



Energy in  
action.™



AGL

AGL UPSTREAM INVESTMENTS PTY LTD  
CAMDEN GAS PROJECT

**Quarterly Produced Water Quality Monitoring Report**

Reporting Period: 4<sup>th</sup> Quarter – April / June 2014

AGL Upstream Investments Pty Ltd  
ABN 58 115 063 744  
Locked Bag 1837, St Leonards NSW 2065  
Level 22, 101 Miller Street, North Sydney NSW 2060  
Telephone: 02 9921 2999 Facsimile: 02 9921 2474  
Complaints Line (24 hours): 02 9963 1318

## Foreword

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

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



## Groundwater Monitoring Results

Table 3 - Produced water monitoring results for 4<sup>th</sup> 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 <sub>3</sub> )	mg/L	1	-	-	6230	-	-	-	-
	Alkalinity (Carbonate as CaCO <sub>3</sub> )	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	-	-	-	-	-

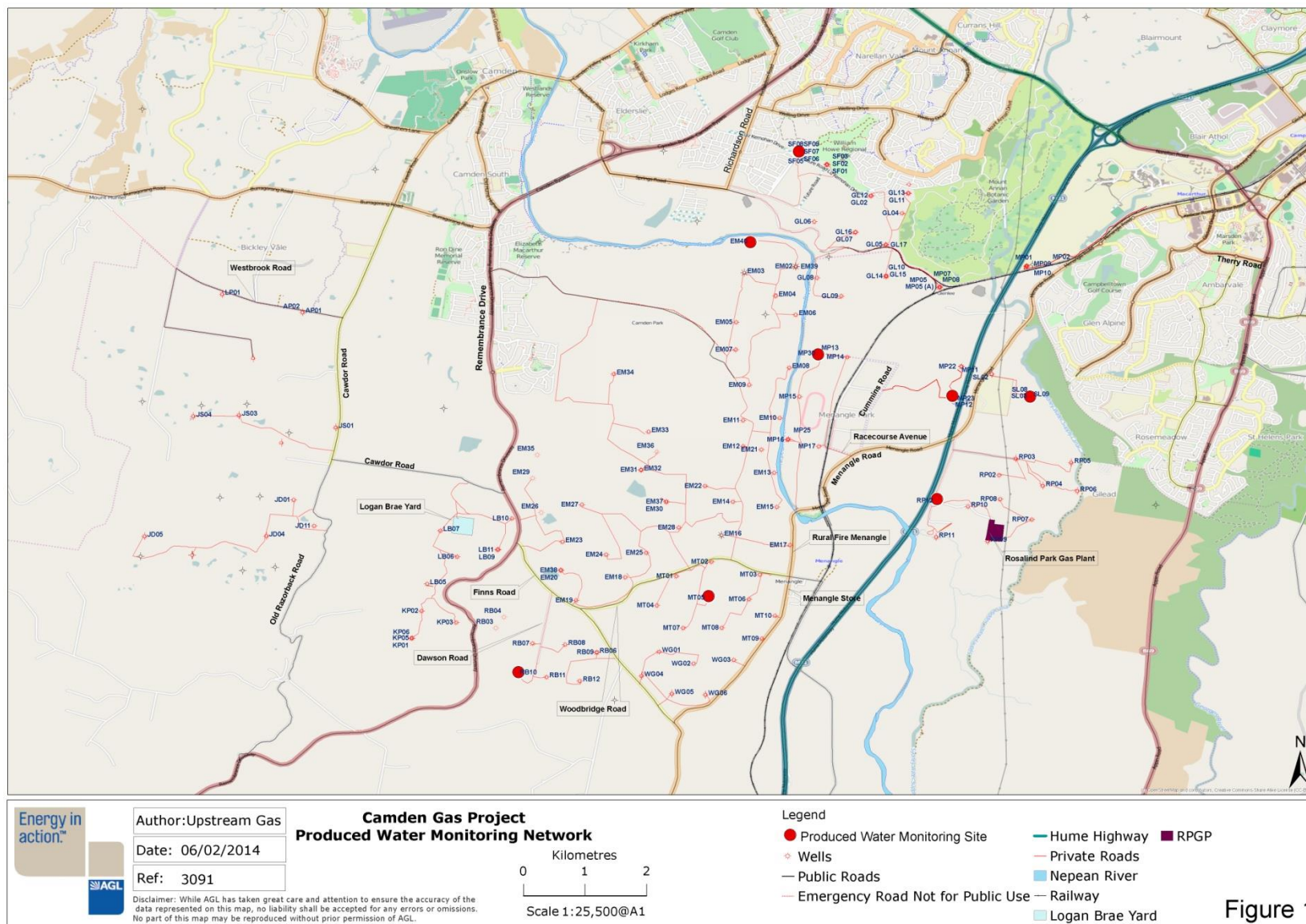


Monitoring point	8	9	10	11	12	13	14	15
Location	EM40	SF08	RB10	MT05	MP12	MP30	RP12	SL03
Sampled Date	Not enough water to sample (26/5/2014)	Not enough water to sample (27/5/2014)	26/5/2014	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)	Not enough water to sample (26/5/2014)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





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

## References

AGL, 2012. Groundwater Management Plan. AGL document. Last revised November 2012. Available online:

<http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Camden/Assessments%20and%20Reports/2012/November/Groundwater%20Management%20Plan%20for%20the%20Camden%20Gas%20Project%20%20%20Nov%202012.pdf>

AGL, 2013. Hydrogeological Summary of the Camden Gas Project area. 31<sup>st</sup> January 2013. Available online:

<http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Camden/Assessments%20and%20Reports/2013/January/Hydrogeological%20Summary%20of%20the%20Camden%20Gas%20Project%20Area.pdf>

Environment Protection Authority (EPA), 2004. Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales, The Department of Environment and Conservation, Sydney, Australia. Available online: <http://www.environment.nsw.gov.au/resources/water/approvedmethods-water.pdf>

The State of NSW and Environment Protection Authority (EPA), 2012. Requirements for publishing pollution monitoring data. Environment Protection Authority, Sydney, Australia. Available online:

<http://www.epa.nsw.gov.au/resources/legislation/20120263reqpubpmdata.pdf>

Parsons Brinckerhoff (PB), 2013. Water Quality Investigation Camden Gas Project. Report for AGL Upstream Investments Pty Ltd, Document number: 2114759C PT\_7196, dated 2 July 2013. Available online:

[http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Camden/Assessments%20and%20Reports/2013/September/2114759C%20%20PT\\_7196\\_RevD\\_web.pdf](http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Camden/Assessments%20and%20Reports/2013/September/2114759C%20%20PT_7196_RevD_web.pdf)