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Technical Note

Project:	Low Moor Road, Sutton In Ashfield
Subject:	Technical Note – Ground Gas Risk Assessment
Date:	18th May 2018
Prepared by:	Rob Woodhouse BSc/BEng (Hons) – Geo-Environmental Engineer
Authorised by:	Stewart Friel MSc BSc (Hons) MIEnvSc - Director
Revision	A – Monitoring data received for Sutton Quarry 07/06/2018

1 Introduction

In January 2018, Rodgers Leask Environmental Ltd (RLE) was commissioned by Hallam Land Management Ltd to undertake site investigation works at land off Low Moor Road, Sutton in Ashfield. The site investigation focussed on the northeast portion of land referred to as the Rolls Royce (RR) parcel. This area will henceforth be referred to as 'the Site'.

It is understood the site is to be redeveloped for a residential end use.

This investigation follows a preliminary investigation documented in the RLE Technical Note dated 13th September 2017:

- *Low Moor Road, Sutton In Ashfield, Technical Note - Permeability Testing and Ground Gas Monitoring.*

A Phase 1 Desk Study was also completed by RLE dated 26th January 2017 which incorporated the 3 No parcels that make up the proposed development area. This includes the RR parcel/the Site:

- *Low Moor Road, Sutton In Ashfield, Phase 1 Desk Study for Hallam Land Management, Rev A.*

Both of the above documents should be read in conjunction with this Technical Note.

2 Objectives

The objectives of this investigation are to:

- To assess the risk of gas migration from the adjacent former household, commercial and industrial waste landfill site to the northeast of the Site, currently managed by Suez (Sutton Quarry), through undertaking window sample (WS) and rotary (RO) boreholes along the boundary of the Site which borders Coxmoor Road.
- To undertake a more robust gas risk assessment by monitoring these boreholes and existing boreholes over an extended period.

- Classify the site with regards to ground gas in accordance with the NHBC Traffic Light System and CIRIA C665.

3 Site Setting

The Site is located to the southwest of Sutton-in-Ashfield, Nottinghamshire. The Site centre co-ordinates are at approximately 451556E, 357656N.

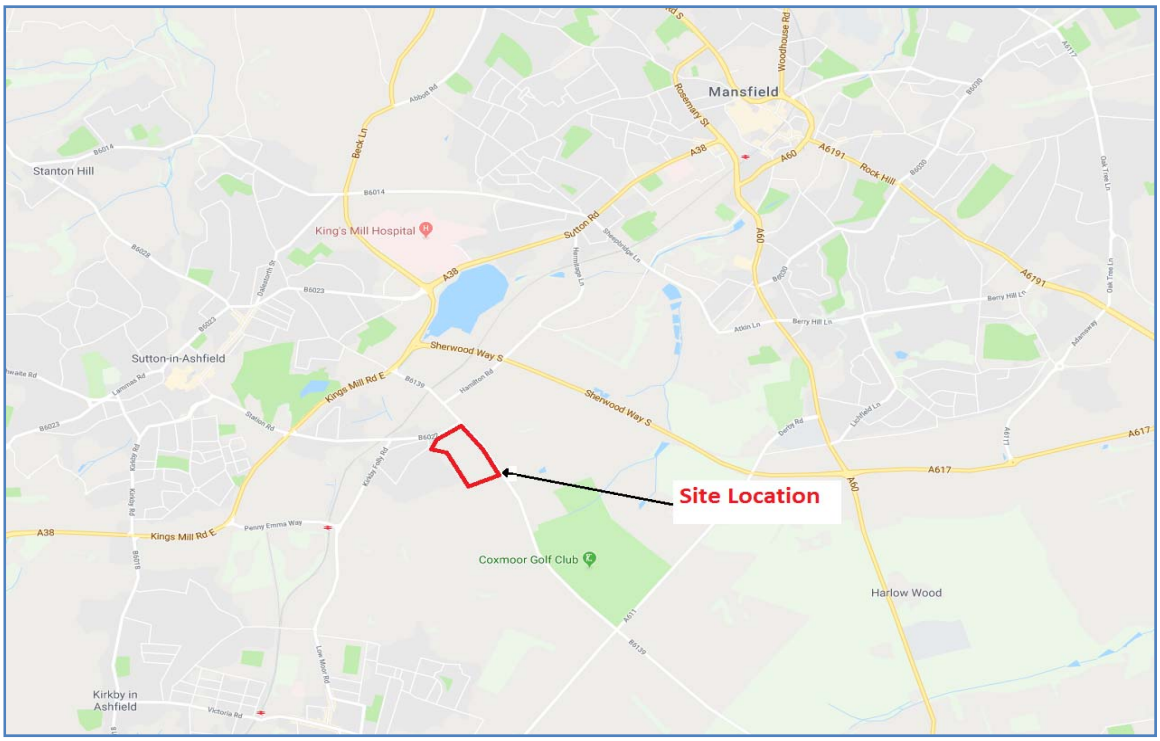


Figure 1 Approximate boundary and location of site.

The Site is currently used as arable farm land.

4 Previous Investigation

4.1 Preliminary Gas Monitoring

An intrusive investigation was undertaken by RLE in April 2017 to determine the depth of made ground in the former onsite landfill area, infiltration testing and assessment of the ground gas regime across the Site.

RLE's Desk Study considered that in areas where landfilling had taken place on or adjacent to the Site the risk of ground gassing impacting the Site would be considered moderate/high and the sensitivity of the Site was considered high.

A minimum of 12 gas monitoring visits over a 6 month period was recommended by RLE to establish the gassing regime of the Site.

During the initial works, a total of 8 No WS boreholes and 2 No Cable Percussion (CP) boreholes were drilled in and around the area of the former landfill, all of which were installed with gas monitoring ancillaries. Six monitoring visits were carried out over a 3 month period.

An initial assessment after the six monitoring visits concluded that any proposed development would require Amber 1 gas protection measures.

Key conclusions from the investigation were that:

- Generally, methane was detected in low concentrations (<5%) in some boreholes at times of low and falling atmospheric pressure.
- The majority of the occurrences of methane were in the deeper CP boreholes, indicating that methane may be generated in the deeper areas of fill onsite.
- Several readings of carbon dioxide were recorded above trigger levels but there was no direct correlation between carbon dioxide and atmospheric pressure.
- The Sutton Quarry landfill was not generating significant concentrations of gas or gas is not migrating onto the Site from the adjacent site.
- It was recommended that further gas monitoring was undertaken.

After the issue of the preliminary gas assessment by RLE; Suez, the owner of the Sutton Quarry landfill expressed concerns that the initial monitoring had not targeted the boundary between the proposed development and their site.

In response, the EHO at Sutton in Ashfield confirmed that “The Council will not accept Amber 1 classification for the dwellings... without first a targeted ground gas investigation....”

RLE liaised with Leigh Warhurst, EHO at Sutton in Ashfield to design a satisfactory targeted ground gas investigation. It was agreed that boreholes at 50m centres and targeting both the bedrock and subsoils at the boundary of the two sites would be satisfactory to the council for a robust risk assessment to be carried out.

5 Site Investigation Works

5.1 Site Works

The further intrusive works were carried out at the Site on the 12th and 13th of February 2018. A combination of Rotary (RO) and WS boreholes were drilled at the north-eastern boundary where the Site is adjacent to the Sutton Quarry site. A borehole location plan is included in **Appendix A**.

5.2 Rationale of Borehole Location and Depth

A total of 4 No RO boreholes and 5 No WS boreholes were drilled along the boundary of the site adjacent with Coxmoor Rd in addition to the 8 No existing WS and 2 No CP boreholes on the Site.

Borehole RO 03 was stopped early and not installed due to dense concrete obstructions. Borehole RO 03A was drilled in close proximity and installed to 10m depth with monitoring ancillaries.

These boreholes allowed both the onsite deep and shallow areas of fill to be targeted along with the bedrock and the subsoils at the boundary of the Site adjacent with Coxmoor Rd as shown in Table 1 below. A copy of the borehole logs is included in **Appendix B**.

Table 1 All boreholes drilled to date

Borehole Reference	Depth (mm)	Borehole Type	Target
WS101 – WS105	0.9 – 4.0m	WS	Soft Strata at Site boundary with Coxmoor Rd
RO 01 – RO 03A	4.0 - 10m	RO	Sandstone Bedrock at Site Boundary with Coxmoor Rd
WS01 – WS08*	1.0 – 4.45m	WS	Area of onsite inert fill
CP01 – CP02*	4.45 – 9.45m	CP	Base of onsite inert fill

**Boreholes from previous investigation*

5.3 Ground Conditions

Ground conditions encountered in this investigation were largely typical of the previous investigation. Deeper RO boreholes uncovered several concrete obstructions at the northern boundary of the site between depths of 1.0 to 7.0m. Detailed findings are as overleaf:

Table 2 Ground Conditions

Strata Encountered	Depth encountered to top of strata (range, m)	Depth encountered to base of strata (m)	Thickness (range, m)
MADE GROUND TOPSOIL Encountered across the investigation area. Comprising dark brown sandy topsoil with gravels of quartzite, brick, concrete and sandstone.	0	0.2 - 0.3	0.2 – 0.3
MADE GROUND FILL MATERIAL Encountered in the northern end of the investigation area. Comprising variable strata of sandy gravelly clay and clayey gravelly sand. Deeper RO boreholes encountered several concrete obstructions.	0.3 – 1.0	2.0 – 7.0	1.7 – 6.0
LENTON SANDSTONE FORMATION Encountered below the made ground across the investigation area. Recovered as orange red brown sand with quartzite gravels. Occasional bands of firm clay were encountered in some boreholes.	0.2 – 0.9	Unproven	Unproven

No groundwater or evidence of contamination was encountered within the exploratory holes.

6 Ground Gas Monitoring and Assessment

6.1 Completed Ground Gas Monitoring

The risk to end users from ground gas has been assessed in accordance with the following documents:

- British Standards BS8485:2015 – Code of practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings;
- CIRIA C665: Assessing risks posed by hazardous ground gas to buildings, 2007.

A minimum of 12 No gas monitoring visits over a period of 6 months is recommended in accordance with CIRIA C665. This assessment is based on a moderate generation potential and high sensitivity development.

Gas monitoring has been carried out using both GA2000 and GA5000 landfill gas analysers with integral flow measuring capability.

A total of 12 No gas monitoring rounds have been completed on the original installations (WS01 – WS08 and CP 1 and 2) across two periods of three months. Monitoring was carried out between 27th April and 19th June 2017 and 14th February to 11th May 2018.

A total of 6 No gas monitoring rounds have been completed on the additional installations at the northern site boundary (WS101-105 and RO1 -3) between 14th February to 11th May 2018.

Several monitoring visits have been carried out during low and falling atmospheric conditions with the lowest recorded pressure during falling conditions being 976mb on the 8th March 2018.

Ground gas monitoring records are presented in **Appendix C**.

6.2 Ground Gas Analysis

Ground gas monitoring has been carried out in order to target two potential sources of ground gas generation:

- **Target A**: The former onsite inert landfill targeted in the first intrusive investigation.
- **Target B**: The adjacent Sutton Quarry landfill and the potential pathways onto the proposed development site.

6.3 Target A - Former onsite inert landfill

RLE's Technical Note dated September 2017 set out an initial recommendation of Amber 1 gas protection measures for development in and around the former inert landfill.

The further monitoring carried out since the issue of the Technical Note has not recorded any elevated concentrations of CO_2 or CH_4 higher than those recorded in the previous period

of monitoring. Higher readings of borehole flow were recorded this time around and therefore the Gas Screening Values (GSV) based on worst case scenario have changed slightly since the original Technical Note.

A summary of the maximum borehole hazardous gas flow rates (Q_{hg}) for carbon dioxide and methane recorded during each monitoring visit undertaken is presented below in Table 3 overleaf.

Table 3 Summary of the maximum borehole hazardous gas flow rates (Qhg) for carbon dioxide and methane - Former onsite inert landfill

Monitoring Visit	Max. CH_4 Concentration (% v/v)	Max. CO_2 Concentration (% v/v)	Max. Initial Gas Flow Rate (l/hr)	Max. Steady Gas Flow Rate (l/hr)	BH CH_4 Hazardous Flow Rate Q_{hg} (l/hr)	BH CO_2 Hazardous Flow Rate (l/hr) Q_{hg}
27/04/2017	<0.1	7.7	0.1	0.1	0.0001	0.0077
02/05/2017	<0.1	5.8	0.1	<0.1	0.0001	0.0058
17/05/2017	2.1	7.6	0.1	<0.1	0.0021	0.0076
26/05/2017	2.2	9.1	0.2	<0.1	0.0044	0.0091
29/06/2017	3.4	6.3	<0.1	<0.1	0.0034	0.0063
19/07/2017	3.1	13.9	<0.1	<0.1	0.0031	0.0139
14/02/2018	2.2	5.5	0.2	2.0	0.0044	0.1100
21/02/2018	0.6	8.1	0.1	0.1	0.0006	0.0081
08/03/2018	2.1	4.2	0.4	0.1	0.0084	0.0042
16/04/2018	1.9	6.6	1.3	0.1	0.0057	0.0066
30/04/2018	2.2	8.4	0.2	0.1	0.0044	0.0084
11/05/2018	1.2	6.8	0.1	0.1	0.0012	0.0068

Q_{hg} based on worst case concentrations and flow rates

GSVs have been calculated using the following figures, and based on worst case hazardous gas concentrations and flow rates from all boreholes within the area of Target A.

Table 4 Calculation of GSVs on site

C_{hg} Methane (% v/v)	C_{hg} Carbon Dioxide (% v/v)	Initial Gas Flow Rate (l/hr)	Steady Gas Flow Rate (l/hr)	Hazardous Gas Flow Rate Q_{hg} CH_4 (l/hr)	Hazardous Gas Flow Rate Q_{hg} CO_2 (l/hr)	Implied Characteristic Situation (CS)	NHBC Traffic Light System
3.4	13.9	1.3	2.0	0.0680	0.278	CS-2 Low Risk	Green / Amber 1

GSV calculated using worst case values

In accordance with the NHBC Traffic Light System, based on the calculated gas screening value alone, the area of the former landfill would be classed as 'Green'. However, in

accordance with guidance presented within CIRIA C665, it is recommended that an Amber 1 classification is adopted at the site for the following reasons:

- Made ground is consistently encountered across the monitoring area presenting a continued source of gas, even if this appears to be of a very low volume.
- Carbon Dioxide has been recorded above the Typical Maximum Concentration (5%) on numerous occasions.
- Methane has also regularly exceeded the Typical Maximum Concentration (1%) on numerous occasions, albeit with less frequency than CO_2.

In accordance with BS 8485:2015, a solution score of 3.5 Points are considered necessary for a Type A Building (based on residential). These points could be obtained in a variety of ways, and shall depend upon the type of foundation adopted, and reference should be made to the above document. The following indicates how these points could be obtained:

- Passive sub floor ventilation (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) 1.5- 2.5 points
- Gas membrane meeting requirements of BS8485 2 points.

The data is consistent with the underlying inert waste deposited in the former landfill and is not considered to represent a significant source of ground gas.

6.4 Target B - adjacent Sutton Quarry landfill

The second period of monitoring undertaken also incorporated the new WS and RO boreholes installed along the boundary with Coxmoor Rd. These were installed to target any ground gas that may be entering the site from the Sutton Quarry site.

Both the subsoils and the bedrock at the boundary were individually targeted. RO boreholes were drilled into the underlying sandstone bedrock, while WS boreholes targeted shallower strata mainly consisting of gravelly sands.

Monitoring of the boreholes in the Target B area recorded no occurrences of methane over limits of detection (0.1%). Carbon dioxide was recorded over typical maximum concentrations on 4 No visits from the total of 6 No monitoring visits undertaken.

A summary of the maximum borehole hazardous gas flow rates for carbon dioxide and methane recorded during each monitoring visit undertaken is presented below in Table 3 below.

Table 5 Summary of the maximum borehole hazardous gas flow rates (Qhg) for carbon dioxide and methane.

Monitoring Visit	Max. CH_4 Concentration (% v/v)	Max. CO_2 Concentration (% v/v)	Max. Initial Gas Flow Rate (l/hr)	Max. Steady Gas Flow Rate (l/hr)	BH CH_4 Hazardous Flow Rate Q_{hg} (l/hr)	BH CO_2 Hazardous Flow Rate Q_{hg} (l/hr)
14/02/2018	<0.1	4.8	<0.1	<0.1	0.0001	0.0048
21/02/2018	<0.1	8.1	0.1	0.1	0.0001	0.0081
08/03/2018	<0.1	4.2	0.4	0.1	0.0004	0.0042
16/04/2018	<0.1	4.9	0.1	0.1	0.0001	0.0049
30/04/2018	<0.1	8.4	0.1	0.1	0.0001	0.0084
11/05/2018	<0.1	6.8	0.1	0.1	0.0001	0.0068

GSVs have been calculated using the following figures, and based on worst case hazardous gas concentrations and flow rates from all boreholes within the area of Target A.

Table 6 Calculation of GSVs at site boundary

C_{hg} Methane (% v/v)	C_{hg} Carbon Dioxide (% v/v)	Initial Gas Flow Rate (l/hr)	Steady Gas Flow Rate (l/hr)	Hazardous Gas Flow Rate Q_{hg} CH_4 (l/hr)	Hazardous Gas Flow Rate Q_{hg} CO_2 (l/hr)	Implied Characteristic Situation (CS)	NHBC Traffic Light System
<0.1	8.4	0.4	0.1	0.0004	0.0084	CS-1	Green / Amber 1

In accordance with the NHBC Traffic Light System, based on the calculated gas screening value alone, the area of the former landfill would be classed as 'Green'. However, in accordance with guidance presented within CIRIA C665, it is recommended that an Amber 1 classification is adopted at the site for the following reasons:

- Made ground is consistently encountered across the monitoring area presenting a continued source of gas, even if this appears to be of a very low volume.
- Carbon Dioxide has been recorded above the Typical Maximum Concentration (5%) on numerous occasions.
- The proximity to the adjacent former landfill site and possible source of future ground gas ingress onto the site.

In accordance with BS 8485:2015, a solution score of 0 Points are considered necessary for a Type A Building (based on residential), no gas protection required.

The GSV for the Target B area indicates a negligible gas regime in this part of the Site. The ground encountered in the investigation revealed some made ground which appears to be inert in nature.

6.5 General Observations

The data obtained from the two periods of gas monitoring across the Site can be summarised into the following salient points:

- The presence of methane has coincided with low and falling atmospheric pressure, suggesting there may be a correlation between the two.
- Methane has been found within the former landfill site area but not at the boundary of the site adjacent to Sutton Quarry.
- Methane has been most prevalent in the deeper boreholes that target the fill at depth (but not found in the underlying bedrock)
- The data suggests that there is less of a correlation between atmospheric pressure and carbon dioxide. Higher concentrations were generally found in times of the lowest atmospheric pressures.
- Gas flow rates have been generally low irrespective of atmospheric pressure suggesting that there is only a negligible source of gas.

  Concentrations of carbon monoxide and hydrogen sulphide have been at very low levels throughout the monitoring period.

6.6 Monitoring data obtained for Sutton Quarry

Further to RLE's gas monitoring, the Environment Agency has supplied gas monitoring data from the adjacent Sutton Quarry site. The data consists of quarterly monitoring results from the past two years and is presented in **Appendix D**. Four boreholes have been monitored, however the locations of which are not supplied. The data is referenced 'Perimeter Gas Monitoring' suggesting the boreholes are situated on the perimeter of the site.

The results of the monitoring indicate that very low levels of landfill gas are detected at the perimeter of the site. The maximum methane detected during the two year monitoring period was 0.1% and the maximum carbon dioxide was recorded at 2.3%. Monitoring was carried out during periods of low pressure with 984mb being the lowest during the period.

Observations of the data:

- Very low levels of both carbon dioxide and methane were detected over the past two years of monitoring which indicates that either there is very little gas being generated within the landfill or that any gas present in the landfill is very well controlled / vented.
- The monitoring interval at Sutton Quarry is carried out on a quarterly basis, indicating that the site is not considered to be high risk to local environs.

7 Conclusions and Recommendations

7.1 Conclusions

Ground gas monitoring at the Site has identified negligible to low gas regime.

Both the area around the former onsite inert landfill and the portion investigated along the northern boundary of the Site can be classified as very low to low risk to potential end users.

It is considered that Amber 1 gas protection measures would be required for developments within the Site. Gas protection measures commensurate with Amber 1 conditions would typically comprise a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into the buildings.

Gas protection measures should be as prescribed in BRE Report 414 (Johnson, 2001).

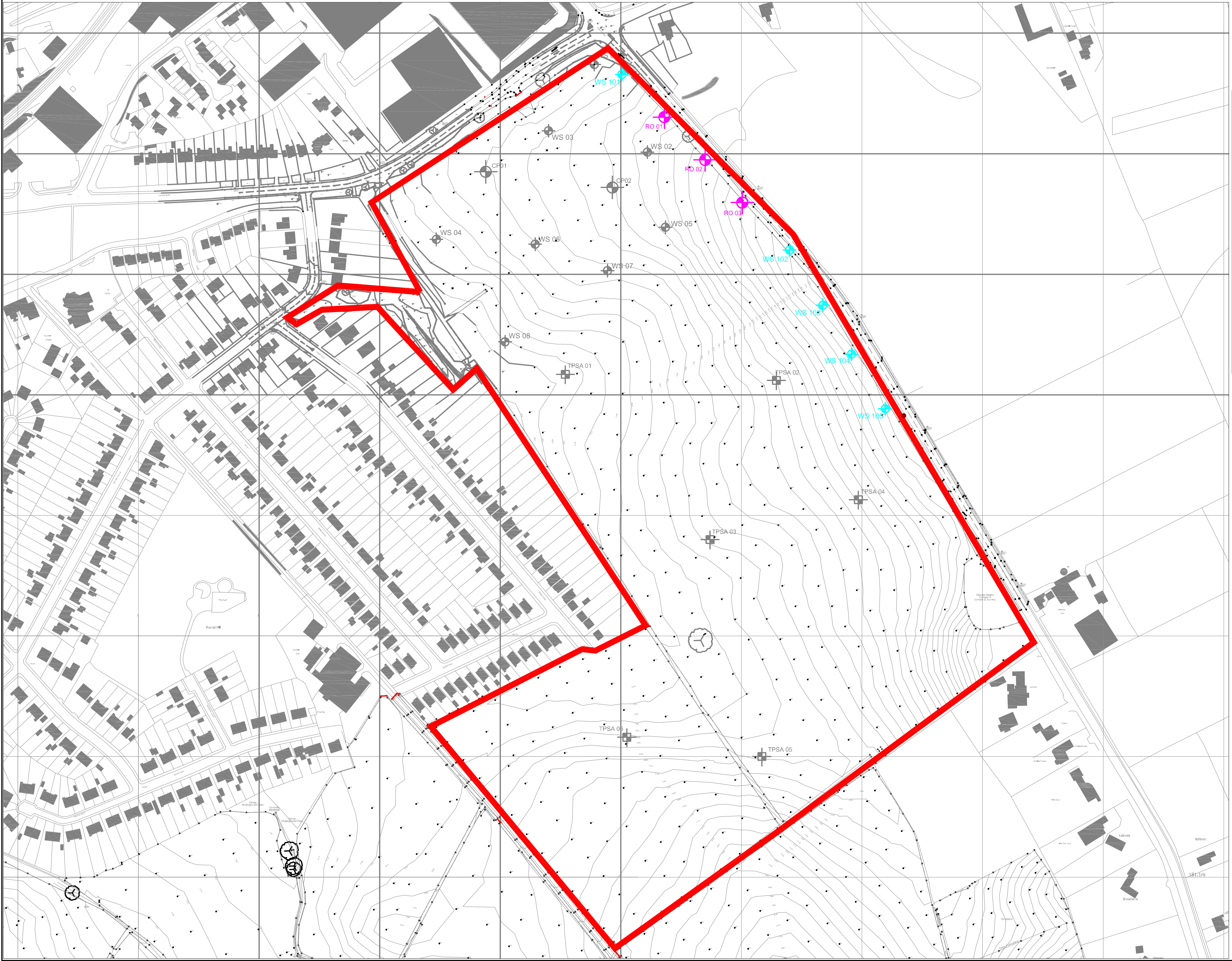
Certification is not a requirement of Amber 1 sites, however BS 8485:2015 recommends that all membranes are verified in accordance with CIRIA C735. In addition, the Local Authority may require all membrane installations to be independently verified. This should be confirmed with the Local Authority prior to development.

In general, the available data is considered consistent with the recorded and verified inert nature of the waste deposited in the onsite landfill and the made ground encountered at the Site boundary. This is not considered to be a significant source of ground gas.

Monitoring data received from the EA indicates that the former landfill at Sutton Quarry poses a low risk to the development site. The data suggests that any gas generated within the landfill is well controlled and does not migrate to the perimeter. Generation levels within the former landfill are likely to be low indicated by the quarterly frequency of monitoring.

The data indicates that there is very low risk to the proposed development end users from ground gas.

Appendix A Borehole Location Plan



GENERAL NOTES

NO DIMENSIONS TO BE SCALED OFF THIS DRAWING.

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS.

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.

ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

KEY

Symbol	Description
(red outline)	Denotes approximate location of site boundary
TPSA 01	Approximate location and reference of Machine Excavated Trial Pit Soakaway Test undertaken by RLE
CP 01	Approximate location and reference of historic Cable Percussive Borehole excavated by RLE
WS 01 (grey)	Approximate location and reference of historic Window Sample Borehole excavated by RLE
WS 01 (cyan)	Approximate location and reference of Window Sample Borehole
RO 01	Approximate location and reference of Rotary Borehole

Rev.	Date	Amendments	By	Chk. by

RODGERS LEASK ENVIRONMENTAL
Consulting Geotechnical & Environmental Engineers

Client
Hallam Land Management

Project
Land Off Low Moor Road
Sutton in Ashfield

Drawing Title
Borehole Location Plan

Status
INFORMATION

Scale	Drawn	Checked	Date
NTS	VH	RW	19/01/18

Project No.	Drawing No.	Rev.
P16-549	101	O

File Path:
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Appendix B Borehole Logs

Borehole Log

Borehole No. **WS101**

Sheet 1 of 1

Project Name:	Low Moor Road, Sutton-in-Ashfield	Project No. P16-549	Co-ords:	451601E - 358566N	Hole Type WLS
Location:	Sutton In Ashfield		Level:		Scale 1:50
Client:	Hallam Land Management		Dates:	13/02/2018	Logged By RW

Sample and In Situ Testing				Level (m)	Depth (m)	Stratum Description	Legend	Water Strikes	Well
Depth (m)	Ref.	Type	Results						
					0.20	MADE GROUND comprising reddish brown slightly clayey sandy slightly gravelly reworked agricultural TOPSOIL. Gravel is sub-angular to sub-rounded, fine to coarse quartzite, brick, concrete and sandstone.			
					0.40	Firm dark brown mottled yellow sandy CLAY.			
						Reddish orange gravelly SAND. Gravel is sub-rounded, fine to coarse quartzite.			
					1.00	End of Borehole at 1.000m			

Remarks

1. Rig refusal at 1.0m 2. No water encountered 3. Ground gas ancillaries installed to 1.0m

Borehole Log

Borehole No. **WS102**

Sheet 1 of 1

Project Name:	Low Moor Road, Sutton-in-Ashfield	Project No. P16-549	Co-ords:	451735E - 358417N	Hole Type WLS
Location:	Sutton In Ashfield		Level:		Scale 1:50
Client:	Hallam Land Management		Dates:	13/02/2018	Logged By RW

Sample and In Situ Testing				Level (m)	Depth (m)	Stratum Description	Legend	Water Strikes	Well
Depth (m)	Ref.	Type	Results						
					0.30	MADE GROUND comprising dark brown slightly clayey slightly sandy gravelly reworked agricultural TOPSOIL. Gravel is sub-angular to sub-rounded, fine to coarse coal, quartzite, sandstone and brick.			
					0.70	MADE GROUND comprising reddish orange clayey gravelly SAND. Gravel is sub-rounded, fine to coarse quartzite.			
						MADE GROUND comprising black brown sandy gravelly CLAY. Gravel is sub-angular to sub-rounded brick, coal, concrete, quartzite and tarmacadam.			
					2.00	End of Borehole at 2.000m			

Remarks

1. Rig refusal at 2.0m 2. No water encountered 3. Ground gas ancillaries installed to 2.0m

Borehole Log

Borehole No. **WS103**

Sheet 1 of 1

Project Name:	Low Moor Road, Sutton-in-Ashfield	Project No. P16-549	Co-ords:	451767E - 358374N	Hole Type WLS
Location:	Sutton In Ashfield		Level:		Scale 1:50
Client:	Hallam Land Management		Dates:	13/02/2018	Logged By RW

Sample and In Situ Testing				Level (m)		Depth (m)	Stratum Description	Legend	Water Strikes	Well
Depth (m)	Ref.	Type	Results							
						0.25	MADE GROUND comprising reddish brown clayey slightly gravelly reworked agriculutural TOPSOIL. Gravel sub-angular to sub-rounded, fine to coarse sandstone, brick and coal.			
					1		Reddish orange slightly clayey gravelly SAND. Gravel is sub-rounded, fine to coarse quartzite.			
					2					
					3					
					4	4.00	End of Borehole at 4.000m			
					5					
					6					
					7					
					8					
					9					
					10					

Remarks

1. Borehole terminated at 4.0m 2. No water encountered 3. Ground gas ancillaries installed to 4.0m

Borehole Log

Borehole No. **WS104**

Sheet 1 of 1

Project Name:	Low Moor Road, Sutton-in-Ashfield	Project No. P16-549	Co-ords:	451791E - 358334N	Hole Type WLS
Location:	Sutton In Ashfield		Level:		Scale 1:50
Client:	Hallam Land Management		Dates:	13/02/2018	Logged By RW

Sample and In Situ Testing				Level (m)	Depth (m)	Stratum Description	Legend	Water Strikes	Well
Depth (m)	Ref.	Type	Results						
					0.20	MADE GROUND comprising reddish brown clayey slightly gravelly reworked agricultural TOPSOIL. Gravel sub-angular to sub-rounded, fine to coarse sandstone, brick and coal.			
						Yellow orange slightly clayey gravelly SAND. Gravel is sub-rounded, fine to coarse quartzite.			
					1.50	End of Borehole at 1.500m			

Remarks

1. Rig refusal at 1.5m 2. No water encountered 3. Ground gas ancillaries installed to 1.5m

Borehole Log

Borehole No. **WS105**

Sheet 1 of 1

Project Name:	Low Moor Road, Sutton-in-Ashfield	Project No. P16-549	Co-ords:	451320E - 358292N	Hole Type WLS
Location:	Sutton In Ashfield		Level:		Scale 1:50
Client:	Hallam Land Management		Dates:	13/02/2018	Logged By RW

Sample and In Situ Testing				Level (m)	Depth (m)	Stratum Description	Legend	Water Strikes	Well
Depth (m)	Ref.	Type	Results						
					0.25	MADE GROUND comprising reddish brown clayey slightly gravelly reworked agricultural TOPSOIL. Gravel sub-angular to sub-rounded, fine to coarse sandstone, brick and coal.			
						Reddish brown slightly clayey SAND.			
					0.90	End of Borehole at 0.900m			

Remarks

1. Rig refusal at 0.9m 2. No water encountered 3. Ground gas ancillaries installed to 0.9m

Borehole Log

Borehole No. **RO 01**

Sheet 1 of 1

Project Name:	Low Moor Road, Sutton-in-Ashfield	Project No. P16-549	Co-ords:	451636E - 358530N	Hole Type RO
Location:	Sutton In Ashfield		Level:		Scale 1:50
Client:	Hallam Land Management		Dates:	13/02/2018	Logged By DS

Sample and In Situ Testing				Level (m)		Depth (m)	Stratum Description	Legend	Water Strikes	Well
Depth (m)	Ref.	Type	Results							
							MADE GROUND comprising dark brown clayey TOPSOIL			
					1	0.90	Dense brown SAND & GRAVEL			
					2					
					3	3.00	Weak reddish brown SANDSTONE			
					4					
					5					
					6					
					7					
					8					
					9					
					10	10.00	End of Borehole at 10.000m			

Remarks

1. No water encountered 2. Gas monitoring ancillaries installed to 10.0m

Borehole Log

Borehole No. **RO 02**

Sheet 1 of 1

Project Name:	Low Moor Road, Sutton-in-Ashfield	Project No. P16-549	Co-ords:	451668E - 358491N	Hole Type RO
Location:	Sutton In Ashfield		Level:		Scale 1:50
Client:	Hallam Land Management		Dates:	13/02/2018	Logged By DS

Sample and In Situ Testing				Level (m)		Depth (m)	Stratum Description	Legend	Water Strikes	Well
Depth (m)	Ref.	Type	Results							
							MADE GROUND comprising dense brown SAND & GRAVEL			
					1	0.90	MADE GROUND comprising concrete obstructions			
					2					
					3					
					4					
					5					
					6					
					7	7.00	Weak reddish brown SANDSTONE			
					8					
					9					
					10	10.00	End of Borehole at 10.000m			

Remarks

1. No water encountered 2. Gas monitoring ancillaries installed to 10.0m

Borehole Log

Borehole No. **RO 03**

Sheet 1 of 1

Project Name:	Low Moor Road, Sutton-in-Ashfield	Project No. P16-549	Co-ords:	451701E - 358454N	Hole Type RO
Location:	Sutton In Ashfield		Level:		Scale 1:50
Client:	Hallam Land Management		Dates:	13/02/2018	Logged By DS

Sample and In Situ Testing				Level (m)		Depth (m)	Stratum Description	Legend	Water Strikes	Well
Depth (m)	Ref.	Type	Results							
							MADE GROUND comprising dark brown clayey TOPSOIL			
					1	1.00	MADE GROUND comprising solid concrete obstruction			
					2					
					3					
					4	4.00	End of Borehole at 4.000m			
					5					
					6					
					7					
					8					
					9					
					10					

Remarks

1. Borehole terminated in concrete, moved 1m to east (RO 03A)

Borehole Log

Borehole No. **RO 03A**

Sheet 1 of 1

Project Name:	Low Moor Road, Sutton-in-Ashfield	Project No. P16-549	Co-ords:	451702E - 358453N	Hole Type RO
Location:	Sutton In Ashfield		Level:		Scale 1:50
Client:	Hallam Land Management		Dates:	13/02/2018	Logged By DS

Sample and In Situ Testing				Level (m)		Depth (m)	Stratum Description	Legend	Water Strikes	Well
Depth (m)	Ref.	Type	Results							
							MADE GROUND comprising dark brown clayey TOPSOIL			
					1	1.00	MADE GROUND comprising concrete obstructions			
					2					
					3					
					4					
					5	5.00	Weak reddish brown SANDSTONE			
					6					
					7					
					8					
					9					
					10	10.00	End of Borehole at 10.000m			

Remarks

1. No water encountered 2. Gas monitoring ancillaries installed to 8.0m due to partial collapse between 8-10m

Appendix C Further Gas Monitoring Records

Ground Gas Monitoring Form

Site Name:	Low Moor Road, Sutton in Ashfield	**RLE Engineer:**	RW
Job No.	P16-549	**Date:**	14/02/2018

Atmospheric Pressure:	999-998 mb	**Weather Conditions:**	Overcast
State:	Falling	**Temperature:**	5℃

Time	BH Ref.	Gas Flow Rate (l/hr)		B/H Pressure (Pa)	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		CO (% ppm)		H2S (% ppm)		Depth of Borehole installation (m bgl)	Depth to Water (m bgl)	Barom mb
		Initial	Steady		Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady			
14:05	**WS01**	<0.1	<0.1	0	<0.1	<0.1	3.8	3.8	14.8	14.8	0	0	0	0	2.00	Dry	999
14:09	**WS02**	<0.1	0.1	-2	<0.1	<0.1	3.9	3.9	14.4	14.4	0	0	0	0	3.20	-	999
14:25	**WS03**	<0.1	-0.1	-1	<0.1	<0.1	0.4	0.5	21.1	21.1	0	0	0	0	2.50	2.42	999
14:29	**WS04**	-0.2	-0.1	-5	<0.1	<0.1	1.6	2.0	10.6	7.1	0	0	0	0	1.00	Dry	999
14:33	**WS05**	<0.1	0.1	-11	<0.1	<0.1	5.5	5.5	9.1	9.1	0	0	0	0	4.00	Dry	999
	WS06																
14:40	**WS07**	<0.1	-2.0	+1	<0.1	<0.1	1.0	1.0	16.5	15.9	0	0	0	0	1.80	Dry	999
	WS08																
14:45	**CPBH01**	<0.1	<0.1	+1	0.1	0.1	0.9	0.9	15.9	15.9	0	0	0	0	8.5	Dry	999
15:06	**CPBH02**	<0.1	<0.1	-1	2.2	2.1	3.2	3.2	0.5	0.5	0	0	0	0	3.45	Dry	999
15:55	**WS101**	-0.1	-0.1	-1	<0.1	<0.1	0.5	0.5	19.1	19.0	0	0	0	0	0.9	Dry	998
15:48	**WS102**	-0.1	-0.1	-2	<0.1	<0.1	2.6	2.6	11.2	10.9	0	0	0	0	1.75	Dry	998
15:40	**WS103**	<0.1	<0.1	0	<0.1	<0.1	2.6	2.6	15.8	15.9	0	0	0	0	3.9	Dry	998
15:36	**WS104**	<0.1	<0.1	0	<0.1	<0.1	1.1	1.1	18.7	18.7	0	0	0	0	1.5	Dry	998
15:25	**WS105**	<0.1	<0.1	0	<0.1	<0.1	0.6	0.6	11.0	11.9	0	0	0	0	1.0	Dry	998
15:10	**RO01**	+0.1	<0.1	0	<0.1	<0.1	4.5	4.5	13.0	12.0	0	0	0	0	10.0	Dry	998
14:58	**RO02**	<0.1	<0.1	0	<0.1	<0.1	3.5	3.5	10.8	9.5	0	0	0	0	10.0	Dry	998
14:50	**RO03**	-0.1	-0.1	-1	<0.1	<0.1	4.8	4.8	13.2	13.2	0	0	0	0	10.0	Dry	998

NOTES
Monitoring order is from **Left to Right** across this table (expect when using a PID, which should be used first).
Monitoring should be for **NO less than 3 minutes**, unless there have been fluctuations between initial and steady state recorded during the 3 minutes, or high concentrations of gases are initially recorded. Monitoring should then be up to 10 minutes or steady state.

Equipment used:	Infra Red Gas Analyser	Geotechnical Instruments GA2000 Gas Analyser	**Last calibrated:**	04/05/2018
	MiniRAE PID	-	**Last calibrated:**	-
Visible signs of vegetation Stress:		No		
Other Comments/ Observations/Tests:		Bung Stuck Tight in WS02. WS06 and WS07 lost.		

Ground Gas Monitoring Form

Site Name:	Low Moor Road, Sutton in Ashfield	RLE Engineer:	RW
Job No.	P16-549	Date:	21/02/2018

Atmospheric Pressure:	1000-1001 mb	Weather Conditions:	Overcast
State:	Rising	Temperature:	6℃

Time	BH Ref.	Gas Flow Rate (l/hr)		B/H Pressure (Pa)	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		CO (% ppm)		H2S (% ppm)		Depth of Borehole installation (m bgl)	Depth to Water (m bgl)	Barom mb
		Initial	Steady		Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady			
10:15	**WS01**	<0.1	<0.1	0	<0.1	<0.1	3.6	3.5	15.0	15.0	0	0	0	0	2.00	Dry	1000
10:21	**WS02**	<0.1	<0.1	0	<0.1	<0.1	3.1	3.1	15.1	15.1	0	0	0	0	3.20	-	1000
10:26	**WS03**	<0.1	<0.1	0	<0.1	<0.1	0.6	0.7	20.9	20.9	0	0	0	0	2.50	2.42	1000
10:33	**WS04**	<0.1	<0.1	0	<0.1	<0.1	1.6	2.0	11.0	11.0	0	0	0	0	1.00	Dry	1000
10:45	**WS05**	<0.1	<0.1	1	<0.1	<0.1	5.0	5.0	9.6	9.6	0	0	0	0	4.00	Dry	1001
	WS06																
10:49	**WS07**	<0.1	<0.1	2	<0.1	<0.1	1.7	1.9	17.2	17.2	0	0	0	0	1.80	Dry	1001
	WS08																
10:55	**CPBH01**	<0.1	<0.1	2	0.1	0.1	1.8	1.8	15.2	15.2	0	0	0	0	8.5	Dry	1001
11:06	**CPBH02**	<0.1	<0.1	1	0.6	0.5	2.3	2.3	0.5	0.5	0	0	0	0	3.45	Dry	1001
8:45	**WS101**	<0.1	<0.1	-1	<0.1	<0.1	1.1	1.1	19.0	19.0	0	0	0	0	0.9	Dry	1000
8:51	**WS102**	<0.1	<0.1	-2	<0.1	<0.1	7.3	7.2	11.0	11.0	0	0	0	0	1.75	Dry	1000
8:59	**WS103**	<0.1	<0.1	-1	<0.1	<0.1	4.3	4.4	15.0	15.0	0	0	0	0	3.9	Dry	1000
9:05	**WS104**	<0.1	<0.1	-2	<0.1	<0.1	1.7	1.7	18.1	18.1	0	0	0	0	1.5	Dry	1000
9:15	**WS105**	<0.1	<0.1	0	<0.1	<0.1	4.1	4.2	11.3	11.3	0	0	0	0	1.0	Dry	1000
9:21	**RO01**	<0.1	<0.1	-2	<0.1	<0.1	8.1	8.1	13.3	13.3	0	0	0	0	10.0	Dry	1000
9:30	**RO02**	<0.1	<0.1	-2	<0.1	<0.1	8.0	8.0	10.3	10.3	0	0	0	0	10.0	Dry	1000
9:39	**RO03**	-0.1	-0.1	-1	<0.1	<0.1	4.5	4.5	14.0	14.0	0	0	0	0	10.0	Dry	1000

NOTES
Monitoring order is from **Left to Right** across this table (expect when using a PID, which should be used first).
Monitoring should be for **NO less than 3 minutes**, unless there have been fluctuations between initial and steady state recorded during the 3 minutes, or high concentrations of gases are initially recorded. Monitoring should then be up to 10 minutes or steady state.

Equipment used:	Infra Red Gas Analyser	Geotechnical Instruments GA5000 Gas Analyser	Last calibrated:	
	MiniRAE PID	-	Last calibrated:	-
Visible signs of vegetation Stress:		-		
Other Comments/ Observations/Tests:		Bung Stuck Tight in WS02 and WS06 lost.		

Ground Gas Monitoring Form

Site Name:	Low Moor Road, Sutton in Ashfield	**RLE Engineer:**	RW
Job No.	P16-549	**Date:**	08/03/2018

Atmospheric Pressure:	979-976 mb	**Weather Conditions:**	Fine
State:	Falling	**Temperature:**	4 ℃

Time	BH Ref.	Gas Flow Rate (l/hr)		B/H Pressure (Pa)	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		CO (% ppm)		H2S (% ppm)		Depth of Borehole installation (m bgl)	Depth to Water (m bgl)	Barom mb
		Initial	Steady		Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady			
14:04	**WS01**	<0.1	<0.1	-1	<0.1	<0.1	2.9	3.0	16.3	16.2	0	0	0	0	2.00	Dry	978
14:25	**WS02**	<0.1	<0.1	-2	<0.1	<0.1	2.2	2.3	19.5	19.4	0	0	0	0	3.20	-	977
14:00	**WS03**	<0.1	<0.1	-5	<0.1	<0.1	0.3	0.3	20.5	20.5	0	0	0	0	2.50	2.45	978
13:50	**WS04**	+0.1	+0.1	+7	<0.1	<0.1	0.8	0.9	5.9	4.9	0	0	0	0	1.00	Dry	979
15:40	**WS05**	<0.1	<0.1	+1	<0.1	<0.1	0.3	0.3	20.1	20.1	0	0	0	0	4.00	Dry	976
	WS06														2.60		
16.00	**WS07**	<0.1	<0.1	0	<0.1	<0.1	0.5	0.6	19.1	19.3	0	0	0	0	1.80	Dry	976
	WS08														2.50		
13:45	**CPBH01**	-0.3	<0.1	0	<0.1	<0.1	1.2	1.2	10.2	10.4	0	0	0	0	8.5	3.35	979
15:20	**CPBH02**	<0.1	<0.1	+5	2.1	2.1	4.0	3.9	0.4	<0.1	0	0	0	0	3.45	Dry	976
14:10	**WS101**	<0.1	<0.1	+1	<0.1	<0.1	0.5	0.5	19.5	19.6	0	0	0	0	0.9	Dry	978
14:45	**WS102**	+0.2	+0.1	+9	<0.1	<0.1	1.8	1.7	18.4	18.5	0	0	0	0	1.75	Dry	976
14:50	**WS103**	+0.1	<0.1	+40	<0.1	<0.1	2.7	2.8	17.3	17.4	0	0	0	0	3.9	Dry	976
15:00	**WS104**	<0.1	<0.1	+1	<0.1	<0.1	0.5	0.5	19.2	19.2	0	0	0	0	1.5	Dry	976
15:15	**WS105**	<0.1	<0.1	+3	<0.1	<0.1	1.6	1.6	15.4	15.4	0	0	0	0	1.0	Dry	976
14:15	**RO01**	<0.1	<0.1	-5	<0.1	<0.1	<0.1	<0.1	20.7	20.7	0	0	0	0	10.0	9.25	977
14:30	**RO02**	+0.4	+0.1	-1	<0.1	<0.1	0.9	1.0	20.1	20.1	0	0	0	0	10.0	Dry	977
14:40	**RO03**	<0.1	<0.1	+2	<0.1	<0.1	4.3	4.2	13.8	14.0	0	0	0	0	10.0	Dry	977

NOTES
Monitoring order is from **Left to Right** across this table (expect when using a PID, which should be used first).
Monitoring should be for **NO less than 3 minutes**, unless there have been fluctuations between initial and steady state recorded during the 3 minutes, or high concentrations of gases are initially recorded. Monitoring should then be up to 10 minutes or steady state.

Equipment used:	Infra Red Gas Analyser	Geotechnical Instruments GA2000 Gas Analyser	**Last calibrated:**	05/04/2017
	MiniRAE PID	-	**Last calibrated:**	-
Visible signs of vegetation Stress:		No		
Other Comments/ Observations/Tests:		WS06 and WS08 lost – Bung stuck in WS02		

Ground Gas Monitoring Form

Site Name:	Low Moor Road, Sutton in Ashfield	**RLE Engineer:**	AG
Job No.	P16-549	**Date:**	16/04/2018

Atmospheric Pressure:	993-996 mb	**Weather Conditions:**	Overcast
State:	Rising	**Temperature:**	11 ℃

Time	BH Ref.	Gas Flow Rate (l/hr)		B/H Pressure (Pa)	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		CO (% ppm)		H2S (% ppm)		Depth of Borehole installation (m bgl)	Depth to Water (m bgl)	Barom mb
		Initial	Steady		Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady			
11:30	**WS01**	<0.1	<0.1	-50	<0.1	<0.1	3.3	3.3	14.2	14.2	0	0	0	0	2.00	Dry	993
12:00	**WS02**	<0.1	0.1	-2	<0.1	<0.1	3.7	3.7	14.6	14.6	0	0	0	0	3.20	-	993
13:15	**WS03**	<0.1	-0.1	-50	<0.1	<0.1	0.4	0.5	21.1	21.1	0	0	0	0	2.50	2.42	994
13:50	**WS04**	-1.3	-0.1	-30	<0.1	<0.1	1.6	2.2	10.6	7.1	0	0	0	0	1.00	Dry	996
13:15	**WS05**	<0.1	0.1	-220	<0.1	<0.1	5.5	5.4	9.2	9.1	1	1	1	1	4.00	Dry	994
	WS06														2.60		
14:10	**WS07**	<0.1	-5.1	-4	<0.1	<0.1	1.7	1.9	16.0	15.8	1	1	2	2	1.80	Dry	996
	WS08														2.50		
13:40	**CPBH01**	<0.1	<0.1	+5	0.1	0.1	1.8	1.7	14.6	15.4	1	1	1	1	8.5	Dry	996
13:30	**CPBH02**	<0.1	<0.1	-35	1.9	1.9	4.1	4.0	0.3	0.2	0	0	2	2	3.45	Dry	994
11:40	**WS101**	-0.1	<0.1	0	<0.1	<0.1	0.8	0.8	19.2	19.1	0	0	0	0	0.9	Dry	993
12:25	**WS102**	<0.1	-0.1	-5	<0.1	<0.1	1.7	4.9	19.6	14.1	1	1	0	0	1.75	Dry	994
12:40	**WS103**	<0.1	-0.1	0	<0.1	<0.1	4.9	3.6	15.9	17.7	0	0	1	1	3.9	Dry	994
12:45	**WS104**	<0.1	-0.1	0	<0.1	<0.1	0.6	0.7	20.5	20.3	1	1	0	0	1.5	Dry	994
12:50	**WS105**	-0.1	-0.1	+4	<0.1	<0.1	2.9	3.0	13.0	12.7	1	1	1	1	1.0	Dry	994
11:50	**RO01**	<0.1	<0.1	-8	<0.1	<0.1	6.2	6.6	14.3	13.8	1	1	0	0	10.0	Dry	993
12:10	**RO02**	<0.1	<0.1	-5	<0.1	<0.1	1.9	1.7	18.2	18.7	0	0	0	0	10.0	Dry	993
12:20	**RO03**	<0.1	<0.1	-7	<0.1	<0.1	3.6	3.3	15.5	16.1	1	1	1	1	10.0	Dry	993

NOTES
Monitoring order is from **Left to Right** across this table (expect when using a PID, which should be used first).
Monitoring should be for **NO less than 3 minutes**, unless there have been fluctuations between initial and steady state recorded during the 3 minutes, or high concentrations of gases are initially recorded. Monitoring should then be up to 10 minutes or steady state.

Equipment used:	Infra Red Gas Analyser	Geotechnical Instruments GA5000 Gas Analyser	**Last calibrated:**	03/01/2018
	MiniRAE PID	-	**Last calibrated:**	-
Visible signs of vegetation Stress:		No		
Other Comments/ Observations/Tests:		Bung Stuck Tight in WS02. WS06 and WS07 lost.		

Ground Gas Monitoring Form

Site Name:	Low Moor Road, Sutton in Ashfield	**RLE Engineer:**	RW
Job No.	P16-549	**Date:**	30/04/2018

Atmospheric Pressure:	989-988 mb	**Weather Conditions:**	Overcast
State:	Falling	**Temperature:**	10℃

Time	BH Ref.	Gas Flow Rate (l/hr)		B/H Pressure (Pa)	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		CO (% ppm)		H2S (% ppm)		Depth of Borehole installation (m bgl)	Depth to Water (m bgl)	Barom mb
		Initial	Steady		Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady			
10:10	**WS01**	<0.1	<0.1	-5	<0.1	<0.1	3.8	3.8	14.8	14.8	0	0	0	0	2.00	Dry	988
10:16	**WS02**	<0.1	0.1	-21	<0.1	<0.1	3.9	3.9	14.4	14.4	0	0	0	0	3.20	-	988
10:25	**WS03**	<0.1	-0.1	-5	<0.1	<0.1	0.4	0.5	21.1	21.1	0	0	0	0	2.50	2.42	988
10:33	**WS04**	-0.2	-0.1	-11	<0.1	<0.1	1.6	2.0	10.6	7.1	0	0	0	0	1.00	Dry	988
10:40	**WS05**	<0.1	0.1	-25	<0.1	<0.1	5.5	5.5	9.1	9.1	0	0	0	0	4.00	Dry	988
	WS06																
10:45	**WS07**	<0.1	-0.1	-4	<0.1	<0.1	1.7	1.9	16.0	15.8	1	1	2	2	1.80	Dry	988
	WS08																
10:55	**CPBH01**	<0.1	<0.1	+5	0.1	0.1	1.8	1.7	14.6	15.4	1	1	1	1	8.5	Dry	988
11:06	**CPBH02**	<0.1	<0.1	-3	2.2	2.1	4.1	3.5	0.3	0.2	0	0	2	2	3.45	Dry	988
8:55	**WS101**	-0.1	-0.1	-5	<0.1	<0.1	1.5	1.5	19.4	19.1	0	0	0	0	0.9	Dry	989
9:26	**WS102**	-0.1	-0.1	-2	<0.1	<0.1	7.7	7.7	11.0	10.9	0	0	0	0	1.75	Dry	989
9:35	**WS103**	<0.1	<0.1	0	<0.1	<0.1	4.3	4.4	15.3	15.3	0	0	0	0	3.9	Dry	989
9:45	**WS104**	<0.1	<0.1	-2	<0.1	<0.1	1.7	1.7	18.7	18.7	0	0	0	0	1.5	Dry	988
9:50	**WS105**	<0.1	<0.1	0	<0.1	<0.1	4.5	4.5	11.7	11.7	0	0	0	0	1.0	Dry	988
9:10	**RO01**	+0.1	<0.1	-2	<0.1	<0.1	8.4	8.4	13.4	12.4	0	0	0	0	10.0	Dry	989
9:15	**RO02**	<0.1	<0.1	-2	<0.1	<0.1	7.7	8.1	10.3	9.9	0	0	0	0	10.0	Dry	989
9:20	**RO03**	-0.1	-0.1	-1	<0.1	<0.1	4.8	4.7	14.1	13.8	0	0	0	0	10.0	Dry	989

NOTES
Monitoring order is from **Left to Right** across this table (expect when using a PID, which should be used first).
Monitoring should be for **NO less than 3 minutes**, unless there have been fluctuations between initial and steady state recorded during the 3 minutes, or high concentrations of gases are initially recorded. Monitoring should then be up to 10 minutes or steady state.

Equipment used:	Infra Red Gas Analyser	Geotechnical Instruments GA5000 Gas Analyser	**Last calibrated:**	03/01/2018
	MiniRAE PID	-	**Last calibrated:**	-
Visible signs of vegetation Stress:		No		
Other Comments/ Observations/Tests:		Bung Stuck Tight in WS02. WS06 and WS07 lost.		

Ground Gas Monitoring Form

Site Name:	Low Moor Road, Sutton in Ashfield	**RLE Engineer:**	AG
Job No.	P16-549	**Date:**	11/05/2018

Atmospheric Pressure:	994-993 mb	**Weather Conditions:**	Fine
State:	Falling	**Temperature:**	20℃

Time	BH Ref.	Gas Flow Rate (l/hr)		B/H Pressure (Pa)	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		CO (% ppm)		H2S (% ppm)		Depth of Borehole installation (m bgl)	Depth to Water (m bgl)	Barom mb
		Initial	Steady		Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady			
15:11	**WS01**	<0.1	<0.1	0	<0.1	<0.1	3.9	3.1	14.0	14.0	0	0	0	0	2.00	Dry	993
15:20	**WS02**	<0.1	0.1	6	<0.1	<0.1	3.4	3.5	14.6	14.5	0	0	0	0	3.20	-	993
15:26	**WS03**	<0.1	<0.1	5	<0.1	<0.1	0.4	0.5	21.1	21.0	0	0	0	0	2.50	2.42	993
15:35	**WS04**	<0.1	<0.1	0	<0.1	<0.1	1.6	1.7	10.6	7.9	0	0	0	0	1.00	Dry	993
15:45	**WS05**	-0.1	<0.1	1	<0.1	<0.1	5.9	5.7	9.2	9.2	0	0	0	0	4.00	Dry	993
	WS06														2.60		
15:51	**WS07**	<0.1	<0.1	1	<0.1	<0.1	1.7	1.9	16.0	15.9	0	0	0	0	1.80	Dry	993
	WS08														2.50		
15:55	**CPBH01**	<0.1	<0.1	-5	<0.1	0.1	1.8	1.7	14.6	15.1	1	0	0	0	8.5	Dry	993
16:03	**CPBH02**	<0.1	<0.1	-3	1.2	1.1	4.0	4.0	0.5	0.2	0	0	1	1	3.45	Dry	993
13.55	**WS101**	-0.1	<0.1	0	<0.1	<0.1	0.8	0.8	19.0	19.0	0	0	0	0	0.9	Dry	994
14:05	**WS102**	<0.1	<0.1	1	<0.1	<0.1	1.7	4.9	15.1	14.5	1	1	0	0	1.75	Dry	994
14:11	**WS103**	<0.1	<0.1	0	<0.1	<0.1	4.5	4.2	15.9	17.7	0	0	1	1	3.9	Dry	994
14:17	**WS104**	<0.1	<0.1	0	<0.1	<0.1	0.6	0.7	20.1	20.3	1	1	0	0	1.5	Dry	994
14:25	**WS105**	-0.1	-0.1	3	<0.1	<0.1	2.9	2.9	13.2	12.9	1	1	1	1	1.0	Dry	994
14:33	**RO01**	<0.1	<0.1	1	<0.1	<0.1	6.7	6.8	14.9	13.9	1	1	0	0	10.0	Dry	994
14:41	**RO02**	<0.1	<0.1	2	<0.1	<0.1	1.9	1.7	18.0	18.9	0	0	0	0	10.0	Dry	994
14:45	**RO03**	<0.1	<0.1	8	<0.1	<0.1	3.9	4.1	16.5	16.9	0	0	0	0	10.0	Dry	994

NOTES
Monitoring order is from **Left to Right** across this table (expect when using a PID, which should be used first).
Monitoring should be for **NO less than 3 minutes**, unless there have been fluctuations between initial and steady state recorded during the 3 minutes, or high concentrations of gases are initially recorded. Monitoring should then be up to 10 minutes or steady state.

Equipment used:	Infra Red Gas Analyser	Geotechnical Instruments GA2000 Gas Analyser	**Last calibrated:**	03/05/2018
	MiniRAE PID	-	**Last calibrated:**	-
Visible signs of vegetation Stress:		No		
Other Comments/ Observations/Tests:		Bung Stuck Tight in WS02. WS06 and WS07 lost.		

Appendix D Sutton Quarry Data

Site	Sutton	Sutton	Sutton	Sutton	Sutton
Sample Point	SU/01	SU/01	SU/02	SU/03	SU/04
Date	18/07/2016	26/07/2016	18/07/2016	18/07/2016	18/07/2016
Comment					
Atmospheric Pressure (mb)		999	1004	1003	1004
Carbon Dioxide (% v/v)		0	0	0.1	0
Flow (Internal) (l/h)		0	0	0	-0.3
Gas Screen Value Carbon Dioxide (l/h)		0	0	0	0
Gas Screen Value Methane (l/h)		0	0	0	0
Methane (% v/v)		0	0	0	0
Monitoring Point Status	UTM				
GAS	OVERGROWN	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Oxygen (% v/v)		20.7	19.8	19.8	19.5
Relative Pressure (mb)		0.16	0	0.05	0.12

	SU/01 05/01/2017	SU/02 05/01/2017	SU/03 05/01/2017	SU/04 05/01/2017
Atmospheric Pressure (mb)	1017	1017	1020	1019
Carbon Dioxide (% v/v)	0.1	0.1	0.1	0.1
Flow (Internal) (l/h)	0	0.1	0.2	0
Gas Screen Value Carbon Dioxide (l/h)	0	0	0	0
Gas Screen Value Methane (l/h)	0	0	0	0
Ground Condition Around Gas Well	Ground Damp/Wet	Ground Damp/Wet	Ground Damp/Wet	Ground Damp/Wet
Methane (% v/v)	0	0	0	0
Monitoring Point Status GAS	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Oxygen (% v/v)	21.7	22.1	21.5	21.5
Relative Pressure (mb)	-0.7	-0.46	-0.31	-0.19

	SU/01 19/04/2017	SU/02 19/04/2017	SU/03 19/04/2017	SU/04 19/04/2017
Atmospheric Pressure (mb)	1012	1015	1012	1012
Carbon Dioxide (% v/v)	0.1	0.1	0.1	0.1
Flow (Internal) (l/h)	-0.3	0.3	0.7	0.6
Gas Screen Value Carbon Dioxide (l/h)	0	0	0	0
Gas Screen Value Methane (l/h)	0	0	0	0
Ground Condition Around Gas Well	Ground Dry	Ground Dry	Ground Dry	Ground Dry
Methane (% v/v)	0	0	0	0
Monitoring Point Status GAS	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Oxygen (% v/v)	20.6	20.8	20	20.3
Relative Pressure (mb)	-0.43	-0.21	-0.21	-0.17

		Atmospheric Pressure (mb)	Carbon Dioxide (% v/v)	Flow (Internal) (l/h)	Gas Screen Value Carbon Dioxide (l/h)	Gas Screen Value Methane (l/h)
SU/01	05/07/2017	998	0.1	0.1	0	0
SU/02	05/07/2017	999	0.1	0	0	0
SU/03	31/07/2017	987	0.1	0.1	0	0
SU/04	31/07/2017	986	0.1	0	0	0

		Ground Condition Around Gas Well	Methane (% v/v)	Monitoring Point Status GAS	Oxygen (% v/v)	Relative Pressure (mb)
SU/01	05/07/2017	Ground Dry	0.1	Satisfactory	19.9	0.1
SU/02	05/07/2017	Ground Dry	0.1	Satisfactory	20.7	-0.08
SU/03	31/07/2017	Ground Dry	0	Satisfactory	20.9	-0.14
SU/04	31/07/2017	Ground Dry	0	Satisfactory	20.6	0.15

Monitoring Point	Date Sampled	Atmospheric Pressure (mb)	Carbon Dioxide (% v/v)	Flow (Internal) (l/h)	Gas Screen Value Carbon Dioxide (l/h)	Gas Screen Value Methane (l/h)
SU/01	18/10/2017	994	1.5	0.1	0	0
SU/02	18/10/2017	996	1.7	0	0	0
SU/03	18/10/2017	995	1.1	0.1	0	0
SU/04	18/10/2017	996	2.3	0.1	0	0

		Ground Condition Around Gas Well	Methane (% v/v)	Monitoring Point Status GAS	Oxygen (% v/v)	Relative Pressure (mb)
SU/01	18/10/2017	Ground Damp/ Wet	0	Satisfactory	20.1	0.27
SU/02	18/10/2017	Ground Damp/ Wet	0	Satisfactory	20.9	0.03
SU/03	18/10/2017	Ground Damp/ Wet	0	Satisfactory	20.4	-0.31
SU/04	18/10/2017	Ground Damp/ Wet	0	Satisfactory	19.7	-0.26

Monitoring Point	Date Sampled	Atmospheric Pressure (mb)	Carbon Dioxide (% v/v)	Flow (Internal) (l/h)	Gas Screen Value Carbon Dioxide (l/h)	Gas Screen Value Methane (l/h)	Ground Condition Around Gas Well
SU/01	31/01/2018	984	2	0.3	0	0	Ground Dry
SU/02	31/01/2018	984	4.3	0.6	0	0	Ground Dry
SU/03	31/01/2018	985	1.5	0.1	0	0	Ground Dry
SU/04	31/01/2018	984	2.1	0.2	0	0	Ground Dry

SU/01	31/01/2018	0.1	Satisfactory	17.6	1.87	
SU/02	31/01/2018	0.1	Satisfactory	16.7	1.75	
SU/03	31/01/2018	0.1	Satisfactory	18.8	0.09	
SU/04	31/01/2018	0.1	Satisfactory	18.5	0.09	