predominantly be below the Kents Thick seam horizon. Thus shallow mining risks have been reduced from 'Moderate' prior to the investigation, to now '**Very Low**'.

No ground stabilisation works deemed necessary in this area; usual strip or trench fill footings would be thought adequate unless any substantial thicknesses of made ground are encountered during future trenching investigations for proposed footprints (*this should be verified by the builder/contractor and acting Building Control Officer for the development*).

Zone B

The Kents Thick coal seam exists beneath this part at a shallow depth beneath recent clay deposits. Considering the fact that the investigation failed to discover any signs of old workings the risk of void migration to surface has been reduced. This is furthered when considering that any old pillar and stall workings at such shallow depth with this type of roof cover would have normally settled so many years later. The overall risk therefore of instability due to shallow mining for this zone is considered to have been reduced from 'Moderate' to '**Low**'.

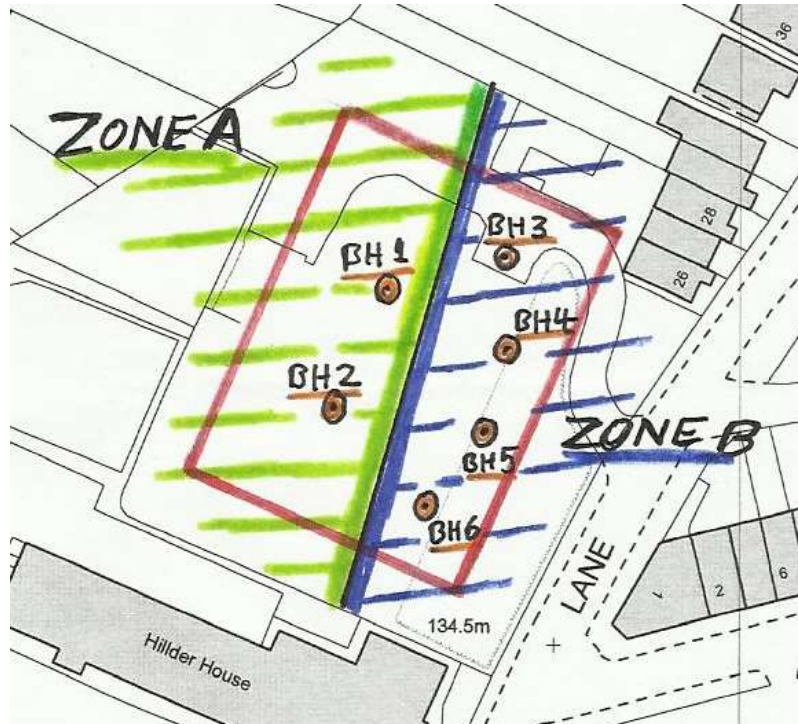
No ground stabilisation works deemed necessary in this area. Although usual strip or trench fill footings could be utilised, we would recommend using strengthened strip foundations given the shallow mining 'low' risk, particularly if any substantial areas of made ground are encountered (*this should be verified by the builder/contractor and acting Building Control Officer for the development*). For example two layers of A393 Reinforced Mesh would suffice.

5 Appendix

5.1 References

- 5.1.1 CIRIA Special Publication No 32 'Construction Over Abandoned Mine Workings'.
- 5.1.2 British Standards Institution: BS 5930:2015 'Code of practice for ground investigations' BSI 2015.
- 5.1.3 British Standards Institution: BS EN ISO 14688-1: 2002 + A1 2013 'Geotechnical Investigation and Testing - Identification and Classification of Soil - Part 1 - Identification and Description. BSI 2013.
- 5.1.4 British Standards Institution: BS EN ISO 14689-1: 2003 'Geotechnical Investigation and Testing – Identification and Classification of Rock – Part 1 – Identification and Description. BSI 2003. Incorporating Corrigendum No. 1 February 2007.
- 5.1.5 British Standards Institution: BS 10175 'The Investigation of Potentially Contaminated Sites. Codes of Practice'. BSI 2011+A1 2013.
- 5.1.6 British Standards Institution: BS EN ISO 22476-3: 2005 + A1 2011 'Geological Investigating and Testing. Field Testing. Standard Penetration Test'.
- 5.1.7 British Standard 1377:1990 Parts 1-9 'Methods of Test for Soils for Civil Engineering Purposes'.

5.2 Borehole Location Plan



Not To Scale (please refer to attached file for scale plan).

5.3 Drilling log sheets



Daily Return (Drilling)

Sheet No.	1
Date	Tuesday 28/12/2016
Contract Name	Mr. R. Richardson
Contract No.	255
Working Day No.	1

Hole No.	Depth (m)	Casing	Dia	Angle	From (m)	To (m)	Description
BH1	3.50	n/r	50mm	Vertical	0	0.70	Made ground
	Scroll rods - full returns; no gas detected				0.70	3.2	Firm clay
					3.20	3.40	Coal
					3.40	3.50	Siltstone
BH2	3.20	n/r	35mm	Vertical	0	0.60	Made ground
	Scroll rods - full returns; no gas detected				0.60	2.90	Firm clay
					2.90	3.05	Coal
					3.05	3.20	Siltstone
							End Of Shift
2	7.70	0.00	Sheet Total		Crew PJO P.Potter A.Oxley		Plant Turmag
2	7.70	0.00	Previous Sheet Total				
2	7.70	0.00	Cummulative Total				

Signed: *M Lyons*

Date: 28/12/2016

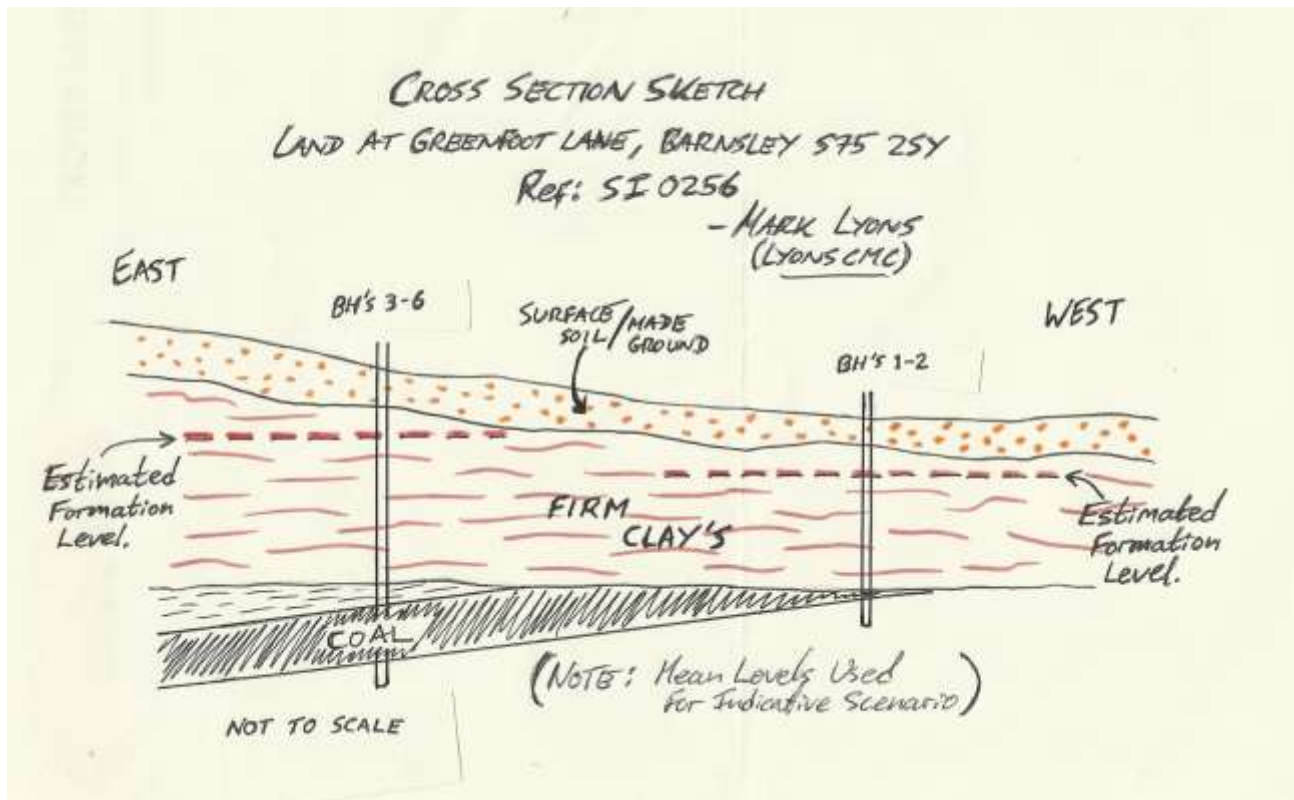
Sheet No.	2
Date	Wednesday 04/01/2017
Contract Name	Mr. R. Richardson
Contract No.	255
Working Day No.	2

Hole No.	Depth (m)	Casing	Dia	Angle	From (m)	To (m)	Description
BH3	6.10	n/r	50mm	Vertical	0	1.20	Soil/made ground
	Full returns; no gas detected				1.20	4.85	Firm clay
					4.85	5.95	Coal
					5.95	6.10	Siltstone
BH4	6.40	n/r	50mm	Vertical	0	0.90	Soil/made ground
	Full returns; no gas detected				0.90	5.25	Firm clay
					5.25	6.35	Coal
					6.35	6.40	Siltstone
BH5	6.10	n/r	50mm	Vertical	0	0.70	Soil/made ground
	Full returns; no gas detected				0.70	5.15	Firm clay
					5.15	6.00	Coal
					6.00	6.10	Siltstone
BH6	5.60	n/r	50mm	Vertical	0	0.85	Soil/made ground
	Only slight loss of flush at 3.85; no gas detected				0.85	3.85	Firm clay
					3.85	4.10	Void
					4.10	5.20	Firm clay
					5.20	5.60	Coal
							(hole terminated due to rods choking).
4	24.20	0.00	Sheet Total		Crew PJO P.Potter A.Oxley		Plant Tracked percussive drill rig; 750mm rods
2	7.70	0.00	Previous Sheet Total				
6	31.90	0.00	Cummulative Total				

Signed: *M Lyons*

Date: 04/01/2017

5.4 Cross Section Sketch



5.5 Site Investigation Process

Borehole Site Investigation (SI) Process Guide (Shallow Underground Coal Workings)

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