October 2017 Monitoring Report

Gloucester Gas Project
Tiedman Irrigation Program
EPL 20358

Reporting Period: September and October 2017

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Forward

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, St Leonards, NSW 2065
MONITORING DATE	20 September and 4 October 2017
MONITORING BY	EMM Consulting Pty Ltd (EMM), on behalf of AGL
ANALYSIS BY	ALS Laboratory, Smithfield (Work order: ES1724806)
DATE AGL OBTAINED DATA	2 and 16 October 2017
REPORT DATE	16 October 2017
REPORT PREPARED BY	James Duggleby, Principal Hydrogeologist, EMM, on behalf of AGL

Introduction

On 4 February 2016 AGL Upstream Investments Pty Ltd (AGL) announced that the GGP will not proceed to final investment stage. AGL will relinquish Petroleum Exploration Licence (PEL) 285 to the NSW Government and are completing a comprehensive decommissioning and rehabilitation program for well sites and other infrastructure in the Gloucester region.

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 Tiedman Irrigation Program, and details monitoring results from fortnightly and monthly water sampling from the Tiedman Irrigation discharge monitoring point (20 September and 4 October 2017 respectively).

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.

The monitoring points that are the subject of this report were part of the GGP groundwater monitoring network, as described in AGL's Water Management Plan for the Tiedman Irrigation Program (AGL, 2012a) and Soil Quality Monitoring and Management Program (AGL, 2012b)). Water monitoring results for the irrigation program are presented in a baseline water monitoring report (PB, 2013a) and six-monthly compliance reports (PB, 2013a, 2013b, 2014a, 2014b, 2015a, and 2015b).

Irrigation discharge point water samples were obtained by a grab sample using a telescopic sampler.

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 calcium, which underwent filtration rather than acid extraction as a preliminary treatment prior to analysis.

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

EPA ID no.	Monitoring Point	Type of monitoring point	Easting (m)	Northing (m)
30	TMB04	Groundwater quality monitoring	402558.1	6448921.7
31	TMB05	Groundwater quality monitoring	402650.1	6448725.3
39	TMB01	Groundwater quality monitoring	401996.98	6449419.7
40	TMB02	Groundwater quality monitoring	401905.11	6449100.6
41	TMB03	Groundwater quality monitoring	401969.53	6448755
42	S4MB01	Groundwater quality monitoring	402581.88	6449409.7
43	TCMB01	Groundwater quality monitoring	402501.7	6448899
44	TTMB02	Groundwater quality monitoring	402699	6449358
45	SP1B	Soil water quality monitoring	402570.3	6449381.3
46	SP2B	Soil water quality monitoring	402444.2	6449100.1
47	SP4B	Soil water quality monitoring	402252	6449131.3
48	SP6B	Soil water quality monitoring	402103.5	6449178.6
49	SP7B	Soil water quality monitoring	402144.8	6449292.1
50	SP8B	Soil water quality monitoring	402159.1	6449454.8
51	SP9B	Soil water quality monitoring	402387.5	6449016.9
52	SP10B	Soil water quality monitoring	402344.2	6448840.6
91	Tiedman Dams Irrigation Discharge	Discharge point of blended water	Tiedman South Dam	

Coordinate reference system: Map Grid of Australia 1994

Table 1 Water quality monitoring points: Irrigation Program (as per EPL 20358)

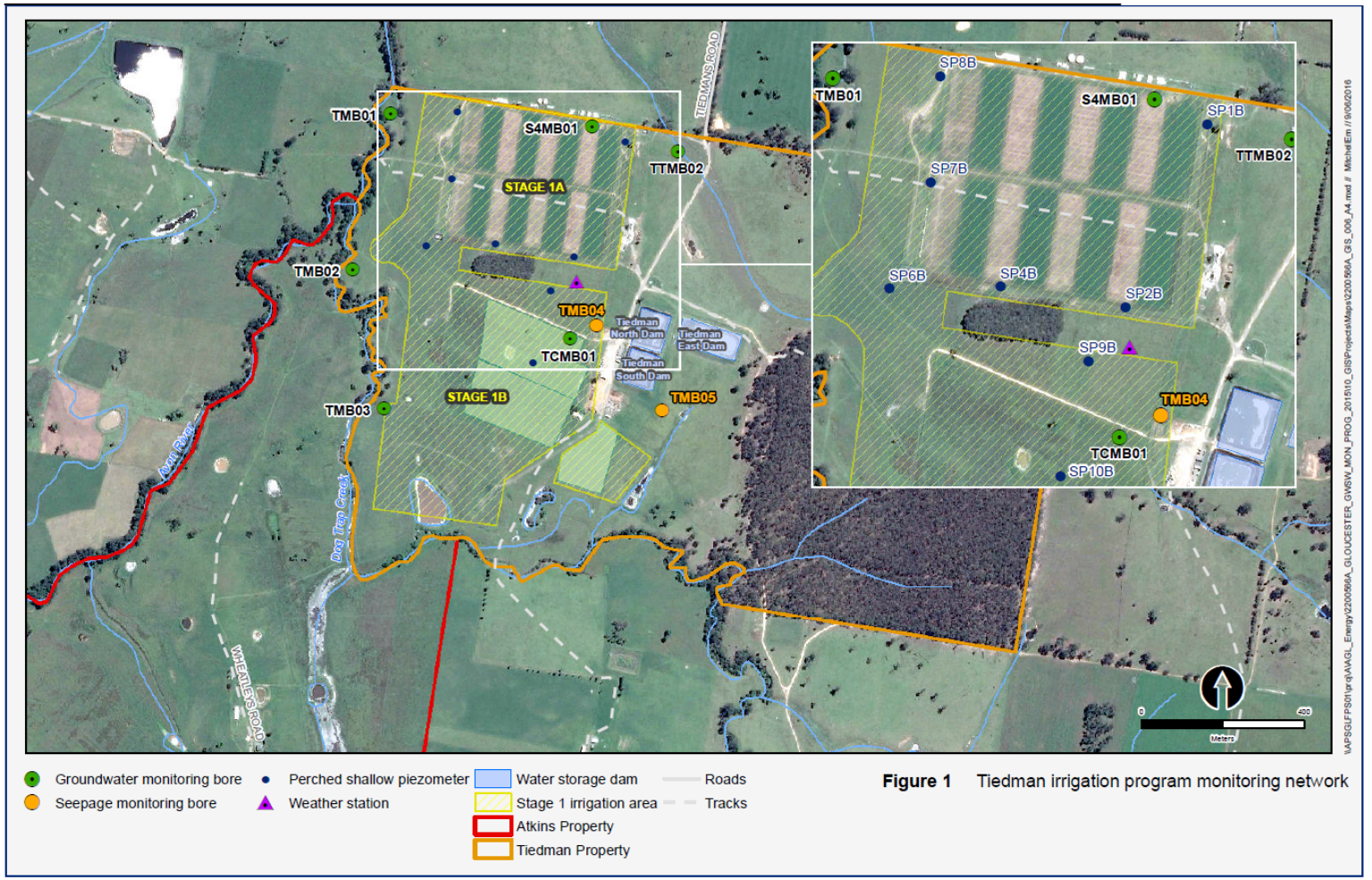

Figure 1 Location of groundwater and surface water quality monitoring points (as per EPL 20358)

Table 2: Analytes monitored and frequency - monitoring points 30 – 52 and point 91, as per the EPL 20358 version valid at the time of sampling (version 5 January 2017)

Analyte	Units of measure	Monitoring points							
		30,31		39,40,41,42,43,44		45,46,47,48,49,50,51, 52		91[b]	
		Frequency	sampling method	Frequency	sampling method	Frequency	sampling method	Frequency	sampling method
Aluminium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Ammonia	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Arsenic	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Barium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Benzene	micrograms per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Beryllium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Bicarbonate	milligrams per litre	Special Frequency 1	Grab sample					Monthly	Grab sample
Boron	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Cadmium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Calcium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Chloride	milligrams per litre	Special Frequency 1	Grab sample					Monthly	Grab sample
Chromium	milligrams per litre			Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Cobalt	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Copper	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Dissolved oxygen	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample		
Electrical conductivity	microsiemens per centimetre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Fortnightly	Probe
Ethyl benzene	micrograms per litre[a]	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Fluoride	milligrams per litre							Monthly	Grab sample
Iron	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Lead	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Magnesium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Manganese	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Mercury	milligrams per litre			Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Molybdenum	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Nickel	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Nitrate	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Nitrite	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Nitrogen (total)	milligrams per litre							Monthly	Grab sample
pH	pH			Quarterly	Grab sample	Quarterly	Grab sample	Fortnightly	Probe
Phosphorus (total)	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Potassium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Reactive Phosphorus	milligrams per litre	Special Frequency 1	Grab sample						
Redox potential	millivolts	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Fortnightly	Probe
Selenium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Silica	milligrams per litre			Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Sodium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Sodium Adsorption Ratio	milligrams per litre[c]							Monthly	Grab sample[c]
Standing water level	meters (Australian Height Datum)	Special frequency 8	Special method 5	Special frequency 8	Special method 5	Quarterly	Special method 1		
Strontium (dissolved)	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Sulfate	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Temperature	degrees Celcius							Fornightly	Probe
Toluene	micrograms per litre[a]	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Total alkalinity	milligrams per litre			Quarterly	Grab sample			Monthly	Grab sample
Total dissolved solids	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Fornightly	Probe
Total organic carbon	milligrams per litre	Special Frequency 1	Grab sample					Monthly	Grab sample
Total suspended solids	milligrams per litre							Monthly	Grab sample
Uranium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Vanadium	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Xylene	micrograms per litre[a]	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample
Zinc	milligrams per litre	Special Frequency 1	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Monthly	Grab sample

Notes:

Special Frequency 1 - Quarterly if inflow within 12 hours of purging dry.

Special Frequency 8 - Every 6 hours. Note these monitoring points may form part of AGL's rehabilitation work, and should a monitoring point be rehabilitated, than monitoring will no longer be required from that point.

Special Method 1 - Manual dip Special Method 4 - By calculation Special Method 5 - Automated datalogger

Shaded grey - not required to be analysed

[a]EPL20358 (issued 5 January 2017) contains inconsistancies in the required Units of Measure for Toluene, Ethyl Benzene and Xylene. For consistency with laboratory data BTEX concentrations are reported here in micrograms per litre.

[b]Monitoring Point 91 is only required during periods when the Licensee is utilising the water for irrigation or stock use.

[c] Unit of measure is incorrectly referenced as 'miligrams per litre' - should be 'ratio'. And sampling method is incorrectly assigned as 'grab sample' in EPL - should be 'Special Method 4 - By calculation'

Groundwater and surface water monitoring results

Table 3: September-October 2017 water monitoring results for monitoring point 91

		Monitoring points	91	
		Location	TID[a]	
		Sampled date	20/09/2017[b]	4/10/2017[c]
		Date AGL obtained data	2/10/2017	16/10/2017
Analyte	Units of measure	Limit of reporting		
Aluminium	mg/L	0.01		0.01
Ammonia	mg/L	0.01		0.03
Arsenic	mg/L	0.001		0.002
Barium	mg/L	0.001		0.106
Benzene	µg/L	1		<1
Beryllium	mg/L	0.001		<0.001
Bicarbonate	mg/L	1		115
Boron	mg/L	0.05		0.06
Cadmium	mg/L	0.0001		<0.0001
Calcium	mg/L	1		19
Chloride	mg/L	1		66
Chromium	mg/L	0.001		<0.001
Cobalt	mg/L	0.001		<0.001
Copper	mg/L	0.001		<0.001
Dissolved oxygen[d]	mg/L	0.01		
Electrical conductivity[d]	µS/cm	1	629	665
Ethyl benzene	µg/L	2		<2
Fluoride	mg/L	0.1		0.2
Iron	mg/L	0.05		0.08
Lead	mg/L	0.001		<0.001
Magnesium	mg/L	1		4
Manganese	mg/L	0.001		0.005
Mercury	mg/L	0.0001		<0.0001
Molybdenum	mg/L	0.001		0.007
Nickel	mg/L	0.001		<0.001
Nitrate	mg/L	0.01		0.03
Nitrite	mg/L	0.01		<0.01
Nitrogen (total)	mg/L	0.1		4.4
pH[d]	pH	0.01	6.05	6.38
Phosphorus (total)	mg/L	0.01		0.53
Potassium	mg/L	1		27
Reactive Phosphorus	mg/L	0.01		
Redox potential[d]	mV	0.1	206.7	-9.1
Selenium	mg/L	0.01		<0.01
Silica	mg/L	0.05		2.96
Sodium	mg/L	1		91
Sodium Adsorption Ratio	ratio	0.01		4.95
Standing water level	m AHD	-		
Strontium (dissolved)	mg/L	0.001		0.188
Sulfate	mg/L	1		90
Temperature[d]	°C	0.1	17.7	18.1
Toluene	µg/L	2		<2
Total alkalinity	mg/L	1		115
Total dissolved solids[d]	mg/L	10	410	430
Total organic carbon	mg/L	1		32
Total suspended solids	mg/L	5		107
Uranium	mg/L	0.001		<0.001
Vanadium	mg/L	0.01		<0.01
Xylene	µg/L	2		<2
Zinc	mg/L	0.005		0.008

Key:

Shaded grey = not required to be analysed

[a]TID = Tiedman Irrigation Discharge monitoring point

[b]fortnightly sample

[c]monthly sample

[d]measured with calibrated field meter

na - not analysed as no sample collected

References

AGL, 2012a. Water Management Plan for the Tiedman Irrigation Program AGL.

AGL, 2012b. Soil Quality Monitoring and Management Program.

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

Parsons Brinckerhoff (PB) 2012. Phase 2 Groundwater Investigations – Stage 1 Gas Field Development Area, Gloucester Gas Project. Report dated January 2012, PR_5630. Available online: https://www.agl.com.au/-/media/AGL/About-AGL/Documents/How-We-Source-Energy/Gloucester-Document-Repository/Water-Reports/20120111Phase-2-Groundwater-Investigations--Stage-1-Gas-Field-Development-Area-Appendices-EP.pdf

Parsons Brinckerhoff (PB) 2013a. Gloucester Gas Project – Tiedman Irrigation Trial Baseline Water Monitoring Program. Report dated January 2013, 2162406D PR_6306. Report prepared by PB for AGL Upstream Investments Pty Ltd.

Parsons Brinckerhoff (PB) 2013b. Tiedman Irrigation Trial – August 2013 Water Compliance Report, Gloucester Gas Project. Report dated August 2013, 2162406F-WAT-RTP-7408 RevC. Report prepared by PB for AGL Upstream Investments Pty Ltd.

Parsons Brinckerhoff (PB) 2014a. Tiedman Irrigation Program – Water Compliance Report for the Period 1 July to 31 December 2013, Gloucester Gas Project. Report dated January 2014, 2162406F-WAT-RPT-7674 RevB. Report prepared by PB for AGL Upstream Investments Pty Ltd.

Parsons Brinckerhoff (PB) 2014b. Tiedman Irrigation Program – Water Compliance Report for the Period 1 January to 4 July 2014, Gloucester Gas Project. Report dated August 2014, 2162406F-WAT-RPT-7674 001 RevD. Report prepared by PB for AGL Upstream Investments Pty Ltd.

Parsons Brinckerhoff (PB) 2015a. Tiedman Irrigation Program – Water Compliance Report for the Period 1 January to 3- June 2015, Gloucester Gas Project. Report dated 13 August 2015, 2268517A-WAT-RPT-001 Rev C. Report prepared by PB for AGL Upstream Investments Pty Ltd.

Parsons Brinckerhoff (PB) 2015b. Tiedman Irrigation Program – Water Compliance Report for the Period 5 July – 31 December 2014, Gloucester Gas Project. Report dated February 2015, 2268517B-WAT-RPT-001 Rev D. Report prepared by PB for AGL Upstream Investments Pty Ltd.

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/licensing/130742reqpubpmdata.pdf