AGL UPSTREAM INVESTMENTS PTY LTD

GLOUCESTER GAS PROJECT

August 2015 Water Monitoring Report

Waukivory Pilot Project: Fracture Stimulation and Flow Test
EPL 20358

Reporting Period: March to August 2015

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Foreword

PREMISES	Gloucester Coal Seam Gas Project Bucketts Way Gloucester NSW 2422
LICENCE DETAILS	Environment Protection Licence 20358
LICENCEE	AGL Upstream Investments Pty Limited (AGL)
LICENCEE'S ADDRESS	Locked Bag 1837, North Sydney, NSW 2060
MONITORING DATE(s)	15, 29 July 2015, 31 March – 5 August, 12 August2015
MONITORING BY	Parsons Brinckerhoff, on behalf of AGL
ANALYSIS BY	ALS Laboratory, Smithfield (Work order: ES1526118, ES1527133, ES1828259)
DATE AGL OBTAINED DATA	12, 14 and 27 August 2015
REPORT DATE	31 August 2015
REPORT PREPARED BY	James Duggleby, Senior Hydrogeologist

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 250 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.

The Gloucester Coal Seam Gas Project has Environment Protection Licence (EPL) 20358 for coal seam gas activities. This Monitoring Report relates to the water monitoring activities specified in Part 5, Monitoring and Recording Conditions, of EPL 20358. This report relates specifically to the monitoring surrounding the Waukivory Pilot Project, and details:

- Monitoring results from fortnightly samples post fracture stimulation at monitoring points 86, 87, 88, 89 (WK11, WK12, WK13, WK14) (Appendix B);
- Monitoring result from monthly samples at monitoring point 92 (AST2) (Appendix B);
- Monitoring results from continuous water level (including piezometric level) monitoring at monitoring points 10, 11, 12, 85, and 90 for the period 1 April 2015 – 5 August 2015 (WKMB01, WKMB02, WKMB03, WKMB05, GR-P3) (Appendix C and Appendix E, Figure 2 and **Error! Reference source not found.**); and
- Monitoring results from continuous water level (pressure) at monitoring points 86, 87, 88, 89 (WK11, WK12, WK13, WK14) from 31 March – 5 August 2015 (Appendix D and Appendix E, Figure 4).

As per the EPL, monitoring encompasses the monitoring points at the locations as shown in Table 1 and Figure 1.

The monitoring points that are the subject of this report are part of the GGP surface water and groundwater monitoring network, as described in AGL's Surface Water and Groundwater Management Plan (SGMP) for the Waukivory Pilot Project (AGL, 2015).

Two methods were used to obtain the surface water samples:

- Water samples were collected directly from the separator valve located at the surface headworks of each gas well; and
- A telescopic sampler to a collect grab samples from the flowback water monitoring point 92.

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:

- Monoethanolamine borate, which was analysed as monoethanolamine using the Liquid Chromatography Triple Quadruple Mass Spectrometry (LC/MSMS) method. The EPA have acknowledged that this method is a suitable technique for representing detections of monoethanolamine borate in water (EPA, 2014b).
- Sodium hypochlorite, where detections of free and total residual chlorine were used as a proxy. The EPA have acknowledged that this method is a suitable technique for representing detections of sodium hypochlorite in water (EPA, 2014a).

Monitoring point 14 is a multizone vibrating wire piezometer with two pressure transducers installed at two different horizons to measure the piezometic levels. Details of the individual monitored zones are included in Appendix C.

Monitoring point 85 is a multizone monitoring well with six pressure transducers installed at six different horizons to measure the piezometric levels. Details of the individual monitored zones are included in Appendix C.

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

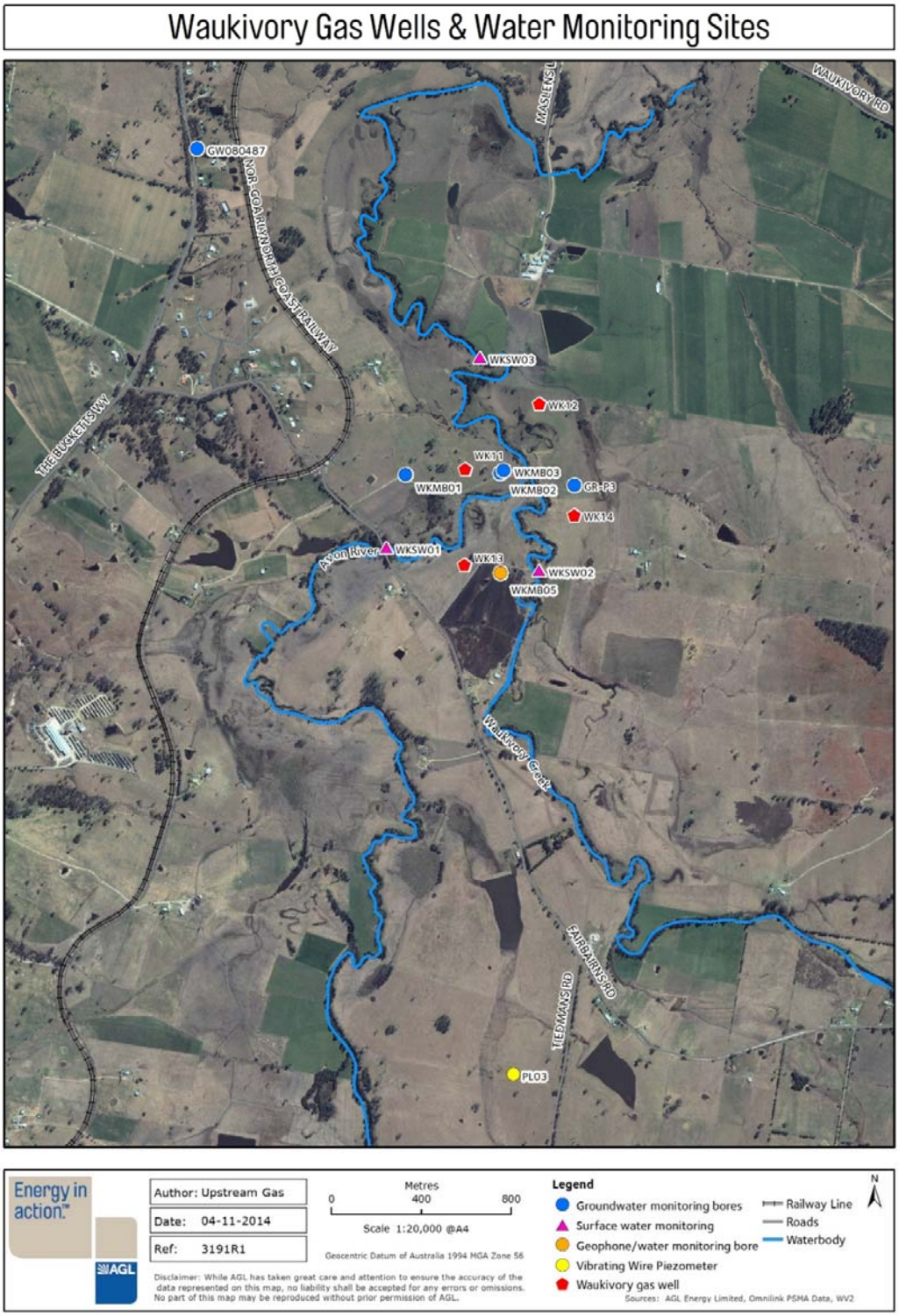
Table 1: Waukivory Pilot Project water monitoring points (as per EPL 20358)

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	Packer and piezometer completion: multizone monitoring well (groundwater)	402576.59	6452128.62
86	WK11	Gas well	402419.02	6452589.82
87	WK12	Gas well	402748.92	6452883.77
88	WK13	Gas well	402416.74	6452164.46
89	WK14	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
92	AST2	Above ground storage tank	Located on the WK13 work pad	

Notes:

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)



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Appendix A: Analytes monitored and frequency required for monitoring points in Table 1 (as per EPL 20358 (dated 1 July 2015))

Pollutant	Units of measure	Monitoring points											
		7,8,9		10,11,12, 90		91		14,85		86,87,88,89		92	
		Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method	Frequency	Sampling method
Aluminium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Ammonia	milligrams per litre			Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Arsenic	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Barium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Benzene	milligrams per litre			Special Frequency 3	Grab sample	Special Frequency 3	Grab sample					Monthly	Grab sample
Beryllium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Bicarbonate	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Boron	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Cadmium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Calcium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Carbonate	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Chloride	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Chromium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Cobalt	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Copper	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Ethyl benzene	milligrams per litre			Special Frequency 3	Grab sample	Special Frequency 3	Grab sample					Monthly	Grab sample
Electrical conductivity	microsiemens per centimetre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Fluoride	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Iron	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Lead	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Magnesium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Manganese	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Mercury	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Methane	milligrams per litre			Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Molybdenum	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Monoethanolamine Borate	micrograms per litre	Special Frequency 5	Method approved in writing by the Authority	Special Frequency 3	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		
Nickel	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Nitrate	milligrams per litre			Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Nitrite	milligrams per litre			Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
pH	pH	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Phosphorus (total)	milligrams per litre			Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Potassium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Reactive Phosphorus	milligrams per litre			Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Selenium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Silica	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Sodium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Sodium Hypochlorite	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 3	Method approved in writing by the Authority			Special Frequency 4	Method approved in writing by the Authority		
Standing water level	meters (Australian Height Datum)			Special Frequency 8	Special Method 5	Special Frequency 6	Special Method 1	Special Frequency 8	Special Method 5	Special Frequency 9	Special Method 3		
Strontium (dissolved)	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Sulfate	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Toluene	milligrams per litre			Special Frequency 3	Grab sample	Special Frequency 3	Grab sample					Monthly	Grab sample
Total dissolved solids	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Total organic carbon	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Total suspended solids	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Uranium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Vanadium	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		
Xylene	milligrams per litre			Special Frequency 3	Grab sample	Special Frequency 3	Grab sample					Monthly	Grab sample
Zinc	milligrams per litre	Special Frequency 5	Grab sample	Special Frequency 3	Grab sample	Special Frequency 3	Grab sample			Special Frequency 4	Grab sample		

Notes:

Special Frequency 3 – Six monthly water quality sampling. Note, this frequency was updated as per correspondance received from the EPA on 11 August 2015 (via email from Peter Jamieson at the EPA).

Special Frequency 4 – Every fortnight for the first 8 weeks of extraction from the commencement of the Waukivory pilot flow testing, then every 2 months thereafter until the cessation of the Waukivory pilot flow testing. Should the flow be suspended during that stage, then the timeframes will also be suspended and recommence when flows from the wells recommence.

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 & 6 months after cessation of fracture stimulation, then monthly for the next 12 months. Sampling requirements to be reassessed in May 2016.

Special Frequency 6 – Quarterly water level monitoring. Note, this frequency was updated as per correspondance received from the EPA on 11 August 2015 (via email from Peter Jamieson at the EPA).

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.

Special method 1 - manual dip

Special method 3 - Use of an automated datalogger. As a back up contingency, by use of Sonolog in the event of failure of an automated datalogger.

Special method 5 - Automated datalogger

Shaded grey = not required to be analysed

Appendix B: Water quality monitoring data for points 86, 87, 88, 89, 92

Analysis by: ALS Laboratory, Smithfield (Work order: ES1526118, ES1527133, ES1828259)

Monitoring points			86			87			88			89			92	
Location			WK11			WK12			WK13			WK14				
Sampled date			15/07/2015	29/07/15: Well not online at time of sampling; unable to collect sample	12/08/2015: Well not online at time of sampling; unable to collect sample	15/07/2015: Well not online at time of sampling; unable to collect sample	29/07/2015	12/08/2015	15/07/2015	29/07/2015	12/08/2015	15/07/2015	29/07/15: Well not online at time of sampling; unable to collect sample	12/08/2015: Well not online at time of sampling; unable to collect sample	29/07/2015	
Date AGL obtained data			27/08/2015	-	-	-	12/08/2015	27/08/2015	27/08/2015	12/08/2015	27/08/2015	27/08/2015	-	-	12/08/2015	
Monitoring event (see key below)			a	a	a	a	a	a	a	a	a	a	a	a	b	
Analyte	**Units of measure**	**Limit of reporting**														**Analyte**
Aluminium	mg/L	0.01	<0.01	-	-	-	<0.01	0.01	<0.01	<0.01	0.01	<0.01	-	-		**Aluminium**
Ammonia	mg/L	0.01	5.9	-	-	-	2.7	2.46	3.99	4	4.28	4.82	-	-		**Ammonia**
Arsenic	mg/L	0.001	0.004	-	-	-	0.004	0.004	0.006	0.004	0.004	0.008	-	-		**Arsenic**
Barium	mg/L	0.001	5.56	-	-	-	2.74	3.98	2.48	2.64	3.06	3.59	-	-		**Barium**
Benzene	mg/L	1													4	**Benzene**
Beryllium	mg/L	0.001	<0.001	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-		**Beryllium**
Bicarbonate	mg/L	1	6180	-	-	-	3720	3600	3780	3380	3000	4540	-	-		**Bicarbonate**
Boron	mg/L	0.05	3.35	-	-	-	3.18	3.56	2.35	2.81	2.44	2.87	-	-		**Boron**
Cadmium	mg/L	0.0001	<0.0001	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-		**Cadmium**
Calcium	mg/L	1	27	-	-	-	22	28	11	11	10	22	-	-		**Calcium**
Carbonate	mg/L	1	<1	-	-	-	<1	<1	47	150	200	<1	-	-		**Carbonate**
Chloride	mg/L	0.1	754	-	-	-	721	720	666	696	668	1230	-	-		**Chloride**
Chromium	mg/L	0.001	<0.001	-	-	-	0.005	0.030	<0.001	0.001	0.002	<0.001	-	-		**Chromium**
Cobalt	mg/L	0.001	<0.001	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-		**Cobalt**
Copper	mg/L	0.001	0.005	-	-	-	<0.001	<0.001	0.003	0.003	0.001	0.002	-	-		**Copper**
Ethyl benzene	mg/L	2													<2	**Ethyl benzene**
Electrical conductivity	µS/cm	1	11600	-	-	-	7860	7810	8020	7670	7410	10400	-	-		**Electrical conductivity**
Fluoride	mg/L	0.1	1.3	-	-	-	1.1	1.5	2.6	2.2	3.0	1.1	-	-		**Fluoride**
Iron	mg/L	0.05	<0.05	-	-	-	0.06	5.30	<0.05	0.12	1.40	<0.05	-	-		**Iron**
Lead	mg/L	0.001	<0.001	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-		**Lead**
Magnesium	mg/L	1	3	-	-	-	4	5	2	2	2	7	-	-		**Magnesium**
Manganese	mg/L	0.001	0.008	-	-	-	0.021	0.051	0.002	0.006	0.010	0.008	-	-		**Manganese**
Mercury	mg/L	0.0001	<0.0001	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-		**Mercury**
Methane	mg/L	0.01	19.30	-	-	-	12.90	8.90	32.90	5.56	21.3	14.3	-	-		**Methane**
Molybdenum	mg/L	0.001	0.003	-	-	-	0.004	0.002	0.006	0.009	0.008	0.004	-	-		**Molybdenum**
Monoethanolamine Borate	µg/L	1	34	-	-	-	13	10	42	13	11	50	-	-		**Monoethanolamine Borate**
Nickel	mg/L	0.001	<0.001	-	-	-	0.001	<0.001	<0.001	0.002	0.001	<0.001	-	-		**Nickel**
Nitrate	mg/L	0.01	<0.05	-	-	-	0.03	<0.01	0.04	0.01	0.02	0.03	-	-		**Nitrate**
Nitrite	mg/L	0.01	<0.05	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	-	-		**Nitrite**
pH	pH Unit	0.01	7.27	-	-	-	7.34	7.41	8.15	8.25	8.52	7.64	-	-		**pH**
Phosphorus (total)	mg/L	0.01	3.15	-	-	-	1.55	1.28	2.6	2.55	2.46	2.07	-	-		**Phosphorus (total)**
Potassium	mg/L	1	9	-	-	-	10	10	10	11	11	12	-	-		**Potassium**
Reactive Phosphorus	mg/L	0.01	0.09	-	-	-	0.06	0.01	0.16	0.6	0.16	0.17	-	-		**Reactive Phosphorus**
Selenium	mg/L	0.01	<0.01	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-		**Selenium**
Silica	mg/L	0.05	35.2	-	-	-	29.7	27.3	24.1	29	25	30.2	-	-		**Silica**
Sodium	mg/L	1	1700	-	-	-	1920	2060	1790	1880	1990	2090	-	-		**Sodium**
Sodium Hypochlorite (reported as free chlorine)	mg/L	0.2	<0.2	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-		**Sodium Hypochlorite (reported as free chlorine)**
Sodium Hypochlorite (reported as residual chlorine)	mg/L	0.2	<0.2	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-		**Sodium Hypochlorite (reported as residual chlorine)**
Standing water level	mAHD	0.01	Refer to Appendix D													**Standing water level**
Strontium (dissolved)	mg/L	0.001	3.64	-	-	-	3.05	3.52	2.26	2.47	2.12	3.41	-	-		**Strontium (dissolved)**
Sulfate	mg/L	1	<10	-	-	-	<1	<1	<10	<1	<1	<10	-	-		**Sulfate**
Toluene	mg/L	2													5	**Toluene**
Total dissolved solids	mg/L	10	6490	-	-	-	4570	3710	4300	4610	3920	6520	-	-		**Total dissolved solids**
Total organic carbon	mg/L	1	477*	-	-	-	3*	4*	152*	81	26*	66*	-	-		**Total organic carbon**
Total suspended solids	mg/L	5	33	-	-	-	13	16	<5	22	29	11	-	-		**Total suspended solids**
Uranium	mg/L	0.001	<0.001	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-		**Uranium**
Vanadium	mg/L	0.01	<0.01	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-		**Vanadium**
Xylene	mg/L	2													<2	**Xylene**
Zinc	mg/L	0.005	<0.005	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-		**Zinc**

Key:

Shaded grey = not required to be reported

- not analysed / available

* nonpurgeable organic carbon analysis was carried out due to high inorganic carbon content

Monitoring event:

a Sample taken fornightly for 8 weeks from commencement of flowback

b monthly sample

Appendix C: Continuous water level monitoring results for monitoring points 10, 11, 12, 85, and 90 for the period 1 April 2015 – 5 August 2015 (tabulated summary)

Monitoring point	10	11	12	85						90
Location	WKMB01	WKMB02	WKMB03	WKMB05						GR-P3
				Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	
Monitored interval (mbgl)	47 - 53	51 - 60	200 - 209	340.0 - 343.0	426.0- 429.0	584.0- 587.0	595.4- 598.4	698.5- 701.5	711.0- 714.0	5.0 - 9.0
Data type	Standing water level									
Units	mAHD (metres Australian Height Datum)									
Data start	1/04/2015	1/04/2015	1/04/2015	1/04/2015	1/04/2015	1/04/2015	1/04/2015	1/04/2015	1/04/2015	1/04/2015
Date data downloaded	5/08/2015	5/08/2015	5/08/2015	5/08/2015	5/08/2015	5/08/2015	5/08/2015	5/08/2015	5/08/2015	5/08/2015
Date data supplied to AGL	14/08/2015	14/08/2015	14/08/2015	14/08/2015	14/08/2015	14/08/2015	14/08/2015	14/08/2015	14/08/2015	14/08/2015
Monitoring frequency required by licence	Every 6 hours	Every 6 hours	Every 6 hours	Every 6 hours	Every 6 hours	Every 6 hours	Every 6 hours	Every 6 hours	Every 6 hours	Every 6 hours
No. of times measured during monitoring period	508	507	508	501	501	501	501	501	501	508
Min. value	90.0	93.5	90.8	104.3	102.1	112.0	116.6	142.2	169.2	97.0
Mean value	95.5	96.5	98.2	105.9	102.8	112.4	116.8	142.9	170.2	97.5
Median value	95.6	96.4	98.4	105.2	102.7	112.4	116.7	142.9	170.2	97.5
Max. value	95.7	97.3	98.6	108.5	103.5	112.8	117.1	143.8	171.1	97.9

Appendix D: Continuous water level monitoring results for monitoring points 86, 87, 88, and 89 from 31 March – 5 August 2015 (tabulated summary)

Monitoring point	86	87	88	89
Location	WK11	WK12	WK13	WK14
Data type	Standing water level			
Units	mAHD (metres Australian Height Datum)			
Data start	31/03/2015	31/03/2015	31/03/2015	31/03/2015
Date end	5/08/2015	5/08/2015	5/08/2015	5/08/2015
Date data supplied to AGL	19/08/2015	19/08/2015	19/08/2015	19/08/2015
Monitoring frequency required by licence	Every 6 hours when using an automated datalogger; or, once every fortnight using a Sonolog in the event of failure of an automated datalogger			
No. of times measured during monitoring period	416	391	480	426
Min. value	-854.9	-532.5	-837.2	-768
Mean value	-283.9	-215.8	-471.2	-356
Median value	-129.9	-197.5	-464.2	-395
Max. value	132.1	41.5	-57.2	71

Appendix E: Continuous water level monitoring results (hydrographs)

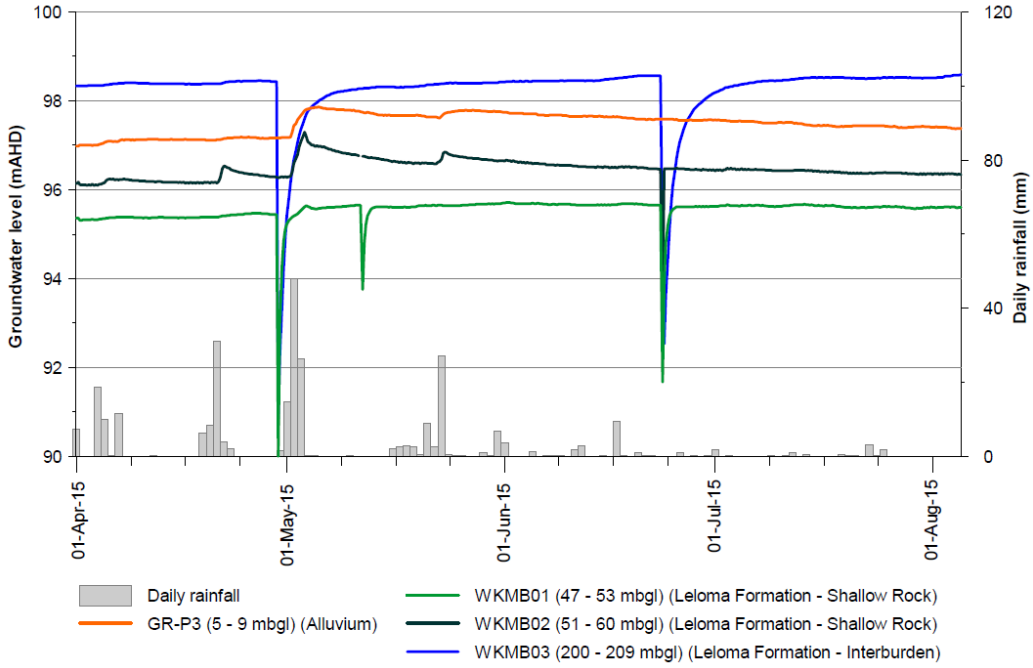

Figure 2: Continuous water level monitoring results for monitoring points 10 (WKMB01), 11 (WKMB02), 12 (WKMB03), and 90 (GR-P3) for the period 1 April 2015 – 5 August 2015.

Note (Figure 2): The brief drop in water levels (shown during late April, May and late June 2015) is caused when technicians visit a bore to take a water sample, temporarily lowering the amount of water in the borehole.

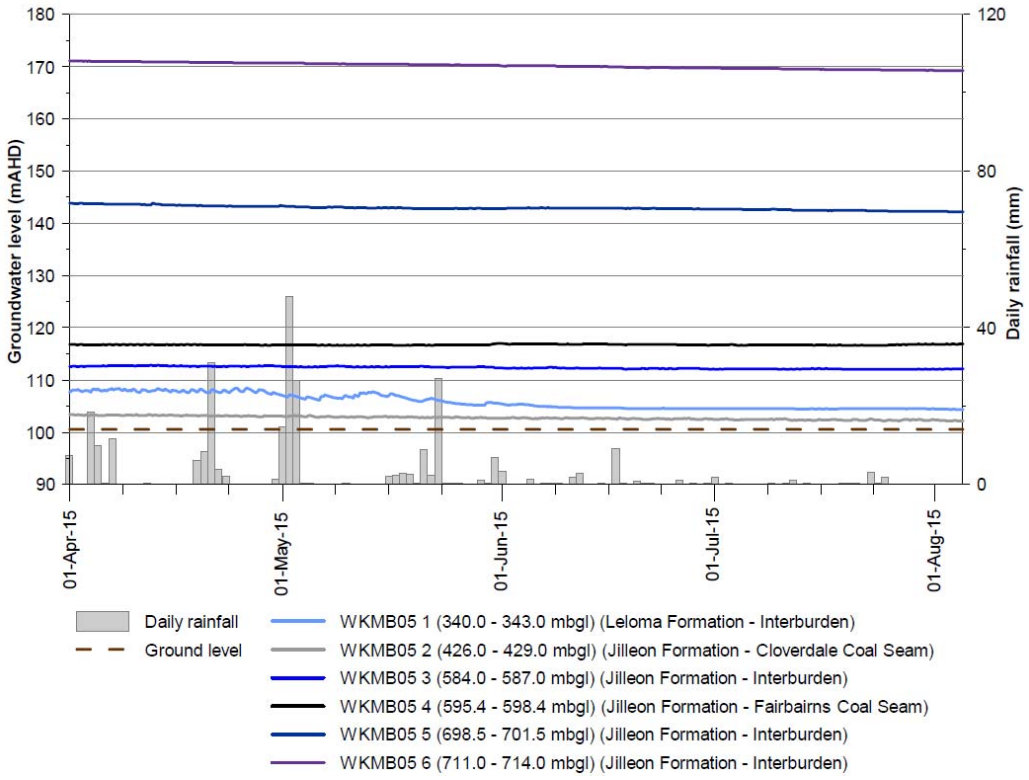

Figure 3: Continuous water level monitoring results for monitoring point 85 (WKMB05) for the period 1 April 2015 – 5 August 2015

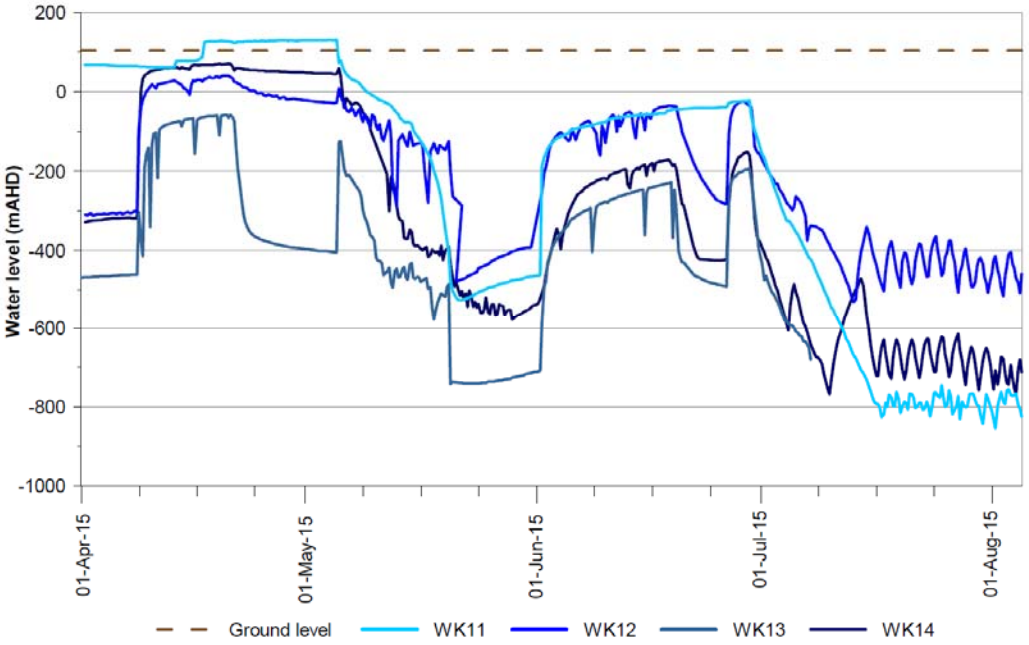

Figure 4: Continuous water level monitoring results for monitoring points 86 (WK11), 87 (WK12), 88 (WK13), 89 (WK14) from 31 March – 5 August 2015

Note (Figure 5): Water levels (pressure levels) in the pilot wells are highly variable and dependent on pump commissioning and operation (including fluctuating pumping rates). When pumping is taking place, pressure level declines (drawdown) are observed in the pilot wells and when pumping ceases the pressure levels re-equilibrate (recover) to that of the target formations. The pump commissioning and flowback phases comprise periods where the pumps have been in operation and periods where pumping has ceased either due to workover intervention or suspension.