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2017 ANNUAL LANDFILL GAS MONITORING REPORT

HYDRO ALUMINIUM

RAMBOLL

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1. INTRODUCTION

This report presents the findings of the monthly gas monitoring undertaken from December 2016 to October 2017 at the Capped Waste Stockpile (CWS) located at the former Hydro Kurri Kurri Aluminium Smelter, shown in **Figure 1, Appendix 1.**

1.1 Objective and Scope

Hydro owns and manages the former Hydro Aluminium Smelter as well as the surrounding buffer lands located at Loxford, New South Wales. In 2014 Hydro announced the permanent closure of the smelter. As part of proposed remediation work, Hydro engaged contractors to design a new onsite containment cell to relocate and permanently place wastes from within the CWS. As part of the design of the containment cell, information on the type and rate of gas generation expected from the waste was required. The objective was to monitor landfill gases from gas vents, gas wells and groundwater wells within the CWS so that composition and generation rates could be estimated.

In order to conduct this work the following tasks were completed:

- Undertake a site inspection. This included identifying and confirming suitability for gas monitoring and sampling of wells and vents at the Site as shown in **Figure 2, Appendix 1**.
- Development of The Landfill Gas Monitoring Protocol (Ramboll Environ 2016) including the monitoring methodology and all relevant workplace health and safety measures. The monitoring methodology is presented in **Appendix 2** and was based on the *Draft Landfill Gas Fugitive Emissions Monitoring Guidelines* (VIC EPA 2011).
- Undertake gas monitoring over a twelve month period at the CWS. Monitoring was undertaken as discrete sampling programs once per month at each of the specified monitoring points. The monitoring was conducted using a GA5000 landfill gas analyser to measure gas concentrations at 12 onsite gas vents, six gas wells and six groundwater monitoring wells to measure the concentrations of methane (CH_4), carbon monoxide (CO), hydrogen sulphide (H_2S), carbon dioxide (CO_2) and oxygen (O_2) as well as flow rates and temperature from the vents and wells. Ammonia sampling was undertaken for three rounds using Kitagawa tubes and associated pump.
- Complete a factual report each month following sampling that tabulated all data and observations.
- Complete a factual report at the completion of 12 rounds, documenting the basis of the monitoring conducted and presentation of the monitoring results in tabular format.

2. CONCEPTUAL SITE MODEL

2.1 Capped Waste Stockpile Characterisation

The Capped Waste Stockpile (CWS) is an onsite stockpile comprising mixed smelter wastes that was capped in 1995. The CWS is located within the Hydro Aluminium Kurri Kurri smelter and is approximately 170 m in length by 130 m in width and is up to 11 m high and currently comprises a grassed clay cap.

The stockpile originated during early site operations between 1969 and 1992, when smelter wastes including Spent Pot Lining (SPL), anodes, scrubber bags, concrete, brick, bulky waste, fines and other smelter wastes were stored within onsite storage facilities situated along the eastern smelter boundary. In the mid-1980s changes to legislation regarding the storage of aluminium smelter wastes resulted in the improvement of storage and waste management on the Site. These improvements resulted in the consolidation of wastes into one stockpile and the capping of that stockpile, now referred to as the Capped Waste Stockpile (CWS). The CWS is located near the eastern boundary of the smelter footprint and adjacent to the surrounding Hydro owned buffer land.

The CWS was capped in 1995 with the following layers:

- 150 mm topsoil and grass layer.
- 450 mm sand drainage layer.
- 900 mm compacted clay layer.
- 150 mm gas collection layer.

At the time the cap was constructed, twelve vents were installed into the gas collection layer to allow any gases within the CWS to dissipate to atmosphere.

Table 2-1 provides a general composition of material within the CWS and the capping layers, as encountered during drilling in 2015.

Table 2-1: Subsurface Conditions beneath the Capped Waste Stockpile

Depth (mbgs)	Lithology
0 – 0.5	Topsoil, SAND, brown, fine to medium grained, moist
0.5 – 1.6	CLAY, red and grey mottled, medium plasticity, dry (stockpile cap)
1.6 – 1.8	Gravel, dark grey / black, fine to medium grained (gas buffer layer)
1.8 – 12	Carbon, spent potlining, bath, and other material such as steel and clay
>12	A mixture of sands and clays. Clays encountered were generally stiff with medium to high plasticity

2.2 Monitoring Locations

Monitoring of gases from the CWS was undertaken from three types of monitoring sites:

- Twelve gas vents (VT1 to VT12) installed within the gas collection layer during capping of the CWS in 1995.
- Six monitoring wells (MW201 to MW206) installed at the base of the CWS in 2015 to intersect groundwater beneath the stockpile.
- Six gas wells (VW01 to VW06) installed within the gas collection layer in 2015 for monitoring purposes.

The gas vents are constructed of large diameter PVC tubing which extends into the 150 mm gas collection layer and is open to the atmosphere at surface. Black PVC tubing has been inserted into the large diameter PVC tubing for gas sampling.

Construction details for the monitoring wells is shown in **Table 2-2**, including the screen interval, screened material, depth to water and depth of these wells. The monitoring wells were constructed with a section of 50mm uPVC slotted pipe at the depth of the water table connected to uPVC pipe that extended to ground surface. The annulus of the borehole was backfilled with 2 mm graded sand to 0.5 m above the length of slotted pipe, followed by a 0.5 m bentonite plug then backfilled with cuttings to surface. Dedicated gas monitoring caps were installed at each monitoring well. Borehole logs for these wells are included in **Appendix 3**.

Table 2-2: Groundwater Well Construction Details

Well ID	Screened Interval (m bgs)	Screened Material	Depth to base of waste (m bgs)	Depth to Water (m bgs) 2015	Depth of Well (m bgs)
MW201	4.5 – 10.5	Waste	10.5	-	10.47
MW202	14 - 15.5	Clayey SAND	12.0	12.19	15.42
MW203	12 – 14	Sandy CLAY	12.0	13.21	14.12
MW204	12.6 – 13.3	Clayey SAND	12.0	12.49	13.72
MW205	12 – 12.5	SAND	12.0	12.38	12.56
MW206	11.8 – 14.8	SAND and Waste	12.0	12.45	14.85

- No groundwater encountered.

Construction details for the gas wells is shown in **Table 2-3**, including screen interval and screened material. The gas wells were constructed with a 200 mm mesh stainless steel tube connected to LDPE tubing. The borehole annulus was backfilled with 2 mm graded sand to 0.5 m above the top of the stainless steel tube, followed by bentonite to surface. The LDPE tubing at surface was capped with a gas sampling port and housed inside a PVC tube. Borehole logs for these wells are included in **Appendix 3**.

Table 2-3: Gas Well Construction Details

Well ID	Screened Interval (m bgs)	Screened Material
VW01	1.7 – 1.9	Waste
VW02	1.6 – 1.8	GRAVEL
VW03	1.75 – 1.95	GRAVEL
VW04	1.55 – 1.75	GRAVEL
VW05	1.5 – 1.7	GRAVEL
VW06	1.35 – 1.5	GRAVEL and SAND

The locations of the gas vents, monitoring wells and gas wells are shown in **Figure 2, Appendix 1**.

3. FIELDWORK

The fieldwork undertaken during each monitoring round is summarised below.

3.1 Health and Safety

Risks associated with landfill gas monitoring were carefully assessed as part of the Health and Safety Plan prior to undertaking fieldwork. The Health and Safety Plan identified appropriate risk management measures and site safety procedures.

Potential risks can arise from a range of hazards associated with monitoring and from the prevailing physical conditions. Some of the hazards identified included:

- Exposure to explosive concentrations of methane.
- Exposure to asphyxiating conditions (lack of oxygen).
- Exposure to a range of volatile organic compounds (VOCs) and trace gases.
- Other general hazards related to landfills.

A potential risk identified in the Health and Safety Plan was the potential for gases to be emitted from the CWS during sampling. As such, a gas filter for use with a face respirator was required to be worn during sampling. After review of the gas data from two rounds, previous gas monitoring by Hydro personnel and site observations, it was considered this risk was low and the Health and Safety Plan was updated to remove the requirement for a face respirator.

3.2 Instrument

The GA5000 Landfill Gas Analyser with additional H_2S, flow anemometer and temperature sensors was used to undertake the monitoring. This monitor enabled the measurement of: methane (CH_4), carbon monoxide (CO), hydrogen sulphide (H_2S), carbon dioxide (CO_2) and oxygen (O_2).

The GA5000 can monitor up to 40 L/s which was considered to be sufficient for this purpose and therefore appropriate for the flow rates encountered.

3.3 Prior to Sampling

Prior to sampling, field personnel were considered to be adequately trained based on the following:

- Previous landfill gas monitoring experience.
- Read and understood the Monitoring Protocol (Ramboll Environ 2016), the draft landfill guidelines (VIC EPA, 2011) and the GA5000 user manual.

Prior to sampling, the instrument was inspected to ensure it was in good working order. The instrument was calibrated by the hire company prior to each monitoring round. Calibration certificates for each round are presented in **Appendix 4.**

3.4 Monitoring Methodology

Ramboll conducted a site walkover and inspection of the sampling locations prior to the initial gas sampling event to ensure the monitoring locations were in a suitable condition for monitoring. It was noted that some of the tubing from gas vents were missing caps, however the tubing end is exposed to atmospheric conditions, as such was not considered to be of concern.

Ramboll completed the following monthly gas monitoring events:

- 16 December 2016
- 13 January 2017
- 27 January 2017
- 24 February 2017
- 31 March 2017
- 28 April 2017
- 26 May 2017
- 30 June 2017

- 31 July 2017
- 25 August 2017
- 20 September 2017
- 27 October 2017

The monitoring methodology for each round of sampling was conducted in general accordance with the Monitoring Protocol presented in **Appendix 2**. The exception to this was the completion of flow readings after the gas concentration readings. This was due to the internal step by step methodology of the GA5000, which undertakes gas reading concentrations prior to flow readings as followed in the GA5000 manual flow chart in **Appendix 5.**

Based on GHD's recommendations, in an email dated 5 October 2017, the methodology was modified and flow readings were conducted prior to gas concentration readings and compared to the readings collected during the previous rounds as an evaluation of variability. The results are presented in **Section 5.**

At the end of each gas monitoring round, all six groundwater wells were gauged to determine the depth to water.

Ammonia sampling was conducted using Kitagawa tubes and associated pump for three rounds, from February 2017 to April 2017. Kitagawa tubes ranging from 50-900 ppm were used to determine the ammonia concentrations in each of the gas vents, gas wells and groundwater wells.

CO readings can be affected by hydrogen and H_2S. To reduce the effect of hydrogen, the GA5000 analyser uses a technique that is hydrogen compensated. Hydrogen compensation is achievable up to a level of around 2000 ppm. Above this level the CO reading will not be compensated for. Review of the results indicated all concentrations of hydrogen were below 2000 ppm and as such, hydrogen was not considered to have impacted CO readings. In addition, the GA5000 includes a bar to indicate hydrogen readings of low, medium or high. If a high hydrogen reading is present (hydrogen bar showing high) then the CO reading may be affected, however during all sampling events the hydrogen bar was below the high range.

A H_2S filter was used on a number of occasions when H_2S and/or CO readings were relatively high and it was thought that H_2S concentrations were having a cross gas effect on CO readings. This was generally above 50ppm for H_2S and above 200ppm for CO. Application of the filter is considered to provide a more accurate CO reading by eliminating the effects of H_2S. During monitoring a comparison of the CO readings without the H_2S filter and with the H_2S filter was undertaken. The use of the H_2S filter reported slightly lower CO readings.

4. QUALITY ASSURANCE / QUALITY CONTROL

4.1 General Quality Control Considerations

An adequate quality control program was completed in accordance with the requirements set out in the *Draft Landfill Gas Fugitive Emissions Monitoring Guidelines* (VIC EPA 2011) and the monitoring protocol (Ramboll Environ 2016) as per **Table 4-1.** Evaluation of the quality control program completed found that landfill gas monitoring data collected is representative and of a suitable quality to ensure that the overarching objectives were met. A review of the quality control completed for the project follows.

Table 4-1: Quality Control Considerations

Quality Control Considerations	Ramboll Comments
Personal competence of monitoring personnel	Yes. Monitoring personnel are competent in gas sampling as demonstrated by experience and training records.
Selection of appropriate instrumentation	Yes. GA5000 is an appropriate instrument for landfill gas monitoring. The GA5000 Operating Manual indicates the instrument is in compliance with the SIRA Certification Service in the United Kingdom and CSA International Certification in the USA and Canada.
Monitoring personnel are suitably trained in use of the instruments	Yes. Monitoring personnel are suitably trained in the use of GA5000.
Operation manuals for the selected instruments have been read	Yes. GA5000 Operation manual has been read.
This landfill gas monitoring guideline has been read	Yes. Landfill gas monitoring guideline has been read.
The landfill gas section (6.7) of the Landfill BPEM has been read	Yes. Landfill gas section (6.7) has been read.
Confirmation that instruments have been calibrated over a suitable range in accordance with the manufacturers' recommendations	Yes. Calibration certificates for each round of monitoring were provided by the equipment hire company, ThermoFisher and are presented in **Appendix 4.** The instrument supplied passed calibration.
Appropriate use and maintenance of the selected instrumentation in accordance with the manufacturers' recommendations	The hire company, ThermoFisher completed regular maintenance of the GA5000.
Completing the monitoring task in accordance with the appropriate method	Yes. Monitoring was completed as per the monitoring protocol presented in **Appendix 2.** The H_2S filter was used as noted in **Section 3.4**.
Completing the monitoring task under appropriate meteorological/environmental conditions	Yes. Monitoring was completed under appropriate weather conditions, and accounted for all seasonal fluctuations.
Adequately designed, installed and maintained monitoring locations	Yes. Monitoring locations included 6 groundwater wells, 6 gas wells and 12 gas vents, as shown in **Figure 2, Assessment 1**.
Ongoing assessment of the data obtained during the monitoring task.	Yes. Twelve rounds of monitoring were completed over a 10 month period and the data collected was assessed each month. Monthly reports are included in **Appendix 6**.

4.2 Assessment of Data during Monitoring

The monitoring gas data was assessed for each month and a summary of the results are presented in **Section 5.** The monthly monitoring reports are presented in **Appendix 6.**

5. RESULTS

5.1 Site Observations

During all monitoring rounds the following was noted:

- No odours were noted from vents, gas wells and groundwater wells with the exception of MW201 which continuously had a chemical odour. This well is screened within the waste of the CWS, whereas the other wells were screened within natural ground below the waste.
- No flows were felt or observed through the gas vents, gas wells or groundwater wells.

5.2 Meteorological and Environmental Conditions

Meteorological data was obtained from the nearest weather station Cessnock Airport AWS station 061260 as reported in the Bureau of Meteorology (BOM), for each month of sampling. A summary of the atmospheric pressure, rainfall and wind for each monitoring event is outlined in **Table 5-1**. The meteorological data is presented in **Appendix 7**.

The meteorology data reported a slightly rising atmospheric pressure during 11 monitoring rounds. The final monitoring round reported a slightly decreasing atmospheric pressure over the monitoring period. No rapid alterations in atmospheric pressure was reported.

Rainfall was reported to be between 0-3mm on each day of monitoring with the exception of three monitoring events, where rainfall was recorded 23.8mm (December 2016), 47.6mm (March 2017) and 45.4mm (October 2017). No heavy rainfall was recorded during the monitoring period.

The average wind speed recorded during the 12 rounds was 19km/hr. The wind direction varied for each monitoring round with no prevailing wind direction observed. The minimum wind speed was 4km/hr recorded for July 2017 and the maximum was 44km/hr recorded for March 2017.

Minimum and maximum temperatures were recorded for each round. The average temperature for the minimum temperatures recorded for the 12 rounds was 12°C and the average temperature for the maximum temperatures recorded for the 12 rounds was 25°C. Variations between the minimum and maximum temperatures were between 8.7°C and 23.1°C

Table 5-1: Meteorological and Environmental Conditions

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)	Barometric Pressure 9am (hPa)	Barometric Pressure 3pm (hPa)	Change in pressure over 6 hours (hPa)	Pressure Tendency over 6 hours	Wind Direction	Wind Speed (km/hr)
16-12-2016	17.1	25.8	23.8	1011.1	1007.6	3.5	falling slowly	ESE	15
13-01-2017	22.7	43.6	0	1008.9	1001.3	7.6	falling	WNW	22
27-01-2017	19.6	29.3	2.4	1017.1	1015	2.1	falling slowly	SE	31
24-02-2017	15.2	32.0	0	1019	1015.9	3.1	falling slowly	E	33
31-03-2017	15.5	22.7	47.6	1014.7	1013.9	0.8	falling slowly	SSW	44
28-04-2017	8.6	20.3	0	1022.1	1019.8	2.3	falling slowly	SSW	26
26-05-2017	2.3	20.2	0	1021.4	1018.9	2.5	falling slowly	NNE	6
30-06-2017	5.7	15.3	0.8	1024.6	1024	0.6	falling slowly	NNW	11
28-07-2017	9.1	21.0	0	1018.2	1014.6	3.6	falling slowly	NNW	4
25-08-2017	9.7	18.4	0	1022.8	1021.8	1	falling slowly	S	13
29-09-2017	4.4	27.5	0	1015.7	1010.4	5.3	falling	NNE	9
27-10-2017	12.2	25.5	45.4	1007.7	1008.3	-0.6	rising slowly	SW	13

5.3 Gas Vents

Gas concentrations for each round of sampling for the gas vents are tabulated and graphed in **Appendix 8**. A summary of the minimum, maximum and average concentration for each gas and flow rate collected during the 12 rounds is presented in **Table 5-2**. VT3 and VT9 were not sampled during the December 2016 round as VT3 was blocked and VT9 was missing tubing. The H_2S filter was used on a number of occasions for gas wells VT5, VT6 and VT7. These occasions are shaded in the table in **Appendix 8**.

Table 5-2: Gas Vents Summary Data

Range	Flow (L/hr)	H_2S (ppm)	CO (ppm)	CH_4 (%v/v)	CO_2 (%v/v)	Min O_2 (%v/v)	Balance	Ammonia (ppm)*
VT1								
MIN	0.0	0.0	0.0	0.0	0.1	1.6	79.1	72.0
MAX	0.3	8.0	9.0	0.1	0.2	20.6	98.2	150.0
AVG	0.1	2.6	3.1	0.0	0.2	7.0	92.5	111.0
VT2								
MIN	-0.1	0.0	0.0	0.0	0.1	4.8	79.0	20.0
MAX	0.3	8.0	9.0	0.1	0.5	20.6	94.1	50.0
AVG	0.1	2.4	1.3	0.0	0.3	13.5	86.0	35.0
VT3								
MIN	-0.2	0.0	0.0	0.0	0.1	14.7	78.9	5.0
MAX	0.2	5.0	3.0	0.0	0.8	20.8	84.9	25.0
AVG	0.0	0.8	0.4	0.0	0.3	18.1	81.2	15.0
VT4								
MIN	0.0	0.0	0.0	0.0	0.1	7.8	79.3	75.0
MAX	0.3	16.0	18.0	0.1	0.2	19.5	91.9	100.0
AVG	0.1	7.3	3.7	0.0	0.1	14.5	85.6	85.0
VT5								
MIN	-0.2	0.0	0.0	0.0	0.0	1.0	77.6	10.0
MAX	0.3	200.0	557.0	0.3	8.4	20.8	98.8	600.0
AVG	0.0	75.6	162.7	0.1	0.8	11.1	87.8	305.0
VT6								
MIN	-0.1	0.0	0.0	0.0	0.1	0.6	79.0	80.0
MAX	0.2	87.0	107.0	0.3	0.8	20.9	99.1	300.0
AVG	0.0	26.0	17.9	0.1	0.2	13.4	86.3	190.0
VT7								
MIN	-0.1	0.0	0.0	0.0	0.0	6.1	79.4	280.0
MAX	0.3	110.0	248.0	0.2	0.2	19.6	93.5	280.0
AVG	0.1	45.6	51.2	0.1	0.1	14.4	85.0	280.0
VT8								
MIN	0.0	0.0	0.0	0.0	0.0	17.5	78.2	50.0
MAX	0.3	10.0	3.0	0.0	0.2	21.1	80.1	50.0
AVG	0.1	2.2	0.4	0.0	0.1	19.9	79.2	50.0
VT9								
MIN	-0.2	0.0	0.0	0.0	0.1	3.0	79.3	40.0

Range	Flow (L/hr)	H_2S (ppm)	CO (ppm)	CH_4 (%v/v)	CO_2 (%v/v)	Min O_2 (%v/v)	Balance	Ammonia (ppm)*
MAX	0.4	1.0	2.0	0.0	0.4	20.6	96.5	40.0
AVG	0.1	0.1	0.3	0.0	0.2	14.2	85.5	40.0
VT10								
MIN	-0.1	0.0	0.0	0.0	0.1	10.2	79.2	120.0
MAX	0.2	12.0	3.0	0.0	0.3	20.3	88.4	120.0
AVG	0.1	3.3	0.5	0.0	0.2	15.7	83.8	120.0
VT11								
MIN	-0.5	0.0	0.0	0.0	0.1	15.4	20.2	20.0
MAX	0.2	4.0	2.0	0.0	0.3	20.5	88.8	20.0
AVG	0.0	0.8	0.3	0.0	0.2	19.3	76.1	20.0
VT12								
MIN	-0.1	0.0	0.0	0.0	0.1	10.4	79.0	25.0
MAX	0.2	1.0	1.0	0.0	0.9	20.9	88.6	25.0
AVG	0.0	0.1	0.2	0.0	0.5	16.3	83.1	25.0

*ammonia sampling was conducted for three rounds (February, March and April 2017)

Review of **Table 5-2** above indicated that during the majority of the sampling rounds, flow rate was neutral or positive. The maximum flow rate was 0.4 L/hr in VT9. Negative flow rates were recorded in the majority of vents in the two January 2017 sampling rounds and in vents VT10 and VT11 in the March 2017 sampling round. Flow rates were recorded prior to and after the gas sampling for the gas wells during the October 2017 round. The results indicated either stable concentrations or a slight increase of 0.0 to 0.2 L/hr in flow rates after the gas sampling for all gas vents. The flow rates recorded for both prior and post gas sampling in October were comparable to flow rates recorded for previous sampling rounds.

The gas vents are installed within the gas collection layer and continuously vent the gases from this collection layer to the atmosphere. The tubing installed within the vents is sitting within the atmospheric conditions of the vent as such concentrations are considered to be likely diluted from the inflow of air into the vent. However, an oxygen deficient atmosphere (O_2 less than 19.5 % v/v) was recorded in the vents in the majority of sampling rounds. Oxygen concentrations showed variability between sampling rounds and vent VT1 was the most oxygen deficient.

The highest H_2S and CO and lowest minimum O_2 concentrations were reported in vents VT05, VT06 and VT07. Methane concentrations were low, below 0.3 %v/v for all vents.

The highest ammonia concentration was reported at VT05, with a concentration of 600 ppm. The remaining vents reported variable concentrations between 5-300 ppm.

5.4 Gas Wells

Gas concentration results for each round of sampling for the gas wells are tabulated and graphed in **Appendix 8**. A summary of the minimum, maximum and average concentration for each gas and flow rate collected during the 12 rounds is presented in **Table 5-3**. The H_2S filter was used on a number of occasions for gas wells VW02, VW03, VW04, VW05 and VW06. These occasions are shaded in the table in **Appendix 8**.

Table 5-3: Gas Wells Summary Data

Range	Temp	Flow (L/hr)	H_2S (ppm)	CO (ppm)	CH_4 (%v/v)	CO_2 (%v/v)	Min O_2 (%v/v)	Balance	Ammonia (ppm)*
VW01									
MIN	14.9	0.0	0.0	0.0	0.9	0.5	0.0	97.6	<50
MAX	28.5	0.3	14.0	7.0	1.4	0.8	0.8	98.4	50.0
AVG	22.8	0.1	4.6	1.8	1.2	0.6	0.2	98.0	50.0
VW02									
MIN	15.1	0.0	5.0	62.0	0.4	0.0	0.0	99.2	40.0
MAX	28.5	0.2	107.0	385.0	0.6	0.8	0.2	99.6	100.0
AVG	22.8	0.1	73.2	183.3	0.6	0.3	0.1	99.4	63.3
VW03									
MIN	12.5	0.0	3.0	45.0	0.4	0.0	0.0	92.9	25.0
MAX	27.9	0.3	85.0	260.0	0.9	1.1	6.3	99.4	500.0
AVG	21.9	0.1	56.9	106.6	0.7	0.5	0.6	98.7	215.0
VW04									
MIN	15.7	0.0	14.0	128.0	0.2	0.0	0.0	99.3	150.0
MAX	28.1	0.3	255.0	1326.0	0.4	0.4	0.5	99.8	280.0
AVG	22.9	0.1	178.4	446.8	0.3	0.1	0.1	99.5	235.0V
VW05									
MIN	16.2	0.0	18.0	273.0	0.1	0.0	0.0	99.6	>900
MAX	31.9	0.2	311.0	1473.0	0.3	0.3	0.3	99.8	>900
AVG	24.2	0.1	209.7	560.3	0.2	0.1	0.1	99.7	>900
VW06									
MIN	14.2	0.0	15.0	65.0	0.1	0.0	0.0	97.3	300.0
MAX	30.3	0.1	320.0	1262.0	0.3	0.2	0.8	99.8	>900
AVG	22.8	0.1	185.1	408.3	0.2	0.1	0.3	99.1	700.0

*ammonia sampling was conducted for three rounds (February, March and April 2017)

Review of **Table 5-3** above indicated that flow rates were neutral or positive in the wells. The maximum flow rate was 0.3 L/hr in wells VW01, VW03 and VW04. Ramboll recorded flow rates prior to and after the gas sampling for the gas wells during the October 2017 round. The results indicated a slight increase of 0.1 to 0.3 L/hr in flow rates after the gas sampling for five of the six gas wells, however VW06 remained at 0.0 L/hr. The flow rates recorded for both prior and post gas sampling in October were comparable to flow rates recorded for previous sampling rounds.

The gas wells are installed within the gas collection layer. The tubing installed within the vents is sealed with a cap. The concentrations reported in the gas wells should be representative of gases within the gas collection layer. The six gas wells were highly oxygen deficient, with oxygen concentrations of less than 1 % v/v in the majority of wells.

The highest H_2S and CO concentrations were recorded in wells VW04, VW05 and VW06 with the highest concentrations of CO reported above 1000 ppm. Methane concentrations were higher than in the gas vents, with concentrations ranging between 0.2 %v/v and 1.4 %v/v.

The highest ammonia concentrations were reported in well VW05 which was consistently above the ammonia limit (900 ppm), followed by VW06, with one sampling event above 900 ppm. The remaining wells indicated concentrations below 500 ppm.

5.5 Groundwater Wells

Gas concentration results for each round of sampling for the gas wells are tabulated and graphed in **Appendix 8**. A summary of the minimum, maximum and average concentration for each gas and flow rate collected during the 12 rounds is presented in **Table 5-4**. The H_2S filter was used on a number of occasions for gas wells MW201, MW202, MW204 and MW206.

Table 5-4: Groundwater Wells Summary Data

Well ID	Water Level mbgs	Flow (L/hr)	H_2S (ppm)	CO (ppm)	CH_4 (%v/v)	CO_2 (%v/v)	Min O_2 (%v/v)	Balance	Ammonia (ppm)*
MW201									
MIN	DRY	0.0	10.0	0.0	0.0	0.0	0.1	78.6	>900
MAX		0.2	445.0	1402.0	0.6	0.1	16.0	99.4	>900
AVG	DRY	0.1	218.9	539.8	0.4	0.1	3.3	95.0	>900
MW202									
MIN	12.21	-0.5	3.0	0.0	0.0	0.0	6.7	79.7	100.0
MAX	12.40	1.9	72.0	149.0	0.4	0.7	19.2	92.5	150.0
AVG	12.31	0.2	33.2	35.3	0.1	0.4	12.7	84.6	116.7
MW203									
MIN	11.72	0.0	0.0	0.0	0.0	0.0	16.5	78.5	75.0
MAX	12.08	2.6	22.0	23.0	0.1	0.8	21.3	82.2	190.0
AVG	11.90	1.0	10.4	7.8	0.0	0.3	19.3	80.0	113.3
MW204									
MIN	12.51	0.0	0.0	0.0	0.0	0.1	2.5	78.6	25.0
MAX	12.65	0.2	210.0	370.0	0.3	1.2	21.2	96.0	75.0
AVG	12.59	0.1	59.9	116.8	0.1	0.3	12.0	87.1	50.0
MW205									
MIN	12.42	-2.1	0.0	0.0	0.0	0.0	12.9	79.6	60.0
MAX	12.54	3.3	47.0	45.0	0.1	0.2	19.8	89.7	180.0
AVG	12.49	0.8	20.7	13.3	0.0	0.1	17.1	82.1	121.7
MW206									
MIN	12.57	-0.2	2.0	2.0	0.0	0.0	0.4	78.0	50.0
MAX	12.88	0.3	185.0	843.0	0.2	0.1	21.5	99.3	>900
AVG	12.68	0.1	100.2	232.8	0.1	0.1	8.4	91.1	383.0

*ammonia sampling was conducted for three rounds (February, March and April 2017)

Review of **Table 5-4** above indicated that flow rates were generally positive or neutral, although negative flow rates were recorded in wells MW202, MW205 and MW206. The maximum flow rate was 3.3 L/hr at MW205. The groundwater wells generally reported higher flow rates than the gas wells and the gas vents. Ramboll recorded flow rates prior to and after the gas sampling for the gas wells during the October 2017 round. The results indicated a slight increase of 0.1 to 0.2 L/hr in flow rates after the gas sampling for four of the six gas wells, however MW203 and MW205 reported an increase of 0.6 L/hr and 1.9 L/hr. The flow rates recorded for both prior and post gas sampling in October were comparable to flow rates recorded for previous sampling rounds.

The groundwater wells are screened below the waste material, in the underlying natural soils, with the exception of MW201 which is installed within the CWS. This is confirmed by the highest H_2S and CO readings reported at MW201, followed by MW206 and MW204. Groundwater wells MW202, MW203 and MW205 reported slightly lower H_2S and CO readings when compared to the other wells. All wells reported oxygen deficiency, with MW201 the most oxygen deficient well. Methane concentrations were similar to the gas vents, with concentrations ranging between 0 %v/v and 0.6 %v/v.

The highest ammonia concentrations were reported in well MW201 which was consistently above the ammonia limit (900 ppm), followed by MW206, with one sampling event above 900 ppm. The remaining wells indicated concentrations below 190 ppm.

5.6 Depth to Groundwater

During all 12 monitoring rounds, the depth to groundwater (m below ground surface (m bgs)) at each of the six groundwater wells was recorded. The results are tabulated in **Appendix 8** and a summary provided below:

- MW201 remained dry for all monitoring events.
- Groundwater levels at MW202 fluctuated between 12.21 m bgs (January 2017) and 12.40 m bgs (May 2017).
- Groundwater levels at MW203 fluctuated between 11.72 m bgs (December 2016) and 12.15 m bgs (October 2017).
- Groundwater levels at MW204 fluctuated between 12.51 m bgs (January 2017) and 12.67 m bgs (October 2017).
- Groundwater levels at MW205 fluctuated between 12.42 m bgs (December 2016) and 12.54 m bgs (February 2017). MW205 was reported to be dry during the final round of monitoring (October 2017).
- Groundwater levels at MW206 fluctuated between 12.57 m bgs (December 2016) and 12.88 m bgs (February 2017).

The results indicate relatively stable levels over the 12 month monitoring period, with depth to groundwater generally changing by a few centimetres between each round. Fluctuations over the 12 month period were relatively similar between the groundwater wells, with MW203 showing a slightly decreasing trend as shown in **Appendix 8.**

6. ASSESSMENT

6.1 Guidelines

Guidelines for ground gases were identified in NSW EPA (2012) Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases. This document provides information on determining characteristic gas situation for methane and carbon dioxide using both maximum gas concentration and maximum flow rate, where:

- Gas Screening Value = maximum flow rate (L/hr) x maximum gas concentration (%).

Gas screening values are assessed against Table 6 in the guidelines, which identifies six characteristic gas situations (1 to 6) from very low risk (1) to very high risk (6).

Other guidelines for landfill gases are presented in **Table 6-1**, including lower explosive limit (LEL), upper explosive limit (UEL), permissible exposure limit (PEL) as time weighted average (TWA) for human exposure and the Immediately Dangerous to Life and Health Level (IDHL).

Table 6-1: Guidelines for Gas Exposure

Gas	Lower Explosive Limit	Upper Explosive Limit	PEL/TWA[1]	IDHL[1]
H_2S	40,000 ppm	440,000 ppm	10 ppm	100 ppm
CO	128,000 ppm	740,000 ppm	35 ppm	1200 ppm
CH_4	50,000 ppm	150,000 ppm	Asphyxiant	Asphyxiant
CO_2	-	-	5000 ppm	40,000 ppm
O_2	-	-	-	-
Ammonia	150,000 ppm	280,000 ppm	25 ppm	300 ppm

- No guidelines available.

1 United State Department of Labor Occupational Safety and Health Administration (OSHA)

6.2 Assessment against Guidelines

6.2.1 NSW EPA Guidelines

NSW EPA (2012) indicates that the Wilson and Card method uses both gas concentrations and borehole flow rates to define a characteristic situation for a site based on the limiting borehole gas volume flow for methane and carbon dioxide. The worst case values are adopted to determine the characteristic gas situation (1 to 6) and associated risk classification. The Wilson and Card classification has been assessed in **Table 6-2**.

The risk classification is low risk in the gas wells and moderate risk in the monitoring wells. The risk classification for the gas vents is low risk for methane and moderate risk for carbon dioxide. For characteristic gas situation 2, NSW EPA (2012) indicates that borehole flow rate is not to exceed 70 L/hr. The maximum flow rate on site was detected in the monitoring wells at 3.3 L/hr, which is a comparatively low flow rate.

Table 6-2: Wilson and Card Classification

Gas	Max. Borehole Flow Rate (L/hr)	Max. Gas Conc. (% v/v)	Gas Screening Value	Characteristic Gas Situation and Risk Classification
Gas Vents				
Methane	0.4	0.3	0.12	2 Low Risk
Carbon Dioxide	0.4	8.4	3.36	3 Moderate Risk
Gas Wells				
Methane	0.3	1.4	0.42	2 Low Risk

Gas	Max. Borehole Flow Rate (L/hr)	Max. Gas Conc. (% v/v)	Gas Screening Value	Characteristic Gas Situation and Risk Classification
Carbon Dioxide	0.3	0.8	0.24	2 Low Risk
Monitoring Wells				
Methane	3.3	0.6	1.98	3 Moderate Risk
Carbon Dioxide	3.3	1.2	3.96	3 Moderate Risk

6.2.2 Other Guidelines

Results in **Section 5** have been assessed against the guidelines outlined above in **Table 6-3**. As there are no guidelines for oxygen, it has been excluded. The assessment indicates that the gas vents, gas wells and monitoring wells have concentrations of H_2S, CO, CH_4, CO_2 and ammonia that exceed the PEL/TWA and IDLH guidelines. The LEL for methane was exceeded in three of the gas wells. The low maximum flow rate of 3.3 L/hr indicates there is a lack of flow and therefore the gas concentrations identified are not a human health or explosive risk currently.

Table 6-3: Assessment against Guidelines

Gas	Maximum Concentration	Locations exceeding LEL	Locations exceeding PEL/TWA[1]	Locations exceeding IDHL[1]
Gas Vents				
H_2S	200 ppm	None	VT4, VT5, VT6, VT7, VT8, VT10	VT5, VT7
CO	557 ppm	None	VT5 to VT7	None
CH_4	3000 ppm	None	-	-
CO_2	84,000 ppm	-	VT2, VT3, VT5, VT6, VT12	VT5
Ammonia	600 ppm	None	VT1 to VT10, VT12	VT5, VT6
Gas Wells				
H_2S	320 ppm	None	VW01 to VW06	VW02, VW04 to VW06
CO	1473 ppm	None	VW02 to VW06	VW04 to VW06
CH_4	14,000 ppm	None	-	-
CO_2	11,000 ppm	-	VW01 to VW03	None
Ammonia	>900 ppm	None	VW01 to VW06	VW03, VW05, VW06
Monitoring Wells				
H_2S	445 ppm	None	MW201 to MW206	MW201, MW204, MW206
CO	1402 ppm	None	MW201 to MW204, MW206	MW201
CH_4	6000 ppm	None	-	-
CO_2	12,000 ppm	-	MW202 to MW204	None
Ammonia	>900 ppm	None	MW201 to MW206	MW206

- No guidelines available.

1 United State Department of Labor Occupational Safety and Health Administration (OSHA)

7. SUMMARY

Ramboll undertook 12 rounds of gas sampling for the period of December 2016 to October 2017 at the CWS located at the former Hydro Kurri Kurri Aluminium Smelter.

The objective was to monitor landfill gases from gas vents, gas wells and groundwater wells so that composition and generation rates could be estimated.

The gas sampling was undertaken in accordance with the *Draft Landfill Gas Fugitive Emissions Monitoring Guidelines* (VIC EPA, 2011) and the monitoring protocol (Ramboll Environ 2016).

Results from the gas vents identified low flow rates, with a maximum flow rate of 0.4 L/hr and oxygen deficiency in all gas vents. The highest H_2S and CO and lowest O2 concentrations were detected in gas vents VT05, VT06 and VT07. The highest ammonia concentrations were recorded in VT05.

Results from the gas wells also identified low flow rates, with a maximum flow rate of 0.3 L/hr and oxygen deficiency in all gas wells. The highest H_2S, CO and ammonia concentrations were detected in gas well VW04, VW05 and VW06.

Results from the monitoring wells identified a higher maximum flow rate of 3.3 L/hr, although this is still a low flow rate. All monitoring wells were oxygen deficient. The highest H_2S, CO and ammonia concentrations were detected in MW201, which is screened within the waste in the CWS.

The characteristic gas situation and associated risk classification was calculated as per NSW EPA (2012). The risk classification is low risk in the gas wells and moderate risk in the monitoring wells. The risk classification for the gas vents is low risk for methane and moderate risk for carbon dioxide.

Assessment of the maximum gas concentrations against the LEL, OSHA PEL/TWA and IDHL guidelines indicated the gas vents, gas wells and monitoring wells have concentrations of H_2S, CO, CH_4, CO_2 and ammonia that exceed the PEL/TWA and IDLH guidelines. The low maximum flow rate of 3.3 L/hr indicates there is a lack of flow and therefore the gas concentrations identified are not a human health risk currently.

8. REFERENCES

Croft & Associates (December 1980) *Environmental Impact Statement for Expansion of an Aluminium Smelter, Line III, Kurri Kurri, NSW*

ENVIRON (2015) *Phase 2 Environmental Site Assessment* (ENVIRON 2015)

NSW EPA (2012) *Guidelines for the Assessment and Management of Site Impacted by Hazardous Ground Gases*

Ramboll Environ (2016) *Landfill Gas Monitoring Protocol* Hydro Aluminium Kurri Kurri Pty Ltd, December 2016 (Ramboll Environ 2016)

VIC Environmental Protection Agency (2011) *Draft Landfill Gas Fugitive Emissions Monitoring Guidelines* (VIC EPA 2011)

VIC Environmental Protection Agency (2015) *Best Practice Environmental Management - Sitting, Design, Operation and Rehabilitation of Landfills* (VIC EPA 2015)

Woodward-Clyde (November 1997) *Review of Groundwater Monitoring, Capral Smelter*, Kurri Kurri, NSW (Woodward-Clyde 1997)

9. LIMITATIONS

Ramboll prepared this report in accordance with the scope of work as outlined in our proposal to Hydro Aluminium Kurri Kurri Australia Pty Ltd dated 23 November 2016 and in accordance with our understanding and interpretation of current regulatory standards.

A representative program of sampling and analysis was undertaken as part of this investigation, based on past and present known uses of the site. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous.

Site conditions may change over time. This report is based on conditions encountered at the site at the time of the report and Ramboll disclaims responsibility for any changes that may have occurred after this time.

The conclusions presented in this report represent Ramboll's professional judgement based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment.

Ramboll did not independently verify all of the written or oral information provided to Ramboll during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll was itself completed and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

9.1 User Reliance

This report has been prepared exclusively for Hydro Aluminium Kurri Kurri Australia Pty Ltd and may not be relied upon by any other person or entity without Ramboll's express written permission.

APPENDIX 1
FIGURES

Client: Hydro Aluminium Kurri Kurri Pty Ltd

Site Location

RAMBOLL

JOB NO: AS130510

Date: Jan 2018

FIGURE 1

Client: Hydro Aluminium Kurri Kurri Pty Ltd

Sampling Locations

RAMBOLL

JOB NO: AS130510

Date: Jan 2018

FIGURE 2

APPENDIX 2
GAS MONITORING PROTOCOL

Intended for

Hydro Aluminium Kurri Kurri Pty Ltd

Date

December 2016

LANDFILL GAS MONITORING PROTOCOL

RAMBOLL

Date	**19/12/2016**
Made by	**Martin Parsons**
Checked by	**Brian Bell**
Approved by	**Brian Bell**

Ref **AS130510**

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APPENDICES

1. INTRODUCTION

Hydro Aluminium Australia Pty Ltd (Hydro) owns and manages the former Hydro Aluminium Smelter as well as the surrounding buffer lands located at Loxford, New South Wales. In 2014 Hydro announced the permanent closure of the smelter. As part of proposed remediation work, Hydro engaged contractors to design and build a new onsite containment cell to relocate and permanently place wastes from within an existing onsite waste repository known as the 'Capped Waste Stockpile' (CWS). As part of the design of the containment cell, information on the type and rate of gas generation expected from the waste was required. Subsequently, Hydro has engaged Ramboll Environ to undertake monitoring of landfill gases from gas vents and select ground water bore locations so that emissions rates of select gases can be estimated.

The objectives of this monitoring protocol are to set standard methods to manage the health and safety and for the conduct of the monitoring of the gas emissions at the CWS.

2. OBJECTIVE

The objective of the monitoring is to assess monthly for a 12 month period the gas concentrations in twelve on site gas monitoring locations and six groundwater monitoring wells for landfill gases methane, carbon dioxide, carbon monoxide, oxygen and hydrogen sulphide, as well as the rate of gas emission at each location. A factual report will be prepared each month to present data for that monitoring event. At the completion of 12 rounds, a report will be prepared, documenting the basis of the monitoring conducted and presentation of a final data table and report outlining data and quality evaluation.

3. HEALTH AND SAFETY PRECAUTIONS

The risks associated with landfill gas monitoring must be carefully assessed before starting work. Appropriate risk management measures must be in place and all site safety procedures followed.

Risks may arise from a range of hazards associated with the prevailing site conditions and may include:

- Travel to and from site;
- Environmental factors;
- Exposure to explosive concentrations of methane;
- Exposure to asphyxiating conditions (lack of oxygen);
- Exposure to a range of volatile organic compounds (VOC's) and trace gases; and
- Other general hazards related to landfills.

In order to understand and mitigate the risks associated with sampling at the site, a Job Safety Analysis (JSA) has been completed which includes controls and mitigations strategies that sampling staff should implement during the monitoring process.

Task	Hazards	Inherent Risk (See matrix below)			Controls	Residual Risk (See matrix below)		
		Consequence (1, 2, 3, 4, 5)	Likelihood (A, B, C, D, E)	Inherent Risk (L, M, H, E)		Consequence (1, 2, 3, 4, 5)	Likelihood (A, B, C, D, E)	Residual Risk (L, M, H, E)
Mobilise and demobilise to site	Vehicle accident	5	D	M	Use defensive driving techniques. Undertake vehicle check prior to operating to ensure vehicle is in good condition. Drive to the conditions (example reduce speed in rain or low visibility).	5	E	L
Driving on site	Vehicle accident	5	D	M	Drive to site conditions and speed limits. Contact James Brown for location of and use of vehicle routes through the site by other contractors. Use defensive driving techniques. Driver to remain on designated roadways, including on Capped Waste Stockpile. Drive to the conditions (example reduce speed in rain or low visibility).	5	E	L
Sampling	Slips & trips	1	C	L	Practice good housekeeping (tools and samples placed away from walk zone).	1	B	L
	Wildlife (kangaroos, wild dogs, snakes etc)	4	D	M	Check for animals in area before getting out of vehicle. Avoid disturbing animals. Keep access gates closed. Do not work alone.	3	E	L
	Manual handling/postural hazards	2	C	M	Use correct manual handling techniques (SMART). **S**ize up the load (Assess the load - size, shape and weight. Assess whether the load needs to be moved. Ensure pathway	2	D	L

Task	Hazards	Inherent Risk (See matrix below)			Controls	Residual Risk (See matrix below)		
		Consequence (1, 2, 3, 4, 5)	Likelihood (A, B, C, D, E)	Inherent Risk (L, M, H, E)		Consequence (1, 2, 3, 4, 5)	Likelihood (A, B, C, D, E)	Residual Risk (L, M, H, E)
					is clear. Assess whether human or mechanical assistance is required). **M**ove the load as close to your body as possible **A**lways bend your knees **R**aise the load with your legs **T**urn your feet in the direction that you want to move the load			
	Exposure to gases	4	C	M	Wear half-face respirator with combination cartridges. Monitor gas levels with LEL gas monitor. Avoid sparks – no smoking or open flames.	3	C	L

		Consequence Category				
		1-Minor	**2-Medium**	**3-Serious**	**4-Major**	**5-Catastropic**
		Minor (first aid) injury; Minor impact on environment that can be remedied.	Significant medical treatment) injury; Major impact on environment that can be remedied.	Long term injury; Permanent impact on environment in local area.	Permanent disabling injury; Long term impact on environment over wide area.	One or more fatalities; Permanent impact on environment over wide area.
Likelihood Category	**A-Almost Certain**	Medium	High	Extreme	Extreme	Extreme
	B-Likely	Medium	Medium	High	Extreme	Extreme
	C-Possible	Low	Medium	High	High	Extreme
	D -Unlikely	Low	Medium	Medium	Medium	High
	E- Rare	Low	Low	Low	Medium	Medium

4. PRIOR TO SAMPLING

It is important that all landfill gas monitoring data collected is representative and of a suitable quality to ensure that the overarching objectives of the monitoring program can be achieved. In order to achieve this, the following criteria should be met prior to sampling:

1. Personal competence of the monitoring personnel including monitoring personnel being suitably trained in use of the instruments;
2. Selection of appropriate instrumentation;
3. Confirm that instruments have been calibrated over a suitable range in accordance with the manufacturers' recommendations;
4. Use of the selected instrumentation in accordance with the manufacturers' recommendations;
5. Undertake monitoring in accordance with the methodology outlined below;
6. Conduct all monitoring in accordance with the JSA and amend the JSA as required if conditions change;
7. Ensure appropriate meteorological/environmental conditions prior to monitoring; and
8. Ensure monitoring locations are adequately designed, installed and maintained.

5. INSTRUMENTS

It is recommended that the GA5000 Landfill Gas Analyser with additional H_2S, flow anemometer and temperature sensors be used to undertake the monitoring. This monitor will enable the measurement of: methane (CH_4), carbon monoxide (CO), hydrogen sulphide (H_2S), carbon dioxide (CO_2) and oxygen (O_2).

If the GA5000 monitor is not available there are similar alternative instruments available that will be able to used and the specifications of the alternative instrument should be compared.

The lowest cost quotation for hire was provided by Air-Met Scientific in Sydney and all queries for the hire and calibration as well as any faults associated with the equipment should be undertaken with them.

6. MONITORING METHODOLOGY

1. Before starting monitoring, check your surrounds and ensure that the conditions are considered safe and adequate for the monitoring period.
2. The inert sample tubing (maximum 1 metre in length) should be attached and the instrument turned on in a location unlikely to be affected by landfill gas (or other air contaminants). Confirm that the instrument is reading gas concentrations that are indicative of the prevailing background conditions (generally <0.1% methane, <0.1% carbon dioxide, <0.1% carbon monoxide, <0.1% hydrogen sulphide, 21.0% oxygen, 79% balance (nitrogen)).
3. Note background information, including: site identification, bore location (latitude and longitude), start time of the monitoring round, date, instruments used (including serial numbers or main instrument and probes) and person completing the monitoring. Changes in any of the above should be noted as should the finish time.
4. Visually inspect the bore and, without breaking the gastight seal, note any issues or deficiencies that may prevent representative data being obtained (such as landfill gas odours, unsealed bores, screened sections of pipework above ground level, failed bentonite seal or an open gas tap). Note whether the bore is locked and secure.

5. Check that the location of the sampling point is appropriate and not too close to the point of directional flow changes.
6. Connect the sample tubing to the bore and record the relative pressure, including whether the pressure is positive (+) or negative (–). If the bore is fitted with a gas sampling tap, connect the sample tubing to the instrument and the gas sampling tap prior to opening the tap. If the bore is fitted with a quick-connect coupling, connect the sample tubing to the instrument before being fitted to the bore quick-connect fitting. Record the differential pressure before starting the instrument pump or measuring gas concentrations.
7. Record the atmospheric pressure. Turn on the pump and using separate probes record temperature and flow. Please make a note the internal diameter of the pipe as this will be used to calculate volumetric flow.
8. Change probes and then record the peak and stabilised concentrations of methane, carbon monoxide, carbon dioxide, and minimum concentration of oxygen. Monitor for three minutes. If the monitored gas concentrations have not reached a stabilised concentration after three minutes of continuous sampling, record the final gas concentrations, along with the direction and rate of change in concentration (rapidly or slowly increasing or decreasing), and note them as non-stabilised final readings.

   Continually assess the data obtained during the monitoring task for stability of measurement. If you suspect that there may be a problem with the operation of the instrument being used, then the equipment hire company should be contacted in the first instance to discuss instrument performance and the need for a replacement.

   Monitoring of H_2S is done with a separate probe but the same methodology should be used as above.

   If very high landfill gas concentrations are recorded on the instrument (>30% v/v of any monitored gas), then monitoring of the bore should be extended beyond three minutes to try to further determine the persistence of the gas detected within the bore.
9. Once the peak and stabilised concentrations have been recorded, fully close the gas sampling tap (if applicable) and disconnect the sample tubing from the gas tap. Keep the instrument pump turned on away from the bore and other sources of gas or contaminants until any residual gas present in the instrument has been purged from the instrument and sample tubing. The gas concentrations reported by the instrument should resemble those likely to be indicative of the prevailing background conditions (generally <0.1% methane, <0.1% carbon dioxide, 21.0% oxygen, 79% balance (nitrogen)).
10. Record all figures in table supplied in Appendix A.
11. Sampling will be completed at the following times:
    1) Mid December 2016;
    2) Early January 2017;
    3) Late January 2017;
    4) Late February 2017;
    5) Late March 2017;
    6) Late April 2017;
    7) Late May 2017
    8) Late June 2017
    9) Late July 2017
    10) Late August 2017
    11) Late September 2017 and
    12) Late October 2017 (FINAL ROUND).

12. Sampling will be completed during varying weather conditions, including during falling atmospheric pressure to capture the worst-case meteorological scenario.

7. REPORTING

Reporting will be completed monthly for eleven sampling occasions and an annual report comprising all data prepared at the completion of sampling.

Each monthly report is to include a tabular representation of the data emailed to the client.

- The annual and final report is to include:
- An outlined of the project objectives and scope;
- An assessment of quality control and a statement on the reliability of the data;
- A tabulated representation of the data;
- All sampling and equipment calibration records included as appendices.

APPENDIX

Landfill Gas Monitoring Sheet

Site:								Date:					Start time:						Finish time:
Monitoring personnel:								Monitoring equipment & serial number:					Date of last calibration:						
Bore ID	Latitude	Longitude	Start time	Temperature oC	Flow l/h	Atmospheric pressure (mb)	Relative pressure (mb)	Peak (% v/v)				Min O_2 (% v/v)	Stabilised (% v/v)						Comments
								H_2S	CO	CH_4	CO_2		H_2S	CO	CH_4	CO_2	O_2	Balance	
Other observations, comments:																			

APPENDIX 3
BOREHOLE LOGS

BOREHOLE NUMBER MW201

CLIENT Hydro Aluminium Kurri Kurri **PROJECT NAME** Groundwater Well Installation

PROJECT NUMBER AS130456 **PROJECT LOCATION** Capped Waste Stockpile

DATE STARTED 26/10/15 **COMPLETED** 26/10/15 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT Sonic **HOLE LOCATION**

HOLE SIZE **LOGGED BY** MT **CHECKED BY**

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Sonic				0			TOPSOIL; SAND; brown, moist, fine to medium grained		
							CLAY; red and grey mottled, dry, medium plasticity		
							GRAVEL; grey, medium grained (gas buffer layer)		
				2			FILL; carbon and SPL ~85%, Bath ~5%, other (steel and clay) ~10%, dry		
								MW201 - 3.0m	CO 30ppm, O2 20.1%, LEL 0%, NH3 0ppm
				4					
				6				MW201 - 6.0m	CO OR (>1500ppm), O2 16%, LEL 16%. NH3 208ppm
				8					
				10				MW201 - 9.0m	CO OR (>1500ppm), O2 3.2%, LEL 69%, NH3 OR (>500ppm)
							Sandy CLAY; moist, light and dark brown mottled, medium plasticity, residual		
				12				MW201 - 11.5m	
				14				MW201 - 14m	
							Borehole MW201 terminated at 14m		
				16					
				18					

BOREHOLE NUMBER MW202

CLIENT Hydro Aluminium Kurri Kurri **PROJECT NAME** Groundwater Well Installation

PROJECT NUMBER AS130456 **PROJECT LOCATION** Capped Waste Stockpile

DATE STARTED 4/11/15 **COMPLETED** 4/11/15 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT Sonic **HOLE LOCATION**

HOLE SIZE **LOGGED BY** MT **CHECKED BY**

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Sonic							TOPSOIL; SAND; light brown, moist, fine grained		
							CLAY; brown/red mottled, medium plasticity, moist		
				2			GAS BUFFER LAYER CARBON AND SPL (~85%), Bath ~5%, other (steel and clay) ~10%	MW202 - 2.0m	CO 925ppm, O2 5.1%, LEL 53%, NH3 0ppm
				4					
				6				MW202 - 6.5m	CO 300ppm, O2 17.0%, LEL 0%, NH3 0ppm
				8					
				10				MW202 - 9.8m	CO 215ppm, O2 16%, LEL 0%, NH3 0ppm
	▼			12			CLAY; grey, medium plasticity, stiff, moist, residual	MW202 - 12.0m	C0 250ppm, O2 15.2%, LEL 0%, NH3 0ppm
				14			Clayey SAND; light grey/light brown mottled, fine to medium grained, wet, residual	MW202 - 13.5m	CO 120ppm, O2 12%, LEL 0%, NH3 0ppm
				16			CLAY; light brown with grey and orange mottling, medium plasticity, stiff, moist, residual		
				18					
							Borehole MW202 terminated at 18m		

BOREHOLE NUMBER MW203

RAMBOLL

CLIENT Hydro Aluminium Kurri Kurri **PROJECT NAME** Groundwater Well Installation

PROJECT NUMBER AS130456 **PROJECT LOCATION** Capped Waste Stockpile

DATE STARTED 28/10/15 **COMPLETED** 28/10/15 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT Sonic **HOLE LOCATION** _____

HOLE SIZE _____ **LOGGED BY** MT **CHECKED BY** _____

NOTES _____

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Sonic							Clayey SAND; brown, moist, fine to medium grained		
							CLAY; brown, orange and grey mottled, dry, stiff, medium plasticity		
				2			GRAVEL; black, fine grained, (gas buffer layer)		
							FILL; Carbon and SPL ~85%, Bath ~5%, Other (steel and clay) ~10%, dry	MW203 - 2.5m	CO 40ppm, O2 20.1%, LEL 0%, H2S 0ppm
				4					
				6					CO 350ppm, O2 18%, LEL 30%, NH3 0, H2S 0ppm
								MW203 - 7.0m	
				8					
								MW203 - 9.0m	CO 350ppm, O2 15%, LEL 23%, NH3 0ppm
				10					
				12			Sandy CLAY; dark grey, moist, low plasticity, tree roots present, residual	MW203 - 12.5m	CO 300ppm, O2 16%, LEL 25%, NH3 0ppm
	▼						SANDY CLAY; light brown, moist, medium plasticity, becoming stiff, residual		
				14				MW203 - 14.5m	
							Borehole MW203 terminated at 15m		CO 125ppm, O2 19%, LEL 3%, NH3 0ppm
				16					
				18					

BOREHOLE NUMBER MW204

CLIENT Hydro Aluminium Kurri Kurri **PROJECT NAME** Groundwater Well Installation

PROJECT NUMBER AS130456 **PROJECT LOCATION** Capped Waste Stockpile

DATE STARTED 11/11/15 **COMPLETED** 11/11/15 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT Sonic **HOLE LOCATION**

HOLE SIZE **LOGGED BY** MT **CHECKED BY**

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Sonic							TOPSOIL; SAND, brown, moist, fine grained		
							CLAY; brown and orange/red mottled, moist, medium plasticity, stiff		
				2			GRAVEL, light grey, fine grained (<8mm), gas buffer layer		
							FILL; Carbon and SPL ~85%, Bath ~5%, Other (steel and clay) ~10%, dry	MW204 - 2.5m	CO OR (>1500ppm), O2 2.0%, LEL 70%, NH3 0R (>500ppm)
				4				MW204 - 4.0m	
				6				MW204 - 6.0m	CO 125ppm, O2 20.1%, LEL 3%, NH3 0ppm
				8					
				10				MW204 - 9.0m	CO 625ppm, O2 5.2%, LEL 4%, NH3 OR (>500ppm)
				12					
	▼						Sandy CLAY; brown/grey mottled, dry, low-medium plasticity, stiff (tree roots present), residual	MW 204 - 12.2m	CO 867ppm, O2 4.6%, LEL 3%, NH3 OR (>500ppm)
							Clayey SAND; light brown/grey mottled, wet, fine to medium grained, residual		
				14			Sandy CLAY; light brown/grey mottled, moist, medium plasticity, stiff, residual	MW204 - 14.0m	
							Clayey SAND; light brown/grey mottled, moist, fine-medium grained, residual		
				16			Sandy CLAY; light brown/grey mottled, moist, medium plasticity, stiff, residual		
				18					
							Borehole MW204 terminated at 18m		

BOREHOLE NUMBER MW205

CLIENT Hydro Aluminium Kurri Kurri **PROJECT NAME** Groundwater Well Installation

PROJECT NUMBER AS130456 **PROJECT LOCATION** Capped Waste Stockpile

DATE STARTED 29/10/15 **COMPLETED** 30/10/15 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT Sonic **HOLE LOCATION**

HOLE SIZE **LOGGED BY** MT **CHECKED BY**

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Sonic							TOPSOIL; Clayey SAND; brown, dry, fine grained		
							CLAY; brown and red mottled, moist, low plasticity with gravel		
				2			GRAVEL; dark grey, fine to medium grained, gas buffer layer		
							FILL; Carbon and SPL, ~85% bath ~10%, 2nd cut SPL (refractory brick), other (steel, clay) ~5%, dry		
				4					CO 1436ppm, O2 7%, LEL 36%, H2S 1.0ppm
								MW205 - 5.5m	
				6					CO 62ppm, O2 16.1%, LEL 4%, H2S 1.0ppm
				8					
								MW205 - 9.0m	CO 55ppm, O2 18.1%, LEL 3%, H2S 0ppm
				10					
								MW205 - 11.3m	
				12					
	▼						SAND; grey, fine to medium grained, wet, pieces of tree roots and organic matter present, residual	MW205 - 12.2m	CO 45ppm, O2 18%, LEL 2%, H2S 0ppm
							Sandy CLAY; light brown, stiff, dry, residual		
				14					
								MW205 - 14.5m	CO 35ppm, O2 18%, LEL 1%, H2S 1ppm
							Borehole MW205 terminated at 15m		
				16					
				18					

BOREHOLE NUMBER MW206

RAMBOLL

CLIENT Hydro Aluminium Kurri Kurri **PROJECT NAME** Groundwater Well Installation

PROJECT NUMBER AS130456 **PROJECT LOCATION** Capped Waste Stockpile

DATE STARTED 3/11/15 **COMPLETED** 3/11/15 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT Sonic **HOLE LOCATION**

HOLE SIZE **LOGGED BY** MT **CHECKED BY**

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Sonic							TOPSOIL; SAND; brown, fine grained, dry		
							Silty CLAY; ligth brown/red mottled, high plasticity		
				2			GRAVEL; dark grey, fine to medium grained, gas buffer layer		
							FILL; Carbon/SPL ~85%, Bath ~5%, other (steel and clay) ~10% Predominantly black carbon and carbon dust. Small sections of white (bath), small sections of red brick (SPL 2nd cut), very hard, dry	MW206 - 3.0m	CO 505ppm, O2 20.1%, LEL 27%, NH3 OR (>500ppm)
				4					
				6					CO 216ppm, O2 18.9%, LEL 4%, NH3 35ppm
								MW206 - 7.0m	
				8					
				10					CO 57ppm, O2 17%, LEL 3%, NH3 0ppm
								MW206 - 11.0m	
	▼			12			Becoming wet	MW206 - 12.0m	CO 47ppm, O2 17.2%, LEL 4%, NH3 0ppm
							SAND; light grey with black mottling, fine grained, residual		
							SAND; light brown/grey, fine to medium grained, tree roots present, residual	MW206 - 13.0m	
							Becoming clayey	MW206 - 13.5m	
				14			Coarse grained at 13.8m Fine-medium grained at 13.9m		
								MW206 - 15.0m	CO 52ppm, O2 18.2%, LEL 5%, NH3 0ppm
				16					
							SAND; dark grey, wet, coarse grained, residual		
				18					
							Borehole MW206 terminated at 18m		

BOREHOLE NUMBER VW01

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Capped Waste Stockpile Soil Vapour Assessment
PROJECT NUMBER AS130437
PROJECT LOCATION Capped Waste Stockpile

DATE STARTED 16/6/15 **COMPLETED** 16/6/15 **R.L. SURFACE** **DATUM**
DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---
EQUIPMENT Pushtube **HOLE LOCATION** CWS
HOLE SIZE **LOGGED BY** MT **CHECKED BY** KG
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
							FILL; SAND; brown, fine to medium grained, moist		Capping layers of Capped Waste Stockpile
				0.5			FILL; CLAY; white and red mottled, high plasticity		
				1.0					
							FILL; GRAVEL; dark grey/green, uniform <6mm		
				1.5			FILL; SANDY gravel; black, (cathode)		Waste within CWS
				2.0			Borehole VW01 terminated at 1.9m		

BOREHOLE NUMBER VW02

RAMBOLL

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Capped Waste Stockpile Soil Vapour Assessment
PROJECT NUMBER AS130437
PROJECT LOCATION Capped Waste Stockpile

DATE STARTED 16/6/15 **COMPLETED** 16/6/15 **R.L. SURFACE** **DATUM**
DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---
EQUIPMENT Pushtube **HOLE LOCATION** CWS
HOLE SIZE **LOGGED BY** MT **CHECKED BY** KG
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
							FILL; Clayey SAND; dark brown, fine to medium grained, moist		Capping layers of CWS
				0.5			FILL; SAND; brown, medium to coarse grained, wet		
				1.0			FILL; CLAY; white and red mottled, high plasticity, moist		
				1.5			FILL; GRAVEL; grey, <5mm, uniform		
							FILL; CATHODE		Waste within CWS
				2.0			Borehole VW02 terminated at 1.8m		

BOREHOLE NUMBER VW03

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Capped Waste Stockpile Soil Vapour Assessment
PROJECT NUMBER AS130437
PROJECT LOCATION Capped Waste Stockpile

DATE STARTED 16/6/15 **COMPLETED** 16/6/15 **R.L. SURFACE** **DATUM**
DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---
EQUIPMENT Pushtube **HOLE LOCATION** CWS
HOLE SIZE **LOGGED BY** MT **CHECKED BY** KG
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
							FILL; Clayey SAND; brown, fine to medium grained, moist		Capping layers of CWS
							FILL; SAND; brown, medium to coarse grained, wet		
				0,5			FILL; CLAY; white and red mottled, high plasticity		
				1,0					
				1,5			FILL; GRAVEL; grey, <5mm, uniform in size		
							FILL; CATHODE		Waste within CWS
				2,0			Borehole VW03 terminated at 1.95m		

BOREHOLE NUMBER VW04

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Capped Waste Stockpile Soil Vapour Assessment
PROJECT NUMBER AS130437
PROJECT LOCATION Capped Waste Stockpile

DATE STARTED 16/6/17 **COMPLETED** 16/6/17 **R.L. SURFACE** **DATUM**
DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---
EQUIPMENT Pushtube **HOLE LOCATION** CWS
HOLE SIZE **LOGGED BY** MT **CHECKED BY** KG
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
							FILL; Clayey SAND; brown, fine to medium grained		Capping layers of CWS
							FILL; COAL		
							FILL; SAND; medium to coarse grained, moist		
				0,5			FILL; CLAY; white and red mottled, high plasticity		
				1,0					
				1,5			FILL; GRAVEL; grey, <5mm, with sand		
							FILL; CATHODE		Waste within CWS
							Borehole VW04 terminated at 1.75m		
				2,0					

BOREHOLE NUMBER VW05

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Capped Waste Stockpile Soil Vapour Assessment
PROJECT NUMBER AS130437
PROJECT LOCATION Capped Waste Stockpile

DATE STARTED 16/6/17 **COMPLETED** 16/6/17 **R.L. SURFACE** **DATUM**
DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---
EQUIPMENT Pushtube **HOLE LOCATION** CWS
HOLE SIZE **LOGGED BY** MT **CHECKED BY** KG
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
							FILL; Clayey SAND; dark brown, fine to medium grained, moist		Capping layers of CWS
							FILL; SAND; brown, medium to coarse grained		
				0.5			FILL; CLAY; white and red mottled, high plasticity		
				1.0					
				1.5			FILL; GRAVEL; grey, <5mm, with sand		
							FILL; CATHODE; brick		Waste within CWS
				2.0			Borehole VW05 terminated at 1.8m		

BOREHOLE NUMBER VW06

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Capped Waste Stockpile Soil Vapour Assessment
PROJECT NUMBER AS130437
PROJECT LOCATION Capped Waste Stockpile

DATE STARTED 16/6/17 **COMPLETED** 16/6/17 **R.L. SURFACE** **DATUM**
DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---
EQUIPMENT Pushtube **HOLE LOCATION** CWS
HOLE SIZE **LOGGED BY** MT **CHECKED BY** KG
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
							FILL; Clayey SAND; dark brown, moist, fine to medium grained		Capping layers of CWS
							FILL; SAND; brown, medium to coarse grained		
				0.5			FILL; CLAY; white and red mottled, high plasticity		
				1.0			FILL; GRAVEL; grey, <5mm with SAND		
							FILL; SAND; yelow, fine grained, moist		
				1.5			FILL; CATHODE		Waste within CWS
							Borehole VW06 terminated at 1.6m		
				2.0					

APPENDIX 4
GA5000 CALIBRATION CERTIFICATES

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0.0 %	60.0 %	1673301C38	☑
CO_2	40 %	----------	40.0 %	1673301C38	☑
O_2	20.9 %	0.0 %	20.9 %	AIR	☑
CO	100 ppm	0 ppm	100 ppm	308535 C3	☑
H_2S	25 ppm	0 ppm	25 ppm	1852397 C25	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	S116497-1	☑

☑ Battery Status 100 %
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

Tag No: 000960

Valid to: 10/02/2017

Date: 14/12/2016

Signed: Mirenka

☑ In-Line filters checked
☑ Data cleared

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 1
☑	☐	H_2S filter + TEMPERATURE PROBE
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 14/12/2016

Signed: Mirenka

TFS Reference	CS006033	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-13	Condition on return:	
Equipment Serial No.	G502797		

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Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0.0 %	60.0 %	1673301 C38	☑
CO_2	40 %	----------	40.0 %	1673301 C38	☑
O_2	20.9 %	0.0 %	20.9 %	AIR	☑
CO	100 ppm	0 ppm	100 ppm	308535C3	☑
H_2S	25 ppm	0 ppm	25 ppm	1852397 C25	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	S116497-1	☑

☑ Battery Status 100%
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

Tag No: 000995

Valid to: 25/02/2017

☑ In-Line filters checked
☑ Data cleared

Date: 11/01/2017

Signed: Milenko

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 1
☑	☐	H_2S filter
☑	☐	Data Cable and Software CD + TEMPERATURE PROBE
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 11/01/2017

Signed: Milenko

TFS Reference	CS006062	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-16	Condition on return:	
Equipment Serial No.	G503743		

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Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0.0 %	60.0 %	1673301 C38	☑
CO_2	40 %	----------	40.0 %	1673301 C38	☑
O_2	20.9 %	0.0 %	20.9 %	AIR	☑
CO	100 ppm	0 ppm	100 ppm	308535 C3	☑
H_2S	25 ppm	0 ppm	25 ppm	185239 7C25	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	527744 C22	☑

☑ Battery Status 100 %
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ In-Line filters checked
☑ Data cleared

Tag No: 000937

Valid to: 03/02/2017

Date: 24/01/2017

Signed: Mirenka

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 1 + 1
☑	☐	H_2S filter + SILICON TUBING
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case + TEMPERATURE PROBE TEMP-1
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 24/01/2017

Signed: Mirenka

TFS Reference	CS006063	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-16	Condition on return:	
Equipment Serial No.	G503743		

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Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0 %	60 %	1764812	☑
CO_2	40 %	----------	40 %	1764812	☑
O_2	20.9 %	0 %	20.9 %	303535	☑
CO	100 ppm	0 ppm	100 ppm	303535	☑
H_2S	25 ppm	0 ppm	25 ppm	1856599	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	311557Z-1	☑

☑ Battery Status 100%
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

Tag No: 000635

Valid to: 19/03/2017

☑ In-Line filters checked
☑ Data cleared

Date: 22/02/2017

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 2
☑	☐	H_2S filter
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 22/02/2017

Signed: [signature]

TFS Reference	CS006191	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-1	Condition on return:	
Equipment Serial No.	G501357		

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0.0 %	60.0 %	1764812 C17	☑
CO_2	40 %	----------	40.0 %	1764812 C17	☑
O_2	20.9 %	0.0 %	20.9 %	AIR	☑
CO	100 ppm	0 ppm	100 ppm	404179 C17	☑
H_2S	25 ppm	0 ppm	25 ppm	138084 C2	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	527744 C20	☑

☑ Battery Status 100%
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

Tag No: 001500

Valid to: 07/06/2017

Date: 29/03/2017

Signed: Mike Lo

☑ In-Line filters checked
☑ Data cleared

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 1
☑	☐	H_2S filter + TEMP-1 → TEMPERATURE PROBE
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 29/03/2017

Signed: Mike Lo

TFS Reference	CS006365	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-16	Condition on return:	
Equipment Serial No.	G503743		

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0.0 %	60.0 %	151248 C19	☑
CO_2	40 %	----------	40.0 %	151248 C19	☑
O_2	20.9 %	0.0 %	20.9 %	AIR	☑
CO	100 ppm	0 ppm	100 ppm	404179 C17	☑
H_2S	25 ppm	0 ppm	25 ppm	171682 C49	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	527744 C16	☑

☑ Battery Status 100%
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

Tag No: GA5000SA

Valid to: 19/08/2017

Date: 24/05/2017

Signed: [signature]

☑ In-Line filters checked
☐ Data cleared

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 1
☑	☐	H_2S filter + TEMPERATURE PROBE TEMP-1
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 24/05/2017

Signed: [signature]

TFS Reference	CS0006836	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000SA	Condition on return:	
Equipment Serial No.	G500157		

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0 %	60 %	1764812	☑
CO_2	40 %	----------	40 %	1764812	☑
O_2	20.9 %	0 %	20.9 %	N/A	☑
CO	100 ppm	0 ppm	100 ppm	1834367	☑
H_2S	25 ppm	0 ppm	25 ppm	171682	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	633411	☑

☑ Battery Status 100%
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ In-Line filters checked
☑ Data cleared

Tag No: 001201

Valid to: 22/08/2017

Date: 28/06/2017

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 3
☑	☐	H_2S filter
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 28/06/2017

Signed: [signature]

TFS Reference	CS006934	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-13	Condition on return:	
Equipment Serial No.			

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	%	60 %	1764812	☑
CO_2	40 %	----------	40 %	1764812	☑
O_2	20.9 %	%	20.9 %		☐
CO	100 ppm	ppm	100 ppm	1834367	☑
H_2S	25 ppm	ppm	25 ppm	171682	☑
H_2 CO/H2 compensated only	1000 ppm	ppm	ppm	633341	☑

☑ Battery Status 100%
☑ 10 minutes test complete
☐ Electrical Safety Tag attached (AS/NZS 3760)

☑ In-Line filters checked
☑ Data cleared

Tag No: 001463

Valid to: 05/07/2019

Date: 28/06/2017

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 3
☑	☐	H_2S filter
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 28/06/2017

Signed: [signature]

TFS Reference	CS006934	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-1	Condition on return:	
Equipment Serial No.	G501857		

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0.0 %	60.0 %	1764812 C7	☑
CO_2	40 %	----------	40.0 %	1764812 C7	☑
O_2	20.9 %	0.0 %	20.9 %	AIR	☑
CO	100 ppm	0 ppm	100 ppm	1834367 C2	☑
H_2S	25 ppm	0 ppm	ppm	462436 C57	☐
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	755442 C9	☑

☑ Battery Status 100%
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ In-Line filters checked
☑ Data cleared

Tag No: 001249

Valid to: 05/10/2017

Date: 26/07/2017

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 1
☑	☐	H_2S filter
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

* Temp Probe TEMP-1 included

Date: 26/07/2017

Signed: [signature]

TFS Reference	CS007188	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-1	Condition on return:	
Equipment Serial No.	G501857		

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0 %	60 %	591518	☑
CO_2	40 %	----------	40 %	591518	☑
O_2	20.9 %	0 %	20.9 %		☑
CO	100 ppm	100 ppm	100 ppm	1834367	☑
H_2S	25 ppm	25 ppm	25 ppm	462436	☑
H_2 CO/H2 compensated only	1000 ppm	1000 ppm	1000 ppm	S105268	☑

☑ Battery Status 100%
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ In-Line filters checked
☑ Data cleared

Tag No: 001249

Valid to: 05/10/2017

Date: 23/08/2017

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☐	☐	Performance check / Battery 100%
☐	☐	Sampling tubing with In-Line filter
☐	☐	Out let tubing (internal flow pod only)
☐	☐	Well cap Quick connect fitting with tubing and In-Line filter
☐	☐	Power Supply
☐	☐	Operating Quick Guide behind foam on lid of case "
☐	☐	Manual behind foam on lid of case "
☐	☐	Spare Inline Filters Qty 2
☐	☐	H_2S filter
☐	☐	Data Cable and Software CD
☐	☐	Soft case with carry strap
☐	☐	Carry case
☐	☐	Check to confirm electrical safety (tag must be valid)

Date: 23/08/2017

Signed: [signature]

TFS Reference	CS007319	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-1	Condition on return:	
Equipment Serial No.	G501857		

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0 %	60 %	591518	☑
CO_2	40 %	———	40 %	591518	☑
O_2	20.9 %	0 %	%	FRESH AIR	☐
CO	100 ppm	0 ppm	100 ppm	1834367	☑
H_2S	25 ppm	0 ppm	25 ppm	669646	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	755442	☑

☑ Battery Status 100%
☑ 10 minutes test complete
☐ Electrical Safety Tag attached (AS/NZS 3760)

☑ In-Line filters checked
☑ Data cleared

Tag No: 001249

Valid to: 05/10/2017

Date: 27/09/2017

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 2
☑	☐	H_2S filter
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☐	☐	Check to confirm electrical safety (tag must be valid)

Date: 27/09/2017

Signed: [signature]

TFS Reference	CS007437	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-1	Condition on return:	
Equipment Serial No.	G501857		

ThermoFisher SCIENTIFIC

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0.0 %	60.0 %	327125 C17	☑
CO_2	40 %	———	40.1 %	327125 C17	☑
O_2	20.9 %	0.0 %	20.9 %	A1R	☑
CO	100 ppm	0 ppm	100 ppm	308535 C2	☑
H_2S	25 ppm	0 ppm	25 ppm	687119 C30	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	755442 C13	☑

☑ Battery Status 100%
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ In-Line filters checked
☑ Data cleared

Tag No: 000974

Valid to: 09/01/2018

Date: 25/10/2017

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☐	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 2
☑	☐	H_2S filter
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

Temp probe checked.

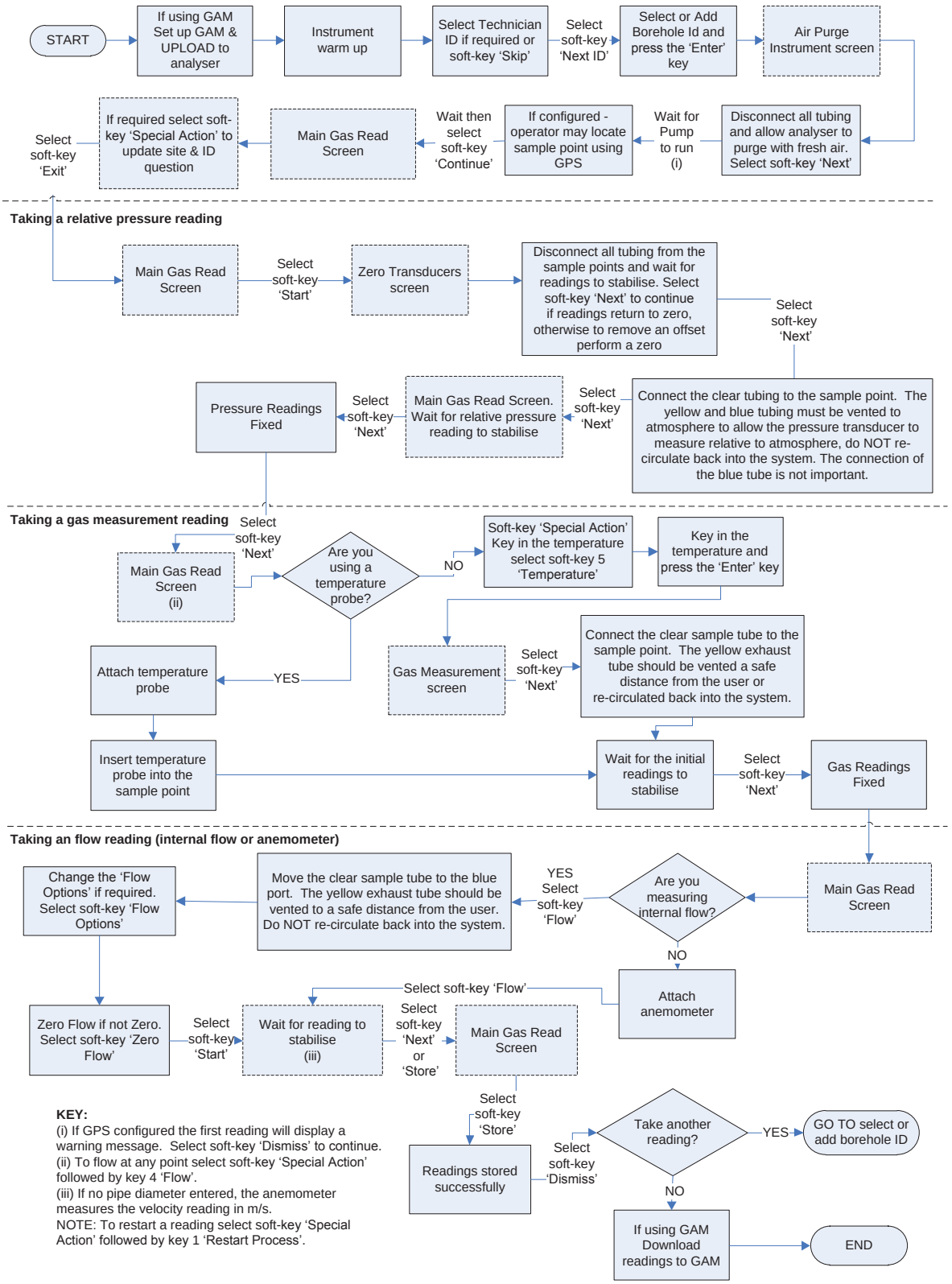
Date: 25/10/2017

Signed: [signature]

TFS Reference	CS007727	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	GA5000-1	Condition on return:	
Equipment Serial No.	G501857		

APPENDIX 5
GA5000 MANUAL FLOW CHART

8.10 Taking gas and flow measurement



APPENDIX 6
MONTHLY MONITORING REPORTS

From:	Kirsty Greenfield
To:	Andrew Walker; Andrew Solomou
Cc:	Fiona Robinson; Natalie Gilbert
Subject:	December Gas Sampling Report
Date:	Thursday, 12 January 2017 10:11:00 AM
Attachments:	Hydro Gas Sampling Results.xlsx image001.png

Hi Andrew and Andrew,

The first round of gas sampling at the Capped Waste Stockpile was completed by Ramboll Environ on 16 December 2016. The following scope of work was completed:

- Measurement of H_2S and CO in ppm, measurement of CH_4, CO_2 and O_2 in %v/v and measurement of flow in L/hr using GA5000 landfill gas analyser.
- Peak and stabilised concentrations were recorded. Stabilised concentrations were recorded at the end of three minutes.
- Measurements were undertaken in six groundwater wells (MW201 to MW206), six gas wells installed into the gas collection layer (VW01 to VW06) and 12 gas vents (VT1 to VT12).
- Temperature was measured in the gas wells and groundwater wells. The tubing was too small for the temperature probe in the vent wells.
- The GA5000 instrument was calibrated by the hire company on 14 December 2016 and passed calibration.
- Measurement of depth to water in the groundwater wells.
- Recording of weather parameters, including temperature, rainfall, barometric pressure, change in barometric pressure over 6 hours, wind direction and wind speed.

Results for the groundwater wells are as follows:

- Depth to groundwater ranged from 12.35m below top of casing to 13.22m below top of casing. Well MW201 was dry.
- Vent air flow was only recorded above 0 L/ hr in two wells, MW202 and MW205, both at 0.1 L/hr.
- H_2S concentrations ranged between 15 ppm in MW205 and 353 ppm in MW201.
- CO concentrations ranged between 1 ppm in MW203 and 368 ppm in MW201.
- CH_4 concentrations ranged between 0 %v/v in MW202, MW203 and MW205 and 0.5 %v/v in MW201.
- CO_2 concentrations ranged between 0 %v/v in MW201, MW202, MW203, MW205 and MW206 and 0.1 %v/v in MW204.

Results for gas wells are as follows:

- Flow was recorded as 0.1 L/hr in five wells. Flow was 0 L/hr in VW03.
- H_2S concentrations ranged between 14 ppm in VW01 and 293 ppm in VW05.
- CO concentrations ranged between 2 ppm in VW01 and 310 ppm in VW05.
- CH_4 concentrations ranged between 0.2 %v/v in VW06 and 1.4 %v/v in VW01.
- CO_2 concentrations ranged between 0 %v/v in VW02 and VW04 and 0.5 %v/v in VW01.

Results for gas vents are as follows:

- Vent VT3 failed sampling as the tube was blocked inside the vent. Vent VT9 did not have

a sampling tube.

- Flow was recorded at 0.1 L/hr in two wells at VT2, VT6 and 0.2 L/hr at VT10. No flows were recorded in the other wells.
- H_2S concentrations ranged between 1 ppm at VT12 and 200 ppm at VT5.
- CO concentrations ranged between 0 ppm at VT2, VT8, VT10 and VT12 and 139 ppm at VT5.
- CH_4 concentrations ranged between 0 %v/v at VT2, VT4, VT8, VT10, VT11 and VT12 and 0.3 %v/v at VT5 and VT6.
- CO_2 concentrations ranged between 0 %v/v at VT7 and VT8 and 1 %v/v at VT5.

The results of the gas sampling are included in the attached spreadsheet.

The next sampling event is scheduled for Friday 13 January 2017. We'd like to access the vent at VT3 to check the tubing inside the vent and also check for tubing inside VT9 at this time.

Yours sincerely
Kirsty Greenfield

Senior Environmental Consultant
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From:	Kirsty Greenfield
To:	Andrew Walker; Andrew Solomou
Cc:	Fiona Robinson; Natalie Gilbert
Subject:	January Gas Sampling Report
Date:	Monday, 13 February 2017 3:51:00 PM
Attachments:	Hydro Gas Sampling Results.xlsx image001.png

Hi Andrew and Andrew,

The second and third rounds of gas sampling were completed by Ramboll Environ on 13 and 27 January 2017. The scope of work was as per that outlined in the December 2016 Gas Sampling Report, issued in January 2017.

Results for groundwater wells are as follows:

- Depth to water has varied by less than 5cm in wells MW202 to MW205 since sampling commenced on 16 December 2016. Depth to water in MW206 has increased 11cm from 13.22m below top of casing to 13.33m below top of casing over the three rounds of sampling. MW201 remains dry.
- Positive air flow was recorded in wells MW201, MW203 and MW204 in the third sampling round. Positive air flow means that the pressure inside the well is greater than atmospheric pressure and air is flowing out of the wells.
- Negative air flow was recorded in wells MW202, WM205 and WM206 in the third sampling round. Negative air flow means that the pressure inside the well is less than atmospheric pressure and air is flowing into the wells.
- Air flow was recorded at 0 L/hr in the second sampling round at all wells except for a small negative flow at MW202. Neutral air flow means that the pressure inside the well is equivalent to atmospheric pressure and there is no air flow.
- With the exception of Well MW204 during the first sampling round, Wells MW202 to MW205 have generally had stabilised oxygen readings of between 17% and 21% v/v over the three rounds, which is similar to fresh air. Wells MW201 and MW206 are oxygen deficient, with oxygen readings generally less than 5 % v/v with the exception of a higher reading of 12% in MW206 during the second round of sampling.
- Elevated H_2S and CO readings were identified in the oxygen deficient wells MW201 and MW206, with H_2S concentrations >60ppm and CO concentrations >50ppm.
- CH_4 and concentrations were recorded in MW201 and MW206 during the third sampling round, with concentrations being between 0.1% v/v and 0.4% v/v.
- CO_2 concentrations are most elevated in Wells MW202 to MW205, with concentrations between 0.1% v/v and 0.4% v/v.

Results for gas wells are as follows:

- Neutral (0 L/hr) or positive air flow (maximum 0.1 L/hr) was detected in the six gas wells over the three monitoring rounds.
- All six wells are highly oxygen deficient, with oxygen concentrations below 0.2% v/v except of VW06 that was <2% v/v.
- H_2S and CO concentrations were recorded in all well with the most elevated in wells VW04 to VW06, with H_2S concentrations >160ppm and CO concentrations >230ppm.
- CH_4 and CO_2 concentrations are most elevated in well VW01, with CH_4 concentrations <1.4% v/v and CO concentrations <0.7% v/v. CO concentrations were not recorded in

Wells VW02, VW03, VW05 and VW06 during any of the sampling rounds.

Results for gas vents are as follows:

- Neutral (0 L/hr) or negative air flow (> -0.5 L/hr) was detected in the two recent gas sampling rounds at all vents aside from VT4. VT4 had a positive air flow of 0.1 L/hr during the second sampling round.
- The oxygen content of the vents, with the exception of VT8 is relatively variable and they are generally oxygen deficient (i.e., <19.5% v/v oxygen), with VT1 and VT5 the most oxygen deficient.
- H_2S and CO concentrations are the most elevated in VT5 at >150ppm and >130ppm respectively, except for the second round, where H_2S and CO concentrations were 0ppm (due to a negative flow). Elevated H_2S and CO concentrations were also identified in VT6 at >11ppm and >10ppm respectively and VT7 and >35ppm and >17ppm respectively.

The results for the gas sampling are included in the attached spreadsheet.

The next sampling event is scheduled for Friday 24 February 2017. Ammonia sampling using Kitagawa tubes will also be completed during the next three sampling rounds.

Yours sincerely
Kirsty Greenfield

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From:	Kirsty Greenfield
To:	Andrew Walker; Andrew Solomou
Cc:	Fiona Robinson; Natalie Gilbert
Subject:	February Gas Sampling Report
Date:	Thursday, 2 March 2017 10:34:00 AM
Attachments:	Hydro Gas Sampling Results.xlsx image001.png

Hi Andrew and Andrew,

The fourth round of gas sampling was completed by Ramboll Environ on 24 February 2017. The scope of work was as per that outlined in the December 2016 Gas Sampling Report, issued in January 2017, with the addition of ammonia sampling using Kitagawa gas detector tubes. Additional information regarding the method of ammonia sampling is provided below.

The weather information indicates that the first four rounds of sampling have been undertaken during falling atmospheric pressure. Wind speeds during the first two rounds were light (15 km/hour in December) to moderate (22km/ hour in early January) on the Beaufort Scale. Wind speeds in the third and fourth rounds were fresh, at 31 km/ hour in late January and 33 km/hour in February. Wind direction has generally been from the east or south east.

Results for groundwater wells are as follows:

- Depth to water decreased between 7 cm and 20 cm in wells MW202 to MW206 from the previous round of monitoring on 27 January 2017. Well MW201 remains dry.
- Positive air flow was recorded in four of the six wells (MW202-MW205). Positive flow rates were elevated compared to previous rounds, with flow rates between 0.1 L/hour (MW204) and 3.3 L/hour (MW205). The flow rate in MW203 was elevated for the last two rounds (2.5 and 2.6 L/hour respectively).
- Neutral air flow (0 L/hour) was recorded at MW201 and MW206. Neutral flow rates have been recorded at these wells in three of the four sampling rounds completed to date.
- Oxygen readings remained stable between 17% v/v and 21% v/v in wells MW203 to MW205. Oxygen readings in MW202, which were 18-19% v/v in previous sampling rounds, dropped to 13% v/v. Oxygen readings in wells MW201 and MW206 remained highly deficient at <5% v/v.
- Elevated H_2S and CO readings continue to be identified in wells MW201 and MW206. It is noted that the CO concentration in MW201 may not be accurate due to interference from high H_2S concentrations. This is further discussed below.
- CO_2 concentrations were recorded in wells MW202 to MW205, with concentrations between 0.2% v/v and 0.4% v/v.

Results for gas wells are as follows:

- Neutral air flow was recorded at four of the six gas wells (VW01, VW02, VW04 and VW06), with a low positive air flow of 0.1 L/hour recorded at the other two wells.
- The six wells remain highly oxygen deficient, with results consistent to previous sampling rounds.
- Elevated H_2S and CO readings continue to be recorded in wells VW04 to VW06. It is noted that CO concentrations in wells VW05 and VW06 may not be accurate due to interference from high H_2S concentrations. This is further discussed below.
- CH_4 and CO_2 concentrations remain most elevated in well VW01. CO_2 was not recorded in wells VW02, VW03, VW05 and VW06, consistent with previous sampling rounds.

Results for gas vents are as follows:

- Neutral air flow was recorded in the majority of the gas vents. Positive air flow of 0.1 L/hour

was recorded in gas vents VT1, VT2 and VT10 during this round.

- Vent VT1 remained highly oxygen deficient. Oxygen concentrations in other gas vents were >16% v/v and show variability between sampling rounds.
- Elevated H_2S and CO concentrations continue to be recorded in gas vents VT5, VT6 and VT7 although the concentrations vary between rounds.
- CH_4 concentrations were 0% v/v at all gas vents during this sampling round.
- CO_2 concentrations were generally 0.1% v/v to 0.3% v/v, aside from elevated concentrations in gas vents VT3 at 0.7% v/v and VT12 at 0.85% v/v.

The GA5000 landfill gas meter includes a warning system, indicating on a scale of green, amber and red if H_2S readings are interfering with CO readings. During this sampling event, the GA5000 H_2S meter moved into the red zone during sampling of gas well VW05, indicating that H_2S concentrations may be interfering with CO readings. The H_2S meter has an internal H_2S filter incorporated in the chemical cell that removes the H_2S for the CO readings. However this has a limited life span and capacity. The sampler has occasionally moved into amber zone during previous sampling rounds which indicated potential for H_2S interference with the CO reading. Ramboll Environ will re-run gas sampling using an external H_2S filter at wells and vents where H_2S concentrations of >25ppm have been identified in previous sampling events. This will include groundwater wells MW201, MW202, MW204 to MW206, gas wells VW02 to VW06 and gas vents VT5 to VT7.

As mentioned above, ammonia sampling was completed on all wells and vents during this sampling event. The method for ammonia sampling included the use of Kitagawa gas detection tubes for 50-900ppm. A Kitagawa pump was hired from Air Met for the sampling. Prior to sampling, calibration of the Kitagawa pump was completed by inserting an unbroken Kitagawa tube into the pump and drawing air through the pump for 1 minute to create a vacuum. On release, the handle of the pump returned to its original position, indicating calibration had been achieved. Sampling was completed by using the tip cutter on the Kitagawa pump to remove the tips of the Kitagawa gas detection tubes, inserting the tubes into the pump, connecting the tubes to the sampling tube at each well/ vent and pulling the pump handle to the 100mL line for one minute. The ammonia concentration in ppm was then recorded. Ammonia results have been included in the attached spreadsheet and are summarised below.

- At the groundwater wells, ammonia concentrations ranged between 75 ppm at wells MW203 and MW204 and >900 ppm at MW201 and MW206. The elevated ammonia concentrations correlate to wells with oxygen deficiency, elevated H_2S and CO concentrations and neutral air flow.
- At the gas wells, ammonia concentrations ranged between 50 ppm at VW01 and >900 ppm at wells VW05 and VW06, which correlates to gas wells with elevated H_2S and CO concentrations.
- At the gas vents, ammonia concentrations ranged between <50 ppm (VT9 to VT12) and >900 ppm at VT7. The three highest ammonia concentrations (300 ppm at VT6, 600 ppm at VT5 and >900 ppm at VT7) were at the gas vents with the most elevated H_2S and CO concentrations (VT5 to VT7).

Ammonia sampling will be undertaken during the next sampling round, to be completed on Friday 31 March 2017.

Yours sincerely
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From:	Kirsty Greenfield
To:	Andrew Walker; Andrew Solomou
Cc:	Fiona Robinson; Natalie Gilbert
Subject:	March Gas Sampling Report
Date:	Friday, 7 April 2017 10:30:00 AM
Attachments:	Hydro Gas Sampling Results.xlsx image001.png

Hi Andrew and Andrew,

The fifth round of gas sampling was completed by Ramboll Environ on 31 March 2017. The scope of work was as per that outlined in the December 2016 Gas Sampling Report, issued in January 2017; and in the February 2017 Gas Sampling Report, issued March 2017 for ammonia sampling.

The weather information indicates that the first five rounds of sampling have been undertaken during falling atmospheric pressure. Winds speeds during the current round were the highest yet at 44km/hr or a strong breeze on the Beaufort Scale. Wind direction was to the south south west. In addition, 47mm on rain fell overnight prior to the sampling event.

Results for groundwater wells are as follows:

- Depth to water generally recovered to levels from the sampling event on 27 January 2017. Well MW201 remains dry.
- Positive air flow was recorded in two of the six wells (MW203 and MW205). Neutral air flow (0 L/hour) was recorded in two wells (MW201 and MW206) and negative air flow was recorded in two wells (MW202 and MW204).
- Oxygen readings remained stable between 17% v/v and 21% v/v in wells MW203 to MW205. Oxygen readings in MW202 continue to fluctuate, with a reading of 11.2% w/w. Oxygen readings in wells MW201 remained highly deficient at <5% v/v. Oxygen readings in MW206, which have previously been highly deficient, were at 21% w/w this round. It is possible that gas within the well was diluted by air.
- H_2S and CO readings were generally lower than in previous rounds. This was most noticeable in MW206, where concentrations in this round were 2ppm and 4ppm respectively compared to concentrations of 185ppm and 172ppm respectively in the previous round.
- CH_4 and CO_2 concentrations were similar to previous sampling rounds.

Results for gas wells are as follows:

- Neutral air flow was recorded at three of the six gas wells (VW02, VW03 and VW04), with a low positive air flow of 0.1 L/hour recorded at the other three wells.
- The six wells remain highly oxygen deficient, with results consistent to previous sampling rounds.
- Elevated H_2S and CO readings continue to be recorded in all gas wells. Results in gas wells VW04 to VW06 are most elevated, with results >100ppm for both gases. Results in gas wells VW01 to VW03 were still elevated but <100ppm and have been variable in VW01.
- CH_4 and CO_2 concentrations remain most elevated in well VW01.

Results for gas vents are as follows:

- Neutral air flow was recorded in the majority of the gas vents. Negative air flow of -0.1 L/hour was recorded in gas vents VT7, VT10 and VT11 during this round.
- Oxygen concentrations continue to show variability between sampling rounds, with the largest variability in vents VT1 and VT2 in this round.
- Elevated H_2S and CO concentrations continue to be recorded in gas vents VT5, VT6 and VT7 although the concentrations vary between rounds.
- CH_4 concentrations were 0% v/v at all gas vents during this sampling round.
- CO_2 concentrations were generally 0.1% v/v to 0.3% v/v, aside from elevated

concentrations in gas vents VT2 at 0.5% v/v and VT12 at 0.7% v/v.

In the previous round, all ammonia sampling was undertaken using Kitagawa tubes with the range 50ppm to 900ppm. During this round, sampling at the gas vents was completed using Kitagawa tubes ranging from 0ppm to 250ppm. Where readings were >250ppm, these sampling locations were re-tested using 50ppm to 900ppm tubes. Ammonia results are outlined below:

- At the groundwater wells, ammonia concentrations ranged between 25 ppm at wells MW204 and >900 ppm at MW201. The elevated ammonia concentrations correlate to wells with oxygen deficiency, elevated H_2S and CO concentrations and neutral air flow. The ammonia reading at MW206 was 50ppm, compared to >900ppm in the previous round and this is again consistent with a significant increase in the oxygen concentrations. Anomalous results for H_2S, CO and CO_2 were also recorded in this well.
- At the gas wells, ammonia concentrations ranged between <50 ppm at VW01 and >900 ppm at VW05. A lower ammonia concentration of 300ppm was recorded in VW06, compared to >900 ppm in the previous round. This gas well also recorded lower H_2S and CO concentrations in this round but remained significantly oxygen deficient.
- At the gas vents, ammonia concentrations were variable compared to previous rounds and varied when re-tested. Elevated concentrations were previously identified in vents VT5 to VT7. VT7 had a consistent result with the previous round at >900ppm. VT5 and VT6 both have considerably lower results at 10ppm and 80ppm respectively, compared to 600ppm and 300ppm in the previous round. Vent VT8 had an ammonia concentration of 50ppm in the previous round. In this round, VT8 was initially tested using a Kitagawa tube with the range 0ppm to 250ppm and returned a reading of >250ppm around 9am. Vent VT8 was then re-sampled around 2pm using a Kitagawa tube with the range 50ppm to 900ppm and returned a result of <50ppm. Ammonia concentrations at vents VT9 to VT12 were more accurate in this round, as they were completed using Kitagawa tubes ranging from 0ppm to 250ppm. In the previous round, these vents had results <50ppm. Ammonia concentrations between 20ppm and 120ppm were recorded in this round.

The final ammonia sampling round will be undertaken during the next sampling round, to be completed on Friday 28 April 2017.

Yours sincerely
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From:	Kirsty Greenfield
To:	Andrew Walker; Andrew Solomou
Cc:	Fiona Robinson; Natalie Gilbert
Subject:	April Gas Sampling Report
Date:	Tuesday, 2 May 2017 9:16:00 AM
Attachments:	Hydro Gas Sampling Results.xlsx image003.png

Hi Andrew and Andrew,

The sixth round of gas sampling was completed by Ramboll Environ on 28 April 2017. The scope of work was as per that outlined in the December 2016 Gas Sampling Report, issued in January 2017; and in the February 2017 Gas Sampling Report, issued March 2017 for ammonia sampling. An external hydrogen sulphide (H_2S) filter was used for the carbon monoxide (CO) concentration monitoring at locations where elevated, as discussed below.

The weather information indicates that the first six rounds of sampling have been undertaken during falling atmospheric pressure. Wind speeds during the current round were 26km/hr or a moderate breeze on the Beaufort Scale. Wind direction was from the south south west. No rainfall occurred during or immediately prior to the sampling event. The ambient temperature, particularly the minimum, was the lowest recorded across all of the sampling rounds.

Results for groundwater wells are as follows:

- Depth to water was generally 5cm to 9cm lower than the previous round. Well MW201 remains dry.
- Positive air flow was recorded in all of the six wells, which is the first time this has happened. The highest positive flow rate was 2.6L/ hour at MW203 and this is similar to the values obtained from this well in rounds 3 and 4. MW203 has had strongly positive flow rates in the past four monitoring rounds.
- Oxygen readings remained stable between 17% v/v and 19% v/v in wells MW203 and MW205 and remained highly deficient at <5% v/v in well MW201. Oxygen readings in other wells continue to fluctuate, with lower readings in wells MW202 (9% v/v) and MW204 (11% v/v) and a high reading of 21.9% v/v in MW206.
- H_2S and CO readings remain low in well MW206, at 19ppm and 2ppm respectively. Readings in other wells were fairly consistent with the previous round, although the concentration in well MW201 was 44 ppm lower and this well continues to have the highest measured concentrations in the groundwater wells.
- CH_4 and CO_2 concentrations were similar to previous sampling rounds.

Results for gas wells are as follows:

- Positive air flow was recorded at five of the six gas wells, with neutral air flow recorded at well VW02.
- The six wells remain highly oxygen deficient and the results are consistent with previous sampling rounds.
- Elevated H_2S and CO readings continue to be recorded in all gas wells, aside from VW01 which are variable. Gas wells VW04 and VW06 have the highest H2S concentrations. The CO readings were significantly different than the previous rounds particularly in gas wells:
  1. VW02 - average of 88 ppm for rounds 1 to 5 up to 299 ppm this round.
  2. VW03 - average of 62 ppm for rounds 1 to 5 up to 260 ppm this round.
  3. VW06 – average of 226 ppm for rounds 1 to 5 and excluding round 4 to 65 ppm this round.
- CH_4 and CO_2 concentrations have been fairly consistent between sampling events and remain most elevated (1.2 and 0.7% v/v respectively) in well VW01.

Results for gas vents are as follows:

- Neutral air flow was recorded in the majority of the gas vents. Positive air flow was recorded in gas vents VT2, VT3, VT8 and VT9 during this round.
- Oxygen concentrations continue to show variability between sampling rounds, with the largest variability in vent VT1 (down to 5.5% v/v but similar to previous round other than round 5). Gas vents VT2 to VT4, VT7 to VT9, VT11 and VT12 all showed an increase in oxygen concentrations this round.
- Elevated H_2S and CO concentrations continue to be recorded in gas vents VT5, VT6 and VT7 although the concentrations vary between rounds. The CO concentrations in VT5 and VT6 were significantly higher than recorded in the previous round.
- CH_4 concentrations were 0% v/v at the majority of gas vents. CH_4 concentrations were 0.1% v/v at gas vents VT1, VT5, VT6, and VT7.
- CO_2 concentrations were generally 0.1% v/v to 0.3% v/v, aside from gas vent VT12 where the recorded concentration was 0.5% v/v.

The external H_2S filter was used when taking the CO readings at the following sampling locations:

- Groundwater wells MW201 and MW202.
- Gas wells VW02 to VW06.
- Gas vents VT5 to VT7.

The external H_2S filter is used to prevent H_2S concentrations from interfering with CO readings. When in use, the CO readings prior to the use of the filter are overwritten with the readings obtained when using the filter. Where the H_2S filter has been used, the CO readings obtained with the H_2S filter fitted have been recorded on the attached spreadsheet. In the field, it was observed that CO readings were generally lower with the external H_2S filter which is the expected outcome as the H_2S is a positive interferent with regards to CO concentrations reported by the GA5000 analyser. The external H_2S filter will continue to be used where an amber H_2S warning light occurs during future sampling.

Ammonia sampling was completed using Kitagawa tubes ranging from <50ppm to 900ppm this round and results are outlined below:

- At the groundwater wells, ammonia concentrations ranged between 50ppm at wells MW204 and >900ppm at MW201. The elevated ammonia concentration in MW201 is associated with a high oxygen deficiency and elevated H_2S and CO concentrations. Ammonia concentrations over the three monitoring rounds have been consistent in MW201 at >900ppm, while concentrations in other wells have been consistently lower in the first three rounds with the exception of MW206 which has experienced highly variable concentrations.
- At the gas wells, ammonia concentrations ranged between 50ppm at VW01 and VW02 and >900ppm at VW05 and VW06. Ammonia concentrations at VW05 have been consistent over the three rounds at >900ppm and like MW204 are associated with a high oxygen deficiency and elevated H_2S and CO concentrations. Low concentrations around 50ppm have been detected at VW01, while other gas wells have had variable concentrations.
- At the gas vents, ammonia concentrations generally lower in this round, with the highest concentration of 280ppm in VT7. Ammonia concentrations in VT1 to VT3, VT5, VT6, and VT8 to VT12 were <50ppm. Ammonia concentrations generally similar over the three sampling rounds, except at VT5, VT6, VT7, VT8 and VT10 where they were more variable. Concentrations at VT5 were 600 ppm in the first round, then dropped to 10 ppm in the second round and were <50ppm in the final round. The ammonia concentrations in VT7 reduced from >900ppm in the first two rounds to 280ppm in the third round.

The third round of ammonia sampling is the final round. The next sampling round for H S, CO,

CH_4, CO_2 and O_2 is to be completed on Friday 26 May 2017.

Yours sincerely
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From:	Kirsty Greenfield
To:	Andrew.Walker@hydro.com; Andrew.Solomou@hydro.com
Cc:	Natalie Gilbert; Fiona Robinson; Nwakamma Ahubelem
Subject:	May Gas Sampling Report
Date:	Friday, 2 June 2017 3:16:00 PM
Attachments:	Hydro Gas Sampling Results.xlsx image001.png

Hi Andrew and Andrew,

The seventh round of gas sampling was completed by Ramboll Environ on 26 May 2017. The scope of work was as per that outlined in the December 2016 Gas Sampling Report, issued in January 2017.

The weather information indicates that the first seven rounds of sampling have been undertaken during falling atmospheric pressure. Wind speeds during the current round were the lowest so far at 6 km/hr or light wind on the Beaufort Scale. Wind direction was from the north north east. No rainfall occurred during or immediately prior to the sampling event. The ambient temperature, particularly the minimum, was the lowest recorded across all of the sampling rounds.

Results for groundwater wells are as follows:

- Depth to groundwater was the same as the April round in well MW201, MW204 and MW205. Depth to water increased between 11cm and 14cm in the remaining wells.
- Positive air flow was recorded in four of the six wells, while neutral air flow was recorded in MW202 and MW203.
- Oxygen readings remained highly deficient at <5% v/v in well MW201. Oxygen readings in other wells continue to fluctuate. The oxygen readings in MW204 and MW206 were significantly lower than the previous round. MW202 also showed a further decline in the oxygen reading.
- H_2S readings were lower in all wells this round, with readings in wells MW201, MW202 and MW205 significantly lower than in the previous round.
- CO readings fluctuated in this round, with significantly higher readings than the previous round recorded in wells MW201, MW202 and MW206.
- CH_4 and CO_2 concentrations were similar to previous sampling rounds.

Results for gas wells are as follows:

- Positive air flow was recorded at all of the six gas wells, ranging between 0.1 L/hr and 0.3 L/hr.
- The six wells remain highly oxygen deficient and the results are consistent with previous sampling rounds.
- The H_2S readings were significantly lower than the previous rounds particularly in gas wells:
    1. VW02 – average of 81 ppm for rounds 1 to 6 down to 5 ppm this round.
    1. VW03 - average of 73 ppm for rounds 1 to 6 down to 3 ppm this round.
    2. VW04 – average of 216 ppm for rounds 1 to 6 down to 14 ppm this round.
    3. VW05 – average of 244 ppm for rounds 1 to 6 down to 18 ppm this round.
    4. VW06 – average of 223 ppm for rounds 1 to 6 and down to 15 ppm this round.
- CO readings were relatively consistent between the previous and current sampling rounds in gas wells VW01 to VW03. CO readings were significantly higher than in previous rounds in gas wells:
    1. VW04 – average of 352 ppm for rounds 1 to 6 up to 1326 ppm this round.
    2. VW05 – average of 513 ppm for rounds 1 to 6 up to 1473 ppm this round.
    3. VW06 – average of 325ppm for rounds 1 to 6 up to 1262 ppm this round.
- CH_4 and CO_2 concentrations have been fairly consistent between sampling events and

remain most elevated (1.3 and 0.5% v/v respectively) in well VW01.

Results for gas vents are as follows:

- Positive air flow was recorded in the majority of the gas vents between 0.1 L/hr and 0.3 L/hr, aside from VT6 which had no measurable flow.
- Oxygen concentrations continue to show variability between sampling rounds, with the largest variability in vent VT6 (up to 17.5% v/v but similar to previous rounds 2 and 4).
- H_2S and CO concentrations were similar to previous rounds in all wells, aside from VT5 to VT7 which recorded significantly lower concentrations of both gases compared to the previous round.
- CH_4 concentrations were 0% v/v at the all gas vents, aside from a concentration of 0.1% v/v at gas vents VT5.
- CO_2 concentrations were between 0% v/v to 0.2% v/v at all gas vents.

The external H_2S filter was used when taking the CO readings at the following sampling locations due to an indication of H_2S interference by the landfill gas meter:

- Groundwater wells MW201 and MW206.
- Gas well VW06.

It is noted that monitored H_2S concentrations have dropped significantly during this sampling round. The following quality assurance checks have been made:

- The field data was compared to the data saved into and downloaded from the instrument and was found to be the same.
- Instrument calibration for H_2S was checked by the hire company on return and was acceptable.
- Operation of the instrument was checked and found to be correct.

The change in H_2S data could be real or may be erroneous for unknown reasons. A data check will be completed in the June round of sampling by using two GA5000 instruments to confirm the June results.

The next sampling round is to be completed on Friday 30 June 2017.

Yours sincerely
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From:	Natalie Gilbert
To:	Andrew.Walker@hydro.com; Andrew.Solomou@hydro.com
Cc:	Fiona Robinson; Kirsty Greenfield
Subject:	June Gas Sampling Report
Date:	Wednesday, 5 July 2017 1:38:40 PM
Attachments:	Hydro Gas Sampling Results.xlsx image001.png

Hi Andrew and Andrew,

The eighth round of gas sampling was completed by Ramboll Environ on 30 June 2017. The scope of work was as per that outlined in the December 2016 Gas Sampling Report, issued in January 2017.

The weather information indicates that the first eight rounds of sampling have been undertaken during falling atmospheric pressure. Wind speeds during the current round were 11 km/hr at 9am and the maximum wind speed was 31 km/hr at 12.17. Wind direction was from the north north west. Rainfall of 0.8mm was recorded on the Bureau of Meterology, however no rainfall was observed during or immediately prior to the sampling event. The ambient temperature, particularly the minimum, was similar to that observed in the May sampling round, which is relatively low compared to the previous rounds of sampling.

Results for groundwater wells are as follows:

- Depth to groundwater was similar to the May round in all wells, fluctuating between 0.2cm and 0. 4cm, with the exception of MW206 whereby the depth to water decreased 10cm and MW201 that remained dry.
- Positive air flow was recorded in wells MW201 and MW203 whilst negative airflow was recorded in MW202 and M205 and neutral air flow was recorded in MW204 and MW206.
- Well MW201 had an oxygen reading of 6% v/v, which is an increase compared to all previous rounds, which have reported oxygen readings below 3.5% v/v but typically <1% v/v. All other wells continued to fluctuate consistent with previous rounds. MW204 and MW206 both had low oxygen readings in the previous round and the readings for the current sampling program were back to the levels recorded for previous round.
- H_2S readings returned to similar levels reported prior to the May 2017 round in wells MW201, MW202 and MW205. The remaining wells also reported higher readings than in the previous round, reporting similar levels to those observed in previous rounds.
- CO concentrations were lower in wells MW201, MW202 and MW206 but in the same order as concentrations prior to the May 2017 round,
- CH_4 and CO_2 concentrations were similar to previous sampling rounds.

Results for gas wells are as follows:

- Neutral air flow was recorded at all of the six gas wells.
- The six wells remain highly oxygen deficient, with four of the six wells reporting 0 %v/v and the results are consistent with previous sampling rounds.
- The H_2S readings reported an increase in concentrations to those reported prior to May 2017 round in all wells, with the exception of VW01 which had a zero reading as was also recorded in the May sampling round.
- CO readings were relatively consistent between the previous sampling rounds in gas wells VW01, with a slight decrease in concentrations at wells VW02 and VW03 to levels observed in rounds 1 to 4. CO readings were lower than in April and May sampling rounds in gas wells for the remaining wells, returning to relatively similar concentrations to those observed in rounds 1 to 6.
- CH_4 and CO_2 concentrations have been fairly consistent between sampling events and remain most elevated (1.4 and 0.7% v/v respectively) in well VW01.

Results for gas vents are as follows:

- Neutral air flow was recorded in all of the gas vents.
- Oxygen concentrations in all vents continue to show variability between sampling rounds, with this round indicating oxygenated wells, with concentrations between 19.6% v/v and 20.9% v/v. With the exception of VT3, VT8 and VT11, the oxygen concentrations in the gas vents were higher than recorded in all of the previous rounds.
- H_2S and CO concentrations were similar to previous rounds in all wells, aside from VT5 to VT7 which recorded lower concentrations of both gases compared to the previous rounds. A decreasing trend at these three vents has been observed during the last two rounds of sampling. A data check was undertaken on these vents using another GA5000 gas analyser to check and confirm the results at vents VT5 to VT7. The results indicated similar concentrations for all gases.
- CH_4 concentrations were 0% v/v at the all gas vents.
- CO_2 concentrations were between 0.1% v/v to 0.3% v/v at all gas vents.

The external H_2S filter was used when taking the CO readings at the following sampling locations due to an indication of H_2S interference by the landfill gas meter:

- Groundwater wells MW201 and MW206.
- Gas wells VW04, VW05 and VW06.

It is noted that concentrations of CO and H_2S concentrations have returned to similar concentrations observed prior to the May 2017 sampling round. The change in H_2S data observed in the May 2017 could be real or may be erroneous for unknown reasons.

The next sampling round is to be completed on Friday 28 July 2017.

Yours sincerely
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From:	Natalie Gilbert
To:	Andrew.Solomou@hydro.com; Andrew.Walker@hydro.com
Cc:	Kirsty Greenfield; Fiona Robinson
Subject:	July Gas Sampling Report
Date:	Friday, 11 August 2017 8:53:40 AM
Attachments:	Hydro Gas Sampling Results.xlsx image001.png

Hi Andrew and Andrew,

The ninth round of gas sampling was completed by Ramboll Environ on 31 July 2017. The scope of work was as per that outlined in the December 2016 Gas Sampling Report, issued in January 2017.

The weather information indicates that the first nine rounds of sampling were undertaken during falling atmospheric pressure. Wind speeds during the current round were 4 km/hr at 9am and increasing to 17 km/hr by 3pm. Wind direction was from the north, north-west in the morning. No rainfall was recorded on the day of sampling or two weeks leading up to the sampling round. The ambient temperature for July was higher than that observed for May and June, however relatively low compared to the previous rounds of sampling.

Results for groundwater wells are as follows:

- Depth to groundwater was similar to the June round in all wells, fluctuating between 0.3cm and MW201 that remained dry.
- Positive air flow was recorded in all wells with the exception of MW2016, whereby neutral air flow was recorded.
- Wells MW202, MW203 and MW205 reported increases in oxygen levels whereas the remaining wells reported a decrease in oxygen levels, with MW201 returning to oxygen levels below <1% v/v.
- H_2S readings were similar to levels reported in June 2017 round, with the exception of wells MW204 and MW206, which reported the highest H_2S readings since December 2016 and February 2017 respectively.
- CO concentrations were similar to levels reported in June 2017 round, with the exception of MW204 which reported the highest CO concentration to date (370 ppm).
- CH_4 and CO_2 concentrations were similar to previous sampling rounds.

Results for gas wells are as follows:

- Positive airflow was recorded in all gas wells with the exception of VW05 and VW06 which had neutral air flow.
- The six wells remain highly oxygen deficient, with five of the six wells reporting 0 %v/v and the results are consistent with previous sampling rounds.
- The H_2S readings reported an increase or similar concentrations to those reported in June 2017 round in all wells.
- CO readings were relatively consistent between the previous sampling rounds in all gas wells. VW01, VW04 and VW06 reported either similar or a slight decrease in concentrations whilst VW02, VW03 and VW05 reported a slight increase in concentrations when compared to the June 2017 round.
- CH_4 and CO_2 concentrations have been fairly consistent between sampling events and remain most elevated (1.4 and 0.7% v/v respectively) in well VW01.

Results for gas vents are as follows:

- Positive airflow was recorded in all of the gas vents.
- Oxygen concentrations in all vents continue to show variability between sampling rounds. Oxygen concentrations at vents showed a decrease at vents VT1, VT2, VT4, VT5 and VT7,

whilst the remaining vents showed relatively similar concentrations.

- H_2S and CO concentrations were similar to previous rounds in all wells, aside from VT5 and VT7 which recorded higher concentrations of both gases compared to the recent sampling rounds. The CO concentrations recorded this round were the highest recorded to date in wells VT5 and VT7.
- CH_4 concentrations were 0 – 0.2% v/v at the all gas vents and consistent with previous sampling rounds.
- CO_2 concentrations were between 0.1% v/v to 0.3% v/v at all gas vents and consistent with previous sampling rounds.

The next sampling round is to be completed on Friday 25 August 2017.

Yours sincerely
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From:	Kirsty Greenfield
To:	Andrew Walker; Andrew Solomou
Cc:	Fiona Robinson; Natalie Gilbert
Subject:	August 2017 Gas Sampling Report
Date:	Thursday, 7 September 2017 3:47:00 PM
Attachments:	Hydro Gas Sampling Results.xlsx image002.png

Hi Andrew and Andrew,

The tenth round of gas sampling was completed by Ramboll Environ on 25 August 2017. The scope of work was as per that outlined in the December 2016 Gas Sampling Report, issued in January 2017.

The weather information indicates that the first ten rounds of sampling were undertaken during falling atmospheric pressure. Wind speeds during the current round were 13 km/hr at 9am with the wind direction from the south. No rainfall was recorded on the day of sampling or two weeks leading up to the sampling round. The maximum ambient temperature for the August sampling round was 18.4°C, which is relatively low compared to the previous rounds of sampling (with the exception of sampling round eight).

Results for groundwater wells are as follows:

- Depth to groundwater was similar to or lower than the July round, with the largest drop in depth to water of 15 cm in MW206. MW201 remained dry.
- Positive air flow was recorded in all wells with the exception of MW202, whereby neutral air flow was recorded.
- Oxygen levels were similar to the July 2017 round with the exception of MW201, where oxygen levels increased from 0.2 %v/v in July 2017 to 21.3 %v/v in the current round. This is the highest level of oxygen reported in MW201 to date.
- H_2S concentrations were lower compared to levels reported in the July 2017 round with most wells decreasing by less than 36 ppm. However MW201 reported a H_2S reading of 241 ppm in July 2017 compared to 10 ppm in the current round which is a significant decrease compared to the normal readings but also similar to the round seven result.
- CO concentrations were also lower compared to levels reported in the July 2017 round with the exception of MW206 which increased from 52 to 402 ppm between rounds nine and ten. The biggest decrease was recorded in MW201, which reported a CO reading of 416 ppm in July 2017 and 0 ppm in the current round.
- CH_4 and CO_2 concentrations were similar to previous sampling rounds.

Results for gas wells are as follows:

- Positive airflow was recorded in three gas wells, VW01, VW03 and VW06, and neutral air flow was recorded in the other three wells.
- The six wells remain highly oxygen deficient, with five of the six wells reporting 0 %v/v and the results are consistent with previous sampling rounds. VW01 was the only well to record an oxygen concentration of greater than zero at 0.8 %v/v during this round.
- The H_2S readings reported a slight decrease but were similar concentrations to those reported in July 2017 round in all wells.
- CO readings reported an increase to those reported in July 2017 with the exception of VW01. However, the CO readings were consistent with previous rounds.
- CH_4 and CO_2 concentrations have been fairly consistent between sampling events and remain most elevated (1 %v/v and 0.6 %v/v respectively for this round) in well VW01.

Results for gas vents are as follows:

- A low positive airflow was recorded in all of the gas vents.

- Oxygen concentrations in all vents continue to show variability between sampling rounds. Marked changes in oxygen concentrations between July 2017 and the current round occurred at vents VT1 (11.1% v/v to 5.3% v/v), VT4 (7.8% v/v to 16.1% v/v), VT5 (6% v/v to 15.5% v/v), VT7 (6.2 %v/v to 15.9 %v/v) and VT9 (20.5% v/v to 3.1% v/v).
- H_2S and CO concentrations were similar to previous rounds in all wells, aside from VT5 and VT7 which recorded lower concentrations of both gases compared to the July 2017 sampling round.
- CH_4 concentrations were 0% v/v at the all gas vents and consistent with previous sampling rounds.
- CO_2 concentrations were between 0.1% v/v to 0.5% v/v at all gas vents and consistent with previous sampling rounds. The CO_2 concentrations in VT9 increased from 0.1 %v/v (in July) to 0.4%v/v (in August).

The next sampling round is to be completed on Friday 29 August 2017.

In addition, we are following up with one of our landfill gas specialists from the US on Andrew's query last month about oxygen displacement. Currently, we think the oxygen is being replaced with nitrogen, rather than ammonia as the ammonia concentrations have been well below 1% v/v in the past.

Yours sincerely

Kirsty Greenfield

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From:	Natalie Gilbert
To:	Andrew.Walker@hydro.com; Andrew.Solomou@hydro.com
Cc:	Fiona Robinson; Kirsty Greenfield
Subject:	September 2017 Gas Sampling Report
Date:	Thursday, 12 October 2017 9:26:36 AM
Attachments:	Hydro Gas Sampling Results.xlsx image001.png

Hi Andrew and Andrew,

September 2017 Gas Sampling Report

The eleventh round of gas sampling was completed by Ramboll Environ on 29 September 2017. The scope of work was as per that outlined in the December 2016 Gas Sampling Report, issued in January 2017.

The weather information indicates that the 11 rounds of sampling were undertaken during falling atmospheric pressure. Wind speeds during the current round were 9 km/hr at 9am with the wind direction from the north north-east. No rainfall was recorded on the day of sampling or two weeks leading up to the sampling round. The maximum ambient temperature for the September sampling round was 27.5°C, which is the highest temperature since February 2017.

Results for groundwater wells are as follows:

- Depth to groundwater was similar to the August round, with groundwater varying between 0.0 - 4 cm. MW201 remained dry.
- Positive air flow was recorded in all wells with the exception of MW203 and MW205 where neutral air flow was recorded.
- Oxygen levels have increased at wells MW202, MW203, MW204 and MW206 since the August 2017 round. MW204 reported comparable oxygen levels to the highest round reported in March 2017. Oxygen levels at MW201 decreased to very low concentration similar to those reported prior to the August round and MW205 also reported a decrease in oxygen levels since August and was slightly greater than the July 2017 result.
- H_2S concentrations at wells MW202, MW203, MW205 and MW206 were similar to the August 2017 round. MW201 reported an increase in H_2S concentration from 10 ppm in August to 327 ppm, returning to similar concentrations reported in the previous rounds, with the exception of round seven. MW204 reported a decrease in concentration from 122 pm in August 2017 to 9 ppm in September and continued the decline from the July concentration.
- CO concentrations at wells MW202 and MW205 were similar to the August 2017 round and remain relatively stable across all monitoring rounds. MW204 reported a decrease in concentrations when compared to the August 2017 round, returning to concentrations reported between January and June 2017 rounds. MW206 reported a decrease in concentrations when compared to the August 2017 round. MW201 recorded an increase in CO concentration from 0 ppm in August to 1238 ppm in September.
- CH_4 concentrations were similar to previous monitoring rounds with the exception of a decrease in concentration at MW204 and an increase at MW201 when compared to the August 2017 round with MW201 concentrations returning to near the concentrations measured in the July sampling round.
- CO_2 concentrations reported a decrease in concentration in all wells with the exception of MW204 which reported similar concentration to previous sampling rounds.

Results for gas wells are as follows:

- Positive airflow was recorded in two gas wells, VW01 and VW03 and neutral air flow was recorded in the other four wells.
- The six wells remain highly oxygen deficient with all wells reporting <1 % v/v. VW01

reported a decrease in concentration, from 0.8 %v/v to 0.2 %v/v during this round, whilst VW04 and VW06 reported a slight increase in concentration compared to the August 2017 round.

- The H_2S readings reported an increase in concentrations in all wells compared to August but were similar to those reported for all rounds at all wells with the exception of round seven (May 2017).
- With the exception of VW01, CO readings reported an increase in all wells compared to those reported in August 2017. However, the CO readings were consistent with previous rounds with the exception of rounds four (February 2017) and seven (May 2017).
- CH_4 concentrations were similar to previous monitoring rounds.
- CO_2 concentrations all decreased when compared to the August 2017 round with concentrations reported between 0 %v/v and 0.5 %v/v at all wells.

Results for gas vents are as follows:

- A low positive airflow was recorded in five of the 12 gas vents, with the remainder reporting neutral flow.
- Oxygen concentrations in all vents continue to show variability between sampling rounds. Most of the vents showed a decrease in oxygen concentrations, with the highest decrease from the August round reported at VT5 (15.2 %v/v to 1.2 %v/v). However, VT8, VT9 and VT11 all reported an increase in oxygen concentrations when compared to the August 2017 round but the concentrations were generally similar to previous rounds.
- H_2S and CO concentrations were similar to previous rounds in all wells, aside from VT5, VT6 and VT7 which recorded higher concentrations of both gases compared to the August 2017 sampling round. The H_2S and CO concentrations in VT5 are far more variable than in the other gas vents.
- CH_4 concentrations were 0% v/v at most of the gas vents, with the exception of VT5, VT6 and VT7 which reported an increase in concentration when compared to the August 2017 round. These wells have reported varying CH_4 concentrations between 0.3 % v/v to 0 % v/v over the monitoring period. As for the H_2S and CO concentrations, the CH_4 concentration recorded in VT5 are more variable than in the other gas vents, although VT6 is also fairly variable for CO concentrations.
- CO_2 concentrations were between 0.1% v/v to 0.5% v/v at all gas vents and consistent with previous sampling rounds with the exception of round 5 (March 2017) for VT5.

The next sampling and final round is to be completed on Friday 27 October 2017.

Yours sincerely
Natalie Gilbert

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APPENDIX 7
METEOROLOGICAL DATA

Cessnock, New South Wales
December 2016 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Th	12.1	32.4	2.2			NNE	35	10:45	22.0	61		N	11	1007.8	28.0	38		S	20	1005.3
2	Fr	10.7	38.3	0			SW	39	13:37	25.1	51		NNW	11	1008.4	35.5	17		WNW	17	1006.3
3	Sa	18.5	29.6	0			ESE	39	13:46	23.9	62		SE	9	1015.3	27.0	51		E	20	1013.1
4	Su	15.3	32.6	0.2			ESE	31	15:57	22.0	73		NNE	6	1015.9	31.2	45		ESE	15	1011.6
5	Mo	20.5	38.2	0			SE	46	17:20	25.3	69		NE	9	1009.5	33.4	51		SE	22	1004.5
6	Tu	20.7	29.2	0.6			SSW	39	23:08	23.4	75		S	11	1010.9	28.5	58		SSE	7	1008.4
7	We	18.1	26.2	15.2			ESE	35	15:33	21.2	73		SW	9	1014.8	25.2	61		ENE	15	1013.5
8	Th	14.9	34.5	0.4			WSW	65	21:37	21.0	80		NNE	7	1008.7	32.5	45		NE	15	999.5
9	Fr	18.1	27.9	0			WSW	67	03:24	21.6	33		WSW	19	1009.1	27.1	19		WSW	17	1009.5
10	Sa	14.5	27.6	0			E	41	16:09	21.6	56		E	13	1021.8	26.3	45		ESE	20	1018.7
11	Su	12.9	30.9	0			E	35	15:56	21.8	62		SSE	9	1021.1	29.6	36		SE	11	1017.7
12	Mo	15.6	33.8	0			NNW	41	14:59	23.3	62		NW	4	1021.8	31.5	32		N	15	1016.8
13	Tu	15.7	38.0	0			NNW	46	13:51	29.3	37		NW	19	1016.2	37.0	19		NW	20	1011.3
14	We	20.0	38.8	0			N	57	15:26	30.3	28		NW	28	1010.3	38.6	16		NNW	22	1006.4
15	Th	19.6	20.1	0			S	35	23:03	19.8	94		SSE	15	1014.9	18.3	89		SSE	19	1015.2
16	Fr	17.1	25.8	23.8			ESE	15	11:40	18.7	95		SSE	7	1012.2	24.4	71		SE	2	1008.8
17	Sa	18.7	33.9	7.6			NW	52	10:49	25.7	71		NW	20	1007.9	32.8	35		WSW	20	1005.5
18	Su	18.6	24.3	0			S	46	00:15	18.9	73		SE	19	1018.0	21.7	55		SE	26	1017.8
19	Mo	14.1	25.3	0			E	39	15:46	20.8	58		ENE	13	1020.0	22.8	51		ESE	24	1016.1
20	Tu	11.7	34.0	0			NW	48	12:43	22.2	60		NNW	9	1010.6	33.1	36		NW	22	1005.4
21	We	16.9	30.9	0			SE	39	15:22	25.2	64		SSE	7	1010.7	28.3	52		SE	24	1009.6
22	Th	19.0	24.2	0			SE	35	14:12	20.8	71		ESE	13	1018.6	23.3	57		ESE	20	1016.6
23	Fr	16.3	28.9	0			ESE	37	15:00	23.4	62		NE	15	1018.2	28.7	50		E	20	1014.7
24	Sa	15.7	30.9	0			NNW	35	16:30	24.0	66		N	13	1015.2	29.9	44		SW	9	1011.9
25	Su	16.2	29.8	19.8			ENE	30	18:33	22.8	74		ESE	13	1015.8	22.8	73		WSW	20	1014.3
26	Mo	16.7	33.8	5.6			E	35	17:40	24.3	69		N	7	1014.7	32.6	38		N	13	1010.5
27	Tu	18.1	34.1	0			SE	35	13:16	26.7	61		NNW	13	1013.4	32.5	45		E	20	1010.8
28	We	17.9	35.5	0			E	37	16:46	25.0	59		ESE	4	1012.9	34.3	31		NNE	11	1008.3
29	Th	18.4	39.2	0			E	43	18:09	30.6	37		NW	15	1007.8	38.8	16		N	19	1003.8
30	Fr	18.9	41.2	0			N	39	11:16	29.1	43		ENE	2	1003.8	40.1	18		NW	19	1000.3
31	Sa	24.1	37.6	0			ENE	37	14:13	29.3	55		NNE	6	1002.4	33.7	45		E	26	1000.7
Statistics for December 2016																					
	Mean	17.0	31.9							23.8	62			11	1013.2	30.0	43			17	1010.1
	Lowest	10.7	20.1							18.7	28		ENE	2	1002.4	18.3	16		SE	2	999.5
	Highest	24.1	41.2	23.8			WSW	67		30.6	95		NW	28	1021.8	40.1	89		#	26	1018.7
	Total			75.4																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201612 Prepared at 13:00 GMT on 2 Jan 2017

Cessnock, New South Wales
January 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Su	22.9	29.5	0			SE	24	15:58	23.8	79		SSE	11	1006.8	29.3	60		W	6	1004.0
2	Mo	20.4	26.2	22.8			SE	41	15:27	22.4	91		ESE	7	1008.3	24.2	66		SE	24	1010.4
3	Tu	14.2	27.3	0			S	41	15:03	22.9	71		S	13	1017.6	25.5	55		SE	24	1016.5
4	We	18.6	26.2	0			E	39	14:25	22.2	61		SE	15	1020.0	24.7	48		ESE	22	1018.5
5	Th	18.0	27.8	0.8			ESE	39	12:52	21.2	87		ESE	9	1018.0	27.4	58		ESE	22	1014.8
6	Fr	17.2	28.4	0			NE	43	13:07	23.9	70		E	13	1016.9	24.7	67		NE	20	1015.7
7	Sa	17.9	29.6	0			E	43	13:45	24.8	64		SE	7	1017.2	28.3	49		ESE	20	1012.8
8	Su	13.5	34.5	0			ENE	30	16:27	23.2	65		ENE	4	1013.1	33.4	29		ENE	7	1009.0
9	Mo	14.7	38.1	0			ENE	31	14:16	26.9	58		NE	2	1011.1	37.0	23		ESE	22	1007.1
10	Tu	21.2	38.5	0			SW	50	16:49	25.1	63		NNW	11	1011.5	36.3	22		NW	15	1007.5
11	We	21.2	40.8	1.0			W	50	12:49	27.4	65		N	9	1007.9	39.8	19		WNW	24	1004.1
12	Th	23.3	30.2	0			E	44	14:43	25.5	65		SSE	13	1011.3	29.3	55		E	28	1009.4
13	Fr	22.7	43.6	0			WNW	48	13:42	25.4	68		NNW	4	1008.9	41.0	23		NNW	24	1001.3
14	Sa	24.6	39.4	0			SSE	39	22:26	33.0	43			Calm	1002.5	38.4	28		NW	20	1001.4
15	Su	21.4	26.5	0			ESE	39	07:26	21.7	82		E	17	1014.1	25.3	56		ESE	13	1014.8
16	Mo	16.2		0						25.2	64		ENE	17	1016.3						
Statistics for the first 16 days of January 2017																					
Mean		19.2	32.4							24.7	68			9	1012.6	31.0	43			19	1009.8
Lowest		13.5	26.2							21.2	43			Calm	1002.5	24.2	19		W	6	1001.3
Highest		24.6	43.6	22.8			#	50		33.0	91		#	17	1020.0	41.0	67		E	28	1018.5
Total				24.6																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201701 Prepared at 23:36 GMT on 15 Jan 2017

Cessnock, New South Wales
January 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Su	22.9	29.5	0			SE	24	15:58	23.8	79		SSE	11	1006.8	29.3	60		W	6	1004.0
2	Mo	20.4	26.2	22.8			SE	41	15:27	22.4	91		ESE	7	1008.3	24.2	66		SE	24	1010.4
3	Tu	14.2	27.3	0			S	41	15:03	22.9	71		S	13	1017.6	25.5	55		SE	24	1016.5
4	We	18.6	26.2	0			E	39	14:25	22.2	61		SE	15	1020.0	24.7	48		ESE	22	1018.5
5	Th	18.0	27.8	0.8			ESE	39	12:52	21.2	87		ESE	9	1018.0	27.4	58		ESE	22	1014.8
6	Fr	17.2	28.4	0			NE	43	13:07	23.9	70		E	13	1016.9	24.7	67		NE	20	1015.7
7	Sa	17.9	29.6	0			E	43	13:45	24.8	64		SE	7	1017.2	28.3	49		ESE	20	1012.8
8	Su	13.5	34.5	0			ENE	30	16:27	23.2	65		ENE	4	1013.1	33.4	29		ENE	7	1009.0
9	Mo	14.7	38.1	0			ENE	31	14:16	26.9	58		NE	2	1011.1	37.0	23		ESE	22	1007.1
10	Tu	21.2	38.5	0			SW	50	16:49	25.1	63		NNW	11	1011.5	36.3	22		NW	15	1007.5
11	We	21.2	40.8	1.0			W	50	12:49	27.4	65		N	9	1007.9	39.8	19		WNW	24	1004.1
12	Th	23.3	30.2	0			E	44	14:43	25.5	65		SSE	13	1011.3	29.3	55		E	28	1009.4
13	Fr	22.7	43.6	0			WNW	48	13:42	25.4	68		NNW	4	1008.9	41.0	23		NNW	24	1001.3
14	Sa	24.6	39.4	0			SSE	39	22:26	33.0	43			Calm	1002.5	38.4	28		NW	20	1001.4
15	Su	21.4	26.5	0			ESE	39	07:26	21.7	82		E	17	1014.1	25.3	56		ESE	13	1014.8
16	Mo	16.2	33.5	0			E	46	14:27	25.2	64		ENE	17	1016.3	32.7	40		ESE	13	1012.1
17	Tu	15.7	41.3	0			NW	41	11:53	25.1	69		N	13	1013.9	40.0	27		NNW	19	1008.2
18	We	24.9	43.1	0			NNW	63	07:59	35.2	31		NW	31	1007.0	40.9	22		NW	26	1002.8
19	Th	18.7	23.7	0			E	31	13:32	22.9	59		SE	13	1014.2	22.8	65		ESE	20	1012.1
20	Fr	16.2	30.8	0			NNW	41	13:44	23.1	67		NNE	9	1001.9	28.2	76		NNW	22	996.1
21	Sa	18.2	27.9	11.4			SSE	46	23:13	21.5	59		SSE	11	1009.8	25.8	46		ESE	19	1010.8
22	Su	16.5	30.2	0			ENE	35	11:06	23.8	60		E	13	1016.8	29.3	43		E	13	1014.0
23	Mo	14.9	37.2	0			ENE	37	18:04	23.7	70		SE	4	1014.3	35.7	32		E	15	1009.4
24	Tu	19.3	40.4	0			NW	59	07:31	32.3	32		NW	24	1008.9	37.1	31		NW	15	1007.0
25	We	19.8	24.0	26.2			S	26	00:17	20.4	77		S	13	1019.8	23.4	70		SE	13	1016.9
26	Th	20.3	25.4	0			SE	26	17:50	22.1	85		SSE	2	1014.8	25.0	76		ESE	9	1013.6
27	Fr	19.6	29.3	2.4			SE	31	15:41	20.6	94		SSW	9	1017.1	28.2	61		SE	17	1015.0
28	Sa	16.6	36.3	1.6			ESE	35	16:32	22.5	82		NNE	7	1016.0	35.5	32		N	7	1011.7
29	Su	19.2	36.3	0			E	37	13:07	27.2	65		NNE	7	1015.5	32.5	52		ESE	22	1012.8
30	Mo	19.2	40.0	0			NNW	44	13:45	26.2	78		NNE	9	1013.1	39.4	26		NW	19	1008.2
31	Tu	24.7		0						31.2	45		NNW	17	1009.6						
Statistics for the first 31 days of January 2017																					
	Mean	19.1	32.9							24.9	66			10	1012.7	31.4	45			18	1009.9
	Lowest	13.5	23.7							20.4	31			Calm	1001.9	22.8	19		W	6	996.1
	Highest	24.9	43.6	26.2			NNW	63		35.2	94		NW	31	1020.0	41.0	76		E	28	1018.5
	Total			66.2																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201701 Prepared at 23:36 GMT on 30 Jan 2017

Cessnock, New South Wales
February 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	We	22.4	30.0	1.8			E	30	16:10	23.5	79		SSE	4	1015.2	28.9	66		ESE	20	1010.5
2	Th	21.5	31.6	0.4			SSE	39	13:00	25.6	83		SE	6	1011.4	27.6	47		S	24	1012.0
3	Fr	21.1	29.0	0.4			SSE	28	14:35	22.6	89		SSE	9	1015.0	27.8	66		S	19	1012.1
4	Sa	22.6	38.8	0			N	56	16:20	25.7	86		E	2	1012.7	36.4	40		WNW	11	1008.5
5	Su	22.9	40.6	8.6			NW	39	12:26	29.0	58		NNE	9	1010.9	39.3	27		WNW	19	1008.0
6	Mo	19.8	42.1	0			S	39	21:11	33.3	35		NNW	11	1010.7	40.7	14		NNE	19	1006.9
7	Tu	24.5	31.1	0			S	41	12:16	26.7	80		ESE	9	1015.9	29.4	60		SSE	19	1016.9
8	We	21.2	29.5	4.2			E	41	09:57	24.1	89		SE	13	1020.6	26.9	65		ESE	24	1019.7
9	Th	19.5	35.3	0.6			ENE	30	14:08	25.3	78		E	9	1018.0	33.1	32		NE	7	1012.6
10	Fr	17.5	44.0	0			N	30	12:06	27.9	53		NW	13	1010.6	42.6	17		NE	13	1006.1
11	Sa	23.2	46.8	0			NW	31	11:35	28.2	67		N	11	1008.3	44.9	15		NNW	13	1002.0
12	Su	22.4	45.9	0			SSE	57	17:09	28.8	69		NW	11	999.9	43.5	9		NW	28	993.3
13	Mo	19.9	30.9	0			E	35	14:27	23.0	58		SE	11	1007.2	30.3	34		NE	11	1004.9
14	Tu	19.7	28.9	0			SSE	43	15:40	23.5	57		ESE	9	1014.0	26.5	53		ESE	26	1012.9
15	We	14.8	29.4	0			E	35	16:35	22.7	70		SE	13	1016.5	27.8	47		E	20	1012.3
16	Th	14.1	37.9	0			E	37	15:48	23.1	70		N	6	1012.0	37.1	21		NW	13	1008.0
17	Fr	17.4	38.6	0			WSW	109	16:12	25.5	64		NE	7	1010.2	37.8	25		NNE	22	1005.4
18	Sa	18.1	37.9	5.0			NW	54	10:51	28.6	48		NW	17	1005.8	31.3	45		SE	26	1002.6
19	Su	20.1	24.4	14.4			ENE	26	16:15	20.4	89		SSW	9	1007.8	22.6	79		E	7	1005.3
20	Mo	13.2	29.9	1.4			WSW	37	10:15	20.9	35		W	17	1011.3	27.9	22		NW	17	1008.7
21	Tu	11.6	29.8	0			ESE	41	15:12	19.0	71		ENE	4	1018.7	29.3	43		E	19	1016.3
22	We	15.6	32.2	0			E	41	15:20	23.7	62		E	9	1020.4	31.6	34		ESE	15	1016.6
23	Th	14.6	35.5	0			E	33	15:04	22.3	71		SE	7	1019.2	33.8	27		E	9	1015.6
24	Fr	15.2	32.0	0			E	39	14:28	23.7	62		SSE	13	1019.0	30.6	39		E	22	1015.9
25	Sa	17.9	26.2	0			S	46	14:54	23.6	71		SSE	9	1018.8	25.4	63		S	28	1017.9
26	Su	18.8	28.2	1.8			SSE	46	16:38	22.3	75		S	20	1020.3	27.6	39		S	26	1019.5
27	Mo	17.9		0.8						22.7	79		S	11	1022.1						
Statistics for the first 27 days of February 2017																					
Mean		18.8	34.1							24.7	68			9	1013.8	32.3	39			18	1010.4
Lowest		11.6	24.4							19.0	35		E	2	999.9	22.6	9		#	7	993.3
Highest		24.5	46.8	14.4			WSW	109		33.3	89		S	20	1022.1	44.9	79		#	28	1019.7
Total				39.4																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201702 Prepared at 23:36 GMT on 26 Feb 2017

Cessnock, New South Wales
March 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	We	18.7	27.4	13.6			SSE	30	12:03	22.7	86		SSE	11	1019.5	25.6	71		WSW	9	1017.3
2	Th	16.4	29.1	2.6			ESE	30	15:13	21.5	82		E	4	1017.5	28.5	56		E	11	1014.3
3	Fr	17.2	28.1	0			ESE	43	11:48	22.6	80		S	15	1015.6	25.8	68		S	22	1014.0
4	Sa	20.1	26.4	8.6			SW	31	13:21	22.4	83		SW	13	1013.4	25.0	71		SW	20	1011.4
5	Su	18.2	24.7	17.6			SW	31	14:39	19.5	95		NNW	9	1010.3	24.5	67		SW	17	1008.5
6	Mo	19.0	26.3	2.6			SW	44	08:26	21.6	60		SSW	26	1011.8	24.8	53		S	17	1011.5
7	Tu	16.4	25.4	0			SSE	50	12:38	20.1	62		SSW	22	1016.5	22.0	62		S	28	1015.9
8	We	16.1	23.9	1.0			SE	44	15:24	19.0	78		S	17	1017.4	23.1	59		SSE	26	1015.7
9	Th	14.5	25.2	1.2			SE	39	14:54	19.6	74		SSW	11	1015.8	23.8	51		SSW	17	1014.0
10	Fr	16.5	25.7	0.8			S	39	08:49	19.8	70		SSW	17	1014.1	24.0	51		SSE	17	1012.7
11	Sa	11.0	27.7	0			ENE	30	17:06	19.4	76		SSE	2	1013.8	25.9	41		E	9	1011.2
12	Su	10.5	32.6	0			E	30	16:26	17.6	83		NNE	7	1010.9	31.7	30		NE	11	1006.7
13	Mo	17.6	30.7	0			ESE	39	17:04	20.1	79		SW	9	1010.4	28.9	40		ESE	24	1010.3
14	Tu	20.0	29.0	0			E	56	18:16	24.0	76		ENE	17	1017.2	26.9	58		ESE	26	1015.9
15	We	19.5	25.2	7.4			E	44	11:44	22.0	89		SSE	11	1019.0	24.8	75		E	20	1016.8
16	Th	21.5	31.3	11.0			E	28	01:21	22.5	96			Calm	1011.4	29.6	57		NW	9	1007.9
17	Fr	21.3	23.5	0						21.3	86		SSW	13	1016.3	21.9	72		SSW	30	1018.1
18	Sa	17.8	27.0							22.0	89		SE	20	1020.2	25.4	68		SE	31	1019.1
19	Su	20.6	29.2	8.4			SE	41	23:03	23.3	92		ESE	13	1018.5	28.5	69		SE	20	1015.9
20	Mo	20.6	28.4	0.4			ENE	28	14:55	23.1	88		S	6	1017.7	27.4	70		E	17	1015.1
21	Tu	20.2	30.8	0			N	26	14:01	22.5	90		S	4	1015.3	30.7	58		N	13	1011.8
22	We	21.0	30.1	0.6			SSE	44	18:15	26.5	73		NW	11	1013.1	28.1	66		NNW	15	1010.8
23	Th	18.8	23.8	8.4			SSW	20	08:21	21.1	83		SSW	11	1017.7	22.3	77		SSE	13	1016.5
24	Fr	18.0	24.8	13.2			SSE	35	14:26	19.2	92		WSW	6	1019.3	24.3	64		ESE	19	1017.6
25	Sa	14.8	26.1	0			ESE	24	18:21	20.0	78		SSE	2	1017.0	24.7	59		NNE	7	1013.3
26	Su	18.5	29.1	0			ESE	30	15:41	21.3	89		NNW	4	1015.2	27.3	62		E	15	1013.4
27	Mo	15.1	28.9	0			NNE	20	10:28	20.8	87			Calm	1016.6	27.8	54		ENE	6	1012.2
28	Tu	17.8	29.0	0			ESE	28	14:33	23.6	81		SE	11	1013.0	27.8	65		E	17	1010.8
29	We	21.4	33.3	0			N	26	12:18	22.7	94		NNE	7	1012.1	32.4	57		N	9	1007.6
30	Th	21.5	25.7	0			SSW	46	20:33	25.2	70		N	7	1007.3	21.5	94			Calm	1006.1
31	Fr	15.5	22.7	47.6			SSW	44	23:22	17.0	65		SSW	19	1014.7	22.1	57		S	13	1013.9
Statistics for March 2017																					
	Mean	17.9	27.5							21.4	81			10	1015.1	26.0	61			16	1013.1
	Lowest	10.5	22.7							17.0	60			Calm	1007.3	21.5	30			Calm	1006.1
	Highest	21.5	33.3	47.6			E	56		26.5	96		SSW	26	1020.2	32.4	94		SE	31	1019.1
	Total			145.0																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201703 Prepared at 13:00 GMT on 2 Apr 2017

Cessnock, New South Wales
April 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Sa	14.7	25.2	0			E	26	16:08	19.1	68		WNW	2	1017.3	23.8	41		SSW	6	1015.7
2	Su	15.3	22.6	11.0			S	43	11:42	18.4	76		SSW	15	1023.3	20.0	66		SSE	20	1023.3
3	Mo	14.5	22.8	0.2			SSE	43	13:02	17.0	81		SSW	20	1026.7	21.9	46		SSE	28	1024.7
4	Tu	13.9	23.5	5.2			SE	54	16:18	18.2	80		SSW	13	1027.0	19.2	70		SSE	17	1025.1
5	We	11.1	20.4	1.8			E	50	12:44	18.0	74		SSW	13	1025.3	19.7	77		SE	20	1022.2
6	Th	11.4	23.1	17.4			SE	30	15:05	16.1	90		ESE	2	1025.3	21.5	49		SE	20	1022.4
7	Fr	10.4	23.5	0			ESE	28	11:48	18.6	79		NNE	9	1027.4	22.0	52		SE	15	1024.6
8	Sa	8.8	25.2	0			NE	28	11:16	18.2	78			Calm	1025.7	24.1	49		E	13	1020.4
9	Su	10.3	26.8	0			SW	54	19:51	20.3	72		NNW	13	1016.1	26.4	39		NNW	22	1008.2
10	Mo	9.4	19.0	6.4			NW	56	11:55	13.7	53		NW	22	1011.4	18.1	45		WNW	19	1009.2
11	Tu	12.2	23.1	0			SW	35	12:05	18.6	60		NW	9	1017.5	21.9	53		SSW	17	1016.8
12	We	16.2	23.5	0			SSW	33	08:40	19.6	69		SSW	20	1022.6	23.2	59		SSW	15	1020.6
13	Th	13.6	24.1	0			SSW	30	12:21	18.5	77		SW	9	1023.3	21.3	60		SE	19	1019.9
14	Fr	10.7	24.9	0			W	19	13:57	18.5	81		NNE	7	1021.8	24.2	33		SW	7	1018.3
15	Sa	7.8		0			ESE	28	15:50	16.5	81		NW	7	1020.6	24.8	29		S	13	1017.2
16	Su	10.8	25.4	0			NNW	26	09:06	17.4	88		NNW	11	1019.9	25.1	37		SE	11	1017.0
17	Mo	10.6	24.6	0			ENE	24	11:52	18.9	73		NNE	6	1023.6	22.5	58		E	13	1020.9
18	Tu	9.3	25.0	0			E	26	14:33	17.9	82		NE	2	1026.4	22.7	60		E	11	1024.2
19	We	9.0	24.3	0			ESE	28	15:18	17.8	89		NNE	6	1029.6	24.0	56		SE	19	1026.7
20	Th	9.6	24.4	0			ESE	33	15:17	19.3	80		SSE	6	1029.6	23.5	56		E	20	1026.5
21	Fr	9.0	24.3	0			ENE	24	11:50	18.7	75		NE	6	1027.7	23.1	49		E	13	1023.7
22	Sa	13.9	23.0	0			N	22	15:23	16.7	92		ESE	6	1025.3	22.2	63		NNW	9	1021.9
23	Su	9.9	25.8	0			NNE	17	11:39	15.2	94		NNW	9	1023.9	24.4	48		E	11	1019.8
24	Mo	10.0	24.7	0			ENE	19	13:52	15.0	99		NNE	7	1022.4	24.3	54		ENE	9	1017.8
25	Tu	12.6	27.7	0			NNW	50	12:32	18.1	92		NNE	11	1015.0	26.0	46		NNW	13	1008.3
26	We	16.2	24.5	6.0			WSW	83	15:40	18.5	85		NNW	13	1007.5	21.4	44		NW	20	1002.8
27	Th	9.6	18.9	1.4			NW	31	06:30	12.3	79		NNW	13	1015.1	18.3	40		SSW	15	1014.5
28	Fr	8.6	20.3	0			SSW	26	11:53	14.7	54		SW	13	1022.1	19.5	38		WSW	9	1019.8
29	Sa	3.1	23.1	0			NW	30	11:17	13.3	77		NNW	9	1020.7	22.0	42		NNE	7	1017.2
30	Su	6.6		0						15.0	88		NNW	4	1022.4	21.7	60		ENE	13	1019.8
Statistics for the first 30 days of April 2017																					
Mean		11.0	23.7							17.3	78			9	1022.1	22.4	50			14	1019.0
Lowest		3.1	18.9							12.3	53			Calm	1007.5	18.1	29		SSW	6	1002.8
Highest		16.2	27.7	17.4			WSW	83		20.3	99		NW	22	1029.6	26.4	77		SSE	28	1026.7
Total				49.4																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201704 Prepared at 05:36 GMT on 30 Apr 2017

Cessnock, New South Wales
May 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	6.5	24.0	0.2			NNW	35	15:00	12.2	99		N	9	1019.9	23.6	48		NNW	20	1015.6
2	Tu	6.7	26.2	0			NW	37	14:23	15.5	83			Calm	1017.6	25.6	34		NW	17	1014.5
3	We	11.5	19.7	0			SSE	31	10:33	16.3	70		SSW	13	1025.9	17.2	71		SSE	15	1025.9
4	Th	10.6	19.7	1.6			SSE	22	09:51	17.3	74		S	13	1030.5	18.7	62		E	9	1028.4
5	Fr	5.7	22.8	0			NE	24	11:35	14.9	83		NNE	7	1030.6	21.8	41		NE	11	1027.0
6	Sa	4.8	23.9	0			NW	30	11:12	12.0	96		E	4	1026.6	23.7	40		NNW	17	1022.0
7	Su	7.8	22.3	0			SW	33	11:17	17.7	63		NNW	6	1023.8	21.9	32		SSW	15	1021.9
8	Mo	3.9	19.9	0			SE	30	14:30	12.9	73		NE	2	1026.7	18.6	52		SE	19	1023.7
9	Tu	4.0	20.6	0			SE	24	13:32	15.1	70			Calm	1026.0	19.3	56		E	15	1022.8
10	We	3.1	21.5	0			S	22	11:24	13.0	88		ESE	2	1024.8	20.7	46		SW	7	1021.0
11	Th	2.9	21.7	0			SE	20	14:28	12.4	86		NW	7	1024.2	20.4	54		ESE	9	1021.7
12	Fr	8.1	19.4	0.2			SSW	17	09:42	15.0	90		N	7	1026.1	19.0	68		SW	7	1023.4
13	Sa	8.4	21.3	0			N	17	12:56	12.3	99		NNE	4	1024.6	20.5	62		ENE	9	1021.0
14	Su	12.2	20.4	0.2			SE	26	13:43	15.2	97		E	6	1021.3	15.6	94		S	13	1018.8
15	Mo	7.8	19.9	6.2			SW	30	08:19	16.1	74		SW	15	1016.5	19.8	56		WSW	7	1013.8
16	Tu	4.1	21.5	0			WSW	24	10:44	12.9	80		NNW	7	1018.0	21.2	37		ENE	4	1015.8
17	We	2.6	20.7	0			SE	20	13:42	11.4	88			Calm	1023.1	20.2	56		E	13	1020.5
18	Th	7.1	21.5	0			SE	30	14:47	13.3	87		NE	2	1026.3	20.6	65		ESE	17	1023.1
19	Fr	10.3	19.6	0			ENE	30	11:02	16.6	92		SE	11	1024.4	17.6	91		E	9	1020.3
20	Sa	14.9	23.5	13.0			NW	24	13:31	16.5	97			Calm	1017.7	22.2	62		NW	11	1015.2
21	Su	9.9	22.9	0			SE	22	14:34	14.5	99		NNE	6	1020.4	20.9	70		ESE	17	1018.1
22	Mo	11.8	21.9	0			SE	24	14:41	17.4	85			Calm	1023.5	20.5	70		SE	17	1020.7
23	Tu	11.0	22.7	0			NW	24	12:24	15.2	99		NNW	7	1022.1	22.4	58		NW	9	1017.4
24	We	8.7	22.6	0			NW	41	10:45	17.3	82		NNE	6	1015.4	21.1	53		WNW	15	1012.8
25	Th	4.1	21.1	0			NNW	19	02:39	13.2	73		NNW	9	1021.2	19.5	48		ENE	6	1018.4
26	Fr	2.3	20.2	0			SSW	15	15:19	11.5	86		NNE	6	1021.4	19.6	51		ESE	9	1018.9
27	Sa	2.9	20.7	0			NNE	17	14:06	9.4	96			Calm	1022.0	20.2	54		N	13	1017.5
28	Su	5.2		0						15.1	79		NW	15	1014.2	21.3	56		NNW	19	1010.7
Statistics for the first 28 days of May 2017																					
	Mean	7.1	21.6							14.4	85			5	1022.7	20.5	56			12	1019.7
	Lowest	2.3	19.4							9.4	63			Calm	1014.2	15.6	32		ENE	4	1010.7
	Highest	14.9	26.2	13.0			NW	41		17.7	99		#	15	1030.6	25.6	94		NNW	20	1028.4
	Total			21.4																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201705 Prepared at 05:36 GMT on 28 May 2017

Cessnock, New South Wales
June 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Th	4.9	17.2	0			SW	31	11:32	11.9	53		SSW	13	1032.0	15.7	50		SW	13	1030.4
2	Fr	1.4	17.9	0.2			SSE	30	13:21	10.8	73		NNE	11	1032.3	16.7	50		SW	17	1029.7
3	Sa	5.3	18.6	0			SW	30	11:59	13.2	68		SW	15	1030.4	17.0	62		SSW	15	1027.5
4	Su	6.2	19.3	0			SSW	20	10:51	13.8	79		SSW	11	1027.6	17.3	64		S	9	1023.9
5	Mo	2.1	18.9	0			N	20	13:07	8.1	99		NNW	7	1025.0	17.5	54		NNW	11	1021.3
6	Tu	0.7	18.2	0			SW	43	23:32	9.4	73		NW	19	1020.4	13.1	65		SSW	15	1017.5
7	We	7.6	15.9	10.8			SSW	37	03:55	10.1	92		SW	11	1019.1	13.2	82		SSW	11	1018.2
8	Th	9.1	18.8	16.2			SSW	33	08:49	15.7	79		SSW	22	1022.5	15.8	91		SSW	11	1021.5
9	Fr	11.3	17.7	2.4			NE	44	23:50	14.7	80		SSW	11	1026.1	17.4	78		S	19	1025.0
10	Sa	10.2	17.5	13.6			SE	31	12:19	14.4	94		SSW	9	1030.2	16.3	81		S	17	1028.5
11	Su	10.1	18.3	0.4			SSW	17	09:38	13.8	97		SSW	2	1028.3	17.3	79		SSE	7	1025.0
12	Mo	8.3	20.3	0			N	19	12:27	12.0	99		WNW	2	1024.4	20.0	56		S	2	1022.7
13	Tu	8.0	19.5	0.4			SE	37	14:05	15.5	74		SW	15	1028.2	17.8	72		SSE	15	1027.7
14	We	11.1	18.7	0.4			S	20	10:10	13.4	98		NNE	7	1030.6	15.8	94		S	6	1027.9
15	Th	9.3	18.5	2.0			N	20	12:23	12.9	99			Calm	1027.5	18.0	68		NW	7	1024.5
16	Fr	7.9	17.9	0			N	20	09:19	11.9	99		NE	6	1025.1	17.4	76		SSW	6	1022.7
17	Sa	11.4	17.6	0			NNW	20	09:27	14.1	89		N	11	1023.5	17.2	78		S	9	1020.4
18	Su	8.8	17.5	0			S	39	18:58	15.2	79		SSW	19	1024.2	15.5	81		SSW	17	1024.4
19	Mo	11.1	20.1	0.2			SSW	39	02:11	15.6	74		S	17	1028.6	18.1	69		S	20	1027.0
20	Tu	8.7	18.9	0			S	26	10:38	13.2	91		NNE	7	1027.4	18.4	67		SSW	13	1024.5
21	We	3.5	18.4	0			SSW	28	14:20	10.0	96		NNW	7	1025.2	17.6	65		SSW	15	1024.4
22	Th	5.4	19.7	0			W	19	11:12	11.5	90		NNE	11	1027.9	18.6	55		NW	2	1023.8
23	Fr	4.2	18.2	0.2			NW	35	12:32	9.6	99		SE	4	1021.5	17.5	57		NW	15	1015.5
24	Sa	4.8	18.8	0			NW	31	10:49	13.7	55		NW	17	1017.9	18.5	45		NW	6	1015.2
25	Su	3.3	20.0	0			NNW	31	14:55	9.5	89		ESE	6	1019.3	19.2	44		NW	17	1015.2
26	Mo	-0.2	18.3	0			N	17	09:59	8.2	89		NE	7	1022.3	17.7	44		SSW	9	1020.7
27	Tu	-0.9	16.9	0			WSW	13	17:47	7.0	92		NNE	7	1026.5	15.7	58			Calm	1023.7
28	We	5.9	14.4	0			NNW	19	11:22	10.5	93			Calm	1022.9	12.5	95		N	9	1021.6
29	Th	9.6	13.8	4.2			NNW	20	17:07	11.1	98			Calm	1021.7	13.3	89		NNW	7	1018.5
30	Fr	5.7	15.3	0.8			SSW	31	12:17	8.9	80		NNW	11	1024.6	14.6	38		SSW	11	1024.0
Statistics for June 2017																					
	Mean	6.5	18.0							12.0	85			9	1025.4	16.7	66			11	1023.1
	Lowest	-0.9	13.8							7.0	53			Calm	1017.9	12.5	38			Calm	1015.2
	Highest	11.4	20.3	16.2			NE	44		15.7	99		SSW	22	1032.3	20.0	95		S	20	1030.4
	Total			51.8																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201706 Prepared at 13:00 GMT on 2 Jul 2017

Cessnock, New South Wales
July 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Sa	-1.1	15.3	0			WSW	24	11:22	7.8	74		N	11	1030.0	14.7	50		SSW	9	1027.8
2	Su	-2.5	16.2	0			NNE	19	13:13	4.7	98			Calm	1028.1	15.7	48		N	11	1023.4
3	Mo	-1.4	17.3	0			NNW	33	23:26	4.9	99		NNE	2	1021.3	16.0	53		NNE	11	1015.6
4	Tu	4.9	21.1	0			NNW	44	14:54	17.2	67		NNW	7	1014.3	20.7	27		NW	24	1011.6
5	We	10.0	19.6	0			WNW	50	13:47	13.5	48		NW	17	1016.3	19.5	32		WNW	13	1010.9
6	Th	7.7	18.0	0			NW	31	00:29	10.8	62		NNW	15	1018.1	17.6	41		NW	9	1014.9
7	Fr	-2.3	19.2	0			NW	39	15:01	5.9	93		NE	6	1014.2	18.6	33		NW	22	1009.7
8	Sa	1.2	17.5	0			NNW	33	10:43	10.5	58		N	11	1017.3	17.2	41		W	17	1015.6
9	Su	2.1	17.3	0			NNW	31	14:07	8.7	71		N	17	1021.7	16.9	39		NW	19	1018.7
10	Mo	-2.1	17.8	0			WSW	33	13:23	7.1	81		ESE	4	1026.8	16.5	42		NNW	9	1024.3
11	Tu	-3.4	17.3	0			S	24	13:21	6.9	87		NNE	4	1030.7	16.5	44		SE	6	1028.7
12	We	2.1	16.7	0			SE	30	14:38	10.4	83		NNE	7	1033.2	12.3	85		S	7	1030.5
13	Th	1.2	16.8	2.4			NNE	19	15:32	6.8	99			Calm	1028.8	16.5	59		NNE	11	1024.2
14	Fr	-0.1	20.5	0			NW	30	14:47	6.0	99			Calm	1020.6	19.0	48		NNW	19	1015.7
15	Sa	6.0	17.6	0			NW	26	13:30	9.9	98			Calm	1019.3	16.8	57		WNW	11	1017.3
16	Su	1.7	18.1	0			NNE	19	14:49	9.0	95		NE	6	1023.1	17.5	41		NNE	9	1020.0
17	Mo	0.7	19.8	0			NW	31	14:06	8.2	97		NNW	6	1021.0	19.6	44		NW	19	1016.7
18	Tu	1.5	23.5	0			NW	57	14:41	11.6	82		NNE	11	1015.1	22.8	35		NNW	28	1007.7
19	We	8.4	17.6	0			WSW	48	14:24	10.9	56		NW	17	1009.2	15.8	36		W	20	1006.5
20	Th	5.9	18.9	0			W	48	13:10	11.7	62		WNW	24	1014.6	18.3	20		W	22	1011.6
21	Fr	0.4	17.2	0			WSW	33	10:22	11.2	52		WSW	11	1020.9	15.7	45		SW	13	1019.7
22	Sa	-3.9	17.8	0			NW	35	13:01	8.5	70		NNW	11	1024.3	17.6	29		NNW	13	1019.2
23	Su	0.1	19.9	0			NW	44	12:08	11.1	48		NW	17	1019.6	19.6	20		NW	24	1014.8
24	Mo	9.3	21.3	0			NW	30	10:40	12.6	37		NW	17	1020.8	21.0	29		WNW	15	1017.9
25	Tu	-1.2	19.9	0			NW	30	07:39	11.4	59		NNW	19	1023.8	19.7	36		NW	13	1019.3
26	We	8.7	24.2	0			WNW	57	13:47	15.4	43		NNW	15	1018.1	22.4	22		W	33	1014.7
27	Th	0.5	19.4	0			NNE	20	15:30	10.9	64		N	9	1025.1	18.0	40		ENE	7	1022.1
28	Fr	-0.3	21.4	0			WNW	56	13:16	10.4	72		NNE	9	1018.1	20.8	17		W	20	1015.8
29	Sa	-2.7	20.2	0			NW	33	11:56	9.9	55		NW	13	1022.2	19.8	19		NNW	15	1016.6
30	Su	6.1	25.3	0			N	35	14:13	16.8	22		NW	20	1016.7	24.1	20		NNW	19	1013.6
31	Mo	9.1	21.0	0			WNW	37	14:29	14.2	62		NNW	4	1018.2	17.9	57		WSW	17	1014.6
Statistics for July 2017																					
	Mean	2.1	19.2							10.2	70			10	1021.0	18.2	39			15	1017.4
	Lowest	-3.9	15.3							4.7	22			Calm	1009.2	12.3	17		SE	6	1006.5
	Highest	10.0	25.3	2.4			#	57		17.2	99		WNW	24	1033.2	24.1	85		W	33	1030.5
	Total			2.4																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201707 Prepared at 13:00 GMT on 7 Aug 2017

Cessnock, New South Wales
August 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Tu	6.9	18.0	0.4			WSW	30	10:35	11.3	76		NNW	11	1024.2	17.7	36		SSW	13	1022.2
2	We	-0.9	19.4	0			SSE	30	15:16	10.2	74		N	9	1024.9	18.4	35		NNW	6	1020.4
3	Th	-0.4	19.3	0			NNW	48	20:50	7.0	93			Calm	1019.9	17.8	56		E	15	1012.3
4	Fr	7.0	15.8	8.0			NW	56	09:42	12.7	67		NW	20	1011.7	15.1	52		NW	24	1010.3
5	Sa	9.9	19.7	0			NW	54	11:09	14.7	49		NW	22	1014.2	19.0	31		NW	24	1011.5
6	Su	3.2	20.6	0			NNW	54	13:44	13.2	57		NE	4	1016.1	19.8	31		NNW	30	1010.0
7	Mo	1.0	19.2	0			NW	61	10:53	14.2	58		N	9	1011.4	17.8	28		WNW	28	1009.3
8	Tu	7.9	19.2	0			NW	39	09:34	12.2	53		WNW	20	1018.9	18.7	24		W	20	1016.7
9	We	4.5	19.9	0			N	35	10:13	10.5	61		NW	20	1023.3	19.2	34		N	11	1019.9
10	Th	-1.3	23.9	0			NW	46	13:32	11.7	65		NNE	4	1019.6	23.5	22		NW	24	1013.3
11	Fr	11.7	27.7	0			NW	54	11:37	20.7	24		NNW	20	1012.9	26.8	17		NW	26	1011.3
12	Sa	6.0	21.3	0			NNW	35	11:14	12.8	53		NNW	17	1021.3	20.6	29		NNW	17	1017.4
13	Su	2.2	20.8	0			SSW	26	00:54	13.3	51		NNW	13	1023.4	19.9	30		E	9	1019.6
14	Mo	-1.2	22.4	0			N	28	15:54	11.4	73		N	9	1020.3	22.0	22		NNW	13	1015.1
15	Tu	1.8	24.4	0			NNW	26	17:32	10.4	76		SE	7	1015.8	21.1	36		NW	9	1009.2
16	We	6.2	24.7	0			WNW	61	13:19	24.1	21		NW	31	1002.0	22.9	21		WNW	24	1004.1
17	Th	5.8	22.6	0			NW	50	14:40	15.3	48		NW	19	1010.2	22.5	21		NW	26	1006.2
18	Fr	7.1	17.9	0			WSW	69	07:10	15.4	39		WNW	30	1010.5	17.2	30		W	28	1009.7
19	Sa	6.5	16.9	0			W	56	00:23	12.4	38		WSW	13	1017.2	15.2	29		SSW	22	1016.7
20	Su	2.4	16.7	0			S	28	11:45	11.2	42		SSW	15	1024.0	15.2	48		S	13	1021.0
21	Mo	0.8	17.2	0			N	31	16:58	7.8	93			Calm	1019.7	16.0	45		NNE	17	1015.3
22	Tu	3.9	21.2	0			ESE	30	16:00	14.6	53		SSE	6	1019.0	20.3	33		E	13	1017.0
23	We	0.6	24.0	0			N	24	16:05	10.8	81		NNE	7	1020.0	23.1	29		N	11	1014.7
24	Th	2.7	20.5	0			S	35	11:36	14.5	54		NNE	7	1017.3	18.3	34		SSE	17	1015.4
25	Fr	9.7	18.4	0			SSE	43	10:54	14.2	54		SSW	17	1022.8	16.6	47		S	22	1021.8
26	Sa	0.3	20.5	0			N	30	12:47	11.7	73		N	13	1024.4	19.9	33		NNE	15	1019.6
27	Su	-0.9	21.5	0			SW	43	15:23	12.8	44		NNW	17	1016.3	20.7	18		WSW	22	1011.8
28	Mo	4.5	17.5	0			S	37	14:15	10.7	51		SW	15	1018.8	16.9	35		S	17	1017.6
29	Tu	0.9	18.1	0			SE	28	15:19	10.9	63		NNE	7	1022.9	17.0	46		ESE	17	1019.4
30	We	2.3	21.1	0			SSE	30	16:16	12.8	71		NNW	7	1021.9	20.6	22		E	7	1019.0
31	Th	1.5	18.2	0			SSW	31	08:22	13.3	45		SSW	19	1027.6	15.7	38		SSE	19	1024.5
Statistics for August 2017																					
	Mean	3.6	20.3							12.9	58			13	1018.5	19.2	32			18	1015.2
	Lowest	-1.3	15.8							7.0	21			Calm	1002.0	15.1	17		NNW	6	1004.1
	Highest	11.7	27.7	8.0			WSW	69		24.1	93		NW	31	1027.6	26.8	56		NNW	30	1024.5
	Total			8.4																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201708 Prepared at 13:00 GMT on 2 Sep 2017

Cessnock, New South Wales
September 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Fr	1.8	19.6	0			SSE	26	10:49	13.2	54		SW	13	1026.0	19.4	32		SSE	6	1020.9
2	Sa	-1.1	24.4	0			N	31	15:33	12.1	59		N	17	1021.6	23.9	18		NNW	15	1017.1
3	Su	1.0	29.9	0			NW	61	19:16	16.3	49		ENE	6	1014.7	27.7	13		NNW	26	1006.5
4	Mo	5.3	22.5	0			NW	59	15:06	16.6	37		WNW	24	1010.8	21.8	20		NW	31	1006.8
5	Tu	8.4	19.8	0			NNW	56	10:21	15.2	37		NNW	20	1012.8	19.0	23		NW	28	1009.8
6	We	10.6	21.7	0			WNW	56	08:57	15.5	27		NW	30	1015.1	21.6	19		NW	17	1012.7
7	Th	7.3	22.9	0			WNW	46	15:10	15.5	42		NW	17	1020.1	22.3	19		WSW	17	1015.6
8	Fr	5.8	21.6	0			WSW	46	12:33	15.5	39		NW	19	1018.5	20.8	24		WSW	20	1015.5
9	Sa	6.3	19.6	0			SSE	43	11:42	14.2	34		SW	17	1022.5	18.6	22		ESE	9	1019.6
10	Su	-1.0	20.9	0			N	20	10:07	13.6	55		N	7	1022.9	19.5	30		NNE	11	1019.1
11	Mo	-0.1	25.5	0			N	30	11:48	15.3	57		NW	13	1020.4	24.8	17		NW	17	1014.9
12	Tu	2.6	30.4	0			NNW	43	14:55	20.5	25		NW	20	1016.8	30.1	16		NNW	22	1011.1
13	We	12.5	33.4	0			WNW	61	10:27	26.6	16		NW	22	1007.2	33.0	13		NNW	28	1001.7
14	Th	9.4	17.2	8.6			W	59	14:21	12.7	51		WSW	30	1011.9	15.8	28		W	30	1012.7
15	Fr	7.1	23.9	0			NW	37	11:04	13.8	46		NNW	22	1020.4	22.8	24		WNW	15	1016.6
16	Sa	5.9	26.1	0			WNW	50	12:31	17.4	43		NW	22	1019.6	24.2	21		WNW	30	1014.2
17	Su	0.9	20.8	0			ESE	31	15:30	15.1	44		SSE	7	1026.5	19.4	33		ESE	15	1023.3
18	Mo	0.3	27.1	0			NNW	50	12:30	14.9	57		N	13	1024.5	26.1	20		NW	20	1017.4
19	Tu	4.2	28.7	0			NNW	50	12:16	24.7	28		WNW	24	1013.4	27.0	7		WSW	20	1012.0
20	We	0.7	22.3	0			E	26	16:42	15.7	44		NNE	7	1020.9	21.1	26		SE	9	1015.8
21	Th	2.0	28.9	0			N	39	14:07	16.3	49		N	20	1016.9	27.5	11		NNW	19	1011.7
22	Fr	2.5	31.1	0			NW	37	12:01	23.0	21		NE	9	1015.0	30.5	10		NNW	17	1010.0
23	Sa	5.6	35.7	0			NW	50	15:24	16.6	51		SE	9	1010.6	35.1	10		NNW	24	1002.9
24	Su	14.3	34.2	0			NW	56	03:30	31.4	18		NNW	24	1002.4	33.0	13		WNW	24	1001.1
25	Mo	7.7	31.5	0			WNW	59	14:29	24.2	25		N	15	1008.0	27.9	11		WNW	33	1005.4
26	Tu	5.1	26.0	0			E	35	15:15	20.1	30		NNE	9	1016.3	22.8	30		ESE	24	1012.9
27	We	11.8	28.1	0			E	26	08:18	19.8	55		ENE	13	1016.3	27.8	30		NE	9	1008.2
28	Th	12.6	27.6	0			NW	46	15:04	22.4	67		NE	9	1008.2	25.5	31		NW	19	1007.1
29	Fr	4.4	27.5	0			NNW	41	13:47	21.7	33		NNE	9	1015.7	26.6	17		NNW	20	1010.4
30	Sa	12.9	25.8	0			WSW	44	12:53	20.7	26		W	13	1014.8	25.6	9		WNW	20	1012.4
Statistics for September 2017																					
Mean		5.6	25.8							18.0	40			16	1016.4	24.7	19			19	1012.2
Lowest		-1.1	17.2							12.1	16		ENE	6	1002.4	15.8	7		SSE	6	1001.1
Highest		14.3	35.7	8.6			#	61		31.4	67		#	30	1026.5	35.1	33		WNW	33	1023.3
Total				8.6																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201709 Prepared at 13:00 GMT on 7 Oct 2017

Cessnock, New South Wales
October 2017 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Su	3.9	26.4	0			E	31	16:32	15.8	71		ENE	7	1021.7	25.1	14		NE	15	1017.8
2	Mo	4.6	24.4	0			N	31	14:08	15.5	70		ENE	6	1023.7	22.9	38		NNW	13	1020.4
3	Tu	14.3	27.5	0.2			E	37	16:12	16.3	90		SSW	4	1023.0	25.6	39		E	7	1018.7
4	We	8.9	28.2	0			ESE	30	12:55	18.6	78		NNE	2	1020.7	24.5	54		SSE	20	1017.8
5	Th	13.5	32.6	0			N	39	12:47	19.4	81		NE	6	1018.7	31.0	24		N	19	1011.9
6	Fr	11.6	24.9	0			WSW	31	09:08	21.8	57		N	9	1012.7	21.3	50		SE	15	1013.6
7	Sa	8.8	21.7	0			E	35	14:22	16.4	59		S	11	1021.5	20.8	46		E	13	1019.8
8	Su	6.0	22.3	0			N	20	13:41	17.1	73		N	7	1020.4	21.7	53		NNW	11	1015.9
9	Mo	14.6	33.7	0			WNW	43	15:03	20.7	76		NNW	19	1011.8	31.0	36		NNW	20	1006.1
10	Tu	17.5	21.4	0.2			ESE	28	17:33	19.3	68		SSE	9	1017.0	20.3	69		SE	15	1015.8
11	We	18.6	31.9	0			ESE	30	16:44	20.3	80		ESE	11	1016.2	29.7	37		NNE	9	1010.7
12	Th	18.9	33.8	0.2			NNW	44	09:27	21.9	72		NNW	24	1010.2	32.5	21		W	15	1008.2
13	Fr	9.9	28.6	0			ESE	37	15:11	20.7	66		E	9	1018.1	27.1	39		NE	17	1013.4
14	Sa	16.6	20.9	0			SSE	43	07:54	19.2	73		SSE	30	1021.0	17.4	86		SSE	17	1021.4
15	Su	15.4	24.3	7.4			NE	39	10:23	19.5	77		E	13	1023.5	23.0	59		SSE	22	1022.1
16	Mo	8.9	24.5	0			ESE	44	14:22	19.6	68		ESE	7	1027.2	23.5	37		ESE	24	1024.8
17	Tu	10.8	25.3	0			ESE	43	14:14	20.2	59		E	19	1027.4	24.9	52		SE	26	1024.6
18	We	11.9	27.8	0			NE	43	12:04	21.1	64		ENE	22	1027.8	26.7	39		ENE	24	1023.6
19	Th	9.9	30.9	0			N	37	11:56	20.5	58		E	4	1025.2	29.5	27		NE	19	1019.3
20	Fr	14.4	20.4	4.6			S	35	13:17	19.6	91			Calm	1019.5	16.5	94		S	20	1018.8
21	Sa	13.6	21.0	17.2			SSE	35	11:02	14.8	64		SSW	15	1020.9	19.4	52		SE	20	1017.7
22	Su	6.6	23.5	0			NW	35	11:39	16.3	78		ENE	6	1014.9	22.5	34		ENE	7	1010.7
23	Mo	11.5	21.7	22.0			SW	35	23:13	16.3	76		SE	7	1017.3	19.4	58		SE	13	1016.5
24	Tu	7.4	29.1	0			NNW	33	12:48	17.5	77		N	9	1019.3	27.3	26		N	19	1014.6
25	We	12.0	32.1	0			NW	59	13:41	23.7	43		NNW	13	1014.1	30.6	21		NW	19	1008.6
26	Th	15.0	29.7	0			N	63	22:35	22.1	70		SSW	13	1006.4	28.3	51		ESE	20	999.7
27	Fr	12.2	25.5	45.4			NW	41	23:02	18.5	78		SW	13	1007.7	23.1	60		SSW	15	1008.3
28	Sa	14.3	29.0	0			N	30	11:35	20.6	77		NW	11	1012.0	28.2	37		N	15	1007.9
29	Su	16.6	32.8	0			NW	39	08:51	24.8	44		WNW	20	1008.5	32.1	34		NNW	19	1004.4
30	Mo	12.6	36.2	0			NW	67	14:28	25.4	49		N	13	1004.0	35.6	13		WNW	31	998.7
31	Tu	8.8		0						15.6	46		WSW	20	1014.0	21.4	27		SW	20	1012.1
Statistics for the first 31 days of October 2017																					
	Mean	11.9	27.1							19.3	68			11	1017.6	25.3	42			17	1014.3
	Lowest	3.9	20.4							14.8	43			Calm	1004.0	16.5	13		#	7	998.7
	Highest	18.9	36.2	45.4			NW	67		25.4	91		SSE	30	1027.8	35.6	94		WNW	31	1024.8
	Total			97.2																	

Observations were drawn from Cessnock Airport AWS {station 061260}

IDCJDW2027.201710 Prepared at 05:36 GMT on 31 Oct 2017

APPENDIX 8
RESULTS

RAMBOLL

Table 1: Gas Vents
Monthly Gas Sampling Results

Project No: AS130510
Hydro Aluminium Smelter
23-01-18

						Peak					Stabilised						
Well ID	Date	Start Time	Temp	Flow (L/hr) initial	Flow (L/hr)	H2S (ppm)	CO (ppm)	CH4 (%v/v)	CO2 (%v/v)	Min O2 (%v/v)	H2S (ppm)	CO (ppm)	CH4 (%v/v)	CO2 (%v/v)	Min O2 (%v/v)	Balance	Ammonia (ppm)
VT1	16-12-16	11:00			0	2	6	0.1	0.1	1.6	2	6	0.1	0.1	1.6	98.2	NS
	13-01-17	8:32			0	3	6	0	0.1	4.5	3	6	0	0.1	5.7	94.2	NS
	27-01-17	9:32			0	0	8	0	0.2	2	0	8	0	0.2	2	97.8	NS
	24-02-17	9:04			0.1	3	1	0	0.1	3.5	3	1	0	0.1	3.5	96.4	150
	31-03-17	12:20			0	7	9	0	0.2	17.2	7	9	0	0.2	17.8	82	72
	28-04-17	10:35			0	4	0	0.1	0.2	5.1	4	0	0.1	0.2	5.3	94.4	<50
	26-05-17	9:40			0.3	1	0	0	0.1	7.3	1	0	0	0.1	7.3	92.6	NS
	30-06-17	8:36			0	0	0	0	0.2	20.6	0	0	0	0.2	20.7	79.1	NS
	31-07-17	9:00			0.3	0	1	0	0.1	11.1	0	1	0	0.1	11.1	88.8	NS
	25-08-17	9:29			0.1	0	0	0	0.2	4	0	0	0	0.2	5.3	94.5	NS
	29-09-17	9:46			0	8	5	0.1	0.1	3.5	8	5	0.1	0.1	3.5	96.3	NS
	27-10-17	9:16		0	0.1	3	1	0	0.2	3.9	3	1	0	0.2	3.9	95.9	NS
VT2	16-12-16	10:50			0.1	5	0	0	0.3	10.9	5	0	0	0.3	11	88.7	NS
	13-01-17	7:47			-0.1	0	1	0	0.2	17.9	0	1	0	0.2	17.9	81.9	NS
	27-01-17	9:26			0	0	1	0	0.4	15.3	0	1	0	0.3	15.4	84.3	NS
	24-02-17	9:11			0.1	1	1	0	0.2	17.3	1	1	0	0.2	17.4	82.4	50
	31-03-17	12:25			0	8	9	0	0.5	4.8	8	9	0	0.5	5.4	94.1	20
	28-04-17	10:41			0.2	3	0	0.1	0.3	9	3	0	0	0.3	9.9	89.8	<50
	26-05-17	9:45			0.1	1	1	0	0.2	12	1	1	0	0.2	12	87.8	NS
	30-06-17	8:41			0	0	0	0	0.2	20.6	0	0	0	0.2	20.8	79	NS
	31-07-16	8:55			0.3	0	0	0	0.2	15.3	0	0	0	0.2	15.3	84.5	NS
	25-08-17	9:23			0.1	2	0	0	0.2	15.2	2	0	0	0.2	15.2	84.6	NS
	29-09-17	9:37			0	6	2	0	0.1	9.5	6	2	0	0.1	9.5	90.4	NS
	27-10-17	9:09		0	0	3	0	0	0.2	14.4	3	0	0	0.2	15	84.8	NS
VT3	16-12-16	10:48		Failed - Sampling tube blocked inside of Vent													
	13-01-17	7:39			-0.1	0	0	0	0.1	19.5	0	0	0	0.1	20.3	79.6	NS
	27-01-17	9:21			-0.2	1	0	0	0.8	17.6	1	0	0	0.7	17.8	81.5	NS
	24-02-17	9:17			0	1	1	0	0.7	17.6	1	1	0	0.7	17.7	81.6	25
	31-03-17	12:34			0	0	3	0	0.2	17.2	0	3	0	0.2	17.8	82	5
	28-04-17	10:46			0.2	0	0	0	0.2	19.4	0	0	0	0.2	19.5	80.3	<50
	26-05-17	9:52			0.2	0	0	0	0.1	19.5	0	0	0	0.1	19.5	80.4	NS
	30-06-17	8:45			0	0	0	0	0.2	20.8	0	0	0	0.2	20.9	78.9	NS
	31-07-17	8:51			0.2	0	0	0	0.2	18.9	0	0	0	0.2	18.9	80.9	NS
	25-08-17	9:18			0.1	0	0	0	0.2	17.6	0	0	0	0.2	18.5	81.5	NS
	29-09-17	9:28			0	5	0	0	0.1	16.6	5	0	0	0.1	18.1	81.8	NS
	27-10-17	9:02		0	0	2	0	0	0.5	14.7	2	0	0	0.4	14.7	84.9	NS
VT4	16-12-16	12:11			0	10	8	0	0.1	10.5	10	8	0	0.1	11.7	88.2	NS
	13-01-17	8:26			0.1	7	0	0	0.1	17.6	7	0	0	0.1	17.7	82.2	NS
	27-01-17	9:38			0	4	4	0	0.1	15.7	4	4	0	0.1	16.1	83.8	NS
	24-02-17	8:58			0	6	0	0	0.1	18.4	6	0	0	0.1	18.5	81.6	100
	31-03-17	12:15			0	12	9	0	0.1	9.8	12	9	0	0.1	10.1	89.8	80
	28-04-17	10:30			0	11	0	0.1	0.1	19.2	11	0	0	0.1	14.3	85.6	75
	26-05-17	9:35			0.3	1	0	0	0.1	14.8	1	0	0	0.1	14.8	85.1	NS
	30-06-17	8:31			0	0	0	0	0.2	19.5	0	0	0	0.2	20.5	79.3	NS
	31-07-17	9:06			0.2	8	3	0.1	0.1	7.8	8	3	0.1	0.1	8	91.8	NS
	25-08-17	9:13			0.1	6	0	0	0.1	16.1	6	0	0	0.1	16.1	83.8	NS
	29-09-17	9:54			0	16	18	0.1	0.1	7.8	16	18	0.1	0.1	7.9	91.9	NS
	27-10-17	9:24		0	0	6	2	0	0.1	16.2	6	2	0	0.1	16.3	83.6	NS
VT5	16-12-16	11:10			0	200	139	0.3	0	1	200	139	0.2	0	1	98.8	NS
	13-01-17	7:54			-0.2	0	0	0	0.1	19.7	0	0	0	0.1	20.4	79.5	NS
	27-01-17	10:09			0	152	142	0.2	0.1	4.4	152	142	0.2	0.1	4.5	95.2	NS
	24-02-17	8:51			0	44	22	0.1	0.1	16.7	44	22	0	0.1	16.9	83	600
	31-03-17	11:01			0	26	5	0	8.4	14	26	5	0	8.4	14	77.6	10
	28-04-17	10:22			0	74	295	0.1	0.1	12.7	74	295	0.1	0.1	13.4	86.4	<50
	26-05-17	9:25			0.1	4	87	0.1	0	12.7	4	87	0.1	0	12.7	87.2	NS
	30-06-17	8:56			0	0	0	0	0.2	20.8	0	0	0	0.1	20.8	79.1	NS
	31-07-17	9:17			0.3	96	297	0.2	0.1	6	96	297	0.2	0.1	6	93.7	NS
	25-08-17	9:06			0.1	35	60	0	0.1	15.2	35	60	0	0.1	15.5	84.4	NS
	29-09-17	10:08			0.1	187	557	0.3	0	1.2	187	557	0.3	0	2.4	97.3	NS
	27-10-17	9:35		0	0.1	89	348	0.1	0.1	8.4	89	348	0.1	0.1	8.4	91.4	NS
VT6	16-12-16	8:52			0.1	87	15	0.3	0.8	0.6	87	15	0.3	0	0.6	99.1	NS
	13-01-17	7:30			-0.1	11	0	0.1	0.1	17.8	11	0	0	0.1	17.8	82.1	NS
	27-01-17	9:11			0	37	10	0.1	0.1	10.1	37	10	0.1	0	10.2	89.7	NS
	24-02-17	8:44			0	15	9	0	0.1	17.6	15	9	0	0.1	17.7	82.2	300
	31-03-17	11:16			0	32	9	0	0.1	10.5	32	9	0	0	10.7	89.3	80
	28-04-17	10:15			0	40	107	0.2	0.1	9.6	40	107	0.1	0.1	9.7	90.1	<50
	26-05-17	9:15			0	1	19	0	0.1	17.5	1	19	0	0.1	17.5	82.4	NS
	30-06-17	8:51			0	0	0	0	0.2	20.9	0	0	0	0.1	20.9	79	NS
	31-07-17	8:46			0.1	4	2	0	0.2	18.6	4	2	0	0.1	18.6	81.3	NS
	25-08-17	9:00			0.2	13	2	0	0.1	15.7	13	2	0	0.1	15.9	84	NS
	29-09-17	9:17			0	51	20	0.2	0.1	7.7	51	20	0.2	0	8.3	91.5	NS
	27-10-17	8:54		-0.1	0.1	21	22	0	0.1	14.2	21	22	0	0.1	15.4	84.5	NS
VT7	16-12-16	11:30			0	106	73	0.2	0	6.4	106	73	0.1	0	8.2	91.7	NS
	13-01-17	8:19			-0.1	38	17	0	0.1	16.8	38	17	0	0.1	17.3	82.6	NS
	27-01-17	9:44			0	47	19	0.1	0.1	14.5	47	19	0.1	0.1	14.7	85.1	NS
	24-02-17	8:25			0	25	8	0	0.1	16.5	25	8	0	0.1	16.9	83	>900
	31-03-17	11:29			0	57	32	0	0.2	11.8	57	32	0	0	12.3	87.7	>900
	28-04-17	9:56			0	32	57	0.1	0.1	16.6	32	57	0.1	0.1	16.6	83.2	280
	26-05-17	8:45			0.1	2	10	0	0.1	18	2	10	0	0.1	18	81.9	NS
	30-06-17	8:26			0	0	0	0	0.2	19.6	0	0	0	0.2	20.4	79.4	NS
	31-07-17	9:25			0.3	110	248	0.2	0.1	6.1	110	248	0.2	0.1	6.2	93.5	NS
	25-08-17	8:54			0.2	21	5	0	0.1	15.7	21	5	0	0.1	15.9	84	NS
	29-09-17	10:16			0.1	80	112	0.1	0	13.1	80	112	0.1	0	13.8	86.1	NS
	27-10-17	9:55		0	0.2	29	33	0	0.1	17.5	29	33	0	0.1	17.8	82.1	NS
VT8	16-12-16	11:18			0	13	0	0	0	19.6	13	0	0	0	19.9	80.1	NS
	13-01-17	8:00			0	0	0	0	0.1	20.4	0	0	0	0.1	20.4	79.5	NS
	27-01-17	10:02			0	0	3	0	0.1	20.3	0	3	0	0.1	20.6	79.3	NS
	24-02-17	8:31			0	1	0	0	0.1	19.7	1	0	0	0.1	19.8	80.1	50
	31-03-17	12:08			0	0	1	0	0.1	20.6	0	1	0	0.1	20.6	79.3	>260
	31-03-17																<50
	28-04-17	10:05			0.3	2	0	0	0.1	21.1	2	0	0	0.1	21.1	78.8	<50
	26-05-17	8:57			0.1	1	0	0	0.1	20.3	1	0	0	0.1	20.3	79.6	NS
	30-06-17	9:02			0	0	0	0	0.1	20.6	0	0	0	0.1	20.6	79.3	NS
	31-07-17	9:40			0.2	3	0	0	0.1	20.6	3	0	0	0.1	20.7	79.2	NS
	25-08-17	8:48			0.1	0	0	0	0.2	17.5	0	0	0	0.2	20.4	79.4	NS
	29-09-17	10:26			0.1	10	0	0	0	18.4	10	0	0	0	21.4	78.6	NS
	27-10-17	9:43		0	0.2	7	0	0	0.1	19.3	7	0	0	0.1	21.7	78.2	NS
VT9	16-12-16	No tube															
	13-01-17	8:13			-0.1	0	0	0	0.1	20.3	0	0	0	0.1	20.3	79.6	NS
	27-01-17	9:03			-0.2	0	1	0	0.4	10.3	0	1	0	0.4	10.4	89.2	NS

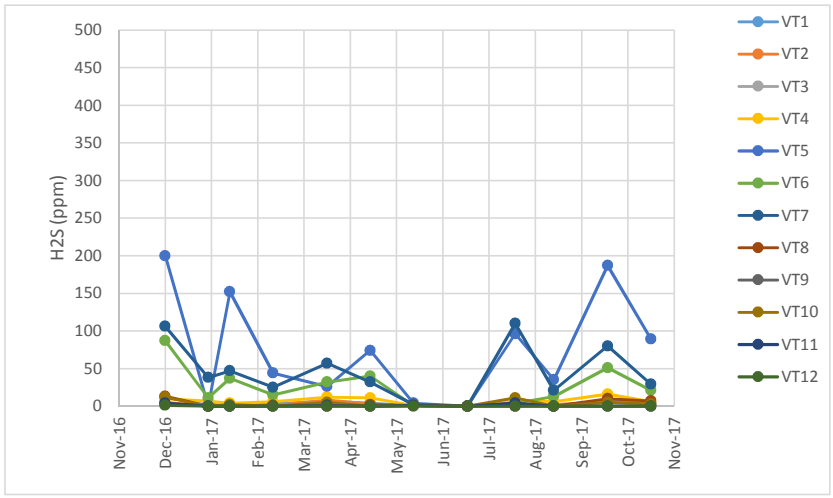
RAMBOLL

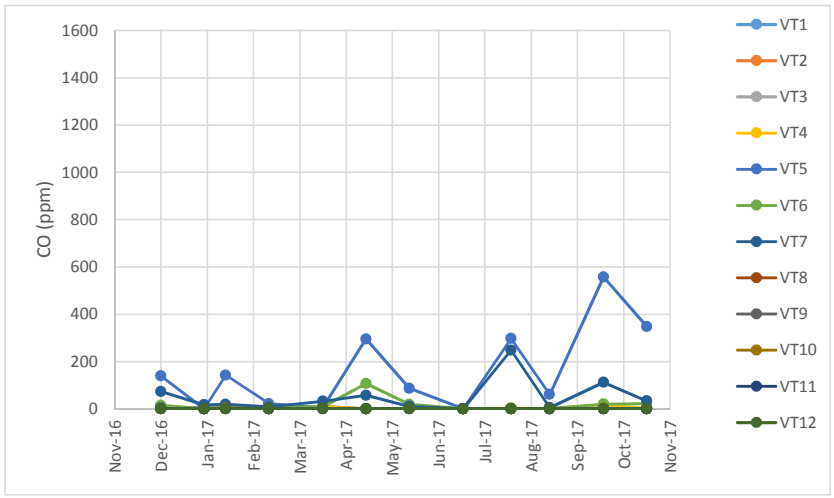
Table 1: Gas Vents
Monthly Gas Sampling Results

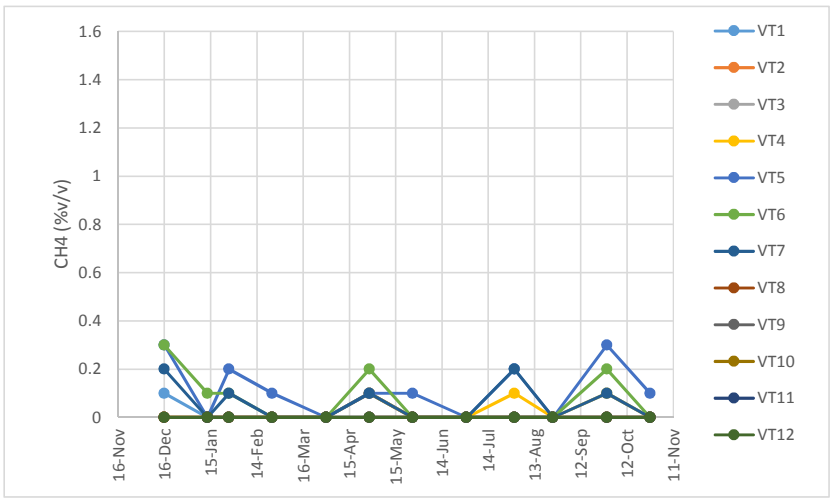
Project No: AS130510
Hydro Aluminium Smelter
23-01-18

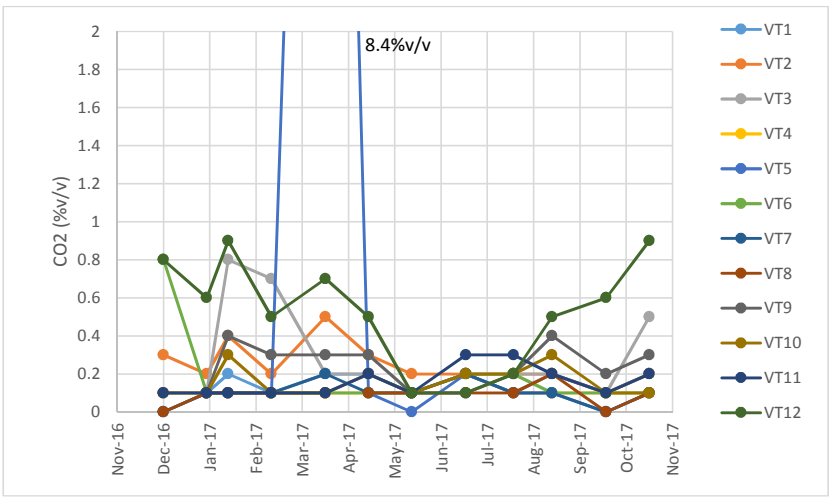
						Peak					Stabilised						
Well ID	Date	Start Time	Temp	Flow (L/hr) initial	Flow (L/hr)	H2S (ppm)	CO (ppm)	CH4 (%v/v)	CO2 (%v/v)	Min O2 (%v/v)	H2S (ppm)	CO (ppm)	CH4 (%v/v)	CO2 (%v/v)	Min O2 (%v/v)	Balance	Ammonia (ppm)
	24-02-17	8:38			0	0	0	0	0.3	14.9	0	0	0	0.3	15	84.7	<50
	31-03-17	12:02			0	0	2	0	0.3	10.2	0	2	0	0.3	10.2	89.5	40
	28-04-17	10:10			0.4	0	0	0	0.3	15.3	0	0	0	0.1	15.4	84.3	<50
	26-05-17	9:05			0.2	1	0	0	0.1	19.8	1	0	0	0.1	19.8	80.1	NS
	30-06-17	9:13			0	0	0	0	0.1	20.6	0	0	0	0.1	20.6	79.3	NS
	31-07-17	8:39			0.2	0	0	0	0.2	20.5	0	0	0	0.1	20.5	79.4	NS
	25-08-17	8:39			0.2	0	0	0	0.4	3	0	0	0	0.4	3.1	96.5	NS
	29-09-17	9:08			0	0	0	0	0.2	13.3	0	0	0	0.2	13.3	86.5	NS
	27-10-17	8:45		0	0.1	0	0	0	0.3	8.4	0	0	0	0.3	8.4	91.3	NS
VT10	16-12-16	11:37			0.2	12	0	0	0.1	13.3	12	0	0	0.1	13.6	86.3	NS
	13-01-17	8:06			0	0	0	0	0.1	20.3	0	0	0	0.1	20.4	79.5	NS
	27-01-17	9:54			-0.1	2	3	0	0.3	16.2	2	3	0	0.2	16.3	83.5	NS
	24-02-17	8:18			0.1	0	0	0	0.1	18.3	0	0	0	0.1	18.3	81.6	<50
	31-03-17	11:44			-0.1	5	0	0	0.1	15.4	5	0	0	0.1	16.3	83.6	120
	28-04-17	9:48			0	0	0	0	0.2	15.7	0	0	0	0.1	15.9	83.9	<50
	26-05-17	8:35			0.1	1	1	0	0.1	19	1	1	0	0.1	19	80.9	NS
	30-06-17	8:19			0	0	0	0	0.2	20	0	0	0	0.2	20.6	79.2	NS
	31-07-17	9:30			0.2	11	0	0	0.2	10.2	11	0	0	0.2	11.4	88.4	NS
	25-08-17	8:31			0.1	0	0	0	0.3	12.7	0	0	0	0.3	12.7	87	NS
	29-09-17	10:32			0.1	5	2	0	0.1	11.3	5	2	0	0.1	11.8	88.1	NS
	27-10-17			0.1	0.1	3	0	0	0.1	15.8	3	0	0	0.1	16.1	83.8	NS
VT11	16-12-16	11:43			0	4	2	0	0.1	18	4	2	0	0.1	18.1	88.8	NS
	13-01-17	7:14			-0.5	0	0	0	0.1	19.1	0	0	0	0.1	19.3	80.6	NS
	27-01-17	8:52			0	0	0	0	0.1	19.9	0	0	0	0.1	19.9	80	NS
	24-02-17	8:10			0	0	0	0	0.1	19.5	0	0	0	0.1	19.6	80.3	<50
	31-03-17	11:51			-0.1	1	0	0	0.1	19.4	1	0	0	0.1	19.6	80.3	20
	28-04-17	9:43			0	0	0	0	0.2	20.1	0	0	0	0.1	20.2	20.2	<50
	26-05-17	8:20			0.1	1	1	0	0.1	20.5	1	1	0	0.1	20.5	79.4	NS
	30-06-17	8:13			0	0	0	0	0.3	20.2	0	0	0	0.2	20.6	79.2	NS
	31-07-17	9:36			0.2	4	0	0	0.3	15.4	4	0	0	0.3	15.4	84.3	NS
	25-08-17	8:25			0.1	0	0	0	0.2	19	0	0	0	0.2	19	80.8	NS
	29-09-17	8:48			0.1	0	0	0	0.1	19.8	0	0	0	0.1	19.8	80.1	NS
	27-10-17			0	0	0	0	0	0.2	20.1	0	0	0	0.2	20.1	79.7	NS
VT12	16-12-16	11:50			0	1	0	0	0.8	10.4	1	0	0	0.7	10.7	88.6	NS
	13-01-17	7:21			0	0	0	0	0.6	14.8	0	0	0	0.6	14.9	84.5	NS
	27-01-17	8:58			-0.1	0	0	0	0.9	12.8	0	0	0	0.9	12.8	86.3	NS
	24-02-17	8:02			0	0	0	0	0.5	17	0	0	0	0.85	17	82.5	<50
	31-03-17	11:56			0	0	1	0	0.7	14.2	0	1	0	0.7	14.2	85.1	25
	28-04-17	9:36			0	0	0	0	0.5	18.5	0	0	0	0.5	18.5	81	<50
	26-05-17	8:10			0.1	0	1	0	0.1	20.9	0	1	0	0.1	20.9	79	NS
	30-06-17	9:17			0	0	0	0	0.1	20.7	0	0	0	0.1	20.7	79.2	NS
	31-07-17	8:35			0.1	0	0	0	0.2	20.4	0	0	0	0.2	20.4	79.4	NS
	25-08-17	8:19			0.1	0	0	0	0.5	17.4	0	0	0	0.5	17.5	82	NS
	29-09-17	8:57			0	0	0	0	0.6	15.6	0	0	0	0.5	15.6	83.9	NS
	27-10-17	8:36		0	0.2	0	0	0	0.9	13.4	0	0	0	0.8	13.8	85.4	NS

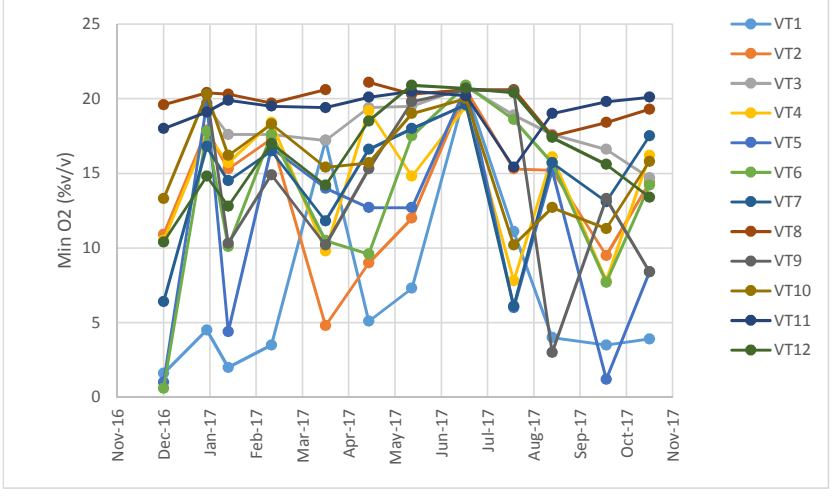
Text highlighted in yellow indicates use of the H2S filter


H2S (ppm)
0
50
100
150
200
250
300
350
400
450
500
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
VT1
VT2
VT3
VT4
VT5
VT6
VT7
VT8
VT9
VT10
VT11
VT12


CO (ppm)
0
200
400
600
800
1000
1200
1400
1600
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
VT1
VT2
VT3
VT4
VT5
VT6
VT7
VT8
VT9
VT10
VT11
VT12


CH4 (%v/v)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
16-Nov
16-Dec
15-Jan
14-Feb
16-Mar
15-Apr
15-May
14-Jun
14-Jul
13-Aug
12-Sep
12-Oct
11-Nov
VT1
VT2
VT3
VT4
VT5
VT6
VT7
VT8
VT9
VT10
VT11
VT12


8.4%v/v
CO2 (%v/v)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
VT1
VT2
VT3
VT4
VT5
VT6
VT7
VT8
VT9
VT10
VT11
VT12


Min O2 (%v/v)
0
5
10
15
20
25
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
VT1
VT2
VT3
VT4
VT5
VT6
VT7
VT8
VT9
VT10
VT11
VT12

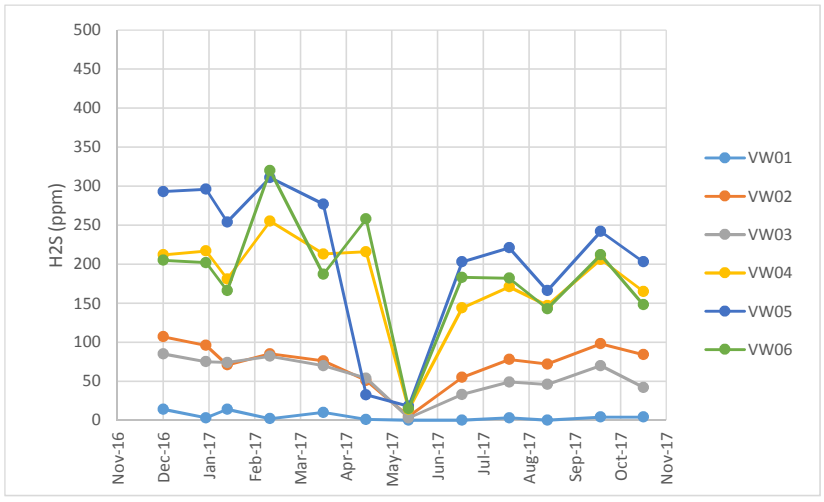
RAMBOLL

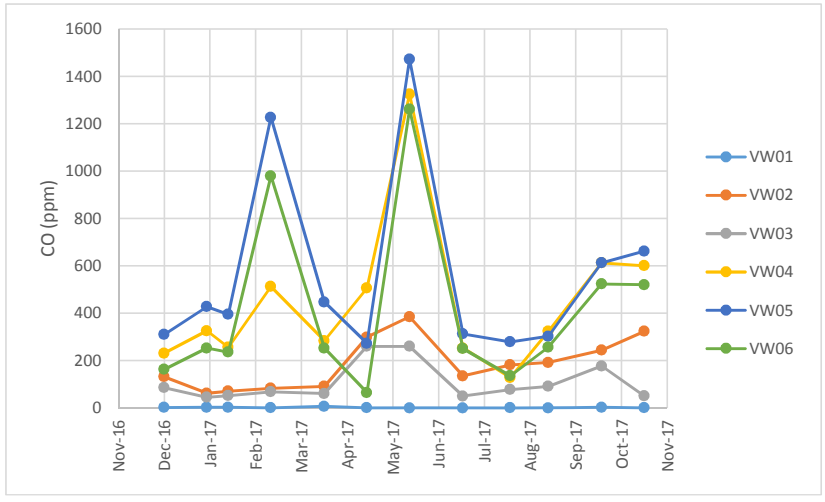
Table 2: Ramboll Gas Wells
Monthly Gas Sampling Results

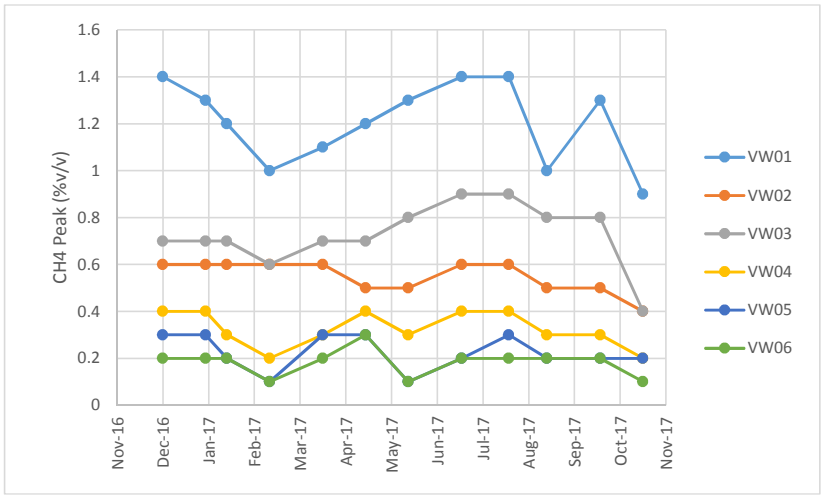
Project No: AS130510
Hydro Aluminium Smelter
23-01-18

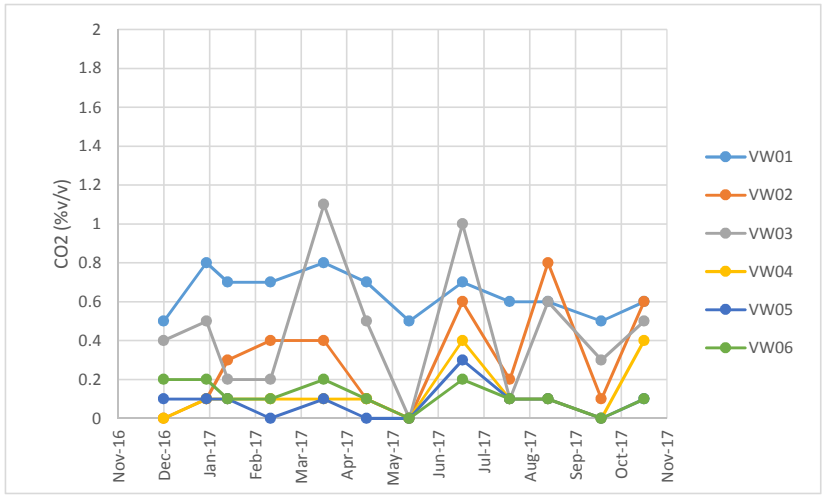
						Peak					Stabilised						
Well ID	Date	Start Time	Temp	Flow (L/hr) initial	Flow (L/hr)	H2S (ppm)	CO (ppm)	CH4 (%v/v)	CO2 (%v/v)	Min O2 (%v/v)	H2S (ppm)	CO (ppm)	CH4 (%v/v)	CO2 (%v/v)	Min O2 (%v/v)	Balance	Ammonia (ppm)
VW01	16-12-2016	12:50	26.3		0.1	14	2	1.4	0.5	0	14	2	1.4	0.5	0	98.1	NS
	13-01-2017	8:51	28.5		0	3	3	1.3	0.8	0.1	3	3	1.3	0.7	0.1	97.9	NS
	27-01-2017	10:22	22.3		0	14	3	1.2	0.7	0.1	14	3	1.2	0.7	0.1	98	NS
	24-02-2017	9:30	24.8		0	2	1	1	0.7	0.3	2	1	0.9	0.7	0.3	98.1	50
	31-03-2017	14:58	23.1		0.1	10	7	1.1	0.8	0	10	7	1.1	0.8	0	98.1	<50
	28-04-2017	11:20	20.4		0.3	1	1	1.2	0.7	0.1	1	1	1.2	0.7	0.1	98	50
	26-05-2017	11:50	21.9		0.2	0	0	1.3	0.5	0.2	0	0	1.3	0.5	0.2	98	NS
	30-06-2017	9:43	NS		0	0	0	1.4	0.7	0.2	0	0	1.4	0.7	0.2	97.7	NS
	31-07-2017	9:44	14.9		0.3	3	1	1.4	0.6	0.1	3	1	1.4	0.6	0.1	97.9	NS
	25-08-2017	9:30	15.6		0.1	0	0	1	0.6	0.8	0	0	1	0.6	0.8	97.6	NS
	29-09-2017	11:21	28.1		0.1	4	3	1.3	0.5	0.2	4	3	1.2	0.5	0.2	98.1	NS
	27-10-2017	10:16	24.5	-0.1	0.2	4	1	0.9	0.6	0.1	4	1	0.9	0.6	0.1	98.4	NS
VW02	16-12-2016	12:42	27.1		0.1	107	132	0.6	0	0.1	107	133	0.5	0	0.1	99.4	NS
	13-01-2017	9:06	28.5		0.1	96	62	0.6	0.1	0.1	96	62	0.6	0	0.1	99.3	NS
	27-01-2017	10:28	23.1		0	71	71	0.6	0.3	0.1	71	71	0.6	0	0.1	99.3	NS
	24-02-2017	9:37	25.4		0	85	83	0.6	0.4	0.1	85	83	0.6	0	0.1	99.3	100
	31-03-2017	14:49	23.7		0	76	91	0.6	0.4	0	76	91	0.6	0	0	99.4	40
	28-04-2017	11:27	21.7		0	51	299	0.5	0.1	0.1	51	299	0.5	0	0.1	99.4	50
	26-05-2017	11:32	20.4		0.2	5	385	0.5	0	0.1	5	385	0.5	0	0.1	99.4	NS
	30-06-2017	9:49	NS		0	55	135	0.6	0.6	0.1	55	135	0.6	0.1	0.1	99.2	NS
	31-07-2017	9:52	15.1		0.2	78	182	0.6	0.2	0	78	182	0.6	0	0	99.4	NS
	25-08-2017	9:40	15.3		0	72	192	0.5	0.8	0	72	192	0.5	0.1	0	99.4	NS
	29-09-2017	11:33	26.9		0	98	244	0.5	0.1	0.2	98	244	0.5	0	0.2	99.3	NS
	27-10-2017	10:27	23.9	0	0.2	84	324	0.4	0.6	0	84	324	0.4	0	0	99.6	NS
VW03	16-12-2016	12:35	26.2		0	85	86	0.7	0.4	0.1	85	86	0.7	0	0.1	99.2	NS
	13-01-2017	8:55	27.9		0	75	45	0.7	0.5	0.1	75	45	0.7	0	0.1	99.2	NS
	27-01-2017	10:57	23.9		0	74	52	0.7	0.2	0.1	74	52	0.7	0	0.1	99.2	NS
	24-02-2017	9:44	26.5		0.1	82	68	0.6	0.2	0.1	82	68	0.6	0	0.1	99.3	500
	31-03-2017	14:38	22.6		0	70	61	0.7	1.1	0.1	70	61	0.7	0.1	0.1	99.1	25
	28-04-2017	11:35	17.8		0.1	54	260	0.7	0.5	0	54	260	0.7	0	0	99.3	120
	26-05-2017	11:37	20.6		0.2	3	260	0.8	0	0.1	3	260	0.8	0	0.1	99.4	NS
	30-06-2017	9:54	NS		0	33	50	0.9	1	0	33	50	0.9	0.1	0	99	NS
	31-07-2017	9:58	12.5		0.3	49	78	0.9	0.1	0	49	78	0.9	0.1	0	99	NS
	25-08-2017	9:50	18.3		0.1	46	91	0.8	0.6	0	46	91	0.8	0.1	0	99.1	NS
	29-09-2017	11:43	20.7		0.1	70	177	0.8	0.3	0.2	70	177	0.7	0	0.2	99.1	NS
	27-10-2017	10:38	23.7	0	0.1	42	51	0.4	0.5	6.3	42	51	0.4	0	6.7	92.9	NS
VW04	16-12-2016	12:23	26.4		0.1	212	231	0.4	0	0.1	212	231	0.4	0	0.1	99.5	NS
	13-01-2017	9:25	28.1		0	217	326	0.4	0.1	0.1	217	326	0.4	0.1	0.1	99.4	NS
	27-01-2017	10:51	23.9		0	181	256	0.3	0.1	0.2	181	256	0.3	0.1	0.2	99.4	NS
	24-02-2017	9:51	27.4		0	255	513	0.2	0.1	0.5	255	513	0.2	0	0.5	99.3	150
	31-03-2017	14:27	23.4		0	213	284	0.3	0.1	0	213	284	0.3	0.1	0	99.6	275
	28-04-2017	11:45	21.1		0.1	216	506	0.4	0.1	0	216	506	0.4	0.1	0	99.5	280
	26-05-2017	11:43	23.2		0.3	14	1326	0.3	0	0.1	14	1326	0.3	0	0.1	99.6	NS
	30-06-2017	10:05	NS		0	144	253	0.4	0.4	0	144	253	0.4	0.1	0	99.5	NS
	31-07-2017	10:07	17.4		0.1	171	128	0.4	0.1	0	171	128	0.4	0.1	0	99.5	NS
	25-08-2017	9:55	15.7		0	147	324	0.3	0.1	0	147	324	0.3	0.1	0	99.6	NS
	29-09-2017	12:05	23.2		0	206	613	0.3	0	0.2	206	613	0.3	0	0.2	99.5	NS
	27-10-2017	10:48	22.1	0	0.1	165	601	0.2	0.4	0	165	601	0.2	0	0	99.8	NS
VW05	16-12-2016	12:13	24.8		0.1	293	310	0.3	0.1	0.1	293	310	0.3	0	0.1	99.6	NS
	13-01-2017	9:21	31.8		0	296	428	0.3	0.1	0	296	428	0.3	0	0	99.7	NS
	27-01-2017	10:45	23.6		0.1	254	395	0.2	0.1	0.1	254	395	0.2	0	0.1	99.7	NS
	24-02-2017	10:00	29.2		0.1	311	1227	0.1	0	0.3	311	1227	0	0	0.3	99.7	>900
	31-03-2017	14:16	25.5		0.2	277	447	0.3	0.1	0.1	277	447	0.3	0	0.1	99.6	>900
	28-04-2017	11:52	20.4		0.1	32.5	273	0.3	0	0	325	273	0.3	0	0	99.7	>900
	26-05-2017	11:12	23.1		0.1	18	1473	0.1	0	0.2	18	1473	0.1	0	0.2	99.7	NS
	30-06-2017	10:12	NS		0	203	313	0.2	0.3	0	203	313	0.2	0.2	0	99.6	NS
	31-07-2017	10:17	16.2		0	221	279	0.3	0.1	0	221	279	0.3	0	0	99.7	NS
	25-08-2017	10:05	16.2		0	166	303	0.2	0.1	0	166	303	0.2	0	0	99.8	NS
	29-09-2017	12:16	31.9		0	242	613	0.2	0	0.1	242	613	0.2	0	0.1	99.7	NS
	27-10-2017	10:58	23	0	0.1	203	662	0.2	0.1	0.1	203	662	0.2	0	0.1	99.7	NS
VW06	16-12-2016	12:05	24.8		0.1	205	163	0.2	0.2	0.6	205	163	0.2	0	1	98.8	NS
	13-01-2017	9:12	30.3		0.1	202	253	0.2	0.2	0.3	202	253	0.2	0	1.4	98.4	NS
	27-01-2017	10:34	23.6		0	166	236	0.2	0.1	0.5	166	236	0.2	0	2	97.8	NS
	24-02-2017	10:09	28.7		0	320	980	0.1	0.1	0.8	320	980	0.1	0	2.6	97.3	>900
	31-03-2017	14:02	23		0.1	187	253	0.2	0.2	0.2	187	253	0.2	0	0.3	99.5	300
	28-04-2017	12:00	22.6		0.1	258	65	0.3	0.1	0	258	65	0.2	0	0	99.8	>900
	26-05-2017	11:25	20.7		0.1	15	1262	0.1	0	0.1	15	1262	0.1	0	0.1	99.8	NS
	30-06-2017	10:18	NS		0	183	251	0.2	0.2	0	183	251	0.2	0.2	0	99.6	NS
	31-07-2017	10:24	14.2		0	182	136	0.2	0.1	0	182	136	0.2	0.1	0	99.7	NS
	25-08-2017	10:15	16.5		0.1	143	257	0.2	0.1	0	143	257	0.2	0	0	99.8	NS
	29-09-2017	12:26	24.8		0	212	524	0.2	0	0.1	212	524	0.2	0	0.1	99.7	NS
	27-10-2017	11:09	21.2	0	0	148	520	0.1	0.1	0.6	148	520	0.1	0	1	98.9	NS

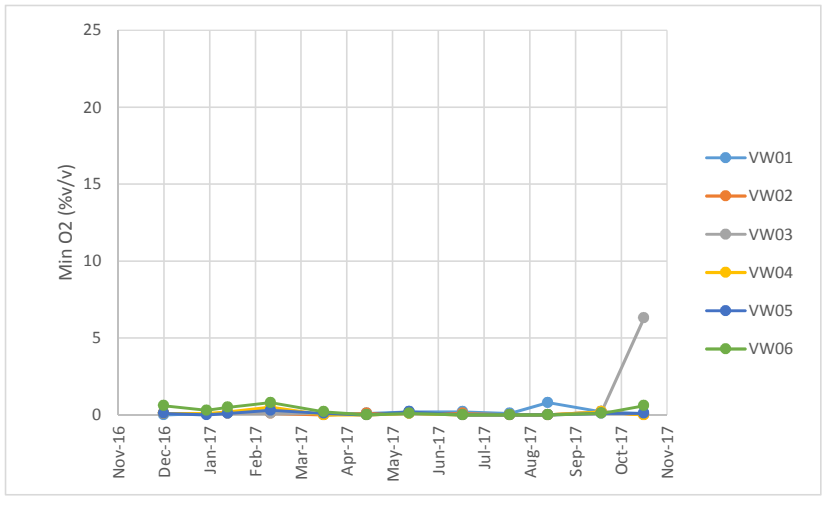
Text highlighted in yellow indicates use of the H2S filter


H2S (ppm)
500
450
400
350
300
250
200
150
100
50
0
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
VW01
VW02
VW03
VW04
VW05
VW06


CO (ppm)
1600
1400
1200
1000
800
600
400
200
0
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
VW01
VW02
VW03
VW04
VW05
VW06


CH4 Peak (%v/v)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
VW01
VW02
VW03
VW04
VW05
VW06


CO2 (%v/v)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
VW01
VW02
VW03
VW04
VW05
VW06


Min O2 (%v/v)
25
20
15
10
5
0
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
VW01
VW02
VW03
VW04
VW05
VW06

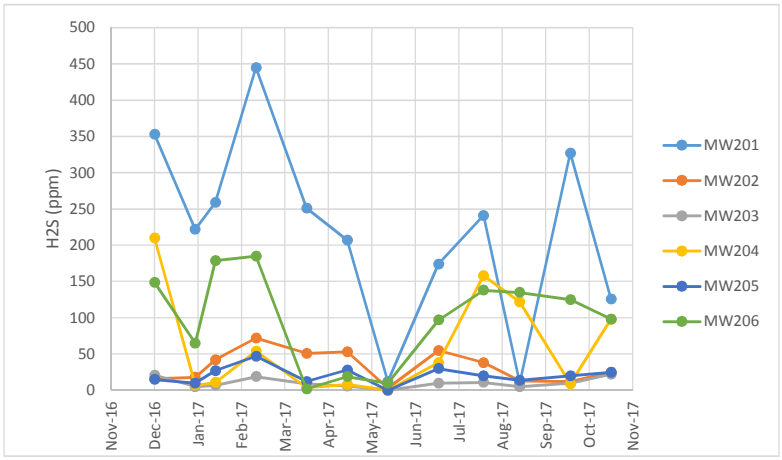
RAMBOLL

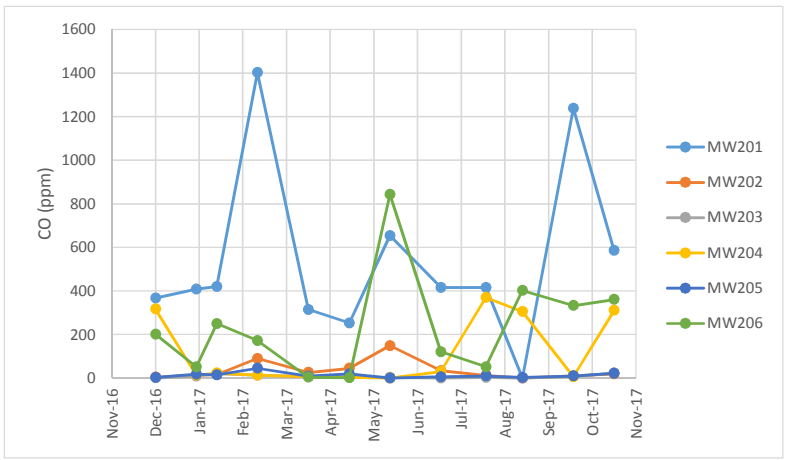
Table 3: Ramboll Groundwater Wells
Monthly Gas Sampling Results

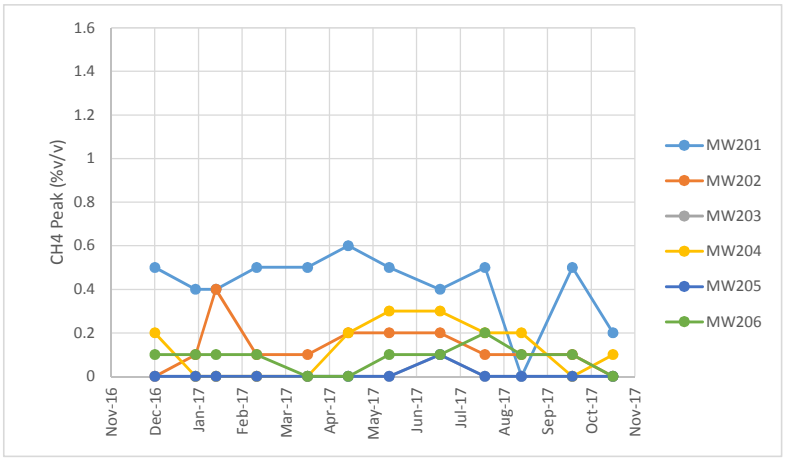
Project No: AS130510
Hydro Aluminium Smelter
23-01-18

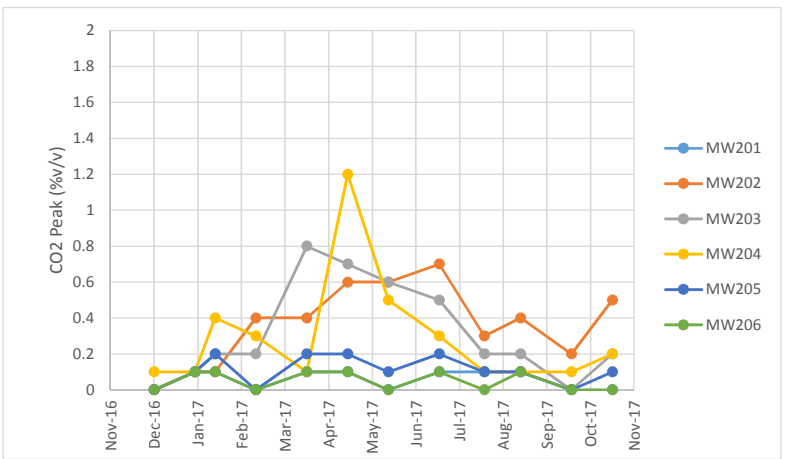
								Peak					Stabilised						
Well ID	Date	Water Level mTOC	Water Level mbgs	Start Time	Temp	Flow (L/hr) initial	Flow (L/hr)	H2S (ppm)	CO (ppm)	CH4 (%v/v)	CO2 (%v/v)	Min O2 (%v/v)	H2S (ppm)	CO (ppm)	CH4 (%v/v)	CO2 (%v/v)	Min O2 (%v/v)	Balance	Ammonia (ppm)
MW201	16-12-2016	DRY	DRY	13:41	30.2		0	353	368	0.5	0	0.1	353	368	0.5	0	0.1	99.4	NS
	13-01-2017	DRY	DRY	10:16	28.2		0	222	409	0.4	0.1	3.4	222	409	0.4	0	3.5	96.1	NS
	27-01-2017	DRY	DRY	11:10	24.2		0.1	259	420	0.4	0.1	1.3	259	420	0.4	0	1.3	98.3	NS
	24-02-2017	DRY	DRY	10:21	28.2		0	445	1402	0.5	0	0.8	445	1402	0.5	0	0.8	98.7	>900
	31-03-2017	DRY	DRY	13:00	23.8		0	251	315	0.5	0.1	0.6	251	315	0.5	0	0.6	98.9	>900
	28-04-2017	DRY	DRY	12:40	22.7		0.2	207	253	0.6	0.1	0.5	207	253	0.6	0	0.5	98.9	>900
	26-05-2017	DRY	DRY	10:15	19.3		0.1	12	654	0.5	0	0.6	12	654	0.5	0	0.6	89.9	NS
	30-06-2017	DRY	DRY	11:07	NS		0.2	174	416	0.4	0.1	6	174	416	0.4	0	6	93.6	NS
	31-07-2017	DRY	DRY	10:40	18.7		0.1	241	416	0.5	0.1	0.2	241	416	0.5	0	0.2	99.3	NS
	25-08-2017	DRY	DRY	10:25	18.1		0.1	10	0	0	0.1	16	10	0	0	0.1	21.3	78.6	NS
	29-09-2017	DRY	DRY	13:23	35.3		0.1	327	1238	0.5	0	0.3	327	1238	0.5	0	0.3	99.2	NS
	27-10-2017	DRY	DRY	11:19	21.4	0	0.2	126	586	0.2	0	10.3	126	586	0.2	0	10.3		NS
MW202	16-12-2016	12.77	12.23	13:35	32.2		0.1	16	4	0	0	17.6	16	4	0	0	18.5	81.5	NS
	13-01-2017	12.75	12.21	10:23	30.3		-0.1	18	16	0.1	0.1	12	18	16	0	0.1	19.4	80.5	NS
	27-01-2017	12.76	12.22	11:17	25.3		-0.5	42	16	0.4	0.1	6.7	42	16	0	0.1	18.6	81.3	NS
	24-02-2017	12.88	12.34	10:59	27.1		0.4	72	90	0.1	0.4	12.6	72	90	0.1	0.4	12.7	86.8	100
	31-03-2017	12.78	12.24	13:10	23.3		0	51	26	0.1	0.4	14.4	51	26	0.1	0.4	14.8	84.7	100
	28-04-2017	12.83	12.29	12:35	20.4		1.9	53	45	0.2	0.6	9	53	45	0.2	0.6	9	90.2	150
	26-05-2017	12.94	12.40	10:44	27.8		0	3	149	0.2	0.6	6.7	3	149	0.2	0.6	6.7	92.5	NS
	30-06-2017	12.90	12.36	10:46	NS		-0.2	55	34	0.2	0.7	9.8	55	34	0.2	0.7	9.9	89.2	NS
	31-07-2017	12.87	12.33	10:49	21.7		0.1	38	13	0.1	0.3	14.1	38	13	0.1	0.2	15.6	84.1	NS
	25-08-2017	12.93	12.39	10:30	17.3		0	13	0	0.1	0.4	14.5	13	0	0	0.2	18.3	81.5	NS
	29-09-2017	12.90	12.36	13:10	33.3		0.5	12	11	0.1	0.2	19.2	12	11	0	0.1	20.2	79.7	NS
	27-10-2017	12.85	12.31	11:19	21.7	0	0.2	25	20	0	0.5	15.4	25	20	0	0.5	16.6	82.9	NS
MW203	16-12-2016	12.35	11.72	13:29	31.7		0	21	1	0	0	16.5	21	1	0	0	19	81	Ns
	13-01-2017	12.37	11.74	10:56	30.4		0	5	9	0	0.1	20.4	5	9	0	0.1	20.6	79.3	NS
	27-01-2017	12.40	11.77	11:41	24.7		2.5	7	21	0	0.2	19.4	7	21	0	0.2	20.3	79.5	NS
	24-02-2017	12.47	11.84	10:49	26.8		2.6	19	14	0	0.2	20.4	19	14	0	0.2	20.5	79.3	75
	31-03-2017	12.44	11.81	13:22	22.8		1.6	9	6	0	0.8	18.9	9	6	0	0.8	18.9	80.3	190
	28-04-2017	12.50	11.87	12:29	18.8		2.6	6	5	0	0.7	18.9	6	5	0	0.7	18.9	80.4	75
	26-05-2017	12.64	12.01	10:35	21.8		0	0	3	0	0.6	17.2	0	3	0	0.6	17.2	82.2	NS
	30-06-2017	12.60	11.97	10:53	NS		1.8	10	0	0.1	0.5	18.3	10	0	0.1	0.5	18.4	81	NS
	31-07-2017	12.63	12.00	10:55	20.2		0.3	11	3	0	0.2	19.8	11	3	0	0.1	20.3	79.6	NS
	25-08-2017	12.67	12.04	10:35	16.5		0.2	5	1	0	0.2	20.2	5	1	0	0.1	20.9	79	NS
	29-09-2017	12.71	12.08	13:02	30.7		0	10	8	0	0	21.3	10	8	0	0	21.5	78.5	NS
	27-10-2017	12.78	12.15	11:39	27	0	0.6	22	23	0	0.2	20.2	22	23	0	0.2	20.2	79.6	NS
MW204	16-12-2016	13.06	12.55	13:20	30.5		0	210	317	0.2	0.1	2.5	210	317	0.2	0.1	3.7	96	NS
	13-01-2017	13.02	12.51	10:49	29.2		0	7	14	0	0.1	19.3	7	14	0	0.1	19.9	80	NS
	27-01-2017	13.04	12.53	11:35	25.2		0.1	11	23	0	0.4	17.2	11	23	0	0.4	17.2	82.4	NS
	24-02-2017	13.16	12.65	10:39	26.9		0.1	54	14	0	0.3	13.5	54	14	0	0.3	17.5	82.2	75
	31-03-2017	13.05	12.54	13:30	24.3		0	4	7	0	0.1	21.2	4	7	0	0.1	21.2	78.7	25
	28-04-2017	13.10	12.59	12:22	26.9		0.2	8	4	0.2	1.2	11.7	8	4	0.2	1.2	11.7	86.9	50
	26-05-2017	13.10	12.59	10:27	20.9		0.1	0	0	0.3	0.5	4.3	0	0	0.3	0.5	4.3	94.9	NS
	30-06-2017	13.14	12.63	10:58	NS		0	38	30	0.3	0.3	11.6	38	30	0.3	0.3	11.6	87.8	NS
	31-07-2017	13.14	12.63	11:05	17.5		0.2	158	370	0.2	0.1	5.4	158	370	0.2	0.1	5.4	94.3	NS
	25-08-2017	13.14	12.63	10:40	17.8		0.2	122	305	0.2	0.1	5.6	122	305	0.2	0.1	5.6	94.1	NS
	29-09-2017	13.14	12.63	12:54	23.8		0.1	9	6	0	0.1	21.1	9	6	0	0.1	21.3	78.6	NS
	27-10-2017	13.18	12.67	11:51	24.8	0.1	0.2	98	311	0.1	0.2	10.4	98	311	0.1	0.2	10.4	89.3	NS
MW205	16-12-2016	13.14	12.42	13:14	28.3		0.1	15	3	0	0	18.8	15	3	0	0	19.3	89.7	NS
	13-01-2017	13.16	12.44	10:43	29.3		0	10	18	0	0.1	19.1	10	18	0	0.1	20.1	79.8	NS
	27-01-2017	13.16	12.44	11:29	25.5		-1.4	27	15	0	0.2	12.9	27	15	0	0.2	19	80.8	NS
	24-02-2017	13.26	12.54	11:22	28.2		3.3	47	45	0	0	15.6	47	45	0	0.3	17.5	82.2	180
	31-03-2017	13.20	12.48	13:40	23.6		1.6	12	9	0	0.2	19.8	12	9	0	0.2	19.8	80	60
	28-04-2017	13.21	12.49	12:17	25.1		1.7	28	19	0	0.2	17.6	28	19	0	0.2	17.6	82.2	125
	26-05-2017	13.23	12.51	11:00	28		0.1	0	0	0	0.1	19.1	0	0	0	0.1	19.1	80.8	NS
	30-06-2017	13.25	12.53	10:31	NS		-2.1	30	6	0.1	0.2	15.7	30	6	0.1	0.1	15.9	83.9	NS
	31-07-2017	13.24	12.52	11:13	21.9		3	20	10	0	0.1	17.2	20	10	0	0.1	18	81.9	NS
	25-08-2017	13.25	12.53	10:50	15.5		1.1	14	3	0	0.1	17.1	14	3	0	0.1	18.4	81.5	NS
	29-09-2017	13.26	12.54	12:46	23.8		0	20	10	0	0	15.9	20	10	0	0	20.4	79.6	NS
	27-10-2017	DRY	DRY	11:58	26.2	0	1.9	25	22	0	0.1	15.8	25	22	0	0.1	17.4	82.5	NS
MW206	16-12-2016	13.22	12.57	13:00	30.6		0	149	202	0.1	0	4.2	149	202	0.1	0	4.2	95.7	NS
	13-01-2017	13.25	12.60	10:36	27.7		0	65	52	0.1	0.1	8.8	65	52	0	0	12.3	87.7	NS
	27-01-2017	13.33	12.68	11:23	25.7		-0.2	179	250	0.1	0.1	0.4	179	250	0.1	0	0.6	99.3	NS
	24-02-2017	13.53	12.88	11:11	27.6		0	185	172	0.1	0	4.9	185	172	0.1	0	4.9	95	>900
	31-03-2017	13.35	12.70	13:53	22.6		0	2	4	0	0.1	21.5	2	4	0	0.1	21.6	78.3	50
	28-04-2017	13.24	12.59	12:12	26.6		0.3	19	2	0	0.1	20.8	19	2	0	0.1	21.9	78	200
	26-05-2017	13.37	12.72	10:50	29.9		0.1	10	843	0.1	0	3.7	10	843	0.1	0	3.7	96.2	NS
	30-06-2017	13.27	12.62	10:40	NS		0	97	121	0.1	0.1	10.9	97	121	0.1	0.1	10.9	88.9	NS
	31-07-2017	13.24	12.59	11:29	15.9		0	138	52	0.2	0	2.9	138	52	0.2	0	2.9	96.9	NS
	25-08-2017	13.39	12.74	11:00	16.8		0.2	135	402	0.1	0.1	0.8	135	402	0.1	0	0.9	99	NS
	29-09-2017	13.37	12.72	12:39	27		0.1	125	333	0.1	0	11.6	125	333	0.1	0	11.6	88.3	NS
	27-10-2017	13.37	12.72	12:06	25.1	0	0.2	98	361	0	0	9.9	98	361	0	0	9.9	90.1	NS

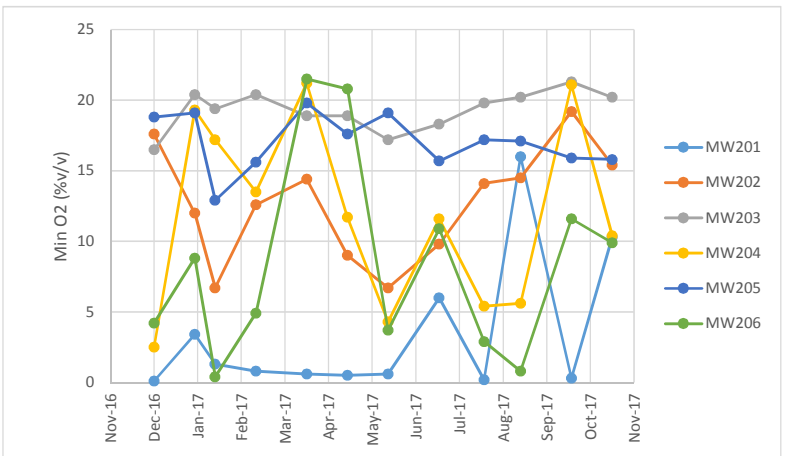
Text highlighted in yellow indicates use of the H2S filter

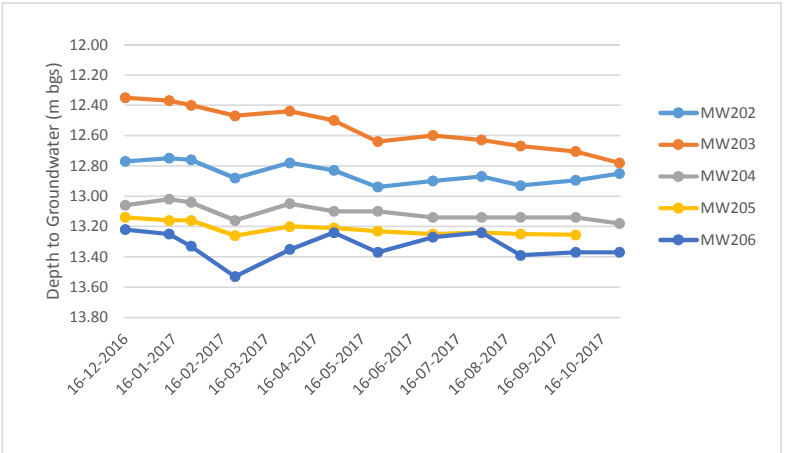

H2S (ppm)
500
450
400
350
300
250
200
150
100
50
0
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
MW201
MW202
MW203
MW204
MW205
MW206


CO (ppm)
1600
1400
1200
1000
800
600
400
200
0
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
MW201
MW202
MW203
MW204
MW205
MW206


CH4 Peak (%v/v)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
MW201
MW202
MW203
MW204
MW205
MW206


CO2 Peak (%v/v)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
MW201
MW202
MW203
MW204
MW205
MW206


Min O2 (%v/v)
25
20
15
10
5
0
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
MW201
MW202
MW203
MW204
MW205
MW206


Depth to Groundwater (m bgs)
12.00
12.20
12.40
12.60
12.80
13.00
13.20
13.40
13.60
13.80
16-12-2016
16-01-2017
16-02-2017
16-03-2017
16-04-2017
16-05-2017
16-06-2017
16-07-2017
16-08-2017
16-09-2017
16-10-2017
MW202
MW203
MW204
MW205
MW206