

The logo consists of a large tan square with the text "Energy in action.™" in blue. Below this square are three smaller tan squares of varying sizes, and at the bottom right is the AGL logo, which is a blue square with a white sun icon and the letters "AGL" in white.

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AGL UPSTREAM INVESTMENTS PTY LTD
CAMDEN GAS PROJECT

Quarterly Produced Water Quality Monitoring Report

Reporting Period: 4th Quarter – April / June 2014

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Foreword

PREMISES	Rosalind Park Gas Plant Lot 35 Medhurst Road GILEAD NSW 2560
LICENCE DETAILS	<u>Environment Protection Licence 12003</u>
LICENCEE	AGL Upstream Investments Pty Limited (AGL)
LICENCEE'S ADDRESS	Locked Bag 1837, North Sydney, NSW 2060
MONITORING DATE	4 th Quarter – April / June 2014 (26-27 th May 2014)
MONITORING BY	AGL
ANALYSIS BY	ALS Laboratory, Smithfield (Work order number: ES1411731)
DATE DATA OBTAINED	4 June 2014
REPORT DATE	17 June 2014
REPORT PREPARED BY	Nicola Fry, Hydrogeologist

Introduction

The Camden Gas Project (CGP) is owned and operated by AGL and is located in the Macarthur region 65 km southwest of Sydney, in the Wollondilly, Camden and Campbelltown Local Government Areas (Figure 1). The CGP has been producing gas for the Sydney region since 2001 and currently consists of 144 gas wells, low-pressure underground gas gathering pipes and a gas plant facility. Not all production wells are currently operational. The production wells are licensed with Water Access Licences, Works Approvals and Use Approvals under the *Water Management Act 2000 (NSW)*, including an allocation of 30 megalitres (ML) per year for the existing CGP and associated dewatering activities from the coal seams. In the 2012-13 financial year, less than 4.7 ML of water was produced from the coal seams for the entire Camden Gas Project operating wellfield.

This Monitoring Report relates to the groundwater monitoring activities specified in Part 5, Monitoring and Recording Conditions, of the Environment Protection Licence 12003. The Licence conditions stipulate groundwater monitoring is required to be carried out at the locations as shown in Table 1 and Figure 1. The specific analytes and frequency tested are shown in Table 2.

The monitoring points that are the subject of this report are part of the CGP groundwater monitoring network, as described in AGL's CGP Groundwater Management Plan (2012). Water samples are taken from each gas well at the separator. The deep groundwater (when brought to the surface) is known as produced water. The water quality samples are analysed by an external NATA certified laboratory (ALS Environmental, Smithfield), in accordance with the EPA Approved Methods Publication "*Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales*" (EPA, 2004), with the exception of chloride, which was analysed with a more recent APHA 22nd Edition (2012) methodology instead of the earlier APHA 20th Edition (1998) methodology (which is referenced in the EPA Approved Methods Publication). AGL is currently corresponding with the EPA regarding use of this more recent methodology.

Many of the operating wells within the Camden Gas Project produce very low volumes of water; frequently, there is not enough water present to allow for sampling at these monitoring points. For the monitoring round in this reporting period (FY14 Q3) only samples from one monitoring point were

able to be taken as there was not enough water present to sample at the remaining monitoring points.

This report is prepared in accordance with the *Requirements for Publishing Pollution Monitoring Data* (EPA, 2012) (Publication Requirements).

Table 3 displays the results of this quarter's monitoring.

Produced water from the coal seams at CGP ranges in quality, as a result of localised natural variations within the coal. Electrical conductivity (which is a measure of salinity) typically varies between about 7,000 and 15,000 $\mu\text{S}/\text{cm}$. However, it is not unusual to see values outside of this range. Low volume water producing wells frequently show very low electrical conductivity values as a result of evaporation and condensation processes occurring in the well bore (PB, 2013). These very low values are not representative of formation water samples. It is noted that the result obtained from this monitoring round (FY14 Q4) is a typical value of electrical conductivity for produced water in the Camden Gas Project. It is also not uncommon to observe elevated levels of TPH (total petroleum hydrocarbons) after specific wells have undergone maintenance activities. These values are not representative of formation water samples.

More information on the hydrogeology and groundwater of the CGP is available in the Hydrogeological Summary (AGL, 2013) which can be viewed at the CGP website: agl.com.au/Camden

Table 1- Groundwater quality monitoring points (as per EPL 12003)

EPA Identification no.	Location	Easting (m)	Northing (m)
8	EM40	290847.38	6226891.16
9	SF08	291443.09	6228310.08
10	RB10	288211.17	6219746.92
11	MT05	290356.75	6221081.15
12	MP12	293574.90	6224380.09
13	MP30	291760.40	6225066.50
14	RP12	293397.37	6222719.00
15	SL03	294583.77	6224486.19

Coordinate reference system: Map Grid of Australia 1994 Zone 56

Table 2 – Analytes monitored and frequency (as per EPL 12003)

Analyte	Units of measure	Frequency	Sampling Method
Aluminium	milligrams per litre	Quarterly	Grab sample
Ammonia	milligrams per litre	Yearly	Grab sample
Arsenic	milligrams per litre	Quarterly	Grab sample
Barium	milligrams per litre	Quarterly	Grab sample
Benzene	milligrams per litre	Yearly	Grab sample
Beryllium	milligrams per litre	Quarterly	Grab sample
Bicarbonate	milligrams per litre	Quarterly	Grab sample
Boron	milligrams per litre	Quarterly	Grab sample
Bromide	milligrams per litre	Quarterly	Grab sample
Cadmium	milligrams per litre	Quarterly	Grab sample
Calcium	milligrams per litre	Quarterly	Grab sample
Carbonate	milligrams per litre	Quarterly	Grab sample
Chloride	milligrams per litre	Quarterly	Grab sample
Chromium	milligrams per litre	Quarterly	Grab sample
Cobalt	milligrams per litre	Quarterly	Grab sample
Copper	milligrams per litre	Quarterly	Grab sample
Electrical conductivity	microsiemens per centimeter	Quarterly	Grab sample
Ethyl benzene	milligrams per litre	Yearly	Grab sample

Fluoride	milligrams per litre	Quarterly	Grab sample
Iron	milligrams per litre	Quarterly	Grab sample
Lead	milligrams per litre	Quarterly	Grab sample
Magnesium	milligrams per litre	Quarterly	Grab sample
Manganese	milligrams per litre	Quarterly	Grab sample
Mercury	milligrams per litre	Quarterly	Grab sample
Methane	milligrams per litre	Yearly	Grab sample
Molybdenum	milligrams per litre	Quarterly	Grab sample
Nickel	milligrams per litre	Quarterly	Grab sample
Nitrate	milligrams per litre	Yearly	Grab sample
Nitrite	milligrams per litre	Yearly	Grab sample
Phenols	milligrams per litre	Yearly	Grab sample
Polycyclic aromatic	milligrams per litre	Yearly	Grab sample
Potassium	milligrams per litre	Quarterly	Grab sample
Reactive Phosphorus	milligrams per litre	Yearly	Grab sample
Selenium	milligrams per litre	Quarterly	Grab sample
Silica	milligrams per litre	Quarterly	Grab sample
Sodium	milligrams per litre	Quarterly	Grab sample
Strontium (dissolved)	milligrams per litre	Quarterly	Grab sample
Sulfate	milligrams per litre	Quarterly	Grab sample
Toluene	milligrams per litre	Yearly	Grab sample
Total dissolved solids	milligrams per litre	Quarterly	Grab sample
Total petroleum hydrocarbons	milligrams per litre	Yearly	Grab sample
Uranium	milligrams per litre	Quarterly	Grab sample
Vanadium	milligrams per litre	Quarterly	Grab sample
Xylene	milligrams per litre	Yearly	Grab sample
Zinc	milligrams per litre	Quarterly	Grab sample



Groundwater Monitoring Results

Table 3 - Produced water monitoring results for 4th Quarter – April/June 2014

Monitoring point	8	9	10	11	12	13	14	15
Location	EM40	SF08	RB10	MT05	MP12	MP30	RP12	SL03
Sampled Date	Not enough water to sample (26/5/2014)	Not enough water to sample (27/5/2014)	26/5/2014	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (27/5/2014)
Data obtained	na	na	4/6/2014	na	na	na	na	na

	Analyte	Units	Limit of reporting							
Physical	Electrical conductivity (lab)	µS/cm	1	-	-	10300	-	-	-	-
	Total Dissolved Solids (measured)	mg/L	10	-	-	7380	-	-	-	-
	TSS	mg/L	5	-	-	<5	-	-	-	-
Major Cations	Calcium (Filtered)	mg/L	1	-	-	5	-	-	-	-
	Magnesium (Filtered)	mg/L	1	-	-	5	-	-	-	-
	Potassium (Filtered)	mg/L	1	-	-	23	-	-	-	-
	Sodium (Filtered)	mg/L	1	-	-	2920	-	-	-	-
	Cations Total	meq/L	0.01	-	-	128	-	-	-	-
Major Anions	Alkalinity (Bicarbonate as CaCO ₃)	mg/L	1	-	-	6230	-	-	-	-
	Alkalinity (Carbonate as CaCO ₃)	mg/L	1	-	-	194	-	-	-	-



Monitoring point	8	9	10	11	12	13	14	15
Location	EM40	SF08	RB10	MT05	MP12	MP30	RP12	SL03
Sampled Date	Not enough water to sample (26/5/2014)	Not enough water to sample (27/5/2014)	26/5/2014	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (27/5/2014)
Data obtained	na	na	4/6/2014	na	na	na	na	na

	Analyte	Units	Limit of reporting								
	Alkalinity (Hydroxide) as CaCO3	mg/L	1	-	-	<1	-	-	-	-	-
	Alkalinity (total) as CaCO3	mg/L	1	-	-	6430	-	-	-	-	-
	Chloride	mg/L	1	-	-	124	-	-	-	-	-
	Anions Total	meq/L	0.01	-	-	132	-	-	-	-	-
	Ionic Balance	%	0.01	-	-	1.49	-	-	-	-	-
Dissolved Metals	Aluminium (Filtered)	mg/L	0.01	-	-	<0.01	-	-	-	-	-
	Arsenic (Filtered)	mg/L	0.001	-	-	0.006	-	-	-	-	-
	Barium (Filtered)	mg/L	0.001	-	-	14.1	-	-	-	-	-
	Beryllium (Filtered)	mg/L	0.001	-	-	<0.001	-	-	-	-	-
	Boron (Filtered)	mg/L	0.05	-	-	0.13	-	-	-	-	-
	Cadmium (Filtered)	mg/L	0.0001	-	-	<0.0001	-	-	-	-	-
	Chromium (III+VI) (Filtered)	mg/L	0.001	-	-	<0.010	-	-	-	-	-



Monitoring point	8	9	10	11	12	13	14	15
Location	EM40	SF08	RB10	MT05	MP12	MP30	RP12	SL03
Sampled Date	Not enough water to sample (26/5/2014)	Not enough water to sample (27/5/2014)	26/5/2014	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (27/5/2014)
Data obtained	na	na	4/6/2014	na	na	na	na	na

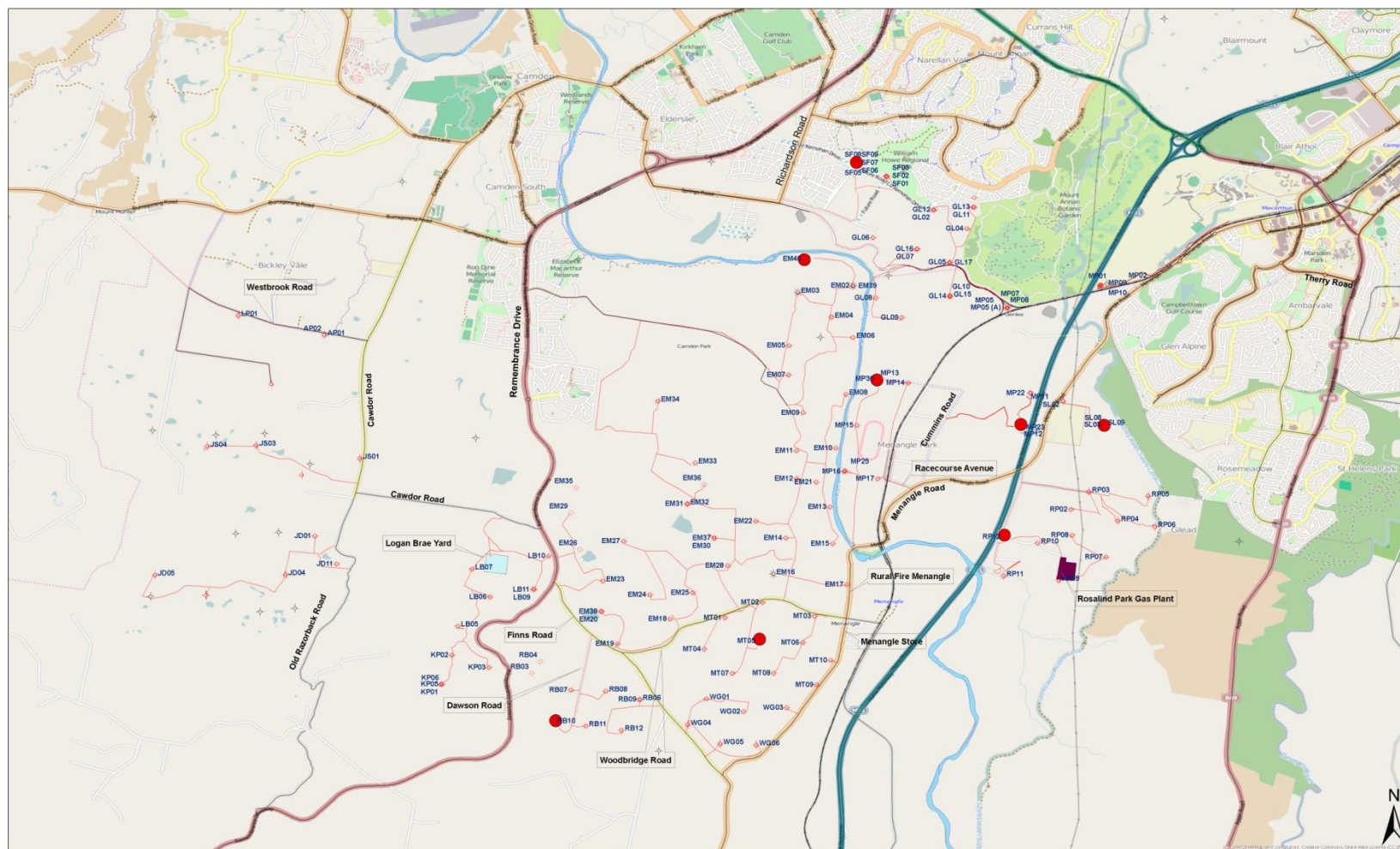
Analyte	Units	Limit of reporting								
Cobalt (Filtered)	mg/L	0.001	-	-	<0.001	-	-	-	-	-
Copper (Filtered)	mg/L	0.001	-	-	<0.001	-	-	-	-	-
Iron (Filtered)	mg/L	0.05	-	-	0.68	-	-	-	-	-
Lead (Filtered)	mg/L	0.001	-	-	<0.001	-	-	-	-	-
Manganese (Filtered)	mg/L	0.001	-	-	0.009	-	-	-	-	-
Mercury (Filtered)	mg/L	0.0001	-	-	<0.0001	-	-	-	-	-
Molybdenum (Filtered)	mg/L	0.001	-	-	0.005	-	-	-	-	-
Nickel (Filtered)	mg/L	0.001	-	-	0.002	-	-	-	-	-
Selenium (Filtered)	mg/L	0.01	-	-	<0.01	-	-	-	-	-
Strontium (Filtered)	mg/L	0.001	-	-	4.22	-	-	-	-	-
Uranium (Filtered)	mg/L	0.001	-	-	<0.001	-	-	-	-	-
Vanadium (Filtered)	mg/L	0.01	-	-	<0.01	-	-	-	-	-




Monitoring point	8	9	10	11	12	13	14	15
Location	EM40	SF08	RB10	MT05	MP12	MP30	RP12	SL03
Sampled Date	Not enough water to sample (26/5/2014)	Not enough water to sample (27/5/2014)	26/5/2014	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (27/5/2014)
Data obtained	na	na	4/6/2014	na	na	na	na	na

	Analyte	Units	Limit of reporting								
	Zinc (Filtered)	mg/L	0.005	-	-	0.008	-	-	-	-	-
Other	Bromide (dissolved) (Filtered)	mg/L	0.1	-	-	0.620	-	-	-	-	-
	Fluoride	mg/L	0.1	-	-	1.2	-	-	-	-	-
	Iodine (dissolved) (Filtered)	mg/L	0.1	-	-	<0.1	-	-	-	-	-
	Silicon as Silica	mg/L	0.1	-	-	14.5	-	-	-	-	-
	Sulfate (Filtered)	mg/L	1	-	-	<10	-	-	-	-	-

- not analysed



	Author: Upstream Gas	Camden Gas Project Produced Water Monitoring Network Kilometres 0 1 2 Scale 1:25,500@A1	Legend ● Produced Water Monitoring Site ◊ Wells — Public Roads - - Emergency Road Not for Public Use — Hume Highway — Private Roads — Nepean River — Railway ■ Logan Brae Yard ■ RGP
	Date: 06/02/2014		
	Ref: 3091		

Disclaimer: While AGL has taken great care and attention to ensure the accuracy of the data represented on this map, no liability shall be accepted for any errors or omissions. No part of this map may be reproduced without prior permission of AGL.

Figure 1

Figure 1- CGP and produced water monitoring locations as listed in EPL12003 (CSG wells)

References

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