

# SLADEN ASSOCIATES

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23 September 2021

Mr Michael Wheat  
c/o Hewitt & Carr Architects  
Daisy Bank House  
17-19 Leek Road  
Cheadle  
Stoke-on-Trent  
ST10 1JE

Dear Lisa

**Re: Updated Assessment of Coal Mining Risks  
Proposed New Residential Conversion  
Old Engine House Farm, Dilhorne, Staffordshire**

## **Introduction**

Mr Michael Wheat has instructed Sladen Associates to assist in assessing risks associated with coal mining legacy issues for a proposed extension, alteration and conversion of a former agricultural building at Old Engine House Farm for residential use.

A Coal Mining Risk Assessment (CMRA) has previously been undertaken for the site and reported as follows:

Coal Mining Risk Assessment. Proposed New Residential Conversion. Old Engine House Farm, Dilhorne, Staffordshire. Prepared for Mr Michael Wheat by Sladen Associates. Report No: 21 2319, May 2021.

That report should be read in conjunction with the present letter.

Figure 1 shows the site location.

## **Geology**

Large-scale mapping published by the British Geological Survey shows the site to be underlain by solid strata of the Pennine Lower Coal Measures of Carboniferous Age.

The Little Dilhorne Coal is shown to outcrop across the site access roadway a little way to the north east of the main site area, dipping to the south west such that that seam would be expected to be present at shallow depth below the main site area. The underlying Dilhorne Coal is shown to outcrop some 180 m to the north east of the Little Dilhorne, crossing the access drive near the brook.

Based on the available mapping, the following downward sequence of coal seams would be anticipated below the site.

Seam	Approximate Depth (m)	Thickness (m)
Little Dilhorne Coal	5	0.7
Dilhorne Coal	25 to 30	1.5
Alecs Coal	75	1.0 to 2.4
Foxfield Coal	90	0 to 0.5
Mans Coal	105	0 to 0.6

There are further, deeper seams

The Dilhorne Coal was widely worked in the area but the Little Dilhorne was only worked sporadically in local areas.

The solid strata in the area are not shown to be overlain by natural superficial soils.

### **Preliminary Recommended Mitigation Strategy**

Based on an assessment of available information, the CMRA Report recommended the following mitigating precautions be adopted:

- That three rotary probe boreholes be put down in the general vicinity of the proposed extended on-site residential building to investigate the potential for very shallow workings. The probe holes should be taken down to the Dilhorne Coal or 30 m depth, whichever is less. Should evidence of significant voids remaining in very shallow workings be found, the potential risk to the proposed structure should be assessed by a suitably qualified engineer. If considered necessary some remedial precautions may be required.
- A programme of gas monitoring should be undertaken prior to final design to allow a risk based assessment of the need for gas exclusion measures for new residential structure.
- Should any coal be exposed in foundation excavations, it should either be removed or blinded with concrete or compacted clay.
- Care should be taken during ground works to observe conditions encountered during site works. Any local areas of unusually deep made ground or other evidence of potential mine entries, such as brick or timber lining materials, should be investigated. If any unrecorded mine entries are encountered, following further risk assessment, the potential need for some further precautions, such as drilling and stabilisation of the entry and/or relocation of the structures, should be assessed by a suitably qualified engineer.

### **Probe Drilling**

Permission for the intrusive rotary drilling works was received from the Coal Authority.

The recommended probe drilling was undertaken by Dragon Drilling Limited working under the supervision of Sladen Associates and comprised three rotary water-flushed boreholes (R1 to R3), each to a depth of 30m. Figure 2 shows the borehole locations. Logs of the boreholes are attached.

### **Ground Conditions**

Below topsoil, ground conditions were found to comprise clay, considered to be weathered mudstone, overlying mudstone with occasional black shale. A layer of black shale was present in R3 from 24.0 to 24.7 m depth.

Full flush was maintained during drilling and no evidence of former workings was encountered.

Based on this work it may be concluded:

1. That the Dilhorne Coal is at greater than 30 m depth
2. That the Little Dilhorne Coal is of poor quality or absent in the local area, possibly represented by black shale and, if so, is at a greater depth than anticipated in the CMRA Report.

## Gas Monitoring

Three shallow gas monitoring wells (GAS 1 to GAS3) were installed by open hole rotary drilling to approximately 1.5 m depth. Each was provided with a gas monitoring standpipe with gravel surround up to 0.5 m depth and bentonite seal from 0.5 m depth to ground level. The monitoring locations are shown on Figure 2. A programme of ground gas monitoring was implemented as follows:

Date	BH	Atmospheric Pressure (bar)	CH <sub>4</sub> (%)	CO <sub>2</sub> (%)	O <sub>2</sub> (%)	Gas Flow Rate	Depth to Groundwater
06-08-21	GAS 1	995	0	3.6	17.7	None	Dry (1.35)
	GAS 2	(rising)	0	5.0	8.2	None	1.47 (1.59)
	GAS 3		0	2.2	19.1	None	Dry (1.59)
13-08-21	GAS 1	1018	0	3.9	17.5	None	Dry
	GAS 2	(steady)	0	5.1	8.0	None	1.45
	GAS 3		0	2.5	19.0	None	Dry
19-08-21	GAS 1	1012	0	3.8	17.6	None	Dry
	GAS 2	(falling)	0	4.9	8.5	None	1.48
	GAS 3		0	2.6	18.9	None	Dry
27-08-21	GAS 1	1026	0	4.0	17.7	None	Dry
	GAS 2	(rising)	0	5.2	8.1	None	1.47
	GAS 3		0	2.2	19.1	None	Dry
03-09-21	GAS 1	1025	0	1.6	19.7	None	Dry
	GAS 2	(falling)	0	5.0	8.2	None	Dry
	GAS 3		0	3.9	17.5	None	Dry
07-09-21	GAS 1	1022	0	5.0	12.1	None	Dry
	GAS 2	(falling)	0	5.0	8.2	None	Dry
	GAS 3		0	3.9	17.5	None	Dry

## Updated Risk Assessment

### Shallow Workings

Owing partially to uncertainties concerning actual depth to seams, risks associated with shallow workings were assessed as moderate to high at the preliminary CMRA stage. Two main risk categories are associated with potential shallow workings: risk of open voids reaching the surface or underside of foundations and risk of differential subsidence due to ongoing consolidation of the workings.

In the light of the site-specific borehole information, the risk of void migration from the worked areas to the surface and the risk of future differential subsidence are both re-assessed as negligible.

### Mine Gas

At the CMRA stage, as one seam was potentially close to outcrop below the study area, there was considered some potential for gas from former workings, if present, to migrate to surface and the associated risk level was judged to be moderate.

However, in view of the absence of evidence of shallow workings and presence of a significant thickness of near surface clay (considered to be weathered mudstone), which would be effectively impermeable to gas advective flow, risks associated with mine gas may be re-assessed as very low.

No methane was detected during the recent monitoring. Carbon dioxide concentrations were generally somewhat above atmospheric levels, with a maximum measured concentration of 5.2 %, but average of only 3.8 %. No measurable gas flows were recorded. Using the terminology of CIRIA 659, (CIRIA Report C659 (2006). Assessing risks posed by hazardous ground gases to buildings) this would correspond to 'Characteristic Situation 1' (CS1) and no special precautions would be considered necessary. However, CIRIA 659 suggests that where carbon dioxide concentrations exceed 5 % consideration should be given as to whether 'CS2' precautions should be adopted. In the present case, in view of the absence of methane, low average carbon dioxide levels and absence of measurable gas flow, it is not considered that CS2 protection is warranted for the present site.

Accordingly no special precautions are considered warranted with respect to ground gas.

### **Updated Proposed Mitigation Strategy**

The following recommendations for the proposed mitigation strategy update and supersede the recommendations provided in the CMRA report.

- Care should be taken during ground works to observe conditions encountered during site works. Any local areas of unusually deep made ground or other evidence of potential mine entries, such as brick or timber lining materials, should be investigated. If any unrecorded mine entries are encountered, following further risk assessment, the potential need for some further precautions, such as drilling and stabilisation of the entry and/or relocation of the structures, should be assessed by a suitably qualified engineer.
- Should any coal be exposed in foundation excavations, which is now considered extremely unlikely, it should either be removed or blinded with concrete or compacted clay.

No special precautions are considered warranted with respect to possible unrecorded shallow mine workings or mine gas.

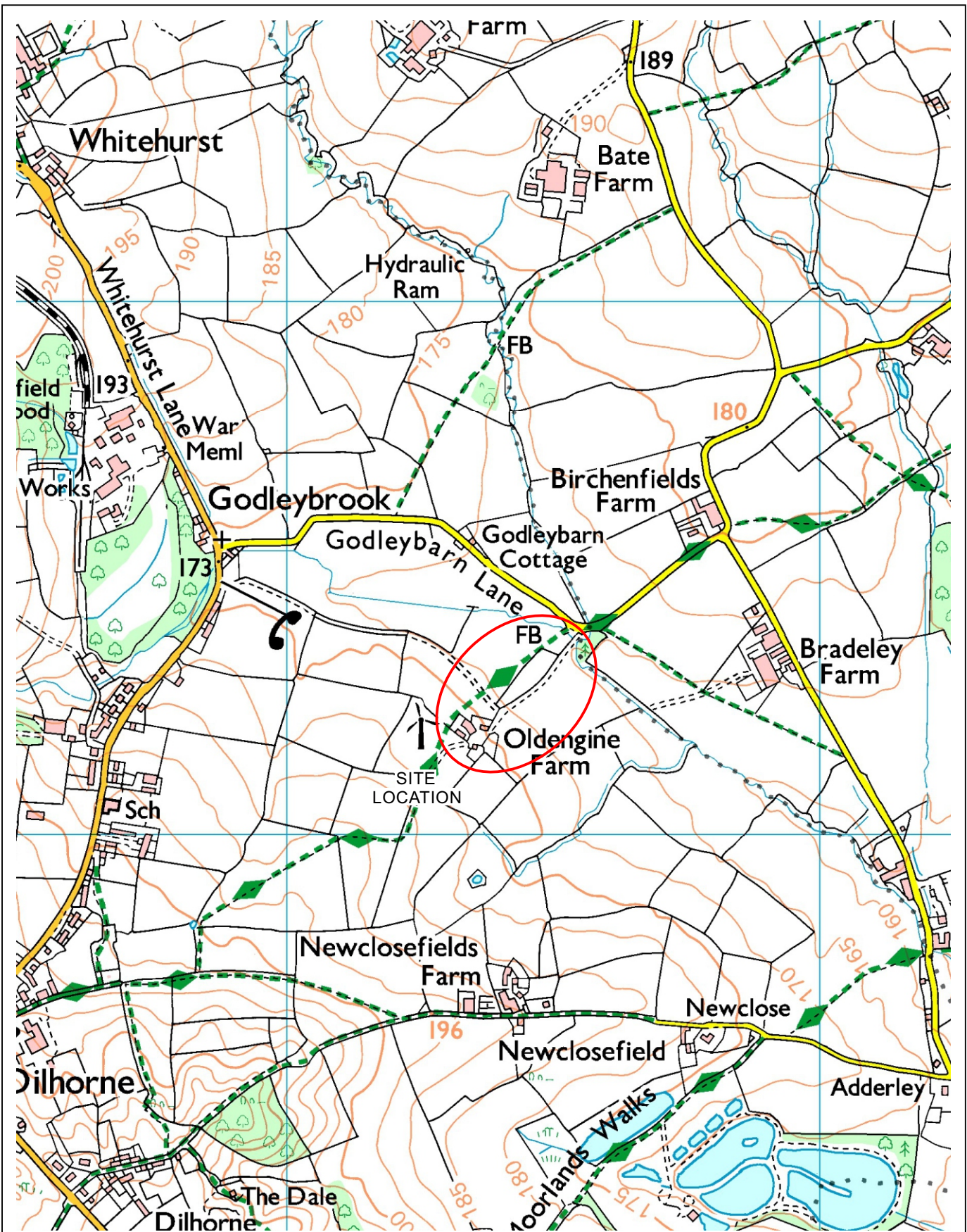
### **Closure**

We trust the above meets your present requirements, should you need any additional information, please do not hesitate to contact our office.

Yours sincerely

J A Sladen BSc, MSc, CEng, CEnv, MICE, FGS  
Director

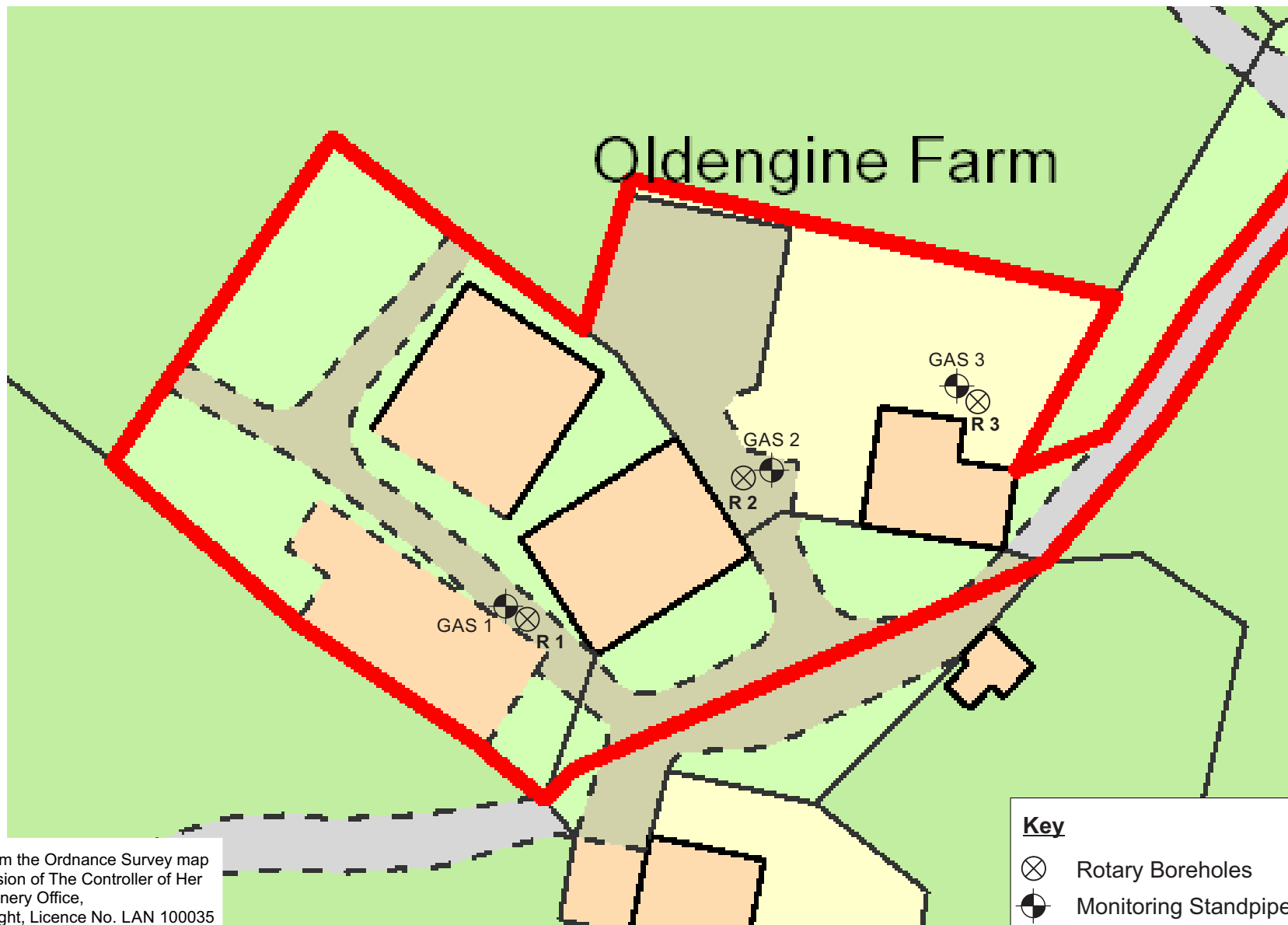
Attachments  
Figures 1 and 2  
Probe Hole Logs



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**SITE LOCATION PLAN**

<p><b>SLADEN ASSOCIATES</b></p>	<p>Report No 21-2319-2</p>	<p>Project Old Engine Farm Birchenfields Lane Dilhorne</p>	<p>Figure <b>1</b></p>
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SITE LAYOUT PLAN

**SLADEN ASSOCIATES**

Report No  
21-2319

Project  
Old Engine Farm, Birchenfields Lane, Dilhorne

Figure  
**2**

ROTARY BOREHOLE INVESTIGATION

PROPOSED NEW RESIDENTIAL CONVERSION  
OLD ENGINE HOUSE FARM, DILHORNE, STAFFORDSHIRE

ALL DEPTHS ARE GIVEN IN METRES (Driller's Description)

BOREHOLE R1

			Flush Return
GL	-	0.50	-
		Topsoil	
0.5	-	9.00	100%
		Blue brown clay, soft drilling	
9.00	-	30.00	100%
		Grey mudstone with clay layers and occasional black shale, firm drilling	

Borehole cased to 9.00 m

Water flush

Borehole backfilled with arisings & bentonite cement

Ground Gas: CH4 - 0%; CO2 - 0%; O2 – 20.1%

BOREHOLE R2

			Flush Return
GL	-	0.50	-
		Topsoil	
0.5	-	7.00	100%
		Blue brown clay, soft drilling	
7.00	-	30.00	100%
		Grey mudstone with occasional black shale, firm drilling	

Borehole cased to 7.50 m

Water flush

Borehole backfilled with arisings & bentonite cement

Ground Gas: CH4 - 0%; CO2 - 0%; O2 – 19.7%

BOREHOLE R3

			Flush Return
GL	-	0.50	-
		Topsoil	
0.50	-	5.50	100%
		Blue brown clay, soft drilling	
5.50	-	24.00	100%
		Grey mudstone with clay layers, firm drilling	
24.00	-	24.70	100%
		Black shale, firm drilling	
24.70	-	30.00	100%
		Grey mudstone with clay layers, firm drilling	

Borehole cased to 6.00 m

Water flush

Borehole backfilled with arisings & bentonite cement

Ground Gas: CH4 - 0%; CO2 - 0%; O2 - 20.1%