



AGL UPSTREAM INVESTMENTS PTY LTD

GLOUCESTER GAS PROJECT

**November 2014 Water Monitoring Report  
Waukivory Pilot Project: Fracture Stimulation and  
Flow Test  
EPL 20358**

Reporting Period: October - November 2014

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## Foreword

<b>PREMISES</b>	Gloucester Coal Seam Gas Project Bucketts Way Gloucester NSW 2422
<b>LICENCE DETAILS</b>	<a href="#"><u>Environment Protection Licence 20358</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>	21 and 22 October, 6 November, and 1 and 3 December 2014
<b>MONITORING BY</b>	Parsons Brinckerhoff, on behalf of AGL
<b>ANALYSIS BY</b>	ALS Laboratory, Smithfield (Work order numbers: ES1422961, ES1423256, ES1424539)
<b>DATE AGL OBTAINED DATA</b>	17 November and 3 December 2014
<b>REPORT DATE</b>	Revision A: 4 December 2014 Revision B (this revision): 10 December 2014
<b>REPORT PREPARED BY</b>	James Duggleby, Senior Hydrogeologist

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## Introduction

AGL is proposing to build the Gloucester Gas Project (GGP) which comprises several stages of development facilitating the extraction of coal seam gas (CSG) from the Gloucester Basin. Concept plan and project approval (Part 3A Approval) for the Stage 1 Gas Field Development Area (GFDA) was granted on 22 February 2011 under Part 3A of the Environmental Planning and Assessment Act (1979) (EP&A Act). In addition the project received approval under the Environment Protection and Biodiversity Conservation Act (1999) (EPBC Act) (EPBC Approval) on 11 February 2013.

The GGP will involve depressurising of deep groundwater and the extraction of gas from multiple coal seams within the Gloucester coal measures. Target coal seam depths will vary from site to site but are expected to range between 200 and 1,000 m below ground level (mbgl). The current GGP includes the construction, operation, and decommissioning of not more than 110 coal seam gas wells and associated infrastructure, including gas and water gathering lines within the Stage 1 GFDA. A comprehensive groundwater investigation (Phase 2 Groundwater Investigations) was completed in early 2012 to confirm the hydrogeological conceptual model across the Stage 1 GFDA (PB, 2012). Surface water and groundwater investigations are ongoing.

This Monitoring Report relates to the water monitoring activities specified in Part 5, Monitoring and Recording Conditions, of the Environment Protection Licence 20358. This report relates specifically to the monitoring surrounding the Waukivory Pilot Project, and details:

1. Final baseline monitoring results from a sampling event carried out before the Waukivory Pilot Project fracture stimulation commenced - 21 and 22 October; and
2. Monitoring results from a sampling event within 24 hours of the completion of the fracture stimulation of AGL gas well WK13, the first well to be fracture stimulated for the Waukivory Pilot Project - 6 November 2014.

As per the Licence, the monitoring encompasses the monitoring points at the locations as shown in Table 1 and Figure 1. The specific analytes and frequency tested are shown in Table 2. The monitoring results for this reporting period are shown in Table 3, Table 4 and Table 5.

The monitoring points that are the subject of this report are part of the GGP groundwater and surface water monitoring network, as described in AGL's Surface and Groundwater Management Plan (SGMP) for the Waukivory Pilot Project (AGL, 2014).

Three methods were used to obtain groundwater and surface water samples:

- A submersible pump at groundwater monitoring bores screened within relatively permeable geological materials, monitoring point 90 (12V pump) and monitoring point 91 (240V pump).
- A micro-purge™ low flow sampling pump at groundwater monitoring points 10, 11, and 12. The micro-purge™ system allows groundwater to be drawn into the pump intake directly from the screened portion of the aquifer, eliminating the need for excessive groundwater purging.
- A telescopic sampler to collect grab samples from the surface water monitoring points 7, 8, and 9.

EC and pH were monitored during purging to ensure that they had stabilised prior to sample collection. 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 (samples from 21 and 22 October 2014), which were analysed using the laboratory's updated method based on the current APHA 22<sup>nd</sup> Edition (2012) guideline. Samples from 6 November 2014 were also analysed (and results reported herein) using the EPA approved methodology which is based on the APHA 20<sup>th</sup> Edition (1998).
- Methane, which was analysed with a laboratory developed in-house technique which offers high resolution based on the "*Technical Guidance for Natural Attenuation Indicators: Methane, Ethane and Ethene*" (USEPA, 2002). The EPA have acknowledged that this method is a suitable technique for detecting dissolved methane in water (EPA, 2014).
- Nitrogen, which was analysed using an updated persulphate digestion method based on the "*Standard Methods for the Examination of Water and Wastewater: 22<sup>nd</sup> Edition*" (APHA, 2012). The EPA have acknowledged that this method is a suitable technique for analysing total nitrogen in water samples (EPA, 2014).

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

The remaining water and land monitoring points in EPL 20358 will be reported in subsequent reports when the requirement for monitoring is triggered.

More information on the groundwater monitoring of the GGP is available on the project website: [agl.com.au/Gloucester](http://agl.com.au/Gloucester)

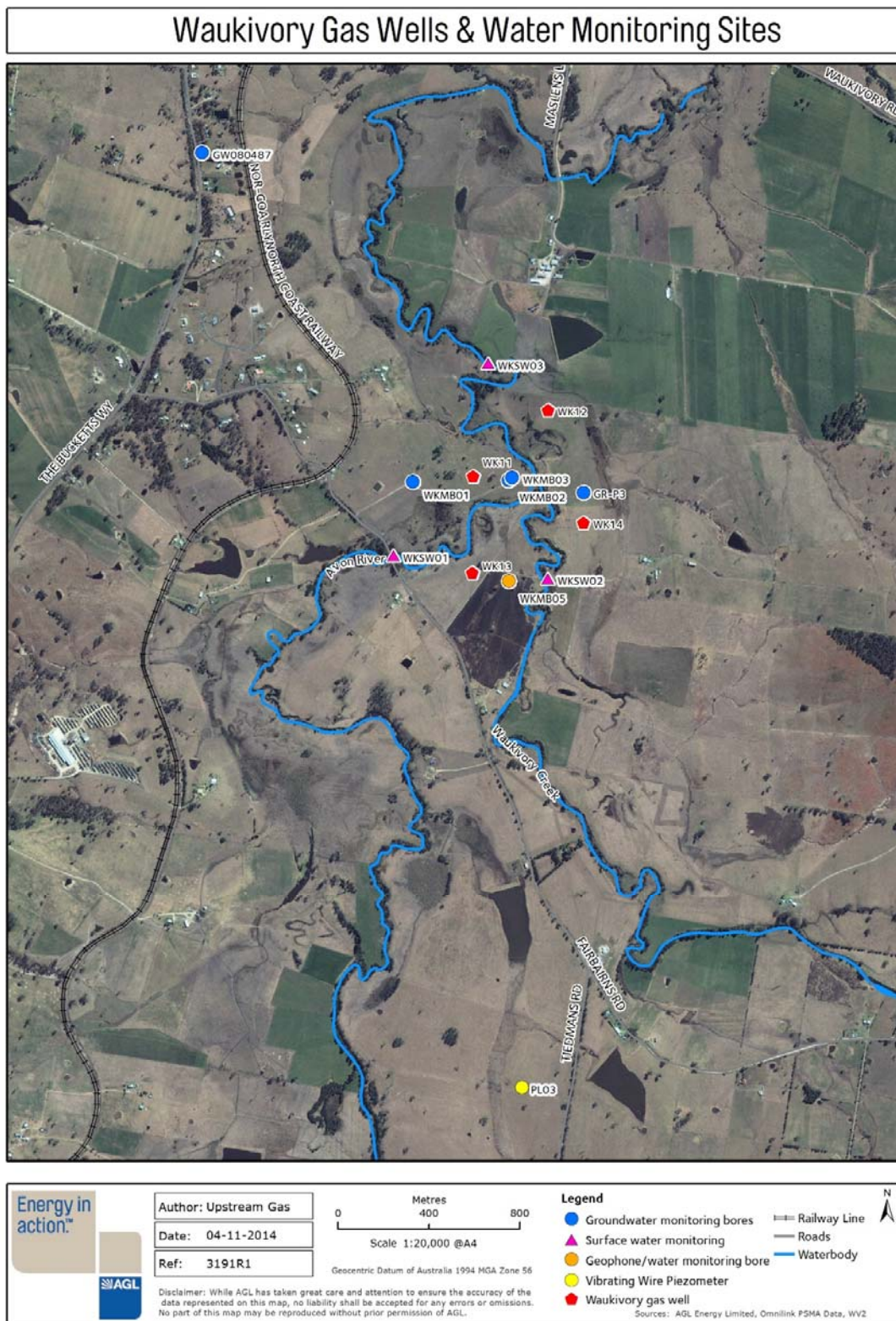
**Table 1: Waukivory Pilot Project water monitoring points (as per EPL 20358)**

EPA Identification no.	Monitoring Point	Type of monitoring point	Easting (m)	Northing (m)
7	WKSW03	Stream gauge (surface water)	402486.36	6453090.65
8	WKSW02	Stream gauge (surface water)	402748.00	6452139.00
9	WKSW01	Stream gauge (surface water)	402069.00	6452241.00
10	WKMB01	Groundwater monitoring bore	402153.63	6452566.28
11	WKMB02	Groundwater monitoring bore	402575.54	6452572.49
12	WKMB03	Groundwater monitoring bore	402589.87	6452584.93
14	PL03	Vibrating wire piezometer (groundwater)	402633.90	6449898.67
85	WKMB05 <sup>a</sup>	Packer and piezometer completion (groundwater)	402576.59	6452128.62
86	WK11 <sup>a</sup>	Gas well	402419.02	6452589.82
87	WK12 <sup>a</sup>	Gas well	402748.92	6452883.77
88	WK13 <sup>a</sup>	Gas well	402416.74	6452164.46
89	WK14 <sup>a</sup>	Gas well	402906.10	6452384.08
90	GR-P3	Private groundwater bore	402905.50	6452518.71
91	GW080487	Private groundwater bore	401226.00	6454020.00

Notes:

- <sup>a</sup> = will be sampled and reported from the commencement of the Waukivory Pilot Project flow testing program.
- Coordinate reference system: Map Grid of Australia 1994

Figure 1: Location of groundwater and surface water quality monitoring points: Waukivory Pilot Program (as per EPL 20358)





**Table 2: Analytes monitored and frequency for points in Table 1 (as per EPL 20358)**

Pollutant	Units of measure	Monitoring points									
		7,8,9		10,11,12		14,85		86,87,88,89		90, 91	
		Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method
<b>Aluminium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Ammonia</b>	milligrams per litre			Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Arsenic</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Barium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Beryllium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Bicarbonate</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Boron</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Cadmium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Calcium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Carbonate</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample



Pollutant	Units of measure	Monitoring points									
		7,8,9		10,11,12		14,85		86,87,88,89		90, 91	
		Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method
<b>Chloride</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Chromium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Cobalt</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Copper</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Electrical conductivity</b>	microsiemens per centimetre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Fluoride</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Iron</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Lead</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Magnesium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Manganese</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Mercury</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample



Pollutant	Units of measure	Monitoring points									
		7,8,9		10,11,12		14,85		86,87,88,89		90, 91	
		Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method
<b>Methane</b>	milligrams per litre			Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Molybdenum</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Monoethanolamine Borate</b>	milligrams per litre	Special Frequency 5	Method approved in writing by the Authority	Special Frequency 3	Method approved in writing by the Authority			Special Frequency 4	Method approved in writing by the Authority	Special Frequency 3	Method approved in writing by the Authority
<b>Nickel</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Nitrate</b>	milligrams per litre			Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Nitrite</b>	milligrams per litre			Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>pH</b>	pH	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Phosphorus (total)</b>	milligrams per litre			Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Potassium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Reactive Phosphorus</b>	milligrams per litre			Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Selenium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample





Pollutant	Units of measure	Monitoring points									
		7,8,9		10,11,12		14,85		86,87,88,89		90, 91	
		Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method
<b>Silica</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Sodium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Sodium Hypochlorite</b>	milligrams per litre	Special Frequency 5	Method approved in writing by the Authority	Special Frequency 3	Method approved in writing by the Authority			Special Frequency 4	Method approved in writing by the Authority	Special Frequency 3	Method approved in writing by the Authority
<b>Standing water level</b>	meters (Australian Height Datum)			Special Frequency 8	Special Method 5	Special Frequency 8	Special Method 5	Special Frequency 9	Special Method 3	Special Frequency 6	Special Method 1
<b>Strontium (dissolved)</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Sulfate</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>THPS (Phosphonium, Tetrakis (Hydroxymethyl-sulfate))</b>	milligrams per litre	Special Frequency 5	Method approved in writing by the Authority	Special Frequency 3	Request for method to be approved by the Authority (pending validation) to be submitted			Special Frequency 4	Grab sample	Special Frequency 3	Request for method to be approved by the Authority (pending validation) to be submitted
<b>Total dissolved solids</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Total organic carbon</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample



Pollutant	Units of measure	Monitoring points									
		7,8,9		10,11,12		14,85		86,87,88,89		90, 91	
		Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method
<b>Total suspended solids</b>	milligrams per litre			Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Uranium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Vanadium</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample
<b>Zinc</b>	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample	Special Frequency 3	Grab sample

Notes:

Special Frequency 3 – One sampling event before the Waukivory Pilot Project fracture stimulation commences, one sampling event within 24 hours of the completion of the fracture stimulation of each well, and one sample at week 2 and week 4 after the completion of the Waukivory Pilot Project fracture stimulation.

Special Frequency 4 – Every fortnight for 8 weeks from the commencement of the Waukivory pilot flow testing, then every 2 months thereafter until the cessation of the Waukivory pilot flow testing.

Special Frequency 5 – One sampling event within 24 hours of the completion of the fracture stimulation of each well, and one sampling event one week after the completion of the fracture stimulation of each well, and one sampling event every 6 months thereafter until the cessation of the Waukivory pilot flow testing.

Special Frequency 6 – One monitoring event to determine water level prior to the Waukivory Pilot

Special Frequency 8 – Every 6 hours

Special Frequency 9 – Every 6 hours when using an automated datalogger, or, once every fortnight using a Sonolog in the event of failure of an automated datalogger.

Shaded grey = not required to be analysed



## Monitoring Results

Table 3: Water quality monitoring results for points 7, 8, 9, and 10 (final baseline sample (21 and 22 October 2014) and sample within 24 hours of completion of first fracture stimulation (WK13) (6 November 2014))

		Monitoring points	7		8		9		10	
		Location	WKS03		WKS02		WKS01		WKMB01	
		Sampled date	21/10/2014	6/11/2014	21/10/2014	6/11/2014	22/10/2014	6/11/2014	21/10/2014	6/11/2014
		Date AGL obtained data	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014
Analyte	Units of measure	Limit of reporting								
Aluminium	mg/L	0.01	<0.01	0.02	<0.01	0.03	0.08	0.08	0.03	0.05
Ammonia	mg/L	0.01							0.66	0.64
Arsenic	mg/L	0.001	<0.001	0.002	0.002	0.003	0.003	0.001	0.002	0.027
Barium	mg/L	0.001	0.055	0.07	0.048	0.093	0.044	0.043	0.249	0.245
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bicarbonate	mg/L	1	74	99	94	114	49	64	851	966
Boron	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	0.1
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	0.0007
Calcium	mg/L	1	20	22	27	28	10	11	5	5
Carbonate	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	0.1	103	92.1	111	99.3	96	85.7	1050	1090
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Cobalt	mg/L	0.001	<0.001	0.001	0.003	0.002	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.015
Electrical conductivity	µS/cm	1	536	541	590	584	485	467	5540	5380
Fluoride	mg/L	0.1	0.1	0.1	0.1	<0.1	<0.1	0.1	1.2	1.3
Iron	mg/L	0.05	0.08	0.19	0.65	1.43	1	0.66	<0.05	0.13
Lead	mg/L	0.001	<0.001	0.003	<0.001	0.004	<0.001	0.003	<0.001	0.053
Magnesium	mg/L	1	13	14	15	15	10	11	2	2
Manganese	mg/L	0.001	0.331	1.21	1.04	0.722	0.144	0.204	0.013	0.018
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Methane	mg/L	0.01							22.8 <sup>b</sup>	12.8 <sup>b</sup>
Molybdenum	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001



Analyte	Units of measure	Limit of reporting	Monitoring points		7		8		9		10	
			Location	WКСW03		WКСW02		WКСW01		WКMB01		
			Sampled date	21/10/2014	6/11/2014	21/10/2014	6/11/2014	22/10/2014	6/11/2014	21/10/2014	6/11/2014	
			Date AGL obtained data	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	
Monoethanolamine Borate (reported as (mono) ethanolamine))	µg/L	1	4	<1	2	<1	<1	<1	<1	<1	<1	
Nickel	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.002	
Nitrate	mg/L	0.01								<0.01	0.02	
Nitrite	mg/L	0.01								<0.01	<0.01	
pH	pH Unit	0.01	7.47	7.47	7.39	7.46	7.62	7.45	8.16	8.23		
Phosphorus (total)	mg/L	0.01							0.04	0.05		
Potassium	mg/L	1	6	7	4	4	6	7	3	5		
Reactive Phosphorus	mg/L	0.01							0.02	0.03		
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Silica	mg/L	0.05	2.02	4.3	12.1	16.4	5.06	2.18	16.1	16.2		
Sodium	mg/L	1	52	58	52	52	69	59	1200	1130		
Sodium Hypochlorite (reported as free chlorine)	mg/L	0.2	0.5	0.8	0.3	0.2	<0.2	<0.2	<0.2	<0.2		
Sodium Hypochlorite (reported as total residual chlorine)	mg/L	0.2	0.6	0.8	0.4	0.2	<0.2	<0.2	<0.2	<0.2		
Standing water level	mAHD	0.01										
Strontium (dissolved)	mg/L	0.001	0.275	0.322	0.329	0.4	0.231	0.224	2.18	2.08		
Sulfate	mg/L	1	<10	<10	<10	<10	24	<10	157	189		
THPS (Phosphonium, Tetrakis (Hydroxymethyl)asulfate)) <sup>a</sup>	mg/L	na	na	na	na	na	na	na	na	na		
Total dissolved solids	mg/L	10	270	266	331	328	322	232	2790	2780		
Total organic carbon	mg/L	1	11	12	12	13	16	18	25	25		
Total suspended solids	mg/L	5							<5	<5		
Uranium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Vanadium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	



		Monitoring points	7		8		9		10	
		Location	WKS03		WKS02		WKS01		WKS01	
		Sampled date	21/10/2014	6/11/2014	21/10/2014	6/11/2014	22/10/2014	6/11/2014	21/10/2014	6/11/2014
		Date AGL obtained data	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014
Analyte	Units of measure	Limit of reporting								
Zinc	mg/L	0.005	0.005	0.01	0.028	0.02	0.39	0.02	0.135	0.051

Notes:

- Shaded grey = not required to be reported
- na = not analysed
- <sup>a</sup> = THPS (Phosphonium, Tetrakis (Hydroxymethyl-sulfate)) was not able to be analysed by the date of this report pending development and validation of an approved method of analysis. Samples have been collected and stored in anticipation of the approved method.
- <sup>b</sup> = Methane units amended for Revision B of this report (issued 10 December 2014) from µg/L to mg/L to be consistent with the reporting units specified by the EPA in the EPL 20358.



**Table 4: Water quality monitoring results for points 11, 12, 90, and 91 (final baseline sample (21 and 22 October 2014) and sample within 24 hours of completion of first fracture stimulation (WK13) (6 November 2014))**

		Monitoring points	11		12		90		91	
		Location	WKMB02		WKMB03		GR-P3		GW080487	
		Sampled date	21/10/2014	6/11/2014	21/10/2014	6/11/2014	21/10/2014	6/11/2014	22/10/2014	6/11/2014
		Date AGL obtained data	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014
Analyte	Units of measure	Limit of reporting								
Aluminium	mg/L	0.01	0.18	0.23	0.25	0.12	0.07	0.05	<0.01	0.02
Ammonia	mg/L	0.01	0.32	<0.01	27.3	22.9	0.01	0.02	0.43	0.54
Arsenic	mg/L	0.001	<0.001	0.007	0.002	0.003	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.001	0.067	0.076	1.11	0.966	0.482	0.498	0.156	0.369
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bicarbonate	mg/L	1	226	277	<1	<1	334	396	951	1170
Boron	mg/L	0.05	<0.05	<0.05	0.09	0.08	<0.05	<0.05	0.05	0.05
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001
Calcium	mg/L	1	<1	<1	2	3	107	115	64	50
Carbonate	mg/L	1	78	85	990	1210	<1	<1	<1	<1
Chloride	mg/L	0.1	67	59.8	372	333	957	998	593	577
Chromium	mg/L	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Copper	mg/L	0.001	<0.001	0.007	0.002	0.001	0.002	<0.001	<0.001	0.002
Electrical conductivity	µS/cm	1	912	920	4030	3670	4140	4100	3970	3900
Fluoride	mg/L	0.1	0.4	0.4	2.4	2.4	0.2	0.3	0.2	0.2
Iron	mg/L	0.05	<0.05	0.05	0.07	<0.05	0.29	0.25	0.43	0.37
Lead	mg/L	0.001	<0.001	0.002	0.012	0.013	<0.001	<0.001	<0.001	<0.001
Magnesium	mg/L	1	<1	<1	<1	<1	69	68	41	32
Manganese	mg/L	0.001	0.005	0.008	0.001	<0.001	0.607	0.612	0.071	0.05
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Methane	mg/L	0.01	5.52	2.38	21.8	20.3	<0.01	<0.01	0.064	0.154
Molybdenum	mg/L	0.001	<0.001	0.004	0.004	0.008	<0.001	<0.001	<0.001	<0.001
Monoethanolamine Borate (reported as (mono) ethanolamine))	µg/L	1	2	<1	<1	<1	<1	<1	<1	<1
Nickel	mg/L	0.001	<0.001	0.002	0.001	0.002	0.001	<0.001	<0.001	<0.001



Analyte	Units of measure	Limit of reporting	Monitoring points		11		12		90		91	
			Location		WKMB02		WKMB03		GR-P3		GW080487	
			Sampled date		21/10/2014	6/11/2014	21/10/2014	6/11/2014	21/10/2014	6/11/2014	22/10/2014	6/11/2014
			Date AGL obtained data		17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014
Nitrate	mg/L	0.01	<0.01	<0.01	0.01	<0.01	0.02	<0.01	<0.01	<0.01		
Nitrite	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
pH	pH Unit	0.01	9.24	9.06	11.5	11.2	7.06	7.21	7.7	7.49		
Phosphorus (total)	mg/L	0.01	0.09	0.17	0.05	0.06	0.08	0.06	<0.01	0.03		
Potassium	mg/L	1	2	6	6	15	1	2	7	8		
Reactive Phosphorus	mg/L	0.01	0.09	0.11	0.05	0.05	0.02	0.02	<0.01	<0.01		
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
Silica	mg/L	0.05	20.2	21.4	110	83.7	34.3	36.3	20.3	19.6		
Sodium	mg/L	1	184	210	694	779	587	619	802	760		
Sodium Hypochlorite (reported as free chlorine)	mg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
Sodium Hypochlorite (reported as total residual chlorine)	mg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
Standing water level	mAHD	0.01					96.71		101.69			
Strontium (dissolved)	mg/L	0.001	0.207	0.235	1.25	1.19	1.96	2.07	5.23	4.69		
Sulfate	mg/L	1	20	48	<1	<10	75	87	114	115		
THPS (Phosphonium, Tetra kis (Hydroxymethylnasulfate)) <sup>a</sup>	mg/L	na	na	na	na	na	na	na	na	na		
Total dissolved solids	mg/L	10	440	504	2350	2350	2130	1930	2170	1860		
Total organic carbon	mg/L	1	5	6	157	156	2	2	2	2		
Total suspended solids	mg/L	5	<5	6	20	23	97	37	<5	16		
Uranium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.003	<0.001	<0.001		
Vanadium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
Zinc	mg/L	0.005	<0.005	0.007	12.6	10.6	0.012	0.011	0.264	0.101		



Notes:

- Shaded grey = not required to be reported
- na = not analysed
- <sup>a</sup> = THPS (Phosphonium, Tetrakis (Hydroxymethyl-sulfate)) was not able to be analysed by the date of this report pending development and validation of an approved method of analysis. Samples have been collected and stored in anticipation of the approved method.



**Table 5: Continuous water level monitoring results for monitoring points 10, 11, 12, and 14 for the period 1 October – 30 November 2014**

Monitoring point	10	11	12	14	
Location	WKMB01	WKMB02	WKMB03	PL03 Sensor 2	PL03 Sensor 3
Data type	Standing Water Level				
Units	mAHD (metres (Australian Height Datum))				
Data date range	01/10/2014 – 30/11/2014				
Date data downloaded	01/12/14	01/12/14	01/12/14	03/12/14	03/12/14
Date data supplied to AGL	03/12/14	03/12/14	03/12/14	03/12/14	03/12/14
Monitoring frequency required by licence	Every 6 hours	Every 6 hours	Every 6 hours	Every 6 hours	Every 6 hours
No. of times measured during monitoring period	215	217	217	244	244
Min. value	89.5	95.2	90.5	86.5	49.0
Mean value	95.0	95.9	96.9	88.7	52.7
Median value	95.2	95.9	97.5	88.8	53.1
Max. value	95.3	96.1	98.3	89.8	55.6

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