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Our Ref: P7791\GAL

Date: 12th March 2021

Davidsons Developments C/O Andrew Granger and Co Ltd
Phoenix House
52 High Street
Market Harborough
Leicestershire
LE16 7AF

Attention of Mr Adam Murray at Andrew Granger and Co Ltd

Dear Adam,

Re: Gas Addendum Letter for Lichfield Drive / Blaby Golf Course, Blaby

The gas monitoring programme at the above site is now complete. The assessment below supersedes the information in the Site Appraisal Report (Ref: GRM/P7791/F.1, dated January 2021) and should be submitted to the regulatory bodies for approval.

The Phase I desk study concluded that the site has a very low ground gas risk, this was due to limited made ground anticipated and no identified off-site sources.

The site is not in an area where radon protective measures are required.

The ground investigation did not identify any potential sources of ground gas and no evidence of hydrocarbon contamination was observed at or below ground level.

As the proposed end use has been classified as high sensitivity (residential with gardens), five 35mm diameter gas/water monitoring standpipes have been installed across the site within the window sample boreholes (WS01, WS05, WS07, WS08 and WS12) and targeted at the natural strata given the lack of any significant thicknesses of made ground.

To confirm potential liabilities, gas monitoring has been carried out fortnightly basis over a period from 9th December 2020 to 16th February 2021, to assess the risk posed to the end user from potentially harmful ground gases.

The post fieldwork monitoring has been designed to identify and assess the groundwater and gas regimes below the site. The results are enclosed for reference and are summarised below:

Land Appraisal | Environmental | Geotechnical | Design | Mining | Inspections

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Borehole	Response Zone (m begl) / Strata	Contamination	No. of Monitoring Visits	Methane (%v/v)	Carbon Dioxide (%v/v)	Oxygen (%v/v)	Flow (l/hr)	Depth to Groundwater (m begl)
WS01	1.0 – 3.5 (NS)	N.R.	6	Response zone flooded on all monitoring visits				0.00 – 0.73
WS05	0.5 – 2.0 (NS)	N.R.	6	0.0 – 0.0	1.1 – 2.2	15.6 – 19.0	-0.2 – -0.8	0.10 – 2.09
WS07	1.0 – 4.0 (NS)	N.R.	6	Response zone flooded on all monitoring visits				0.00 – 0.10
WS08	0.5 – 5.45 (NS)	N.R.	6	0.0 – 0.0	0.8 – 4.5	10.2 – 15.8	0.0 – 0.0	0.39 – 1.32
WS12	0.5 – 5.45 (NS)	N.R.	6	0.0 – 0.0	1.7 – 3.5	18.3 – 19.8	0.0 – 0.0	0.31 – 0.74

Notes: NS= Natural Strata, N.R. = Not Recorded. Atmospheric Pressure: 979mb-1013mb

Ground Gas Risk Assessment

The primary guidance document to determine if gas protection measures are required is BS8485:2015+A1:2019. This uses hazardous gas flow rates (Q_{hg}), which are gas concentrations multiplied by borehole flow rates, to derive a Gas Screening Value (GSV) for the site. The gas regime is then determined based on the GSV and other limiting factors including gas concentrations and flow rates.

It should be noted that during several monitoring visits, several wells, and areas of the site overall, were observed to be waterlogged and as such resulted in the flooding of response zones. All wells installed were flooded on at least one occasion, flooded wells were bailed before being monitored. Due to well flooding, monitoring results obtained during these events have been discounted from the overall assessment so as to produce a representative model of the gas regime beneath the site. It should be noted that no elevated results have been omitted from the assessment due to flooded response zones.

Additionally, the most significant gas flow reading to date has been negative (-0.8l/hr), and in order to adopt a conservative approach this has been converted to a positive reading so as to assume a worst-case scenario for the site.

Methane concentrations above the monitor's lower limits of detection were not detected during monitoring period. Therefore, in the following assessment the monitor's lower limit of detection for methane (0.1% v/v) has been used.

Using the default methane concentration of 0.1%v/v and the maximum flow rate of 0.8l/hr a Q_{hg} of 0.0008l/hr has been calculated for methane. Using the maximum recorded carbon dioxide concentration of 4.5%v/v and the maximum flow rate of 0.8l/hr a Q_{hg} of 0.036l/hr has been calculated for carbon dioxide. On this basis the GSV for the site is determined as 0.036l/hr.

As the GSV is less than 0.07l/hr and the maximum recorded concentrations of methane and carbon dioxide are less than 1%v/v and 5%v/v respectively, the site has been assessed as 'Characteristic Situation 1 (very low hazard potential) as outlined in Table 2 of BS8485:2015, for which gas protection measures are not required.

Additional Considerations

The results of the monitoring period to date have revealed depleted oxygen levels within the vicinity of WS08 situated at the eastern boundary of the site. This is considered to pose an asphyxiation risk to site workers in subfloor and confined spaces. It is recommended that there is no unnecessary entry in excavations and if man entry is required, it is recommended that gas monitoring is conducted during operations to ensure adequate concentrations of oxygen are present and ventilation of excavations is undertaken.

Groundwater

The monitoring program has confirmed the presence of shallow groundwater beneath the site and additionally standing water has frequently been observed at surface.

Groundwater was encountered at between 0.0m and 2.09m begl, however on many of the monitoring visits borehole wells and surrounding areas were observed to be flooded. It is considered that simple de-watering techniques (eg. sump-pumping) may be suitable to control groundwater ingress in shallow or short-term excavations, however well-pointing may be necessary for deeper and long-term excavations. The observed conditions may also pose an issue with stability during excavation.

Care should be taken to ensure that dewatering does not lead to settlement of soils below existing structures or services on or off-site.

We trust this is suitable for your current requirements, should you require any further information or would like any clarification of the points raised please do not hesitate to contact us.

Yours sincerely,
for GRM Development Solutions Ltd



Andrew Lamont BSc (Hons), FGS
Engineering Geologist



Siobhan Jackson BSc (Hons), MEnvSc, CEnv
Principal Geo-environmental Scientist

Enc:

P7791 Gas Monitoring Location Plan
P7791 Gas Monitoring Results



NOTES:

CLIENT:	Andrew Granger & Co
PROJECT:	Lichfield Drive/ Blaby Golf Centre
TITLE:	Gas Monitoring Plan

PROJECT No:	P7791
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DATE:	Nov 2020
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DESIGN/DRAWN:	PC
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DRAWING NUMBER:	1
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ISSUE:	ISSUE
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In-Situ Gas Monitoring Results

Project Name	Lichfield Road / Golf Course Blaby
Project Number	7791
Client	Andrew Granger & Co
Date	09/12/2020
Weather	Cloudy
Atmospheric Pressure (mb)	1001
Pressure Trend	Rising
Equipment	Gas Data LMSXi
Operator	Bryan Burgh

Ground Gas													
Well ID	Response Zone			Methane		CO2		Oxygen		Gas Flow		PID Reading	
	mbegl			%v/v		%v/v		%v/v		l/h		ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
WS01	1.00	3.50	NS	0.00	0.00	3.70	3.70	18.30	18.30	0.00	0.00	Not Recorded	
WS05	0.50	2.00	NS	0.00	0.00	2.20	2.20	17.10	17.10	-0.80	-0.50	Not Recorded	
WS07	1.00	4.00	NS	0.00	0.00	1.90	1.90	20.20	20.20	0.00	0.00	Not Recorded	
WS08	0.50	5.45	NS	0.00	0.00	4.20	4.20	12.90	12.90	0.00	0.00	Not Recorded	
WS12	0.50	5.45	NS	0.00	0.00	1.70	1.70	20.20	20.20	0.00	0.00	Not Recorded	

Groundwater	
Depth to Groundwater	Total Well Depth
mbegl	mbegl
0.73	3.39
Not Detected	2.58
0.10	3.30
Not Detected	5.53
0.74	5.33

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L. = 5% Flammable Gas)
N.D.	Not Detected
N.R.	Not Recorded
PID	Photo-Ionising Detector
%	By volume

Ground Material Key

NS Natural Strata

Key

	Threshold gas concentration exceeded
	Response Zone Flooded

Comments

rising head tests done see borehole soak results



In-Situ Gas Monitoring Results

Project Name Lichfield Road / Golf Course Blaby
 Project Number 7791
 Client Andrew Granger & Co
 Date 22/12/2020
 Weather Partly Sunny
 Atmospheric Pressure (mb) 1006
 Pressure Trend Steady
 Equipment Gas Data LMSXi
 Operator Bryan Burgh

Ground Gas													
Well ID	Response Zone			Methane		CO2		Oxygen		Gas Flow		PID Reading	
	mbegl			%v/v		%v/v		%v/v		l/h		ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
WS01	1.00	3.50	NS										
WS05	0.50	2.00	NS	0.00	0.00	2.20	2.20	18.70	18.70	0.00	0.00	Not Recorded	
WS07	1.00	4.00	NS	0.00	0.00	2.30	2.30	17.00	17.00	0.00	0.00	Not Recorded	
WS08	0.50	5.45	NS	0.00	0.00	4.50	4.50	10.20	10.20	0.00	0.00	Not Recorded	
WS12	0.50	5.45	NS	0.00	0.00	0.90	0.90	20.50	20.50	0.60	0.00	Not Recorded	

Groundwater	
Depth to Groundwater	Total Well Depth
mbegl	mbegl
1.92	2.58
0.00	3.29
1.32	5.52
0.47	5.31

Notes

L.E.L. Lower Explosive Limit (100% L.E.L. = 5% Flammable Gas)
 N.D. Not Detected
 N.R. Not Recorded
 PID Photo-Ionising Detector
 % By volume

Ground Material Key

NS Natural Strata

Key

Threshold gas concentration exceeded
 Response Zone Flooded

Comments

WS01 Flooded pic sent to pm
 A lot of standing water on site



In-Situ Gas Monitoring Results

Project Name	Lichfield Road / Golf Course Blaby
Project Number	7791
Client	Andrew Granger & Co
Date	04/01/2021
Weather	Drizzle
Atmospheric Pressure (mb)	1013
Pressure Trend	Steady
Equipment	Gas Data LMSXi
Operator	Bryan Burgh

Ground Gas													
Well ID	Response Zone			Methane		CO2		Oxygen		Gas Flow		PID Reading	
	mbegl			%v/v		%v/v		%v/v		l/h		ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
WS01	1.00	3.50	NS	0.00	0.00	1.60	1.60	13.50	13.50	-1.00	-0.90	Not Recorded	
WS05	0.50	2.00	NS	0.00	0.00	2.00	2.00	15.60	15.60	0.00	0.00	Not Recorded	
WS07	1.00	4.00	NS	0.10	0.10	1.50	1.50	19.70	19.70	0.00	0.00	Not Recorded	
WS08	0.50	5.45	NS	0.10	0.00	0.80	0.80	15.80	15.80	0.00	0.00	Not Recorded	
WS12	0.50	5.45	NS	0.20	0.10	2.50	2.50	18.70	18.70	0.00	0.00	Not Recorded	

Groundwater	
Depth to Groundwater	Total Well Depth
mbegl	mbegl
0.49	3.37
2.09	2.59
0.00	3.27
0.70	5.51
0.74	5.41

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L. = 5% Flammable Gas)
N.D.	Not Detected
N.R.	Not Recorded
PID	Photo-Ionising Detector
%	By volume

Ground Material Key

NS Natural Strata

Key

	Threshold gas concentration exceeded
	Response Zone Flooded



In-Situ Gas Monitoring Results

Project Name	Lichfield Road / Golf Course Blaby
Project Number	7791
Client	Andrew Granger & Co
Date	20/01/2021
Weather	Raining
Atmospheric Pressure (mb)	979
Pressure Trend	Falling
Equipment	Gas Data LMSXi
Operator	Bryan Burgh

Ground Gas													
Well ID	Response Zone			Methane		CO2		Oxygen		Gas Flow		PID Reading	
	mbegl			%v/v		%v/v		%v/v		l/h		ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
WS01	1.00	3.50	NS										
WS05	0.50	2.00	NS	0.00	0.00	1.10	1.10	19.00	19.00	-0.20	0.00	Not Recorded	
WS07	1.00	4.00	NS										
WS08	0.50	5.45	NS	0.00	0.00	3.10	3.10	14.60	14.60	0.00	0.00	Not Recorded	
WS12	0.50	5.45	NS	0.00	0.00	1.40	1.40	20.20	20.20	0.00	0.00	Not Recorded	

Groundwater	
Depth to Groundwater	Total Well Depth
mbegl	mbegl
1.12	2.59
0.39	5.52
0.31	5.32

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L. = 5% Flammable Gas)
N.D.	Not Detected
N.R.	Not Recorded
PID	Photo-Ionising Detector
%	By volume

Ground Material Key

NS	Natural Strata
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Key

	Response Zone Flooded
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Comments

Whole site saturated
 WS01 + WS07 flooded see pics



In-Situ Gas Monitoring Results

Project Name	Lichfield Road / Golf Course Blaby
Project Number	7791
Client	Andrew Granger & Co
Date	04/02/2021
Weather	Cloudy
Atmospheric Pressure (mb)	1008
Pressure Trend	Steady
Equipment	Gas Data LMSXi
Operator	James Wardle

Ground Gas													
Well ID	Response Zone			Methane		CO2		Oxygen		Gas Flow		PID Reading	
	mbegl			%v/v		%v/v		%v/v		l/h		ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
WS01	1.00	3.50	NS										
WS05	0.50	2.00	NS										
WS07	1.00	4.00	NS										
WS08	0.50	5.45	NS	0.00	0.00	1.70	1.70	18.90	18.90	0.00	0.00	Not Recorded	
WS12	0.50	5.45	NS	0.00	0.00	3.50	3.50	18.30	18.30	0.00	0.00	Not Recorded	

Groundwater	
Depth to Groundwater	Total Well Depth
mbegl	mbegl
0.45	5.50
0.57	5.27

Notes

L.E.L. Lower Explosive Limit (100% L.E.L. = 5% Flammable Gas)
 N.D. Not Detected
 N.R. Not Recorded
 PID Photo-Ionising Detector
 % By volume

Ground Material Key

NS Natural Strata

Key

Response Zone Flooded

Comments

1 5 7 all flooded



In-Situ Gas Monitoring Results

Project Name	Lichfield Road / Golf Course Blaby
Project Number	7791
Client	Andrew Granger & Co
Date	16/02/2021
Weather	Drizzle
Atmospheric Pressure (mb)	1000
Pressure Trend	Falling
Equipment	Gas Data LMSXi
Operator	Bryan Burgh

Ground Gas													
Well ID	Response Zone			Methane		CO2		Oxygen		Gas Flow		PID Reading	
	mbegl			%v/v		%v/v		%v/v		l/h		ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
WS01	1.00	3.50	NS	Not Recorded		Not Recorded		Not Recorded		Not Recorded		Not Recorded	
WS05	0.50	2.00	NS	Not Recorded		Not Recorded		Not Recorded		Not Recorded		Not Recorded	
WS07	1.00	4.00	NS	0.00	0.00	1.50	1.50	20.20	20.20	0.00	0.00	Not Recorded	
WS08	0.50	5.45	NS	0.00	0.00	2.80	2.80	19.50	19.50	0.00	0.00	Not Recorded	
WS12	0.50	5.45	NS	0.00	0.00	2.30	2.30	19.80	19.80	0.00	0.00	Not Recorded	

Groundwater	
Depth to Groundwater	Total Well Depth
mbegl	mbegl
0.00	3.33
0.10	2.60
0.00	3.28
0.46	5.53
0.61	5.31

Notes

L.E.L. Lower Explosive Limit (100% L.E.L. = 5% Flammable Gas)
 N.D. Not Detected
 N.R. Not Recorded
 PID Photo-Ionising Detector
 % By volume

Ground Material Key

NS Natural Strata

Key

Response Zone Flooded

Comments

WS07 monitor was abandoned as sucking up water
 WS01 and WS05 flooded see photos