1 Croft Stairs
Newcastle upon Tyne
NE1 2HG

Our Ref: 201017.GA.01
27 May 2021

Mr M. Coulthard
Silverstone Building Consultancy
19 Grey Street,
Newcastle upon Tyne
NE1 6EE

RE: Updated Ground Gas Risk Assessment – Storage Land, Unit 21, Haugh Lane Industrial Estate, Hexham

Dear Michael,

This letter report is an addendum to the Roberts Environmental Ltd (REL), Phase II Geo-Environmental Site Investigation and Risk Assessment (Ref: 201017, Dated: December 2020), undertaken for the potential redevelopment of the site for a Commercial end-use.

During the ground investigation undertaken in November 2020, 3 No. ground gas installations were positioned within windowless sampling boreholes WS01, WS02 and WS03. In total, taking into consideration the proposed commercial end usage of the site and gas generation potential of underlying strata, REL considered 4 No. monitoring rounds would be sufficient to provide an appropriate ground gas risk assessment.

As part of the original REL, Phase II Report (Ref: 201017, Dated: December 2020), a preliminary ground gas risk assessment was presented using the results of 1 No. gas monitoring round, out of the 4 No. rounds scheduled.

The remaining 3 No. gas monitoring rounds have subsequently been completed and subject to review to assess the applicability of gas monitoring data. The results have then been used to undertake an updated ground gas risk assessment to inform ground gas protection requirements. Please refer to the following sections for further information.

Ground Gas Sources

According to the available information, the subject site is located within a Coal Mining Reporting Area, however it is not located within a Development High Risk Area or an Area of Past or Probable Shallow Coal Mine Workings. However, as detailed within the Phase II Report (reference: 201017) there are no shallow coal mine workings anticipated to be present below the site or immediate surrounding area.

Based on a review of available BGS mapping, no significant deposits of Made/artificial Ground are recorded on site. In addition, there are no historic landfills recorded within a 500m radius of the subject site.

Accredited Contractor CHAS.co.uk
Chartered Environmentalist

Roberts Environmental Limited registered in England and Wales number 07950036
Registered Office: 1 Croft Stairs, Newcastle upon Tyne, NE1 2HG

A hydrocarbon odour was noted within WS01 within the south/south-western part of the site, at a depth of 2.90m to 3.45m bcgl, with a hydrocarbon sheen noted on the gravel recovered from the borehole. No visual or olfactory evidence of ground gas generating materials were identified at the site during the site investigation with negligible depths of Made Ground recorded.

Gas Monitoring Results

All of the gas monitoring was undertaken by engineers from Roberts Environmental Limited using a Gas Data GFM 435 infra-red gas analyser with integrated flow meter and electronic dipmeter. Gas monitoring was undertaken during periods of low and/falling pressure.

A summary of the worst-case gas monitoring results is presented in the table below, with copies of the monitoring sheets presented within **Enclosure 2**.

BH No.	Peak Methane (% v/v)	Peak Carbon Dioxide (% v/v)	Minimum Oxygen (% v/v)	Total Gas Emission Rate (l/hr)	Atmospheric Pressure Range (m bars)
WS01	0.00	5.90	7.30	7.80	978 – 1013
WS02	0.00	5.10	0.80	1.60	978 – 1002
WS03	0.00	5.10	7.20	0.40	978 - 1013

As can be seen in the table above, the ground gas monitoring results have not identified any Methane concentrations and whilst not shown in the table above, Hydrogen Sulphide and Carbon Monoxide has remained undetected throughout the monitoring rounds, see **Enclosure 2.**

The installations recorded a peak concentration of Carbon Dioxide of 5.90% v/v within WS01 although similar concentrations were also recorded in WS02 and WS03. In general, Oxygen levels have been recorded depleted across the monitoring rounds with the minimum Oxygen value of 0.80% v/v recorded within WS02.

Flow rates were recorded between 0.40 and 7.80l/hr across the site.

Groundwater levels were recorded during the monitoring, with the following groundwater levels noted;

- WS01 between 1.80m and 2.60m bcgl;
- WS02 between 1.95m and 2.72m bcgl; and
- WS03 between 1.85m and 2.62m bcgl.

Gas Screening Value Calculation

To determine the Gas Screening Value (GSV) and subsequently the Characteristic Situation value (CS), the ground gas risk assessment has been undertaken with reference to the document CIRIA C665, Table 8.5, page 88. In accordance with CIRIA C665 the following equation is used: -

Gas Screening Value (l/hr) = maximum gas concentration (%) / 100 x measured borehole flow rate (l/hr).

Therefore, the calculation is as follows;

= (5.90 (% by vol) / 100) x 7.80 (l/hr)

The gas screening value (GSV) for Carbon Dioxide is calculated at 0.4602 l/hr.

Conclusions

The GSV as calculated (0.4602 l/hr) falls above the upper limit of 0.07 l/hr imposed under the Characteristic Situation 1 (CS1) classification, but below the upper limit of 0.70 l/hr imposed under the Characteristic Situation 2 (CS2) classification and as such, Basic ground Gas protection measures in line with CS2 would therefore be required in the construction of new properties.

For the final specifications of ground gas protection, consultation with the Local Authority would be recommended. However, based on the classification based above, it is considered that any gas protection would likely include for a cast in-situ reinforced floor slab, or beam and block floor slab with a sub-floor void of no less than 150mm, with air bricks spaced in accordance with approved building regulations.

In addition, a dedicated gas membrane would likely be required which must extend across the floor space and external walls of the property and be fully sealed using manufacturer approved materials..

We trust the information we have provided to you is to your satisfaction. However, if you require any further information or clarification, please do not hesitate to contact us.

Yours sincerely,

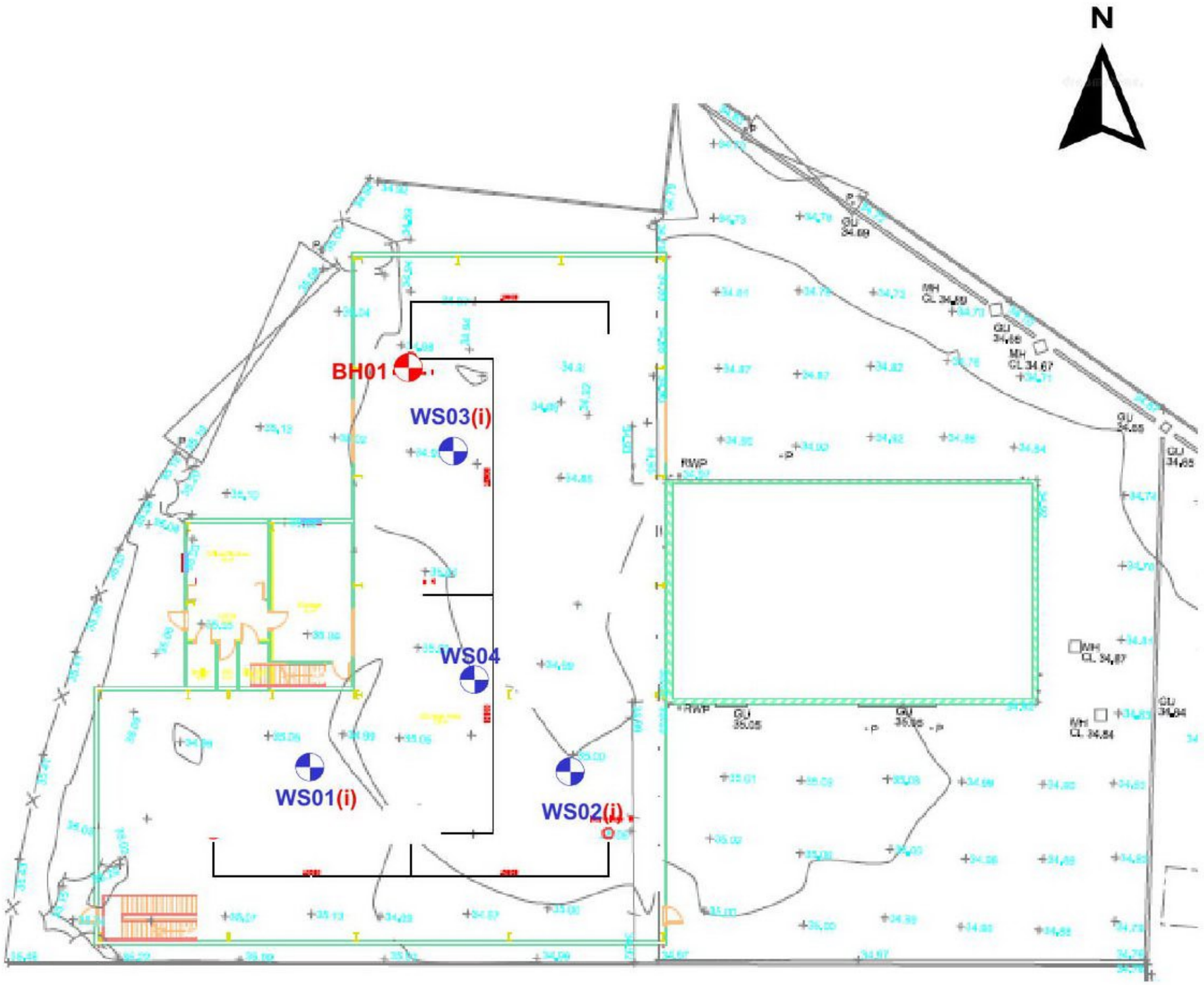
[redacted]

Emily Broughton BSc (Hons) MSc
Environmental Consultant
For and on behalf of Roberts Environmental Ltd
0191 230 4521

Enclosures

- Enclosure 1 – Borehole Location Plan
- Enclosure 2 – Ground Gas Monitoring Records

Enclosure 1



DO NOT SCALE

Key

BH	Rotary Borehole
WS (i)	Windowless Sampling Boreholes (i) with installations

CLIENT:
Silverstone

PROJECT:
Haugh Lane, Rotherham

TITLE:
Indicative Borehole Location Plan

DESIGN / DRAWN:	DATE:
EB	November 2020

PROJECT NO:	DRAWING NO:
201017	201017.01

ROBERTS
ENVIRONMENTAL LTD
1 Croft Stairs, Newcastle upon Tyne NE1 2HG
Tel: +44 (0) 191 2304521
http:// www.robertsenvironmental.co.uk

Enclosure 2

Roberts Environmental Monitoring Form

Site: Haugh Lane, Hexham

Job No: 201017

Date: 03/12/2020

Visit: 1 of 4

Equipment: GFM435 Gas Analyser

Meteorological Information					
Ground Conditions	Dry	Damp	Wet	Snow	Frost
Wind	Calm	Light	Moderate	High	
Cloud Cover	None	Slight	Cloudy	Overcast	
Precipitation	None	Slight	Moderate	Heavy	
Pressure trend (daily)	Falling	Steady	Rising		
Odour	Hydrocarbo odour within WS01				

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Borehole	Gas Flow (l/hr)	Borehole Pressure (pa)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Atm Pressure	Other Gases (PPM)			Depth to Water m bgl (Base BH)	what3words?
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	mb	PID	H_2S	CO		
WS01	0.0	0.0	0.0	0.0	0.0	0.0	4.9	5.9	9.4	7.5	978	N/R	0.0	0.0	2.60 (5.00)	
WS02	0.3	1.0	0.0	0.0	0.0	0.0	4.9	5.1	10.8	6.2	978	N/R	0.0	0.0	2.72 (4.90)	
WS03	0.3	1.0	0.0	0.0	0.0	0.0	0.9	5.1	18.8	10.9	978	N/R	0.0	0.0	2.62 (4.85)	

Notes:
Monitoring order is from **Left to Right** across table.
Minimum monitoring period 3 minutes extended where elevated concentrations of gases initially recorded.
* LEL = Lower Explosive Limit = 5 % v/v

Additional Notes:

Monitored by: E. Broughton

Signed: [redacted]

Project lead E. Broughton

Signed: [redacted]

Roberts Environmental Monitoring Form

Site: Haugh Lane, Hexham

Job No: 201017

Date: 14/01/2021

Visit: 2 **of** 4

Equipment: GFM435 Gas Analyser

Meteorological Information					
Ground Conditions	Dry	Damp	Wet	Snow	Frost
Wind	Calm	Light	Moderate	High	
Cloud Cover	None	Slight	Cloudy	Overcast	
Precipitation	None	Slight	Moderate	Heavy	
Pressure trend (daily)	Falling	Steady	Rising		
Odour					

ROBERTS ENVIRONMENTAL LTD

Borehole	Gas Flow (l/hr)	Borehole Pressure (pa)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Atm Pressure	Other Gases (PPM)			Depth to Water m bgl (Base BH)	what3words?
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	mb	PID	H_2S	CO		
WS01	0.6	3.0	0.0	0.0	0.0	0.0	0.0	4.8	19.2	19.1	1013	1.0	0.0	0.0	2.34(5.0)	
WS02	0.0	0.0	0.0	0.0	0.0	0.0	0.1	5.0	19.0	4.7	990	1.0	0.0	0.0	2.31(4.9)	
WS03	0.4	2.0	0.0	0.0	0.0	0.0	4.5	4.7	17.2	10.3	1013	1.0	0.0	0.0	2.32(4.8)	

Notes:
Monitoring order is from **Left to Right** across table.
Minimum monitoring period 3 minutes extended where elevated concentrations of gases initially recorded.
* LEL = Lower Explosive Limit = 5 % v/v

Additional Notes:
BH 2 WAS MONITORED ON THE 19/1/21 DUES TO THE SNOW THE WEEK BEFOE AND UNABLE TO LOCATE
AND UNABLE TO LOCATE

Monitored by: L. Pearson

Signed: [redacted]

Project lead E. Broughton

Signed: [redacted]

Roberts Environmental Monitoring Form

Site: Haugh Lane, Hexham

Job No: 201017

Date: 04/02/2021

Visit: 3 **of** 4

Equipment: GFM435 Gas Analyser

Meteorological Information					
Ground Conditions	Dry	Damp	Wet	Snow	Frost
Wind	Calm	Light	Moderate	High	
Cloud Cover	None	Slight	Cloudy	Overcast	
Precipitation	None	Slight	Moderate	Heavy	
Pressure trend (daily)	Falling	Steady	Rising		
Odour	N/A				

ROBERTS ENVIRONMENTAL LTD

Borehole	Gas Flow (l/hr)	Borehole Pressure (pa)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Atm Pressure	Other Gases (PPM)			Depth to Water m bgl (Base BH)	what3words?
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	mb	PID	H_2S	CO		
WS01	1.0	4.0	0.0	0.0	0.0	0.0	0.2	3.7	19.8	7.3	1003	0.5	0.0	0.0	1.80 (4.95)	
WS02	0.3	0.0	0.0	0.0	0.0	0.0	3.5	5.0	15.4	0.8	1002	0.0	0.0	0.0	1.95(4.90)	
WS03	0.0	0.0	0.0	0.0	0.0	0.0	4.8	4.7	7.2	10.3	1001	0.4	0.0	0.0	1.85(4.82)	

Notes:
Monitoring order is from **Left to Right** across table.
Minimum monitoring period 3 minutes extended where elevated concentrations of gases initially recorded.
* LEL = Lower Explosive Limit = 5 % v/v

Additional Notes:

Monitored by: L. Pearson

Signed: [redacted]

Project lead E. Broughton

Signed: [redacted]

Roberts Environmental Monitoring Form

Site: Haugh Lane, Hexham

Job No: 201017

Date: 19/02/2021

Visit: 4 **of** 4

Equipment: GFM435 Gas Analyser

Meteorological Information					
Ground Conditions	Dry	Damp	Wet	Snow	Frost
Wind	Calm	Light	Moderate	High	
Cloud Cover	None	Slight	Cloudy	Overcast	
Precipitation	None	Slight	Moderate	Heavy	
Pressure trend (daily)	Falling	Steady	Rising		
Odour					

ROBERTS ENVIRONMENTAL LTD

Borehole	Gas Flow (l/hr)	Borehole Pressure (pa)	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Atm Pressure	Other Gases (PPM)			Depth to Water m bgl (Base BH)	what3words?
			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	mb	PID	H_2S	CO		
WS01	7.8	62.0	0.0	0.0	0.0	0.0	0.0	0.1	19.7	20.0	990	0.0	0.0	0.0	1.80 (5.00)	
WS02	1.6	9.0	0.0	0.0	0.0	0.0	0.0	0.0	19.7	20.0	990	0.0	0.0	0.0	1.97 (4.90)	
WS03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.3	19.9	990	0.0	0.0	0.0	1.88 (4.83)	

Notes:
Monitoring order is from **Left to Right** across table.
Minimum monitoring period 3 minutes extended where elevated concentrations of gases initially recorded.
* LEL = Lower Explosive Limit = 5 % v/v

Additional Notes:

Monitored by: L. Pearson

Signed: [redacted]

Project lead E. Broughton

Signed: [redacted]