



19060-PWAG-00-XX-LTR-G-6000-P01

03 April 2020

Michael Pedley
Middleton Sheet Metal Co Ltd,
Spring Vale,
Middleton,
Manchester,
M24 2HS

Dear Michael,

Ground Gas Risk Assessment, Middleton Sheet Metals, Land South of Hanson Close Middleton

Summary

Following submission of the Phase 2 report (19060-PWAG-00-XX-GR-2000-P01) in January 2020, PWA Geo-Environmental (PWAG) has completed six gas monitoring visits over a three month period. This addendum report outlines the findings from the gas monitoring and presents a quantitative assessment of gas risk to determine the characteristic gas situation (CS) for the site.

It is understood that the proposed development will comprise a large industrial unit, associated service yard and car parking. Therefore, in accordance with Table 3 of BS:8485:2015+A1:2019, the development is considered to mostly comprise a Type D building with office areas comprising Type C building.

Based on six ground gas monitoring visits, the site has been classified as Characteristic Situation (CS) 2 and ground gas protection measure are required:

- For office areas (Type C building) this could comprise the structural barrier of the floor and a gas resistant membrane.
- For manufacturing areas (Type D building) this could comprise gas resistant membrane. Alternatively, we understand that the floor slab may be designed to support larger loads and, in this situation, gas protection could comprise a well reinforced cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations.

Report limitations

This report has been prepared for the sole use of our client and PWA Geo-Environmental Ltd accepts no liability for any use of this document other than by the client and only for the purpose stated in the document for which it was prepared and provided. All reasonable skill, care and diligence has been applied in examining the information obtained. However, PWA Geo-Environmental Ltd accepts no responsibility for inaccuracies in the data supplied or for opinions based on any such inaccurate data.



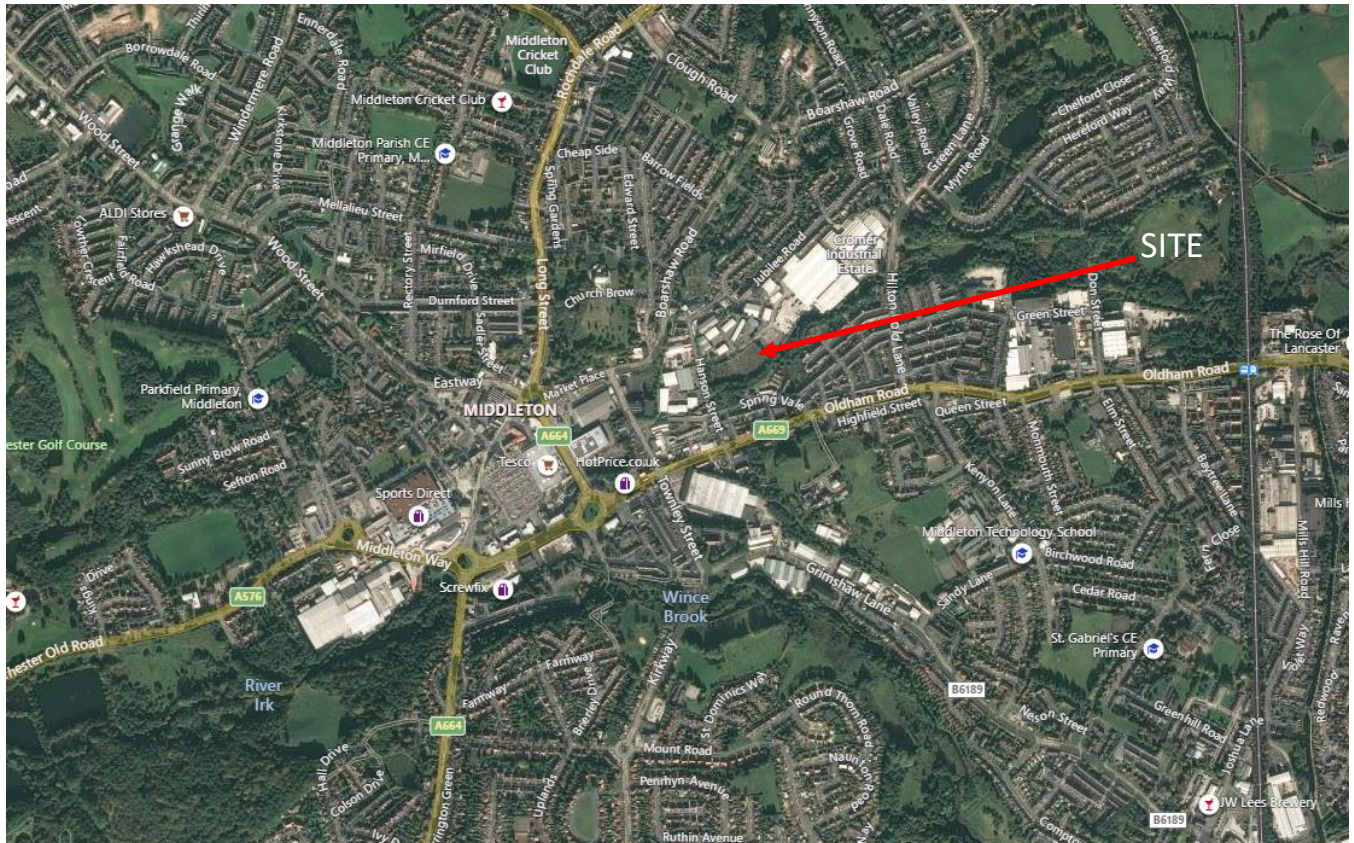
Background

Middleton Sheet Metal Co Ltd (MSM) proposes to redevelop overgrown vacant brownfield land south of Hanson Close, Middleton with a large industrial unit, associated service yard and car parking. A proposed site layout is shown in drawing no. 1936/01B in **Enclosure 1**. The site occupies an area of approximately 1.1 hectares and is surrounded by other commercial and industrial properties.

This letter details the findings of the ground gas monitoring programme following its completion and provides an assessment of the ground gas risk at the site.

Site location

The site is located south of Hanson Close, Middleton. A site location plan reproduced from Holebase Bing maps is shown below.



Previous Investigations

Previous ground investigations include:

- PWAG – Phase 1 Geo-Environmental Assessment and Coal Mining Risk Assessment: May 2019; and
- PWAG – Phase 2 Geo-Environmental Assessment: January 2020.

The following provides a summary of the relevant information. However, the reader should refer to the original report for all information.

Phase 1 Geo-Environmental Assessment and Coal Mining Risk Assessment

The Phase 1 report recommended that a ground investigation should be undertaken to assess existing ground conditions, evaluate potential ground gas issues and obtain geotechnical information for substructure design.

Phase 2 Geo-Environmental Assessment

PWAG conducted a limited ground investigation in January 2020 that comprised:



- Four cable percussive boreholes drilled to a maximum depth of 21.2 m bgl and completed with four gas monitoring wells; and
- Six trial pits to a maximum depth of 2.70 m bgl.

Exploratory hole locations are shown within 19060-PWAG-00-XX-DR-G-1000-P01 presented in **Enclosure 1**. Exploratory hole records from the cable percussive boreholes are presented in **Enclosure 2**.

Ground conditions included asphalt and concrete hardstanding covering much of the site over a downward sequence of made ground, reworked natural, alluvium and bedrock. Made ground was of variable composition and encountered to depths between 5.75 and 7.60 m bgl. Reworked natural deposits were encountered between 0.30 and 4.00 m bgl comprising firm brown sandy clay to dense brown sand. Alluvium compositions varied from soft to stiff clays to occasionally loose, mostly dense sands with approximately 75% of the material observed as granular. Mudstone and siltstone bedrock was encountered between 14.90 and 20.50 m bgl.

Four samples of made ground were analysed for total organic carbon and the results varied from 0.79 – 3.47%.

Ground Gas Monitoring

Monitoring wells were placed to target specific features that were identified as plausible sources of ground gases. These included:

- Areas of deep made ground (BH02-04); and
- Alluvium (BH01) (potentially containing natural organic matter such as peat).

The monitoring program entailed six fortnightly visits over three months covering periods of rising, falling and steady atmospheric pressure. Copies of the gas monitoring records are presented in **Enclosure 3**. A summary of the monitoring data is presented below:

Well	Depth of Response Zone and Stratum	Flooded Response Zone?	Concentration ranges (%v/v)		Flow (l/hr)	
			CO ₂ (steady)	CH ₄ (peak)	Peak	Steady
BH01	6.00 to 15.00 m (ALV - sand)	6 out of 6	ND – 1.7	ND – 1.0	-12	ND
BH02	1.00 to 5.00 m (MG with rare organic material and hydrocarbon odour)	No	4.5 – 11.6	20.9 – 24.4	ND	ND
BH03	1.00 to 5.00 m (MG with rare organic material and hydrocarbon odour)	No	0.1 – 0.9	ND – 0.2	ND	ND
BH04	2.00 to 6.00 m (MG)	No	4.9 – 10.0	ND – 2.2	-2.1	ND

No sign of hydrocarbon staining on the dip meter or hydrocarbon odour was noted during monitoring visits.

Revised Ground Gas Conceptual Site Model

The PWAG Phase 1 Geo-Environmental Assessment identified a moderate gas risk associated with the potential generation of ground gases and vapours from organic material within alluvium and made ground. Subsequently, a ground investigation was carried out to evaluate this risk.

Following the Phase 2 assessment, it was considered that deep (up to 7.3 m) made ground could be a source of ground gases. However, alluvium was observed to comprise mostly sand with some gravel. As no organic or peaty material was observed in the alluvium, this was discounted as a likely source. Subsequent gas monitoring over six visits supports this opinion. Considering these observations and gas results, the conceptual site model has been revised.

Ground Gas Source	Pathways	Receptors	Severity
Made Ground	Inhalation of gases / accumulation in confined spaces	Future site users	Moderate
	Accumulation in confined spaces	Construction workers	



Ground Gas Risk Assessment

A site characteristic gas screening value (GSV) is calculated based on the borehole hazardous gas flow rate – Q_{hg} . This is calculated for methane and carbon dioxide in accordance with BS:8485:2015+A1:2019 based on the measured gas flows, gas concentrations or a limit of detection (taken as 0.1 l/hr for flow and 0.1% for gas concentration), whichever is higher. The derived GSV is used to determine a characteristic gas situation (CS).

A review of the gas monitoring data indicates a maximum concentration of 11.6% v/v carbon dioxide, a maximum of 24.4% v/v methane, undetected oxygen concentration as the minimum, a maximum positive peak flow rate of 5.2 l/hr and a maximum steady state flow 0.1 l/hr. Gas flows were detected in visits where the atmospheric pressure was shown to be steady during the course of the monitoring. On all monitoring visits, the response zone for BH01 (that was set at a greater depth in alluvium) was flooded. Therefore, flow measurements at this position were influenced by groundwater movement and considered unrepresentative.

From the monitoring results, the maximum GSV for methane was calculated to be 0.0224 l/hr at BH02 equating to CS1 conditions. This was based on the maximum methane concentration and the maximum peak flow rate recorded. However, due to high methane concentrations (>20% v/v), Table 2 of BS:8485:2015+A1:2019 recommends this be increased to CS2.

The GSV for carbon dioxide was calculated using the maximum steady state flow and maximum steady gas concentrations. A GSV of 0.0116 l/hr was derived that equates to CS1. Peak steady carbon dioxide concentrations of >5.0% v/v were recorded and similarly to methane, Table 2 recommends that the characteristic gas situation be increased to CS2.

Carbon monoxide was detected as sporadic peaks with a maximum concentration of 60 ppm recorded at BH04 on one occasion. Other than BH01, carbon monoxide concentrations stabilised at non-detect. Hydrogen sulphide was also recorded at a maximum concentration of 8 ppm at BH02 and typically stabilised at non-detect. Typically, these lasted <0.5 seconds and could represent interference. However, as these peak concentrations exceeded the HSE Workplace Exposure Limits they should be taken into consideration in the development phase health and safety plan (HSE limits are 20 ppm for short term (15 minutes) exposure or 100 ppm for long term exposure of carbon monoxide and 5 ppm for short term (15 minutes) exposure or 10 ppm for long term exposure for hydrogen sulphide).

Conclusions and Recommendations

The risks associated with the ground gases methane (CH_4) and carbon dioxide (CO_2) are assessed using BS 8485:2015+A1:2019 and guidelines from CIRIA 665.

The GSV for methane and carbon dioxide concentrations within the made ground indicates the site should be classified as CS2 and ground gas protection measures are required.

The development is considered to mostly comprise a Type D building with office areas comprising Type C building. Under CS2 conditions, BS8485:2015+A1:2019 recommends:

- For office areas (Type C building) a minimum gas protection score of 2.5. This could be achieved through a combination of the structural barrier of a cast in situ ground bearing floor slab with only nominal mesh reinforcement (0.5 points) **and** a gas resistant membrane (2 points).
- For manufacturing areas (Type D building) a minimum gas protection score of 1.5. This could comprise gas resistant membrane (2 points). **Alternatively**, we understand that the floor slab may be designed to support larger loads and, in this situation, gas protection could comprise a well reinforced cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations (1.5 points).

As a bare minimum, all gas protection systems should include at least pressure relief (a preferential pathway to atmosphere) for gases which might otherwise build up under the building footprint. This can be achieved through



a layer of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building.

It is important to note that the installation of a gas resistant membrane must meet all of the criteria of Table 7 in BS8485:2015+A1:2019, otherwise the point score is zero.

Once design measures have been selected in accordance with BS8485:2015+A1:2019 these should be developed into a detailed design supported by detailed drawings and specifications.

During the ground gas monitoring, concentrations of carbon dioxide (an asphyxiant) were found to exceed HSE Workplace Exposure Limits for personnel in the working environment of 1.5% for short term (15 minutes) exposure or 0.5% for long term exposure. Furthermore, concentrations of oxygen within monitoring installations were commonly recorded below the HSE recommendations of 18% in BH02-04. In addition, carbon monoxide and hydrogen sulphide were occasionally detected. Whilst risks to construction workers are not generally discussed in this report, all contractors and maintenance workers should be made aware of the potential for elevated concentrations of carbon dioxide, depressed oxygen concentrations, trace carbon monoxide and trace hydrogen sulphide, and should take all necessary Health and Safety precautions when working in trenches or confined spaces.

Should the land use or proposed building type change from those assumed in this letter then re-evaluation of the conclusions and recommendations will be required. Similarly, should future alterations be made to the building then the implication of ground gas risk should be taken into consideration.

The conclusions and recommendations presented in this report are considered reasonable based on the information that was available. However, these are not guaranteed to gain approval from regulatory authorities. Therefore, we recommend that copies of this report are passed to the appropriate regulator for review and comment before undertaking any additional work.

If you have any questions, please do not hesitate to contact us.

Yours sincerely,

Alice Smith
Geoenvironmental Engineer
For and on behalf of PWA Geo-Environmental Ltd

Enclosures

- | | |
|--------------|----------------------------|
| Enclosure 1: | Drawings |
| Enclosure 2: | Exploratory Logs |
| Enclosure 3: | Ground Gas Monitoring Data |

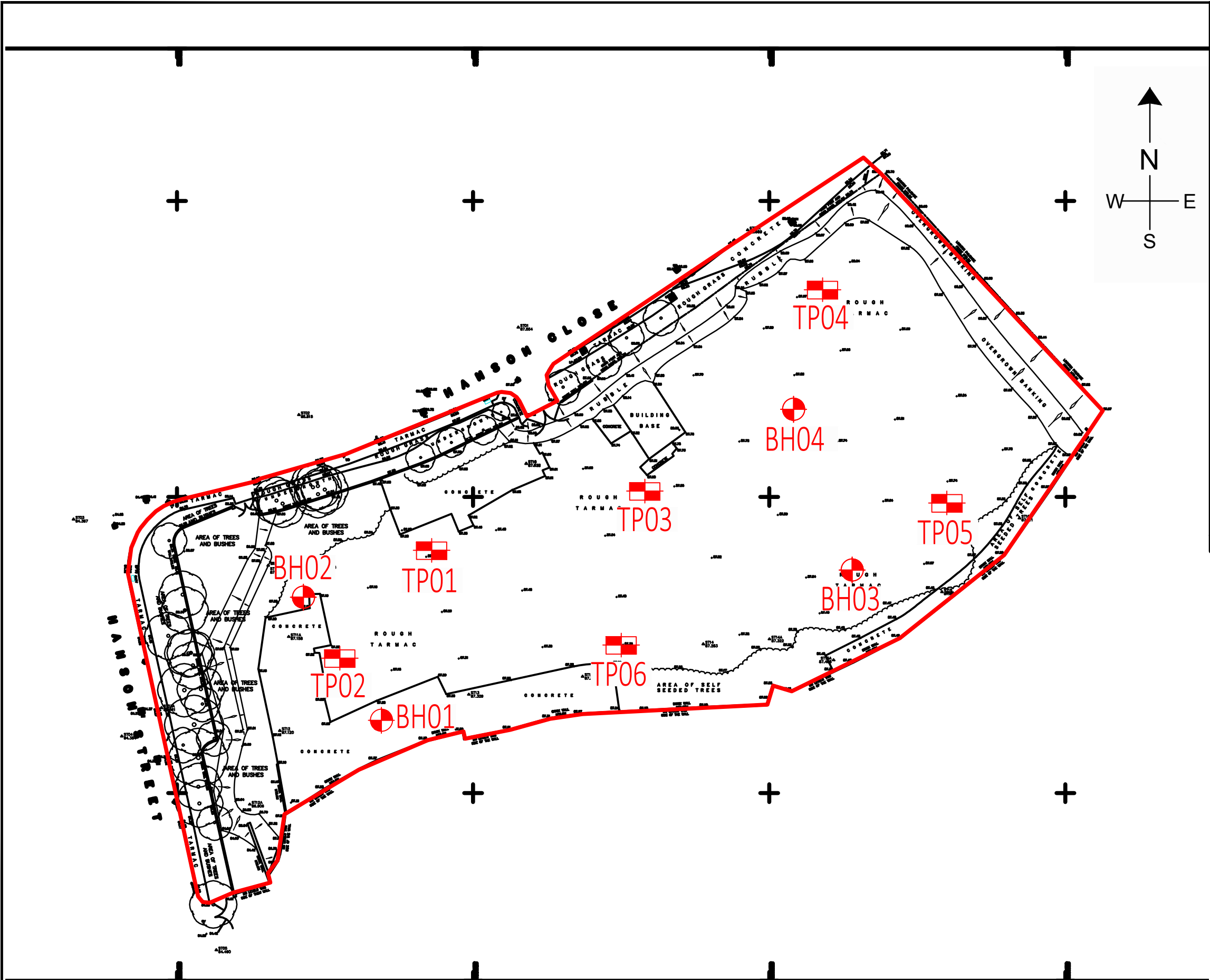


Enclosure 1

Drawings



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KEY:

- TRIAL PIT LOCATION
- BOREHOLE LOCATION
- INDICATIVE SITE BOUNDARY

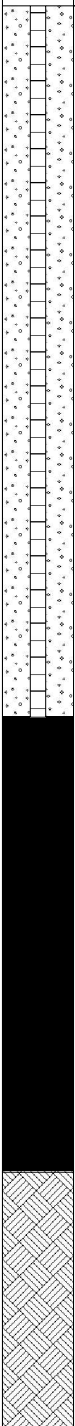
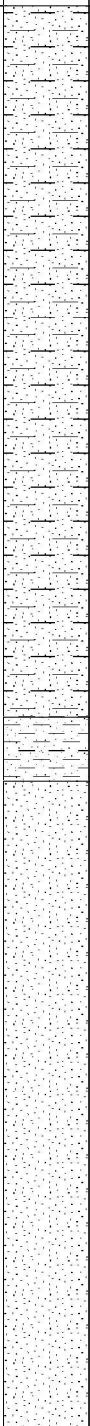
Rev	Date	Remarks	Drawn	Chk'd			
Paul Waite Associates pwa Geo-Environmental Consulting Civil , Structural & Geo-Environmental Engineers Summit House, Riparian Way, The Crossings, Crosshills, Keighley, BD20 7BW T - 01535 633350 E-Mail: info@pwaite.co.uk www.pwaite.co.uk							
Client		MIDDLETON SHEET METALS CO. LTD					
Project		LAND OFF HANSON CLOSE MIDDLETON M24 2YP					
Title		EXPLORATORY HOLE PLAN					
Size	Scale	Designed	Checked	Date			
A3	NTS	DJJA	IMP	DEC 19			
Drawing Status		PRELIMINARY					
Job Number	Originator	Volume	Level	Type	Role	Drawing No.	Rev
19060	-PWAG	- 00	- XX	- DR	- G	- 1000	P02



Enclosure 2

Exploratory Logs

Approved by: DA

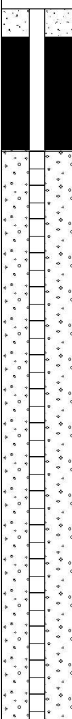
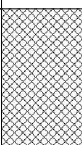
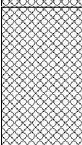
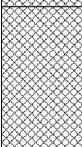
		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG			Borehole ID: CP01 Sheet 2 of 3			
Project Name:		MSM Middleton			Project Number: 19060		Elevation: 87.30		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS			Coordinates: E387485, N406062				Scale: 1:50	
Client Name:		Middleton Sheet Metal Co. Ltd.			Dates: 09/12/2019 - 18/12/2019				Logged By: AAS	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale		
		Depth (m)	Type	Results						
		11.00	SPT(C)	N=50 (3,5/5,15,15,15)			Dense brown clayey fine and medium SAND. GRANULAR ALLUVIUM	11		
		12.00 12.00	SPT(C) D	N=34 (7,10/8,8,8,10)			12			
		13.00					13			
		14.00 14.00	SPT(S) D	N=17 (3,2/4,5,4,4)			14			
		15.00 15.00	SPT(S) D	N=16 (2,2/2,3,5,6)	15.00		15			
		16.00			15.45		16			
		17.00 17.00	SPT(S) D	N=13 (4,3/3,3,4,3)			17			
	18.00				18					
		19.00 19.00	SPT(S) D	N=15 (1,2/3,3,4,5)		19				
		20.00				20				

Remarks: Borehole terminated in bedrock.
No visual or olfactory evidence of contamination.
Groundwater not recorded.
On completion, borehole collapsed back from 21.20 to 18.20 m.
Bentonite seal 18.20 - 15.00 m. A slotted standpipe (50 mm) was installed to 15.00 m, granular response zone 15.00 - 6.00 m, bentonite seal 6.00 - 0.20 m and concrete with flush cover 0.20 - 0.00 m.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Approved by: DA

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG			Borehole ID: CP01 Sheet 3 of 3			
Project Name:		MSM Middleton			Project Number: 19060		Elevation: 87.30		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS			Coordinates: E387485, N406062				Scale: 1:50	
Client Name:		Middleton Sheet Metal Co. Ltd.			Dates: 09/12/2019 - 18/12/2019				Logged By: AAS	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale		
		Depth (m)	Type	Results						
		20.50	B		20.50		Medium dense brown medium and coarse SAND. GRANULAR ALLUVIUM	21		
	21.00	SPT(S)	50 (25 for 50mm/50 for 30mm)				Grey weak MUDSTONE recovered as angular fine to coarse gravel.			
	21.00	D		21.20			MUDSTONE			
								22		
								23		
								24		
								25		
								26		
								27		
								28		
								29		
								30		
Remarks: Borehole terminated in bedrock. No visual or olfactory evidence of contamination. Groundwater not recorded. On completion, borehole collapsed back from 21.20 to 18.20 m. Bentonite seal 18.20 - 15.00 m. A slotted standpipe (50 mm) was installed to 15.00 m, granular response zone 15.00 - 6.00 m, bentonite seal 6.00 - 0.20 m and concrete with flush cover 0.20 - 0.00 m.									ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test Approved by: DA	

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG			Borehole ID: CP02 Sheet 1 of 1				
Project Name:		MSM Middleton			Project Number: 19060		Elevation: 87.20		Hole Type: CP		
Project Location:		Hanson Close, Middleton, M24 2HS			Coordinates: E387471, N406083			Scale: 1:50			
Client Name:		Middleton Sheet Metal Co. Ltd.			Dates: 09/12/2019 - 18/12/2019			Logged By: AAS			
Install. 	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description		Scale		
		Depth (m)	Type	Results							
		1.00 1.00	SPT(S) D	N=5 (1,1/2,0,1,2)	1.00		Brick, concrete, rubble, slab BOULDERS. (Drillers description) MADE GROUND		1		
		2.00 2.00	SPT(S) D	N=9 (1,1/2,2,1,4)			Loose brown slightly clayey slightly gravelly silty SAND. Gravel is sub-angular to rounded fine to coarse sandstone and siltstone. REWORKED MADE GROUND		2		
		3.00 3.00	SPT(S) D	N=6 (1,0/1,1,2,2)	3.45		2.00 - 2.45 m: <i>Rare organic material (up to 3 mm diam).</i>		3		
		4.00 4.00	SPT(S) D	N=1 (1,0/0,1,0,0)			Brown sandy gravelly SILT. Gravel is angular to sub-rounded fine to coarse siltstone, sandstone, brick and slag. Slag has hydrocarbon sheen. MADE GROUND		4		
		5.00 5.00	SPT(S) D	N=8 (4,1/2,2,2,2)	5.20 5.45		4.00 - 4.45 m: <i>Pockets (up to 20 mm) of black sandy gravelly silt. Gavel is angular and sub-angular fine and medium coal. Faint hydrocarbon odour. SPT indicates very loose.</i>		5		
							Firm brown CLAY. (Drillers description) COHESIVE ALLUVIUM		6		
									7		
									8		
									9		
									10		
Remarks: Borehole terminated at target depth within made ground. Hydrocarbon odours and sheens between 3.45 and 5.45 m. Groundwater not recorded. On completion, a 50 mm slotted standpipe was installed to 5.00m, granular response zone 5.00 - 1.00 m, bentonite seal 1.00 - 0.20 m, concrete and flush cover 0.20 - 0.00 m. ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test Approved by: DA											

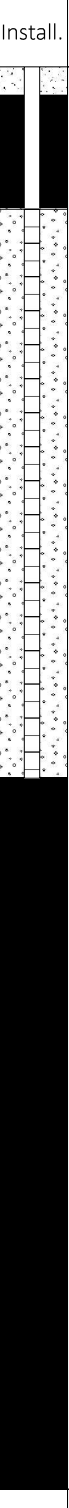
BOREHOLE LOG

Borehole ID:

CP03

Sheet 1 of 2

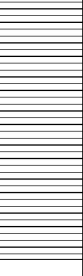
Project Name:	MSM Middleton	Project Number: 19060	Elevation: 87.50	Hole Type: CP
Project Location:	Hanson Close, Middleton, M24 2HS	Coordinates: E387564, N406088		Scale: 1:50
Client Name:	Middleton Sheet Metal Co. Ltd.	Dates: 09/12/2019 - 18/12/2019		Logged By: AAS

Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale
		Depth (m)	Type	Results				
							Brick, concrete rubble and slab BOULDERS. MADE GROUND	
	1.00	SPT(S)	N=7 (5,2/0,1,3,3)	1.00				1
	1.00	D		1.15		Medium dense brown sandy SILT. MADE GROUND		
	2.00	SPT(S)	N=3 (2,1/0,1,1,1)	2.00		Medium dense black gravelly SAND. Gravel is sub-angular medium sandstone and brick. REWORKED MADE GROUND		2
	2.00	D				Very soft brown slightly gravelly sandy CLAY. Gravel is sub-angular and sub-rounded fine to coarse brick and coal fragments. Coal has a faint hydrocarbon odour.		
	2.00	B		2.80		MADE GROUND		3
	3.00	SPT(S)	N=3 (0,1/0,1,1,1)			Very loose brown slightly gravelly silty SAND. Gravel is fine to coarse sub-angular and sub-rounded sandstone and brick.		
	3.00	D		3.60		MADE GROUND		4
	4.00	SPT(S)	N=5 (1,1/1,1,1,2)			Loose brown slightly clayey slightly sandy slightly gravelly SILT. Gravel is fine and medium angular and sub-angular sandstone, siltstone and coal. Rare plant stems (up to 5mm diam).		
	4.00	D		4.80		MADE GROUND		5
	5.00	SPT(S)	50 (25 for 40mm/50 for 160mm)			Recovered as grey circular disk coarse siltstone gravel with rare black inclusions (up to 3mm). Pockets (up to 15 mm) of dark brown silt.		
	5.00	D		6.20		MADE GROUND		6
	6.50	D				Soft brown slightly gravelly clayey SAND to sandy CLAY. Gravel is sub-angular coarse sandstone. Rare relic roots (up to 4mm diam).		
	6.95	SPT(S)	N=5 (1,3/2,1,1,1)	7.30		GRANULAR ALLUVIUM		7
	8.00	D				Brown fine to coarse SAND. GRANULAR ALLUVIUM		
8.45	SPT(S)	N=26 (3,5/5,7,6,8)			8.00 - 8.45 m: SPT indicates medium dense.		8	
9.50	D				9.50 - 9.95 m: SPT indicates dense.		9	
9.95	SPT(S)	N=43	10.00				10	
			(3,7/10,10,11,12)					

Remarks:	Borehole terminated in bedrock. Faint hydrocarbon odour between 2.00 and 2.90 m. Groundwater not recorded. On completion borehole backfilled with bentonite pellets 19.41 - 5.00 m. A slotted standpipe 50 mm was installed to 5.00 m, granular response zone 5.00 - 1.00 m, bentonite seal 1.00 - 0.20 m, concrete and flush cover 0.20 - 0.00 m.
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ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Approved by: DA

pwa Geo Environmental		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG				Borehole ID: CP03 Sheet 2 of 2			
Project Name:		MSM Middleton				Project Number: 19060		Elevation: 87.50		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS				Coordinates: E387564, N406088				Scale: 1:50	
Client Name:		Middleton Sheet Metal Co. Ltd.				Dates: 09/12/2019 - 18/12/2019				Logged By: AAS	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description		Scale		
		Depth (m)	Type	Results							
		11.00 11.00	SPT(S) D	N=22 (5,6/6,4,6,6)	11.45		Stiff brown friable slightly clayey SILT. COHESIVE ALLUVIUM		11		
		12.50 12.50	SPT(S) D	N=28 (4,5/6,7,7,8)			Medium dense brown clayey SAND with pockets of brown silty sand. COHESIVE ALLUVIUM			12	
		14.00 14.00	SPT(S) D	N=17 (4,4/4,4,4,5)	13.30		Firm brown slightly sandy CLAY. COHESIVE ALLUVIUM		13		
		15.50 15.50	SPT(S) D	N=9 (1,1/1,2,2,4)		15.20		Loose brown and orange fine and medium SAND. GRANULAR ALLUVIUM		14	
		16.70 16.70	SPT(S) D	N=23 (5,4/3,5,6,9)	16.70			Stiff grey mottled brown clayey SILT with occasional angular fine gravel sized mudstone lithorelics. COHESIVE ALLUVIUM			15
		17.50	D			17.50		Extremely weak grey MUDSTONE recovered as angular coarse gravel. MUDSTONE		16	
		18.50 18.50	SPT(S) D	50 (6,8/50 for 295mm)	19.41						17
		19.00 19.00	SPT(S) D	50 (5,10/50 for 230mm)					18		
										19	
											20
Remarks: Borehole terminated in bedrock. Faint hydrocarbon odour between 2.00 and 2.90 m. Groundwater not recorded. On completion borehole backfilled with bentonite pellets 19.41 - 5.00 m. A slotted standpipe 50 mm was installed to 5.00 m, granular response zone 5.00 - 1.00 m, bentonite seal 1.00 - 0.20 m, concrete and flush cover 0.20 - 0.00 m. ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test Approved by: DA											

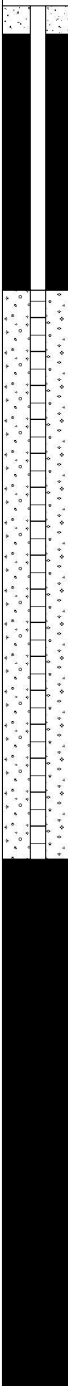
BOREHOLE LOG

Borehole ID:

CP04

Sheet 1 of 2

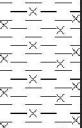
Project Name:	MSM Middleton	Project Number: 19060	Elevation: 87.70	Hole Type: CP
Project Location:	Hanson Close, Middleton, M24 2HS	Coordinates: E387554, N406115		Scale: 1:50
Client Name:	Middleton Sheet Metal Co. Ltd.	Dates: 09/12/2019 - 18/12/2019		Logged By: AAS

Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale
		Depth (m)	Type	Results				
					0.50		Limestone hardcore GRAVEL. MADE GROUND	1
		1.00 1.00	SPT(S) D	N=5 (2,1/2,1,1,1)			Loose brown very clayey SAND with rare angular fine gravel. REWORKED MADE GROUND	
		2.00 2.00	SPT(S) D	N=3 (0,1/1,0,1,1)	1.70		Very soft brown sandy CLAY with rare fine gravel. REWORKED MADE GROUND	2
		3.00 3.00	SPT(S) D	N=8 (1,1/1,2,3,2)			3.00 - 3.45 m: SPT indicates firm to stiff. 3.10 - 3.20 m: Band of dark brown clayey fine and medium sand. 3.30 - 3.40 m: Band of firm brown slightly sandy slightly gravelly clay.	
		4.00 4.00	SPT(S) D	N=12 (2,1/2,3,3,4)	3.70		Medium dense dark brown silty gravelly SAND. Gravel is angular and sub-angular fine to coarse brick, sandstone and coal. MADE GROUND	4
		5.00 5.00	SPT(S) D	N=8 (1,1/1,2,2,3)			5.00 - 5.45 m: Occasional relic rootlets. SPT indicates loose.	
		6.50 6.50	SPT(C) D	N=24 (6,6/4,6,6,8)	6.30		Medium dense brown angular to sub- rounded fine to coarse limestone, sandstone, limestone ballast and brick GRAVEL. Possible fines washed away.	7
		7.30	D			7.30	MADE GROUND	
		8.00 8.00	SPT(S) D	N=25 (2,3/4,5,8,8)	7.30		Medium dense brown fine to coarse SAND. GRANULAR ALLUVIUM	8
		9.50 9.50	SPT(S) D	N=36 (3,4/6,10,10,10)			9.50 - 9.95 m: Pockets of fine sand. SPT indicates dense.	
								10

Remarks: Borehole terminated in bedrock.
No visual or olfactory evidence of contamination.
Groundwater not recorded.
On completion borehole backfilled with bentonite pellets 15.55 - 6.00 m. A slotted standpipe 50 mm was installed to 6.00 m, granular response zone 6.00 - 2.00 m, bentonite seal 2.00 - 0.20 m, concrete and flush cover 0.20 - 0.00 m.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Approved by: DA

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG			Borehole ID: CP04 Sheet 2 of 2			
Project Name:		MSM Middleton			Project Number: 19060		Elevation: 87.70		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS			Coordinates: E387554, N406115				Scale: 1:50	
Client Name:		Middleton Sheet Metal Co. Ltd.			Dates: 09/12/2019 - 18/12/2019				Logged By: AAS	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale		
		Depth (m)	Type	Results						
		11.00 11.00	SPT(S) D	49 (3,7/49 for 245mm)	11.00		Medium dense brown fine to coarse SAND. GRANULAR ALLUVIUM	11		
							Dense brown very silty SAND. GRANULAR ALLUVIUM			
		12.50 12.50	SPT(S) D	N=40 (5,6/7,11,11,11)	12.10		Dense brown very sandy SILT. GRANULAR ALLUVIUM	12		
								13		
		14.00 14.00	SPT(S) D	N=14 (1,2/2,3,4,5)	13.50		Stiff brown silty CLAY locally clayey silt. COHESIVE ALLUVIUM	14		
		14.90	SPT(S)	50 (25 for 110mm/50 for 20mm)	14.90		Siltstone bedrock recovered as angular medium to coarse siltstone gravel. SILTSTONE	15		
					15.50			16		
								17		
								18		
								19		
								20		
Remarks: Borehole terminated in bedrock. No visual or olfactory evidence of contamination. Groundwater not recorded. On completion borehole backfilled with bentonite pellets 15.55 - 6.00 m. A slotted standpipe 50 mm was installed to 6.00 m, granular response zone 6.00 - 2.00 m, bentonite seal 2.00 - 0.20 m, concrete and flush cover 0.20 - 0.00 m.								ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test Approved by: DA		



Enclosure 3

Ground Gas Monitoring Data

Ground Gas and Groundwater Monitoring Record Sheet



JOB DETAILS:

Client: Middleton Sheet Metals
Site: Middleton Sheet Metals
Date: 07-01-20

Job No: 19060
Visit No: 1 of 6
Operator: Alice Smith
Project Manager: Ian Parkinson

	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Qhg per borehole		WELL AND WATER DATA						Comments
Monitoring Point	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Top of BH (mAOD)	Water level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady											
PWA Geo-Environmental Installed Wells																											
BH01	ND	ND	ND	ND	ND	ND	8	ND	1	ND	20.1	20.3	NR	NR	-12.0	NR	ND	360	0.0120	NR	5.76	14.30		-5.76	6.00 - 15.00 ALV	Response zone flooded	
BH02	23.5	23.5	ND	ND	11.6	11.6	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	0	0.0235	0.0116	NR	4.90		NR	1.00 - 5.00 MG		
BH03	ND	ND	ND	ND	2.3	0.8	ND	ND	ND	ND	5.0	13.4	NR	NR	ND	ND	ND	0	0.0001	0.0008	NR	4.93		NR	1.00 - 5.00 MG		
BH04	ND	ND	ND	ND	4.9	4.9	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	660	0.0001	0.0049	5.48	5.63		NR	2.00 - 6.00 MG	Likely to be wet mud	
Max	23.5	23.5	ND	ND	11.6	11.6	8	ND	1	ND	20.1	20.3	NR	NR	-12.0	ND	ND	660	0.0235	0.0116	5.76	14.30	NR	-5.76			
Min	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	0	0.0001	0.0008	5.48	4.90	NR	-5.76			

ND - Not detected

NR - Not recorded

NB: Where no flow (ND) recorded, Qhg values are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of Qhg.

State of ground: ☒ Dry ☐ Moist ☐ Wet ☐ Snow ☐ Frozen
Wind: ☒ Calm ☒ Light ☐ Moderate ☐ Strong
Cloud cover: ☐ None ☐ Slight ☐ Cloudy ☒ Overcast
Precipitation: ☐ None ☒ Slight ☐ Moderate ☐ Heavy
Time monitoring performed: 8:12 Start 10:30 End
Barometric pressure (mbar): 1005 Start 1002 End
Pressure trend (Daily): Falling ☒ Steady ☐ Rising
Source: wunderground.com ☐ Before ☐ After
Air Temperature (Deg. C): ☐ Before ☐ After

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GFM436
Gas Range: CH₄ 0 - 100% CO₂ 0 - 100% O₂ 0 - 25%
Gas Flow range: +100/-50 l/hour
Differential Pressure: (+/-) 1000 Pa
Date of last calibration: 12-08-19
Date of next calibration: 12-08-20

Ambient air check: CH₄ CO₂ O₂

MG - Made ground
ALV - Alluvium
RTD - River Terrace Deposits
WB - Weathered Bedrock

Ground Gas and Groundwater Monitoring Record Sheet



JOB DETAILS:

Client: Middleton Sheet Metals
Site: Middleton Sheet Metals
Date: 16-01-20

Job No: 19060
Visit No: 2 of 6
Operator: Alice Smith
Project Manager: Ian Parkinson

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Qhg per borehole		WELL AND WATER DATA						Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	Methane (%wv)		%LEL		Carbon dioxide (%wv)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%wv)				Flow rate (l/hr)	Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)			CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Top of BH (mAOD)	Water level (mAOD)	Response Zone																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady	Peak	Steady																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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BH01	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	

ND - Not detected

NR - Not recorded

NB: Where no flow (ND) recorded, Qhg values are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of Qhg.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground: ☒ Dry ☐ Moist ☐ Wet ☐ Snow ☐ Frozen
 Wind: ☒ Calm ☐ Light ☐ Moderate ☐ Strong
 Cloud cover: ☐ None ☐ Slight ☐ Cloudy ☐ Overcast
 Precipitation: ☒ None ☐ Slight ☐ Moderate ☐ Heavy
 Time monitoring performed: ☐ 8:00 Start ☐ 9:40 End
 Barometric pressure (mbar): ☐ 999 Start ☐ 997 End
 Pressure trend (Daily): ☐ Falling ☒ Steady ☐ Rising
 Source: ☐ wunderground.com ☐ Before ☐ After
 Air Temperature (Deg. C): ☐ Before ☐ After

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GFM436
Gas Range: CH₄ 0 - 100% CO₂ 0 - 100% O₂ 0 - 25%
Gas Flow range: +100/-50 l/hour
Differential Pressure: (+/-) 1000 Pa
Date of last calibration: 12-08-19
Date of next calibration: 12-08-20

Ambient air check: CH₄ CO₂ O₂

Ground Gas and Groundwater Monitoring Record Sheet



JOB DETAILS:

Client: Middleton Sheet Metals
Site: Middleton Sheet Metals
Date: 31st January 2020

Job No: 19060
Visit No: 3 of 6
Operator: Alice Smith

Project Manager: Ian Parkinson

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA			Qhg per borehole		WELL AND WATER DATA						Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Top of BH (mAOD)	Water level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
PWA Geo-Environmental Installed Wells																										
BH01	0.7	0.7	17.0	16.9	1.6	1.6	4	4	1	1	19.8	19.8	NR	NR	5.2	nr	34.0	360	0.0364	NR	5.74	13.62			6.00 - 15.00 ALV	Response zone flooded
BH02	23.4	22.7	>>>>	>>>>	11.2	11.1	20	ND	8	ND	ND	ND	NR	NR	ND	ND	ND	0	0.0234	0.0111	ND	4.90			1.00 - 5.00 MG	Around 60s, fluctuation in CO between 0-20 and H2S 0-8ppm
BH03	ND	ND	ND	ND	1.6	0.9	ND	ND	ND	ND	20.0	15.2	NR	NR	ND	ND	ND	0	0.0001	0.0009	ND	4.93			1.00 - 5.00 MG	
BH04	ND	ND	ND	ND	8.5	8.4	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	0	0.0001	0.0084	5.60	5.61			2.00 - 6.00 MG	Fluctuation in CO between 0-4 and H2S 0-1ppm.
Max	23.4	22.7	17.0	16.9	11.2	11.1	20	4	8	1	20.0	19.8	NR	NR	5.2	ND	34.0	360	0.0364	0.0111	5.74	13.62	NR	NR		
Min	ND	ND	ND	ND	1.6	0.9	ND	ND	ND	ND	ND	ND	NR	NR	5.2	ND	ND	NA	0.0001	0.0009	5.60	4.90	NR	NR		

ND - Not detected

NR - Not recorded

MG - Made ground

ALV - Alluvium

RTD - River Terrace Deposit

WB - Weathered bedrock

NB: Where no flow (ND) recorded, Qhg values are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of Qhg.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground: ☐ Dry ☒ Moist ☐ Wet ☐ Snow ☐ Frozen
 Wind: ☐ Calm ☐ Light ☒ Moderate ☐ Strong
 Cloud cover: ☐ None ☒ Slight ☒ Cloudy ☐ Overcast
 Precipitation: ☒ None ☐ Slight ☐ Moderate ☐ Heavy
 Time monitoring performed: ☐ 8:00 ☐ 9:20
 Barometric pressure performed: ☐ 989 ☐ 988
 Pressure trend (Daily): ☒ Falling ☐ Steady ☐ Rising
 Source: ☐ wunderground.com ☐ Before ☐ After
 Air Temperature (Deg. C): ☐ Before ☐ After

< slight at BH03 for 20mins

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GFM400
 Gas Range: CH₄ 0 - 100% CO₂ 0 - 100% O₂ 0 - 25%
 Gas Flow range: +100/-50 l/hour
 Differential Pressure: (+/-) 1000 Pa
 Date of last calibration: 12-08-19
 Date of next calibration: 12-08-20

Ambient air check: CH₄ CO₂ O₂

Ground Gas and Groundwater Monitoring Record Sheet



JOB DETAILS:

Client: Middleton Sheet Metals
Site: Middleton Sheet Metals
Date: 14th February 2020

Job No: 19060
Visit No: 4 of 6
Operator: Alice Smith

Project Manager: Ian Parkinson

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Qhg per borehole		WELL AND WATER DATA						Comments
	Methane (%w/v)		%LEL		Carbon dioxide (%w/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%w/v)				Flow rate (l/hr)	Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)			CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Top of BH (mAOD)	Water level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady															
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady															
PWA Geo-Environmental Installed Wells																											
BH01	1.0	1.0	24.4	24.4	1.7	1.7	4.0	4.0	1.0	0.0	19.4	19.4	NR	NR	-0.6	NR	-2.0	40	0.0060	NR	5.66	13.34			6.00 - 15.00 ALV	Response zone flooded	
BH02	23.8	23.8	>>>>	>>>>	6.3	6.3	4.0	ND	ND	ND	ND	ND	NR	NR	ND	ND	0	0.0238	0.0063	ND	4.88			1.00 - 5.00 MG			
BH03	0.2	0.0	4.1	ND	0.1	0.1	4.0	ND	ND	ND	19.0	20.4	NR	NR	ND	ND	0	0.0002	0.0001	ND	4.93			1.00 - 5.00 MG			
BH04	1.6	1.0	37.2	23.6	9.5	9.5	4.0	ND	ND	ND	ND	ND	NR	NR	-0.7	ND	-2.0	150	0.0112	0.0095	ND	5.57			2.00 - 6.00 MG		
Max	23.8	23.8	37.2	24.4	9.5	9.5	4	4	1	0	19.4	20.4	NR	NR	-0.6	ND	-2.0	150	0.0238	0.0095	5.66	13.34	NR	NR			
Min	0.2	0.0	4.1	ND	0.1	0.1	4	ND	ND	ND	ND	ND	NR	NR	-0.7	ND	ND	0	0.0002	0.0001	5.66	4.88	NR	NR			

ND - Not detected

NR - Not recorded

NB: Where no flow (ND) recorded, Qhg values are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of Qhg.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground: ☐ Dry ☐ Moist ☐ Wet ☒ Frozen
Wind: ☒ Calm ☐ Light ☐ Moderate ☐ Strong
Cloud cover: ☐ None ☒ Slight ☐ Cloudy ☐ Overcast
Precipitation: ☒ None ☐ Slight ☐ Heavy
Time monitoring performed: ☐ 7:50 Start ☐ 8:50 End
Barometric pressure (mbar): ☐ 1000 Start ☐ 1000 End
Pressure trend (Daily): ☐ Falling ☒ Steady ☐ Rising
Source: ☐ wunderground.com
Air Temperature (Deg. C): ☐ 4 Before ☐ 4 After

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GFM 430
Gas Range: CH₄ 0 - 100% CO₂ 0 - 100% O₂ 0 - 25%
Gas Flow range: +100/-50 l/hour
Differential Pressure: (+/-) 1000 Pa
Date of last calibration: 12-08-19
Date of next calibration: 12-08-20

Ambient air check: CH₄ CO₂ O₂

Ground Gas and Groundwater Monitoring Record Sheet



JOB DETAILS:

Client: Middleton Sheet Metals
Site: Middleton Sheet Metals
Date: 03/03/2020

Job No: 19060
Visit No: 5 of 6
Operator: Alice Smith
Project Manager: Ian Parkinson

	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Qhg per borehole		WELL AND WATER DATA						Comments
Monitoring Point	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Top of BH (mAOD)	Water level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady											
PWA Geo-Environmental Installed Wells																											
BH01	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	5.66	13.38			6.00 - 15.00 ALV	Position flooded	
BH02	21.9	21.9	>>>>	>>>>	6.0	6.0	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	ND	0.0219	0.0060	ND	4.90			1.00 - 5.00 MG		
BH03	ND	ND	ND	ND	1.2	0.8	ND	ND	ND	ND	5.3	7.2	NR	NR	ND	ND	ND	ND	0.0001	0.0008	4.92	4.93			1.00 - 5.00 MG		
BH04	1.6	1.6	36.6	36.5	9.8	9.8	ND	ND	ND	ND	0.0	0.0	NR	NR	-2.1	0.0	-7.0	345	0.0336	0.0000	5.40	5.59			2.00 - 6.00 MG		
Max	21.9	21.9	36.6	36.5	9.8	9.8	ND	ND	ND	ND	5.3	7.2	NR	NR	-2.1	0.0	-7.0	345	0.0336	0.0060	5.66	13.38	NR	NR			
Min	ND	ND	ND	ND	1.2	0.8	ND	ND	ND	ND	ND	ND	NR	NR	-2.1	0.0	ND	ND	0.0001	0.0000	4.92	4.90	NR	NR			

ND - Not detected

NR - Not recorded

NB: Where no flow (ND) recorded, Qhg values are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of Qhg.

MG - Made ground

ALV - Alluvium

RTD - River Terrace Deposit

WB - Weathered bedrock

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground: ☐ Dry ☐ Moist ☒ Wet ☐ Snow ☐ Frozen
Wind: ☐ Calm ☒ Light ☐ Moderate
Cloud cover: ☐ None ☐ Slight ☒ Cloudy ☐ Overcast
Precipitation: ☐ None ☒ Slight ☐ Moderate
Time monitoring performed: 08:16 Start 09:00 End
Barometric pressure (mbar): 983 Start 982 End
Pressure trend (Daily): ☐ Falling ☐ Steady ☐ Rising
Source: Wunderground.com
Air Temperature (Deg. C): ☐ 3 Before ☐ 4 After

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GFM430 (BM36)
Gas Range: CH₄ 0-100% CO₂ 0-100% O₂ 0-25%
Gas Flow range: +100/-50 l/hour
Differential Pressure: (+/-) 1000 Pa
Date of last calibration: 12/08/2019
Date of next calibration: 12/08/2020
Ambient air check: CH₄ ND CO₂ ND O₂ 20.6

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS:

Client: Middleton Sheet Metals
Site: Middleton Sheet Metals
Date: 13-03-20

Job No: 19060
Visit No: 6 of 6
Operator:

Project Manager: Ian Parkinson

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA			Qhg per borehole		WELL AND WATER DATA						Comments	
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Top of BH (mAOD)	Water level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady											
	Sirius Installed Wells																										
BH01	0.4	0.4	9.9	9.8	1.4	1.4	ND	ND	ND	ND	19.9	19.9	NR	NR	ND	ND	ND	ND	0.0004	0.0014	5.60	13.37		-5.60	6.00 - 15.00 ALV	Response zone flooded	
BH02	20.9	20.8	>>>>	>>>>	4.5	4.5	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	ND	0.0209	0.0045	0.00	4.89		0.00	1.00 - 5.00 MG		
BH03	ND	ND	ND	ND	0.9	0.7	ND	ND	ND	ND	12.4	13.8	NR	NR	ND	ND	ND	ND	0.0001	0.0007	0.00	4.92		0.00	1.00 - 5.00 MG		
BH04	2.2	1.7	49.5	40.0	10.4	10.0	60.0	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	ND	0.0022	0.0100	5.40	5.60		-5.40	2.00 - 6.00 MG		
Max	20.9	20.8	49.5	40.0	10.4	10.0	60	ND	ND	ND	19.9	19.9	NR	NR	ND	ND	ND	ND	0.0209	0.0100	5.60	13.37	NR	0.00			
Min	ND	ND	ND	ND	0.9	0.7	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	ND	0.0001	0.0007	0.00	4.89	NR	-5.60			

ND - Not detected

NR - Not recorded

NB: Where no flow (ND) recorded, Qhg values are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of Qhg.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground: ☒ Dry ☒ Moist ☐ Wet ☐ Snow ☐ Frozen

Wind: ☒ Calm ☐ Light ☐ Moderate ☐ Strong

Cloud cover: ☐ None ☒ Slight ☐ Cloudy ☐ Overcast

Precipitation: ☒ None ☐ Slight ☐ Moderate ☐ Heavy

Time monitoring performed: ☐ 8:00 Start ☐ 9:00 End

Barometric pressure (mbar): ☐ 1002 Start ☐ 1002 End

Pressure trend (Daily): ☐ Falling ☐ Steady ☒ Rising

Source: ☐ Wunderground.com ☐

Air Temperature (Deg. C): ☐ 6 Before ☐ 8 After

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GFM430 (BM36)

Gas Range: **CH₄** **CO₂** **O₂**

Gas Flow range: +100/-50 l/hour

Differential Pressure: (+/-) 1000 Pa

Date of last calibration: 12-08-19

Date of next calibration: 12-08-20

Ambient air check: **CH₄** **CO₂** **O₂**