

Our ref: R2744-L20190925
Your ref: Ground Gas Risk Assessment

Ruth Roberts
The Towers Day Nursery
Llangollen Road
Acrefair
Wrexham
LL14 3SG

26 September 2019

By e-mail: ruth831@btinternet.com

Dear Ruth,

Ground Gas Risk Assessment

Smith Grant LLP (SGP) has been instructed to carry out a ground gas risk assessment at the above site in order to assess whether gas protection measures are required.

SGP understand that the building has been partially constructed and that a Visqueen membrane has been installed although this has not been subject to independent validation. Building Control has acknowledged the presence of the membrane during a site inspection although this was following the pouring of the slab and it is understood that this inspection was for the purpose of radon protection and not other ground gasses (methane and carbon dioxide).

A copy of an email between the Contaminated Land Officer (CLO) and Planning Officer dated 04 July 2019 has been provided which confirms that sufficient information has not been provided to demonstrate that gas protection from ground gases have been implemented. Three recommendations for further works were made by the CLO which are summarised in brief as:

1. Further detail on gas protection measures installed, or;
2. Risk assessment to establish whether gas protection measures are required, or;
3. The retrospective fitting of gas protection measures.

Background Review

To establish which of the above recommendations would be the most applicable to the site, SGP conducted a background review of the information made available to determine in the first instance whether a plausible ground gas source with the potential to impact the site was present and whether this would require assessment.

SGP has been provided with copies of the following reports:

- Geotechnics Phase 1 Desk Study (ref.PN183817)
- Geotechnics Ground Investigation (ref. PN193948)
- NKC Geotech Mining Investigation Report (ref. 1924)

Geotechnics Phase 1 Desk Study

The Geotechnics Desk Study Report identified one historical landfill (J C Edwards) located approximately 125m to the southeast which accepted inert, industrial and household waste. The potential presence of shallow mineworkings was also reported and recommendations were made for a gas monitoring programme to be conducted.

SGP has obtained a copy of correspondence from the CLO following review of the desk study which confirms that whilst Geotechnics report the historical landfill to be approximately 125m from the site, Local Authority records show the landfill to be approximately 35m away.

Geotechnics Ground Investigation

The Geotechnics Ground Investigation was limited to a desk-based Coal Mining Risk Assessment to address the potential risk from the coal mining legacy within the area, no intrusive works were carried. The report concluded that an intrusive mining investigation should be carried out to determine the presence of shallow mineworkings which could be present on the site.

NKC Geotech Mining Investigation

NKC carried out the drilling of 6 boreholes on the site, 1x 30m and 5x 15m in accordance with the recommendations made within the Geotechnics Ground Investigation Report. NKC concluded that there was no evidence of past mining activity below the proposed garage and that remedial works with respect to shallow mineworkings were not required.

Based on the totality of the reviewed information SGP conclude that no on-site sources of ground gas have been identified but that 1 off-site source (historical landfill) has the potential to impact the site and that a gas monitoring programme is required to establish whether gas protection measures are required.

Ground Gas Risk Assessment

Site Investigation

SGP attended site on 08.08.19 and drilled two boreholes (BH1 and BH2) around the partially constructed garage, the locations of the boreholes are provided in Drawing D01.

Boreholes were drilled to a maximum depth of 2m where refusal occurred due to shallow bedrock. Ground conditions were consistent with those reported by NKC with a surface cover of a granular fill underlain by a clayey coarse gravel to 2.m bgl where sandstone bedrock was encountered. Boreholes were installed with a gas monitoring standpipe with the well screen located between 0.5-1.5m bgl. Copies of the borehole logs and installation details are appended to this report.

Ground Gas Monitoring

A 6-week ground gas monitoring programme was carried out from 16.08.19 to 25.09.19, copies of the monitoring records are appended to this report.

Methane concentrations failed to exceed the gas analysers limit of detection (<0.1% v/v) during all the monitoring visits. Concentrations of carbon dioxide ranged from 1% v/v to a maximum concentration of 3.1% v/v.

No depleted oxygen concentrations were reported which ranged from 17.3% - 23.9% v/v with concentrations of carbon monoxide and carbon dioxide below limits of detection (<1%) on all occasions.

No positive flows were recorded during the monitoring period.

One round of gas monitoring was completed during a period of low atmospheric pressure (<1000mb), and 3 rounds (30.08.19, 20.09.19 and 25.09.19) were carried out when the pressure consistently dropped over the previous 3 days but remained above 1000mb.

Guidance published by CIRIA ("Assessing risk posed by hazardous ground gases to buildings", CIRIA C665, 2007), CIEH ("The Local Authority Guide to Ground Gas", CIEH, 2008) and BS8485:2007

("Code of Practice for the Characterisation and Remediation of Ground Gas in Affected Developments") has been referred to in determining potential risks posed by ground gases. Screening assessment criteria of 1% methane, 5% carbon dioxide and 0.07 l/hr gas screening value have been referred to initially. The gas screening value (GSV) is the product of gas concentration and flow.

Table 1. Ground Gas Monitoring Results

Well	No. visits	Max CH ₄ (%)	Max CO ₂ (%)	Max Flow (l/hr)	CH ₄ GSV (l/hr)	CO ₂ GSV (l/hr)	CIRIA Classification
BH1	6	<0.1	1.8	<0.1	<0.07	<0.07	CS1
BH2	6	<0.1	3.1	<0.1	<0.07	<0.07	CS1
Site ¹	6	<0.1	3.1	<0.1	<0.07	<0.07	CS1

1: Initial site classification is based on highest recorded flows and maximum recorded concentrations from the full dataset
 GSV – Gas Screening Value (=maximum concentration x maximum gas flow over monitoring period)
 Atmospheric pressure ranged from 1000mb to 1019mb

Gas Screening values (GSVs), calculated as the product of concentration and flow were all low, and concentrations of methane and carbon dioxide were below the respective thresholds in which gas protection measures would be required. The results classify the site as CIRIA CS1 "very low risk" meaning that there is no requirement for the installation of basic gas protection measures.

Conclusions

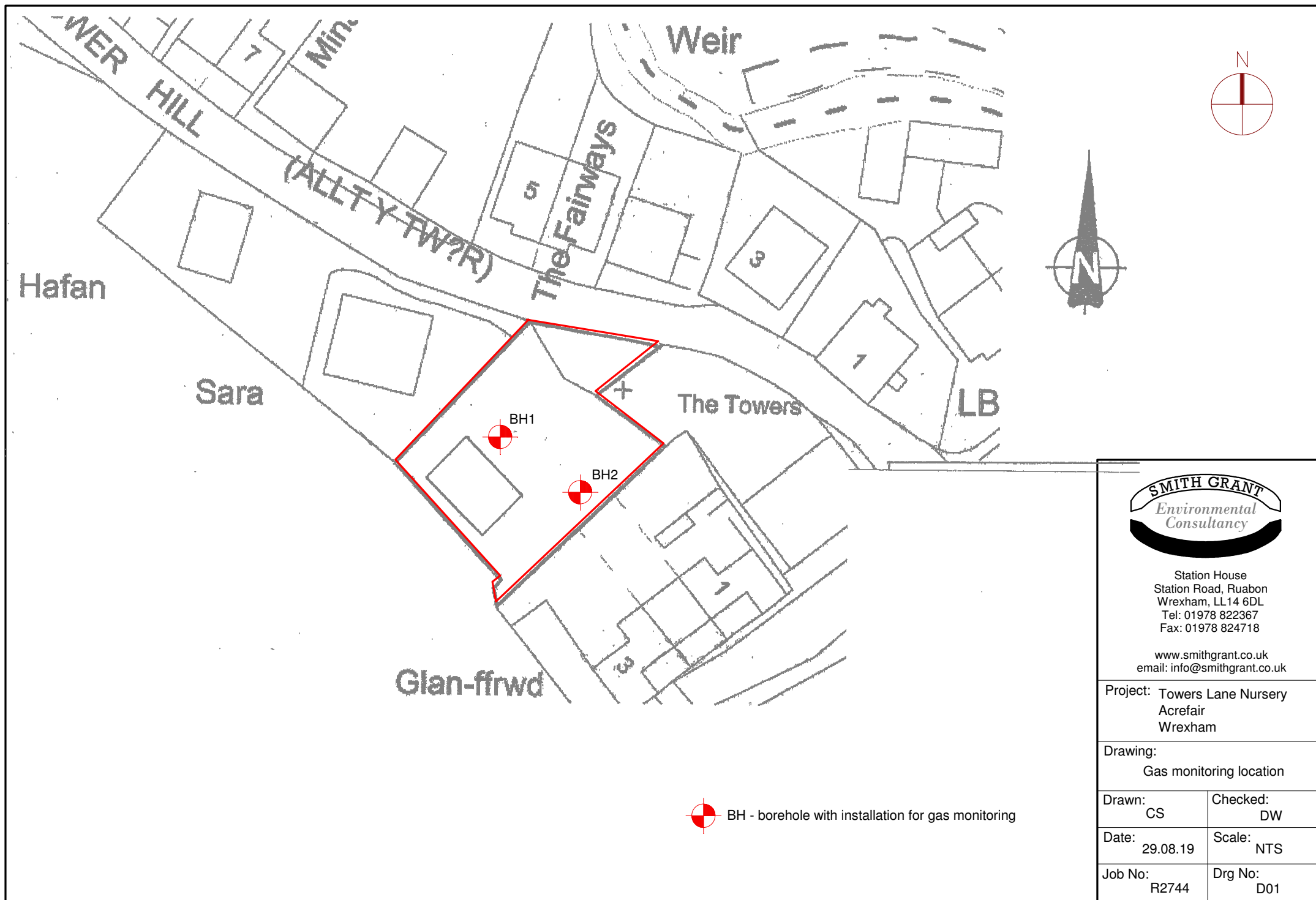
It is concluded that concentrations and flows of methane and carbon dioxide are below thresholds in which precautionary gas protection measures would be required in new buildings. Gas protection measures with regards to carbon dioxide and methane are not required, however it is understood that a Visqueen membrane has been installed within the building to mitigate against the potential ingress of radon and that this would provide precautionary level of protection in any case. It is considered that no further actions are required with respect to ground gas.

Yours sincerely
 for: Smith Grant LLP



D Wayland BSc MSc AssocCIWM MCIWEM C.WEM
 Partner

Enc:
 Drawing D01: Gas Monitoring Location Plan
 Borehole Logs: BH1 & BH2
 Gas Monitoring Record: G01-G06



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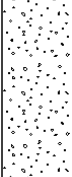
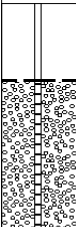
Project: Towers Lane Nursery
Acrefair
Wrexham

Drawing:
Gas monitoring location

Drawn: CS	Checked: DW
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Date: 29.08.19	Scale: NTS
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Job No: R2744	Drg No: D01
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Geo-Ventures (UK) Limited <i>Geotechnical and Environmental Services</i>						Site Towers Day Nursery, Acrefair, Wrexham		Borehole Number BH 1			
Boring Method Cable Percussion		Casing Diameter 150mm cased to 2.00m		Ground Level (mOD)		Client				Job Number 19-1825	
		Location		Dates 08/08/2019		Engineer Smith Grant LLP				Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr	
0.20 0.30 0.60	D D D					(0.25) 0.25 (0.15) 0.40 (0.30) 0.70	MADE GROUND : grey clayey sandy fine / medium angular gravel fill MADE GROUND : grey gravelly clayey soil fill Brown gravelly SILT Brown slightly clayey sandy coarse sub-rounded / sub-angular GRAVEL. Cobbles and boulders noted by driller	   			
1.20	D					(1.30)					
2.00	D					2.00	Complete at 2.00m				
Remarks Services inspection pit excavated by hand to 1.20m Water added to borehole to assist drilling								Scale (approx) 1:50	Logged By Dr J Crook	Figure No. 19-1825.BH 1	

Geo-Ventures (UK) Limited Geotechnical and Environmental Services							Site Towers Day Nursery, Acrefair, Wrexham		Borehole Number BH 2	
Boring Method Cable Percussion		Casing Diameter 150mm cased to 2.00m		Ground Level (mOD)		Client		Job Number 19-1825		
		Location		Dates 08/08/2019		Engineer Smith Grant LLP		Sheet 1/1		
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20	D					(0.25)	MADE GROUND : grey sandy fine / medium angular gravel fill			
0.40	D					0.25				
						(0.25)	MADE GROUND : brown clayey gravelly soil fill			
						0.50				
0.70	D					(0.30)	Brown gravelly SILT			
						0.80				
1.20	D					(1.20)	Brown slightly clayey sandy coarse sub-rounded / sub-angular GRAVEL. Cobbles and boulders noted by driller			
2.00	D					2.00	Complete at 2.00m			
Remarks Services inspection pit excavated by hand to 1.20m Water added to borehole to assist drilling Chiselling from 0.80m to 2.00m for 1.00 hour.								Scale (approx) 1:50	Logged By Dr J Crook	
								Figure No. 19-1825.BH 2		

Geo-Ventures (UK) Limited Geotechnical and Environmental Services					Site Towers Day Nursery, Acrefair, Wrexham					Borehole Number BH 1						
Installation Type Single Installation			Dimensions Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 150 mm			Client					Job Number 19-1825					
			Location		Ground Level (mOD)	Engineer Smith Grant LLP					Sheet 1/1					
Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling										
						Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)	
											5 min	10 min	15 min	20 min		
						Groundwater Observations During Drilling										
						Date	Start of Shift					End of Shift				
							Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
				0.50	Bentonite Seal											
				1.50	Well Screen	Instrument Groundwater Observations										
						Inst. [A] Type : Slotted Standpipe										
						Date	Instrument [A]			Remarks						
							Time	Depth (m)	Level (mOD)							

Remarks 0.50m of plain pipe above ground level											
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GROUND GAS MONITORING REPORT

Site name:	Towers Lane Nursery		Job number:	R2744		Barometric pressure at:	start:	1013	mb	finish:	1013	mb	
Time at:	start	11:00	Date:	16.08.19		Pressure trend:	increasing then decreasing					(previous 3 days)	
	finish	11:30	Staff:	CS		Instruments:	GFM430 ¹						
Record code:	G01		Weather conditions:	cloudy				Ground conditions:		wet			

Well No.	Methane %vol		Carbon dioxide %vol		Oxygen %vol		Carbon monoxide ppm	Hydrogen sulphide ppm	VOCs ppm	Gas flow l/hr		Well pressure mb	Depth to water m bgl	Depth to base m bgl	Notes
	Peak	steady	peak	steady	min	steady				peak	steady				
BH01	<0.1	<0.1	0.2	0.2	20.2	20.2	<1	<1		<0.1	<0.1	<0.01	1.40	1.63	
BH02	<0.1	<0.1	0.2	0.2	20.7	20.7	<1	<1		<0.1	<0.1	<0.01	1.25	1.29	
Limit of Detection	0.1%		0.1%		0.1%		1ppm	1ppm	0.1ppm	0.1l/hr (-60/+100)	0.1l/hr (-60/+100)	1Pa_0.01mb (-800/+1500)			
Accuracy (% of reading)	±3.0%		±3.0%		±0.5%		±5%	±5%	±5%						

1. Date of last calibration 14.05.19

Site name:	Towers Lane Nursery		Job number:	R2744		Barometric pressure at:	start:	1020	mb	finish:	1020	mb
Time at:	start	13:00	Date:	22.08.19		Pressure trend	increasing then decreasing					
	finish	13:30	Staff:	CS		Instruments:	GFM430 ¹					
Record code:	G02		Weather conditions:	cloudy					Ground conditions:	dry		

Well No.	Methane %vol		Carbon dioxide %vol		Oxygen %vol		Carbon monoxide ppm	Hydrogen sulphide ppm	VOCs ppm	Gas flow l/hr		Well pressure mb	Depth to water m bgl	Depth to base m bgl
	Peak	steady	peak	steady	min	steady				peak	steady			
BH01	<0.1	<0.1	1.7	1.7	23.9	23.9	<1	<1		<0.1	<0.1	<0.01	1.46	1.62
BH02	<0.1	<0.1	3.1	3.1	20.5	20.5	<1	<1		<0.1	<0.1	<0.01	1.25	1.27
Limit of Detection	0.1%		0.1%		0.1%		1ppm	1ppm	0.1ppm	0.1l/hr (-60/+100)	0.1l/hr (-60/+100)	1Pa_0.01mb (-800/+1500)		
Accuracy (% of reading)	±3.0%		±3.0%		±0.5%		±5%	±5%	±5%					

1. Date of last calibration 14.05.19

Site name:	Towers Lane Nursery		Job number:	R2744		Barometric pressure at:	start:	1003	mb	finish:	1003	mb	
Time at:	start	09:00	Date:	30/08/2019		Pressure trend	1017-1015-1013 (slow falling pressure)					(previous 3 days)	
	finish	09:10	Staff:	PRM		Instruments:	GFM430 ¹						
Record code:	G03		Weather conditions:	Overcast (7/8), no precipitation, slight breeze, 14°C				Ground conditions:		Dry underfoot			

Well No.	Methane %vol		Carbon dioxide %vol		Oxygen %vol		Carbon monoxide ppm	Hydrogen sulphide ppm	VOCs ppm	Gas flow l/hr		Well pressure mb	Depth to water m bgl	Depth to base m bgl	Notes
	Peak	steady	peak	steady	min	steady				peak	steady				
BH01	<0.1	<0.1	1.8	1.8	18.7	18.7	<1	<1		<0.1	<0.1	<0.01	1.57	1.63	Silty Base
BH02	<0.1	<0.1	2.3	2.3	18.4	18.4	<1	<1		<0.1	<0.1	<0.01	1.28	1.29	Silty Base
Limit of Detection	0.1%		0.1%		0.1%		1ppm	1ppm	0.1ppm	0.1l/hr (-60/+100)	0.1l/hr (-60/+100)	1Pa_0.01mb (-800/+1500)			
Accuracy (% of reading)	±3.0%		±3.0%		±0.5%		±5%	±5%	±5%						

1. Date of last calibration 14.05.19

Site name:	Towers Lane Nursery		Job number:	R2744		Barometric pressure at:	start:	1007	mb	finish:	1007	mb	
Time at:	start	14:00	Date:	03/09/2019		Pressure trend	1013-1020-1021 (rising pressure)					(previous 3 days)	
	finish	14:10	Staff:	PRM		Instruments:	GFM430 ¹						
Record code:	G04		Weather conditions:	Partly cloudy, no precipitation, light breeze, 14°C					Ground conditions:		Dry underfoot		

Well No.	Methane %vol		Carbon dioxide %vol		Oxygen %vol		Carbon monoxide ppm	Hydrogen sulphide ppm	VOCs ppm	Gas flow l/hr		Well pressure mb	Depth to water m bgl	Depth to base m bgl	Notes
	Peak	steady	peak	steady	min	steady				peak	steady				
BH01	<0.1	<0.1	1.7	1.7	19.0	19.0	<1	<1		<0.1	<0.1	<0.01	1.57	1.63	Silty Base
BH02	<0.1	<0.1	1.9	1.9	18.6	18.6	<1	<1		<0.1	<0.1	<0.01	1.28	1.29	Silty Base
Limit of Detection	0.1%		0.1%		0.1%		1ppm	1ppm	0.1ppm	0.1l/hr (-60/+100)	0.1l/hr (-60/+100)	1Pa_0.01mb (-800/+1500)			
Accuracy (% of reading)	±3.0%		±3.0%		±0.5%		±5%	±5%	±5%						

1. Date of last calibration 14.05.19

Site name:	Towers Lane Nursery		Job number:		R2744		Barometric pressure at:		start:	1014	mb	finish:	1014	mb	
Time at:	start	11:00	Date:		20/09/2019		Pressure trend		1030-1028-1024 (falling pressure)					(previous 3 days)	
	finish	11:15	Staff:		CS		Instruments:		GFM430 ¹						
Record code:	G05		Weather conditions:		Dry, sunny					Ground conditions:		Dry underfoot			

Well No.	Methane %vol		Carbon dioxide %vol		Oxygen %vol		Carbon monoxide ppm	Hydrogen sulphide ppm	VOCs ppm	Gas flow l/hr		Well pressure mb	Depth to water m bgl	Depth to base m bgl	Notes
	Peak	steady	peak	steady	min	steady				peak	steady				
BH01	<0.1	<0.1	1.00	1.00	17.30	17.30	<1	<1		<0.1	<0.1	<0.01	dry	1.90	wet at the base
BH02	<0.1	<0.1	1.20	1.20	18.10	18.00	<1	<1		<0.1	<0.1	<0.01	dry	1.56	wet at the base
Limit of Detection	0.1%		0.1%		0.1%		1ppm	1ppm	0.1ppm	0.1l/hr (-60/+100)	0.1l/hr (-60/+100)	1Pa_0.01mb (-800/+1500)			
Accuracy (% of reading)	±3.0%		±3.0%		±0.5%		±5%	±5%	±5%						

1. Date of last calibration 14.05.19

Site name:	Towers Lane Nursery		Job number:	R2744		Barometric pressure at:	start:	988	mb	finish:	988	mb	
Time at:	start	13:30	Date:	25.09.19		Pressure trend:	1006-1000-998 falling pressure					(previous 3 days)	
	finish	14:00	Staff:	CS		Instruments:	GFM430 ¹						
Record code:	G06		Weather conditions:	Dry, partially cloudy					Ground conditions:	wet			

Well No.	Methane %vol		Carbon dioxide %vol		Oxygen %vol		Carbon monoxide ppm	Hydrogen sulphide ppm	VOCs ppm	Gas flow l/hr		Well pressure mb	Depth to water m bgl	Depth to base m bgl	Notes
	Peak	steady	peak	steady	min	steady				peak	steady				
BH01	<0.1	<0.1	0.70	0.70	16.80	16.80	<1	<1		<0.1	<0.1	<0.01	1.68	1.90	
BH02	<0.1	<0.1	0.50	0.50	18.50	18.50	<1	<1		<0.1	<0.1	<0.01	1.55	1.56	
Limit of Detection	0.1%		0.1%		0.1%		1ppm	1ppm	0.1ppm	0.1l/hr (-60/+100)	0.1l/hr (-60/+100)	1Pa_0.01mb (-800/+1500)			
Accuracy (% of reading)	±3.0%		±3.0%		±0.5%		±5%	±5%	±5%						

1. Date of last calibration 14.05.19