

AS/p2ad/3647

2nd June 2020

Frances Hampson
Deloitte LLP
2 Hardman Street
Manchester
M3 3HF

Dear Frances Hampson

PROJECT: THQ; ENABLING WORKS CONDITION : GROUND GAS MONITORING

A total of six monitoring visits have been undertaken at the THQ site however only 5 have been provided within the most recently issued report. Please see complete ground gas monitoring completed at the THQ site provided alongside this letter.

It is noted that during the gas monitoring there were difficulties locating boreholes on multiple visits, due to the vegetation clearance and archaeology surveys underway at the time damaging / burying wells. However, with the exception of BH106, gas readings have been taken from all wells between 4 and 6 times over the course of the monitoring period.

Notwithstanding the complications encountered on-site, we also have to consider the gas regime in the “post-earthworks” (i.e. post-Enabling Works) condition. We have not identified any credible sources of off-site ground gas generation (such as filled ground, landfills etc.) and the only on-site sources considered present relate to organic rich soils associated with the watercourse, topsoil or 2019 vegetation removal works. The Phase 1 Office footprint is to be excavated to the underlying glacial clay / weathered mudstone, with all unsuitable organic rich material encountered removed from site. As such, we anticipate that most sources of ground gas generation will be removed during the Enabling Works phase.

CS1 Justification

A total of six gas monitoring visits were undertaken between December 2018 and March 2019 under atmospheric pressures between 984 and 1033mbar. Monitoring wells were placed to give an adequate spread across the development site and to target areas of concern, with regards to contamination and groundwater issues (i.e. mounded material at BH101a and hydrocarbon contamination at BH104).

Gas monitoring indicated no flow in all boreholes, except for BH103. High flow rates within BH103 (62 l/hr, 86 l/hr, -52 l/hr) were recorded on only three of the six visits but were not sustained; steady flow was recorded as 0 l/hr for all visits at this location. Methane and carbon dioxide levels within BH101a and BH104 were consistently greater than 1% and 5% respectively, with a methane concentration of 6.20% recorded in BH101a during the final visit. No flow was recorded in these



boreholes, as either peak or steady. No flow and low levels of methane and carbon dioxide were recorded within the remaining wells.

Given the sporadic peak gas flow readings recorded within BH103 (which were highly positive or negative values and subsided to 0.0 l/hr in their steady state), the changes in water levels between visits and the response zone sealed into clay deposits, we believe the high flow is likely due to pressure build-up caused by rising / falling water levels and is not representative of the gas regime. Both BH101a and BH104 were installed in areas of approximately 3.00m of reworked / made ground and elevated levels of carbon dioxide and methane are likely from the decay of organic matter and, in the case of BH104, possibly also from the hydrocarbon contamination noted there. As noted above, it is likely these materials will be removed as part of the cut / fill exercise and, it is assumed, that in the area of BH104 this would equate to removing the source of elevated methane and carbon dioxide readings.

The deeper monitoring wells – BH102, BH103 (excluding flow rates) and BH106 – are considered to be representative of the gas regime at the completed development site (i.e. post cut and fill and removal of deleterious material) and, based on this data, we believe the site to be classified as CS1.

We trust the enclosed is sufficient for your requirements however if any aspect requires clarification please do not hesitate to get in touch.

Yours sincerely



Alex Smiles
Earth Sciences Director

Enc : Gas Monitoring Results



COMPLEX CHALLENGES ... MADE SIMPLE

 Civil, Structural & Environmental Engineers Commercial Wharf, 6 Commercial St, MCR, M15 4PZ	Job No:	3647	Site:	THG
	Date:	11/12/2018	Client:	MAG
	Engineer:	LS	Equipment:	GFM 435

	2 Days Prior	1 Day Prior	On day of Monitoring
Weather Conditions:	Sunny spells	Drizzle	Overcast
Barometric Pressure Trend:	Falling	Rising	Falling
Surface Ground Conditions:			

VISIT ONE	Start	Finish	
Time:	10.50	Time:	13.30
Barometric Pressure:	1016	Barometric Pressure:	1014
Background Oxygen:	20.6	Background Oxygen:	20.1

Monitoring Point	Gas Concentration												Groundwater			Remarks
	Flow Rate (l/h)	Peak						Flow Rate (l/h)	Steady						Depth to Water	
BH N°		CH ₄ %	CO ₂ %	O ₂ %	LEL %	H ₂ S/C O (ppm)	CH ₄ %		CO ₂ %	O ₂ %	LEL %	H ₂ S/C O (ppm)				
BH101A	0.00	0.00	2.10	8.80	0.00	0/0	0.00	0.00	2.10	8.80	0.00	0/0	4.15	4.15	WAB	
BH102	0.00	0.00	0.00	14.60	<<<	0/11	0.00	0.00	0.00	14.60	<<<	0/10	2.12	4.30	2.18	
BH103	0.00	0.00	0.30	15.80	<<<	0/0	0.00	0.00	0.30	15.80	<<<	0/0	0.59	3.74	3.15	
BH104	0.00	0.00	4.00	1.30	<<<	0/0	0.00	0.00	4.00	1.30	<<<	0/0	2.57	2.66	0.09	Silty
BH106	0.00	0.00	0.60	19.70	<<<	0/0	0.00	0.00	0.60	19.70	<<<	0/0	0.95	3.70	2.75	

Comments:



Civil, Structural & Environmental Engineers

Commercial Wharf, 6 Commercial St, MCR, M15 4PZ

Job No:

3647

Site:

THG

Date:

04/01/2019

Client:

MAG

Engineer:

LS

Equipment:

GFM 435

2 Days Prior

1 Day Prior

On day of Monitoring

Weather Conditions:

Overcast

Overcast

Dry

Barometric Pressure Trend:

Rising

Rising

Rising

Surface Ground Conditions:

Wet

VISIT TWO

Start

Finish

Time:

10.40

Time:

11.40

Barometric Pressure:

1033

Barometric Pressure:

1031

Background Oxygen:

20.6

Background Oxygen:

20.1

Monitoring Point

Gas Concentration

Groundwater

Peak

Steady

BH N°

Flow Rate
(l/h)

CH₄
%

CO₂
%

O₂
%

LEL
%

H₂S/C
O
(ppm)

Flow Rate
(l/h)

CH₄
%

CO₂
%

O₂
%

LEL
%

H₂S/C
O
(ppm)

Depth to
Water

Depth to
Base

Head of
water

Remarks

BH101A

0.00

1.00

6.10

0.50

22.80

0/10

0.00

1.00

6.10

0.50

22.80

0/10

4.15

4.15

WAB

BH102

0.00

0.00

0.00

13.50

<<<

0/10

0.00

0.00

0.00

13.50

<<<

0/0

2.40

4.32

1.92

BH103

62.50

0.00

0.70

13.40

<<<

0/10

0.00

0.00

0.70

12.90

<<<

0/10

1.08

3.67

2.59

Silty

BH104

0.00

2.20

6.10

0.60

50.90

0/12

0.00

2.20

6.10

0.60

50.70

0/10

2.56

2.65

0.09

UNABLE TO LOCATE WELL

Comments:



Civil, Structural & Environmental Engineers

Commercial Wharf, 6 Commercial St, MCR, M15 4PZ

Job No:

3647

Site:

THG

Date:

11/01/2019

Client:

MAG

Engineer:

LS

Equipment:

GFM 435

2 Days Prior

1 Day Prior

On day of Monitoring

Weather Conditions:

Cold / overcast

Cold / foggy

cold / overcast

Barometric Pressure Trend:

Stable

Rising

Rising

Surface Ground Conditions:

Wet

Wet

Wet

VISIT THREE

Start

Finish

Time:

14.15

Time:

15.00

Barometric Pressure:

1019

Barometric Pressure:

1020

Background Oxygen:

20.9

Background Oxygen:

20.5

Monitoring Point

Gas Concentration

Groundwater

Peak

Steady

BH N°

Flow Rate
(l/h)

CH₄
%

CO₂
%

O₂
%

LEL
%

H₂S/C
O
(ppm)

Flow Rate
(l/h)

CH₄
%

CO₂
%

O₂
%

LEL
%

H₂S/C
O
(ppm)

Depth to
Water

Depth to
Base

Head of
water

Remarks

BH101A

0.00

1.80

5.70

1.50

42.40

0/0

0.00

1.80

5.70

1.50

42.40

0/0

WAB

4.15

Silty

BH102

0.00

0.00

0.00

13.50

<<<

0/0

0.00

0.00

0.00

13.50

<<<

0/0

2.51

4.28

1.77

Silty

BH103

0.00

0.00

0.80

16.60

<<<

0/10

0.00

0.00

0.80

16.60

<<<

0/0

1.09

3.60

2.51

Silty

BH104

0.00

2.80

5.90

1.10

62.30

0/0

0.00

2.70

5.90

1.20

62.30

0/0

2.57

2.67

0.10

BH106

UNABLE TO LOCATE WELL

Comments:



Civil, Structural & Environmental Engineers

Commercial Wharf, 6 Commercial St, MCR, M15 4PZ

Job No:

3647

Site:

THG

Date:

23/01/2019

Client:

MAG

Engineer:

LS

Equipment:

GFM 435

2 Days Prior

1 Day Prior

On day of Monitoring

Weather Conditions:

Cold / overcast

Cold / Sleet

cold / overcast

Barometric Pressure Trend:

Falling

Falling

Falling

Surface Ground Conditions:

Wet

Wet

Wet

VISIT FOUR	Start	Finish
Time:	10.20	11.15
Barometric Pressure:	995	993
Background Oxygen:	20.7	20.1

Monitoring Point	Gas Concentration												Groundwater			
	Flow Rate (l/h)	Peak					Flow Rate (l/h)	Steady								
BH N°		CH ₄ %	CO ₂ %	O ₂ %	LEL %	H2S/C O (ppm)		CH ₄ %	CO ₂ %	O ₂ %	LEL %	H2S/C O (ppm)	Depth to Water	Depth to Base	Head of water	Remarks
BH101A	0.00	2.30	3.60	3.00	53.60	0/10	0.00	2.30	3.60	3.00	53.60	0/0	WAB	4.14	WAB	
BH102	0.00	0.00	0.00	14.60	<<<	0/0	0.00	0.00	0.00	14.60	<<<	0/0	2.04	4.27	2.23	
BH103	86.90	0.00	0.50	18.60	<<<	0/12	0.00	0.00	0.50	18.60	<<<	0/0	0.90	3.59	2.69	
BH104	0.00	3.30	6.10	2.30	76.10	0/0	0.00	3.30	6.10	2.30	76.10	0/0	2.55	2.65	0.10	
BH106	UNABLE TO LOCATE WELL															

Comments:



Civil, Structural & Environmental Engineers

Commercial Wharf, 6 Commercial St, MCR, M15 4PZ

Job No:

3647

Site:

THG

Date:

01/02/2019

Client:

MAG

Engineer:

LS

Equipment:

GFM 435

2 Days Prior

1 Day Prior

On day of Monitoring

Weather Conditions:

Light snow

cold, sunny spells

Cold, sunny spells

Barometric Pressure Trend:

Surface Ground Conditions:

Wet

Wet

Wet

VISIT FIVE

Start

Finish

Time:

10.40

Time:

11.20

Barometric Pressure:

984

Barometric Pressure:

982

Background Oxygen:

20.7

Background Oxygen:

20.5

Monitoring Point

Gas Concentration

Groundwater

Peak

Steady

BH N°

Flow Rate
(l/h)

CH₄
%

CO₂
%

O₂
%

LEL
%

H₂S/C
O
(ppm)

Flow Rate
(l/h)

CH₄
%

CO₂
%

O₂
%

LEL
%

H₂S/C
O
(ppm)

Depth to
Water

Depth to
Base

Head of
water

Remarks

BH101A

0.00

2.60

3.70

3.70

59.80

0/0

0.00

2.60

3.70

3.70

59.80

0/0

WAB

4.15

WAB

BH102

UNABLE TO LOCATE WELL

BH103

0.00

0.00

0.00

15.10

0.00

0/0

0.00

0.00

0.00

15.10

0.00

0/0

2.00

3.59

1.59

BH104

UNABLE TO LOCATE WELL

BH106

UNABLE TO LOCATE WELL

Comments:



Civil, Structural & Environmental Engineers

Commercial Wharf, 6 Commercial St, MCR, M15 4PZ

Job No:

3647

Site:

THG

Date:

28/03/2019

Client:

MAG

Engineer:

MN

Equipment:

GFM 435

2 Days Prior

1 Day Prior

On day of Monitoring

Weather Conditions:

Mild, overcast

Mild, scattered clouds

Sunny, scattered clouds

Barometric Pressure Trend:

Falling

Rising

Falling

Surface Ground Conditions:

VISIT SIX

Start

Finish

Time:

2.45

Time:

4.25

Barometric Pressure:

1020

Barometric Pressure:

1018

Background Oxygen:

21.0

Background Oxygen:

21.3

Monitoring Point

Gas Concentration

Groundwater

Peak

Steady

BH N°

Flow Rate
(l/h)

CH₄
%

CO₂
%

O₂
%

LEL
%

H₂S/CO
(ppm)

Flow Rate
(l/h)

CH₄
%

CO₂
%

O₂
%

LEL
%

H₂S/CO
(ppm)

Depth to
Water

Depth to
Base

Head of
water

Remarks

BH101A

0.00

5.10

5.80

0.40

>>>

0/0

0.00

5.10

5.80

0.40

>>>

0/0

WAB

4.15

NO ACCESS - BEING USED AS COMPOUND

BH103

-52.00

0.00

0.40

20.10

0.00

0/0

0.00

0.00

0.40

20.10

0.00

0/0

1.04

3.58

BH104

0.00

6.20

5.80

1.20

>>>

0/0

0.00

6.20

5.80

0.20

>>>

0/0

2.57

2.66

UNABLE TO LOCATE WELL

Comments: