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Australia

CRINGILA PS MONTHLY
SUBSURFACE GAS
MONITORING REPORT –
DECEMBER 2018

February 2019
J153825-02

Department of Education
Cringila Public School







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Document Control

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1	Electronic	Greg Mott	Senior Group Leader, School Infrastructure

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Cringila PS Monthly Subsurface Gas Monitoring Report – December 2018

Department of Education

Cringila Public School

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1 INTRODUCTION

This report summarises the findings of the December 2018 monthly round of subsurface gas monitoring carried out at Cringila Public School, located at 35 Sheffield Street, Cringila NSW (refer **Figure 1** in **Appendix A** for site layout).

The works were undertaken on 20/12/2018. The work forms part of an ongoing monitoring program prepared for the site in response to a Clean-Up Notice issued to the site (Notice No. 1557944, dated 25th October 2017). Works are undertaken in conjunction with weekly near-surface temperature monitoring and ambient air quality monitoring for the purpose of assessing subsurface gas risk associated with combusting coal fill processes identified within the north western hotspot area within the school grounds prior to and during the remediation phase.

2 CLIMATIC CONDITIONS

Daily meteorological data obtained from the Albion Park Weather (Wollongong Airport) (station 068241) was collected prior to and during the monitoring round to provide meteorological data and to assist in accounting for changes in gas concentrations between monitoring events.

The weather station is situated approximately 14km south of the site. **Table 1** below summarises the meteorological variation experienced in the vicinity of the site leading up to and during the monitoring event.

Table 1: Weather Observations – Albion Park (station 068241)

Date	Temperature		Rainfall	Wind Parameters				Barometric Pressure	
	9am	3pm		9am		3pm		9am	3pm
	°C	°C	mm	Direction	Speed (km/hr)	Direction	Speed (km/hr)	hPa	hPa
14/12/2018	21.2	21.6	10.2	SW	2	E	17	1002.4	1003.5
15/12/2018	22.1	24.9	17.2	W	2	NE	22	1007.5	1005.2
16/12/2018	23.8	25.7	5	SE	6	ENE	24	1007.7	1005.4
17/12/2018	22.4	27.8	0.6	NE	9	NE	17	1010.1	1008.5
18/12/2018	24.3	23.9	0	S	20	ESE	19	1015	1013.9
19/12/2018	20.5	22.9	0	SE	6	ENE	13	1015.6	1012.9
20/12/2018	24.5	24.9	2.6	NE	6	NE	20	1007.8	1002.4

The weather observations (as demonstrated in **Table 1** above) indicate the following:

- Temperatures during the week prior, and on the morning of monitoring were mild and were observed to increase throughout the day.
- Moderate rainfall (17.2mm) was observed on the 15th of December, with very light rain (2.6mm) falling on the day of monitoring.
- High wind speeds (>10km/ph) were recorded consistently in the afternoons of the week prior to the day of monitoring. Morning wind speeds were generally lower, including the morning of the day of monitoring; and
- Barometric pressure was observed to fluctuate over the week prior to monitoring, peaking around the 18th and 19th of December before dropping on the day of monitoring.

3 FIELDWORK METHODOLOGY

Fieldwork was undertaken on 20/12/2018. Monitoring was carried out using a calibrated GA5000 Landfill Gas Meter (calibration certificates provided in **Appendix B**). The monitoring ports of the GA5000 were fitted to the X-cap of each of the 9 subsurface monitoring wells and subsurface gas and flow rate recorded (refer to **Figure 3** of **Appendix A** for locations);

- Methane (CH₄) - (%v/v): Maximum and stable concentrations;
- Carbon Dioxide (CO₂) - (%v/v): Maximum and stable concentrations;
- Oxygen (O₂) - (%v/v): Minimum and stable concentrations;
- Carbon Monoxide (CO) - (ppm): Maximum concentration;
- Hydrogen Sulphide (H₂S) - (ppm): Maximum concentration;
- Relative pressure (mbar);
- Atmospheric pressure (mbar);
- Balance (v/v%); and
- Flow rate (L/hr): stabilised concentration (in monitoring wells only).

Service pits were assessed by inserting the GA5000 nozzle into the pits with the sampling tube inserted at least 30 cm below the cover grate for a minimum of 30 seconds. Locations of service pits monitored (P1 to P5) are presented in **Figure 3** of **Appendix A**.

4 ASSESSMENT CRITERIA

4.1.1 Surface Gas Criteria

The threshold concentration for surface methane concentrations comprised the following:

- CH₄ 1.0% v/v within site buildings, within void spaces below buildings and service trenches obtained from Section 5.4 (Gas Accumulation Monitoring in Enclosed Structures) of NSW EPA (2016), *Environmental Guidelines: Solid Waste Landfills* and NSW EPA (2012), *Guideline for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*.

4.1.2 Criteria for Ground Gases

Criteria for ground gases in gas monitoring wells is selected based on the threshold levels presented in *Solid Waste Landfills Guideline* (NSW EPA 2016) and presented in **Table 2**.

Analyte	Threshold level reference	Unit	Threshold Level	Comments
CH ₄	NSW EPA 2016 ⁽¹⁾	% (volume/volume)	1.0	The threshold level for further investigation and corrective action
CO ₂			1.5	

Note:

1. The threshold levels for further investigation and corrective action are detection of methane at concentrations above 1% (volume/volume) carbon dioxide at concentrations of 1.5% (volume/volume) above established natural background levels.

When above levels are exceeded, further characterisation of the obtained values through the calculation of gas screening values (GSV) will be required. Both on-site and off-site risk associated with subsurface landfill gas is further characterised through the calculation of the GSV. Using both the total concentration and flow rate, the level of risk associated with identified subsurface gas concentrations at each of these locations can be assessed. The method of deriving a GSV and associated landfill gas risk has been adopted by the calculations below specified in the Modified Wilson and Card classification *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA 2012).

GSV refer to the concentration of CH₄ or CO₂ gas measured in a monitoring well multiplied by the measured borehole flow rate.

Table 3 below presents a summary of the Modified Wilson and Card classification used to calculate GSV and CS as well as risk classification in accordance with the guideline.

Gas Screening Value Threshold (L/hr)	Characteristic Gas Situation	Risk Classification	Additional Factors
<0.07	1	Very low risk	Typically CH ₄ <1% v/v and/or CO ₂ <5% v/v, otherwise consider increase to Situation 2 ¹
<0.7	2	Low risk	Borehole flow rate not to exceed 70L/hr otherwise consider increase to Situation 3
<3.5	3	Moderate risk	-
<15	4	Moderate to high risk	Consider need for Level 3 risk assessment
<70	5	High risk	Level 3 risk assessment required

¹ This was discussed in the scope of the Phase 2 Environmental Site Assessment (Greencap 2018), as indoor monitoring at School Building is regularly undertaken and results obtained so far did not indicate any gas intrusion, GSV values obtained during this monitoring program that are less than 0.07 will be considered as Very Low Risk.

Gas Screening Value Threshold (L/hr)	Characteristic Gas Situation	Risk Classification	Additional Factors
>70	6	Very high risk	

Gas criteria Applicable criteria for service pits is presented in **Table 4**.

Analyte	Threshold level reference	Unit	Threshold Level	Comments
CH ₄	NSW EPA 2016 ⁽¹⁾	% (volume/volume)	1.0	The threshold level for further investigation and corrective action
CO ₂			1.5	
CO ₂	Safe Work Australia HSIS ⁽²⁾	ppm	TWA ⁽³⁾ : 5000 STEL ⁽⁴⁾ : 30,000	Work Place Exposure Standards
H ₂ S	Safe Work Australia HSIS ⁽²⁾	ppm	TWA: 10 STEL: 15	- Only applicable to service pits to assess risks for utility workers
CO	Safe Work Australia HSIS ⁽²⁾	ppm	TWA: 30	- Not applicable for ground gas

5 MONITORING RESULTS

5.1 Subsurface Gas Well Monitoring

A summary of subsurface gas well results is presented below in **Table 5**.

CH₄ was not detected in any of the monitoring wells.

CO₂ concentrations were detected in exceedance of the adopted 1.5% threshold in wells GG2, GG3, GG4, GG5, GG6, GG7 and GG9.

Measured flow rates recorded in all subsurface monitoring wells ranged between -0.1 - 0.1L/hr.

Detections of CO or H₂S recorded during the December monitoring round were all well below threshold levels. O₂ concentrations ranged between 2.5%v/v (GG9) and 18.0%v/v (GG1).

5.2 Characteristic Gas Situation

All calculated CH₄ and CO₂ GSVs CH₄ in each of the monitored wells indicated a Characteristic Gas Situation of CS1 "Very Low Risk" according to the Modified Wilson and Card classification method presented below.

Table 5: Subsurface Gas Results

Well ID	Monitoring Date	Time	Relative Pressure (mb)	Stable Flow Rate (L/hr)	Methane		Gas Screening Value	Carbon Dioxide		Gas Screening Value	Oxygen (%v/v)	Carbon Monoxide (ppm)	Hydrogen Sulfide (ppm)	Barometric Pressure (mBar)
					Peak (%v/v)	Stable (%v/v)		Peak (%v/v)	Stable (%v/v)					
GG1	12/20/2018	13:25	0.80	0.0	0.0	0.0	0.00	1.0	1.0	0.00	18.0	0	2	1002
GG2	12/20/2018	13:10	0.80	0.1	0.0	0.0	0.00	5.3	5.3	0.01	11.0	1	1	1000
GG3	12/20/2018	13:55	0.97	0.1	0.0	0.0	0.00	10.7	5.3	0.01	11.3	1	3	1002
GG4	12/20/2018	13:45	0.75	-0.1	0.0	0.0	0.00	12.4	12.4	-0.01	4.7	1	3	1002
GG5	12/20/2018	14:10	0.97	0.0	0.0	0.0	0.00	3.8	3.8	0.00	13.7	0	3	1001
GG6	12/20/2018	14:15	0.72	0.0	0.0	0.0	0.00	5.3	5.3	0.00	10.6	0	3	1000
GG7	12/20/2018	14:40	0.67	0.0	0.0	0.0	0.00	3.5	3.5	0.00	11.1	0	2	1000
GG8	Inaccessible													
GG9	12/20/2018	14:45	0.75	0.0	0.0	0.0	0.00	11.8	11.8	0.00	2.5	1	2	1000

Hazardous Ground Gas Guideline Criteria

	Denotes Characteristic Gas Situation of 1 (NSW EPA (2012), <i>Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases</i>)
	Denotes Characteristic Gas Situation of 2 (NSW EPA (2012), <i>Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases</i>)
	Denotes Characteristic Gas Situation of 3 (NSW EPA (2012), <i>Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases</i>)
	Elevated above the 1% volume criteria for CH ₄ and 1.5% CO ₂ presented in the NSW EPA <i>Solid Waste Landfill Guidelines</i>

5.3 Service Pits

A total of 12 service pits were monitored in the field for potential accumulated or venting gas. A summary of gas results from service pits is presented in **Table 6** below.

No detectable concentrations of CH₄ were identified in any of the accessible service pits across the school. Very low concentrations of CO₂ were detected in service pit P2, however all CO₂ concentrations recorded are below the threshold levels specified in the NSW EPA (2016). Concentrations of CO or H₂S were detected in service pits during the December monitoring round, these detections remain below Work Place Exposure Standard.

Due to operational constraints, service pits P9 and P12 were not accessible during the December monitoring round.

Table 6: Service Pit Readings

Service Pit	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	CO (ppm)	H ₂ S (ppm)	Balance (%v/v)	Barometric Pressure (mBar)
P1	0.0	0.0	19.8	0	2	P1	0.0
P2	0.0	0.2	20.3	0	2	P2	0.0
P3	0.0	0.0	19.5	1	2	P3	0.0
P4	0.0	0.0	19.3	1	2	P4	0.0
P5	0.0	0.0	20.3	0	2	P5	0.0
P6	0.0	0.0	19.5	1	2	P6	0.0
P7	0.0	0.0	19.6	0	2	P7	0.0
P8	0.0	0.0	19.8	1	2	P8	0.0
P9	Inaccessible						
P10	0.0	0.0	19.3	0	2	P10	0.0
P11	0.0	0.0	19.3	1	3	P11	0.0
P12	Inaccessible						

6 MONTHLY SITE INSPECTION CHECKLIST

During the monthly subsurface gas monitoring round, a monthly site inspection checklist is also compiled. In summary, the site inspection highlighted the following:

- There was no evidence of subsidence (i.e. cracks, depressions, slumping) within the northwest hotspot.
- There was no evidence of slope failure within the northwest hotspot.
- There was no evidence of vegetation deterioration within the northwest hotspot.
- There was no visual or olfactory evidence of combustion (e.g. fumes, smoke) within the northwest hotspot.

- The exclusion zone fencing surrounding the northwest hotspot was intact and adequate to deter unauthorised access.

Refer to the Monthly Site Inspection Checklist in **Appendix B**.

7 CONCLUSIONS

Based on the findings, Greencap concludes:

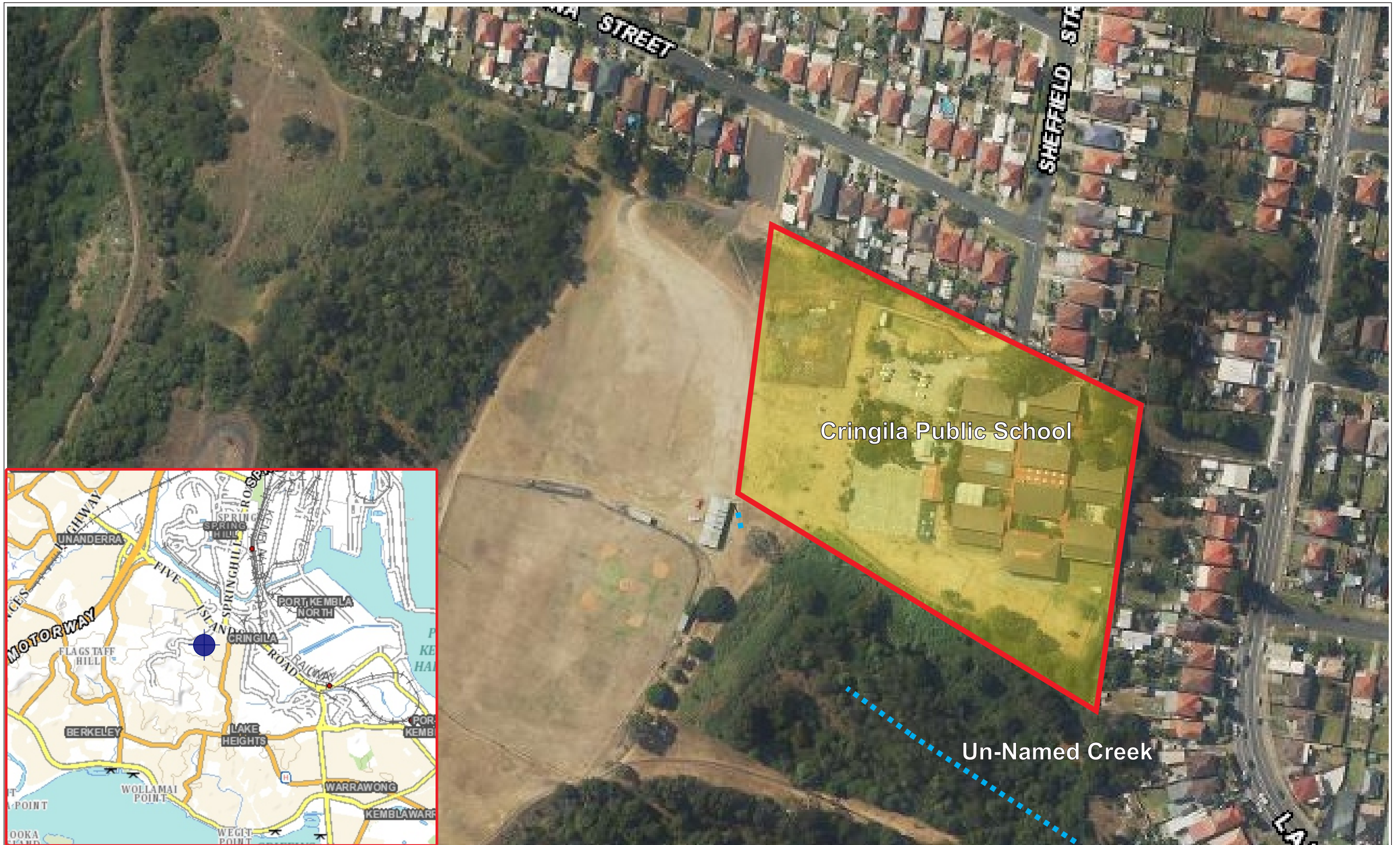
- CH₄ was not detected in any of the subsurface wells.
- All monitoring wells had a CSV of 1 (very low risk). Detections of CO₂ in exceedance of assessment criteria are not considered to pose a risk to site users or nearby receptors.
- Results have indicated that gas emissions from service pits were below relative criteria and indicative of background concentrations.

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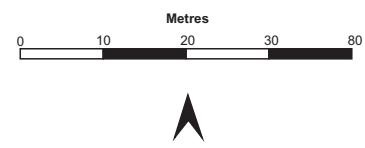
Department of Education

Cringila Public School

Appendix A: Figures



- Legend:**
- Site Boundary
 - Drainage



Level 2, 11-17 Khartoum Road
 North Ryde, NSW 2113
 Ph: 02-9889-1800
 Fx: 02-9889-1811

Client Name:		Department of Education			
Client Number:		C107471	Project Number: J155958		
Project Description: Monthly Monitoring Report- Cringila Public School					
Address:		Cringila Public School			
Prepared:	AMW	Reviewed:	MB	Date:	19/06/2018
Figure 1		Site Location and Regional Context			

Disclaimer: Greencap Pty Ltd has produced this map for the purpose of presenting a summary of relevant spatial information and gives no warranty in relation to the data (including accuracy, reliability, completeness or suitability) and accepts no liability (including without limitation liability for negligence) for any loss, damage or costs (including consequential damage) relating to any use of or reliance upon the data. Data must not be used for direct marketing or be used in breach of privacy laws. Service Layer Credits: © 2016 NSW Land and Property Information (Six Maps)



Legend:

- Site Boundary
- Groundwater Monitoring Well
- Ground Gas Monitoring Well
- Service Pit Location

Metres

0 10 20 30 40

▲

		Client Name: Department of Education	
		Client Number: C107471	Project Number: J155958-01
Level 2, 11-17 Khartoum Road North Ryde, NSW 2113 Ph: 02-9889-1800 Fx: 02-9889-1811		Project Description: Monthly Monitoring Report - Cringila Public School	
Address: Cringila Public School		Prepared: AMW	Reviewed: MB
Figure G: Groundwater Well, Gas Well and Service Pit Locations		Date: 19/06/2018	

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Appendix B: Monthly Site Inspection Checklist

SITE INSPECTION CHECKLIST

Date:20/12/2018

Personnel on site: Tom Oyston/Rowan Clark

Weather: Warm, light winds

Inspection Item	Yes	No	Comment/ Notes	Actions required
Were all sections of the site inspected?— Please tick a box below after inspection. <input checked="" type="checkbox"/> North west hotspot area <input checked="" type="checkbox"/> Western batter <input checked="" type="checkbox"/> Southern playground <input checked="" type="checkbox"/> Basketball courts <input checked="" type="checkbox"/> Car park <input checked="" type="checkbox"/> Remaining open spaces <input checked="" type="checkbox"/> Site boundary fences	Yes		Note inaccessible areas (if any):	Take temperature readings on the schools fencing by an infrared temperature gun. Record temperatures below (mark locations on the site layout provided on the next page). Western fence (one point): N/A Northern fence (two points): N/A Eastern fence (one point): N/A Southern fence (two points): N/A Exclusion zone fencing (three points): N/A
Was there any evidence of subsidence? (e.g. cracks, depressions, slumping)		No		If Yes: Take photo, mark location, indicate observations on the site layout provided on the next page, take (note on left) surface gas readings for (CO and CO ₂), and inform Greencap Project Managers (Wollongong <u>and</u> Sydney).
Was there any evidence of slope failure?		No		If Yes: Take photo, mark location, indicate observations on the site layout provided on the next page, and inform Greencap Project Managers (Wollongong <u>and</u> Sydney).
Was there any evidence of deteriorating vegetation?		No		If Yes: Take photo, mark location, and indicate observation areas on the site layout provided on the next page.
Was there any visual or olfactory evidences of combustion (e.g. fumes, burning smell, smoke)		No		If Yes: Take photo, mark location, indicate observations on the site layout provided on the next page, take (note on left) surface gas readings for (CO and CO ₂), and inform Greencap Project Managers (Wollongong <u>and</u> Sydney).
Was exclusion zone fencing intact?	Yes			If No: Take photo, mark location, and indicate observation areas on the site layout provided on the next page, and inform School Principal.

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Appendix C: Calibration Certificates

Company: Active Environmental Solutions Hire	Manufacturer: Geotechnical Instruments Ltd	Serial #: G501571
Contact: Aleks Todorovic	Instrument: Portable Gas Analyser	Asset #: -
Address: 2 Merchant Avenue Thomastown Vic 3074	Model: GA5000	Part #: -
Phone: 03 9464 2300 Fax: 03 9464 3421	Configuration: CH4; CO2: O2; H2S; CO	Sold: -
Email: Hire@aesolutions.com.au	Wireless: -	Last Cal: -
	Network ID: -	Job #: -
	Unit ID: -	Cal Spec: Std

Item	Test	Pass/Fail	Comments
Battery	Li Ion	✓	
Charger	Charger, Power supply	✓	
Internal Flow Pod	Zeroed	✓	
Pump	Flow	✓	>600 mL/min
Filter	Filter, fitting, etc	✓	
Tubing	Set of 3 tubes	✓	
Display	Operation	✓	
PCB	Operation	✓	
Connectors	Condition	✓	
Firmware	Version	✓	1.14.12
Datalogger	Operation	✓	
Monitor Housing	Condition	✓	
Case	Condition/Type	✓	
Sensors			
Oxygen		✓	
CH4		✓	
CO2		✓	
H2S		✓	
CO/H2		✓	
Toxic 3		-	
Toxic 4		-	
Toxic 5		-	

Engineer's Report- Calibration Certificate

Setup, service and calibration for hire

Sensor	Span Gas	Concentration	Traceability Lot #	CF	Reading	
					Span	
Oxygen	Nitrogen	99.99% N2 (0 % O2)	15051 C26	1	0.0%	
	Fresh air	20.9	Fresh Air	1	20.9%	
CH4	Nitrogen	99.99% N2 (0% CH4)	15051 C26	1	0.0%	
	Methane	60%	2174-1-2	1	60.0%	
CO2	Nitrogen	99.99% N2 (0% CO2)	15051 C26	1	0.0%	
	Carbon Dioxide	40%	2174-1-2	1	40.0%	
CO	Nitrogen	99.99% N2 (0 PPM CO)	15051 C26	1	0 PPM	
	Carbon Monoxide	100 PPM	564600 C147	1	100 PPM	
H2	Nitrogen	99.99% N2 (1000 PPM H2)	15051 C26	1	0 PPM	
	Hydrogen	1000 PPM	2309-2-2	1	1000 PPM	
H2S	Nitrogen	99.99% N2 (0 PPM H2S)	15051 C26	1	0 PPM	
	Hydrogen Sulfide	25 PPM	564600 C147	1	25 PPM	

Calibrated/Repaired by: Milenko Sasic

Date: 14TH November 2018 Next due: 14TH May 2019

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