

The logo consists of the text "Energy in action.™" in a blue sans-serif font, positioned within a large, light brown rounded rectangle. Below this rectangle are three smaller, overlapping light brown shapes: a small square on the left, a medium square in the center, and a small square on the right. At the bottom right of these shapes is the AGL logo, which features a blue square with a white sunburst icon and the letters "AGL" in white.The AGL logo is a blue square containing a white sunburst icon and the letters "AGL" in white.

AGL UPSTREAM INVESTMENTS PTY LTD

GLOUCESTER GAS PROJECT

**December 2015 Monitoring Report:  
Tiedman Irrigation Program  
EPL 20358**

Reporting Period: November 2015

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): 1300 799 716



## Foreword

<b>PREMISES</b>	Gloucester Coal Seam Gas Project Bucketts Way Gloucester NSW 2422
<b>LICENCE DETAILS</b>	<u><a href="#">Environment Protection Licence 20358</a></u>
<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>	16, 17, 18, and 19 November 2015
<b>MONITORING BY</b>	Parsons Brinckerhoff, on behalf of AGL
<b>ANALYSIS BY</b>	ALS Laboratory, Smithfield (Work orders: ES1536395, ES1536521, ES1536682)
<b>DATE AGL OBTAINED DATA</b>	11 December 2015
<b>REPORT DATE</b>	30 December 2015
<b>REPORT PREPARED BY</b>	Nicola Fry, 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 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.

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:

1. Monitoring results from the quarterly water sampling event at the Tiedman Irrigation Program (16 – 19 November 2015).

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 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).

The following sampling methods were used to obtain surface water and groundwater samples:

- Submersible 12V pump at the groundwater monitoring bores screened within relatively permeable geological materials: TMB01, TMB02 and TMB03. A minimum of three well volumes was purged prior to sampling.
- Submersible 12V pump at the seepage monitoring bores TMB04 and TMB05 which are screened within material of very low permeability. The physical parameters of the purged groundwater were initially tested, then the bores were purged dry and if any inflow was observed within 12 hours then physical parameters were tested again and a sample taken for analysis.
- Disposable bailer at the shallow perched soil water piezometers (with piezometers purged dry and if any inflow was observed within 12 hours then physical parameters were tested again and a sample taken for analysis).
- In-situ snap sampler for groundwater monitoring bore S4MB01, screened within material of relatively low permeability.
- Grab sample using a telescopic sampler for surface water and dam water samples.

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 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](http://agl.com.au/Gloucester)

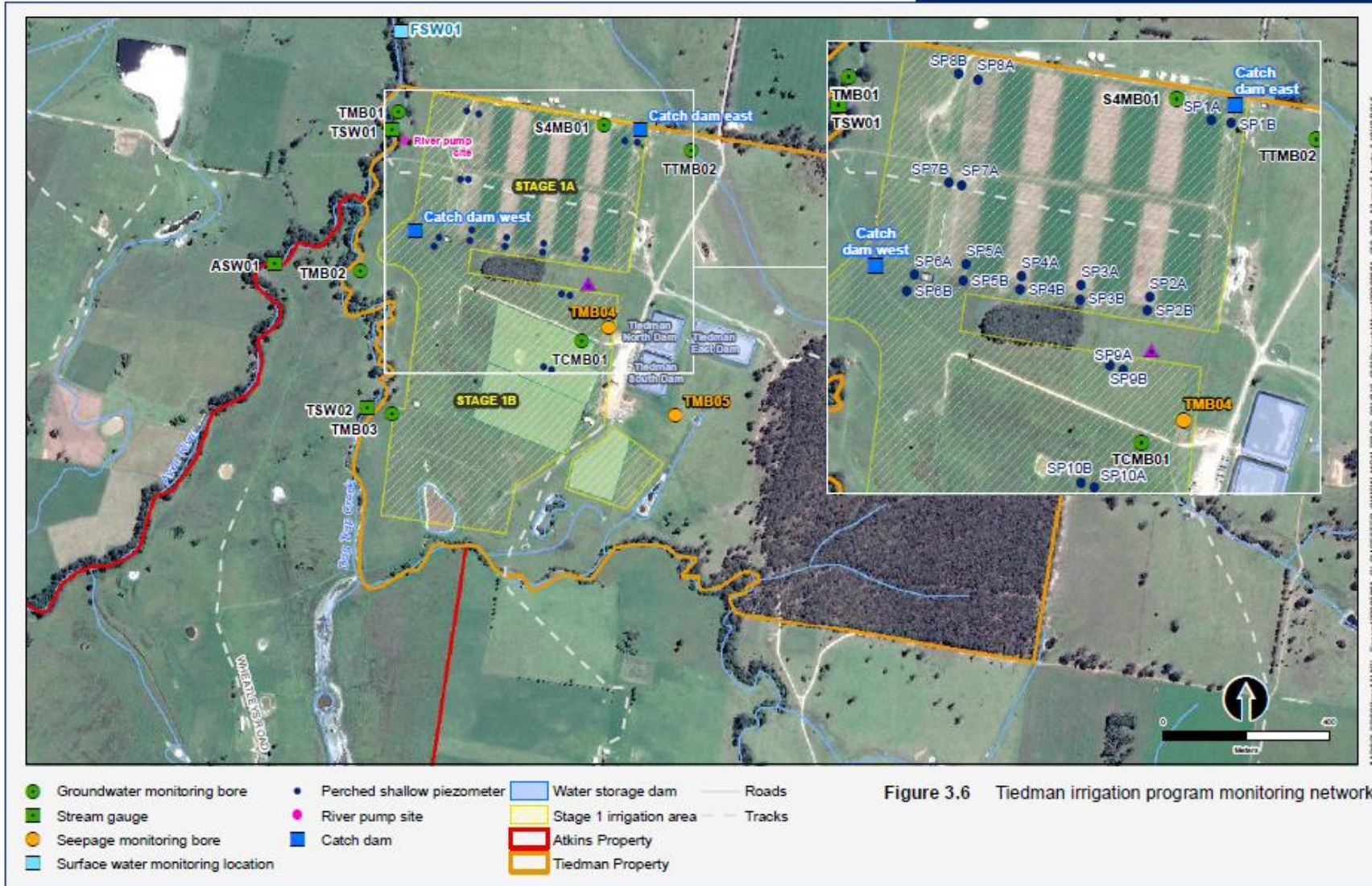


**Table 1: Water quality monitoring points: Irrigation Program (as per EPL 20358)**

EPA ID no.	Monitoring Point	Type of monitoring point	Easting (m)	Northing (m)
27	TND	Produced water storage dam	Tiedman property	
28	TSD	Produced water storage dam	Tiedman property	
29	TED	Produced water storage dam	Tiedman property	
30	TMB04	Groundwater quality monitoring	402558.1	6448921.7
31	TMB05	Groundwater quality monitoring	402650.1	6448725.3
33	CDE	Surface water quality monitoring – catch dam east	Tiedman property	
34	CDW	Surface water quality monitoring – catch dam west	Tiedman property	
35	FSW01	Surface water quality monitoring	402001	6449646
36	ASW01	Surface water quality monitoring	401711.09	6449092.2
37	TSW01	Surface water quality monitoring	401993.98	6449416.7
38	TSW02	Surface water quality monitoring	401922.1	6448740.9
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

Coordinate reference system: Map Grid of Australia 1994

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



**Table 2: Analytes monitored and frequency- monitoring points 27 – 52, as per the EPL 20358 version valid at the time of sampling (version 17 September 2015)**

Analyte	Units of measure	Monitoring points															
		27		28		29		30,31		33,34		35, 36,37,38		39,40,41,42,43,44		45,46,47,48,49,50,51, 52	
		Frequency	sampling method	Frequency	sampling method	Frequency	sampling method	Frequency	sampling method	Frequency	sampling method	Frequency	sampling method	Frequency	sampling method	Frequency	sampling method
Aluminium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Ammonia	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Arsenic	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Barium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Benzene	micrograms per litre <sup>a</sup>					Weekly <sup>b</sup>	Grab sample	Special Frequency 1	Grab sample			Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Beryllium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Bicarbonate	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample								
Boron	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Cadmium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Calcium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Chloride	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample								
Chromium	milligrams per litre									Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Cobalt	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Copper	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Dissolved oxygen	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Electrical conductivity	microsiemens per centimetre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Special Frequency 8	Special method 5	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Ethyl benzene	micrograms per litre <sup>a</sup>					Weekly <sup>b</sup>	Grab sample*	Special Frequency 1	Grab sample			Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Iron	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Lead	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Magnesium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Manganese	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Mercury	milligrams per litre									Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Molybdenum	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Nickel	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Nitrate	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Nitrite	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample			Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
pH	pH	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Phosphorus (total)	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Potassium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Reactive Phosphorus	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample								
Redox potential	millivolts	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Selenium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Silica	milligrams per litre									Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Sodium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Sodium Adsorption Ratio	sodium adsorption ratio			Quarterly	Special Method 4												
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	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Sulfate	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Toluene	micrograms per litre <sup>a</sup>					Weekly <sup>b</sup>	Grab sample*	Special Frequency 1	Grab sample			Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Total alkalinity	milligrams per litre									Each overflow event	Grab sample			Quarterly	Grab sample	Quarterly	Grab sample
Total dissolved solids	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Total organic carbon	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample								
Total suspended solids	milligrams per litre									Each overflow event	Grab sample	Quarterly	Grab sample				
Uranium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Vanadium	milligrams per litre	Quarterly	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample	Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Xylene	micrograms per litre <sup>a</sup>					Weekly <sup>b</sup>	Grab sample*	Special Frequency 1	Grab sample			Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample
Zinc	milligrams per litre							Special Frequency 1	Grab sample	Each overflow event	Grab sample	Special Frequency 10	Grab sample	Quarterly	Grab sample	Quarterly	Grab sample

Notes:  
 Special Frequency 1 - Quarterly if inflow within 12 hours of purging dry.  
 Special Frequency 8 - Every 6 hours  
 Special Frequency 10 - Quarterly, and daily during any discharge from points 33 or 34  
 Special Method 1 - Manual dip                      Special Method 4 - By calculation  
 Special Method 5 - Automated datalogger  
 Shaded grey - not required to be analysed

<sup>a</sup>EPL20358 (issued 17 September 2015) contains inconsistencies in the required Units of Measure for Benzene, Toluene, Ethyl Benzene and Xylene. For consistency with laboratory data BTEX concentrations are reported here in micrograms per litre.  
<sup>b</sup>Weekly sampling from Monitoring Point 29 (Tiedman East Dam) only required if/when flowback water from the Waukivory Pilot Project is transferred to TED.



## Groundwater and surface water monitoring results

Table 3: November 2015 water monitoring results for monitoring points 27 – 39

		Monitoring points	27	28	29	30	31	35	36	37	38	39
		Location	TND	TSD	TED	TMB04	TMB05	FSW01	ASW01	TSW01	TSW02	TMB01
		Sampled date	16/11/2015	16/11/2015	16/11/2015	17/11/2015	17/11/2015	17/11/2015	18/11/2015	17/11/2015	17/11/2015	17/11/2015
		Date AGL obtained data	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015
Analyte	Units of measure	Limit of reporting										
Aluminium	mg/L	0.01	0.02	0.03	0.02	0.02	0.07	0.16	0.71	0.21	0.29	<0.01
Ammonia	mg/L	0.01	0.01	0.04	0.03	0.16	0.71	0.03	0.03	0.03	0.05	0.15
Arsenic	mg/L	0.001	0.004	0.009	0.002	0.002	0.002	0.002	<0.001	<0.001	0.001	0.001
Barium	mg/L	0.001	0.182	0.084	0.11	0.072	0.121	0.033	0.035	0.034	0.039	0.236
Benzene	ug/L	1			<1	<1	<1	<1	<1	<1	<1	<1
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bicarbonate	mg/L	1	152	68	148	104	41					
Boron	mg/L	0.05	0.09	0.08	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	mg/L	1	51	16	9	87	60	5	7	5	6	219
Chloride	mg/L	0.1	88.5	77.2	133	2050	2330					
Chromium	mg/L	0.001						<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	0.001	<0.001	<0.001	<0.001	0.06	0.068	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.001	<0.001	0.001	<0.001	0.003	<0.001	0.03	<0.001	0.002	0.003	<0.001
Dissolved oxygen <sup>a</sup>	mg/L	0.01	0.45	0.4	0.43	5.43	4.12	7.96	8.81	10.48	4.54	1.57
Electrical conductivity	µS/cm	1	955	850	904	7240	7480	178	169	178	250	8060
Ethyl benzene	ug/L	2			<2	<2	<2	<2	<2	<2	<2	<2
Iron	mg/L	0.05	<0.05	<0.05	<0.05	10.3	64.2	0.57	0.85	0.65	1.03	2.82
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.001	<0.001	<0.001	<0.001
Magnesium	mg/L	1	12	4	4	208	235	3	4	4	6	222
Manganese	mg/L	0.001	0.004	0.002	0.009	10.1	22.1	0.023	0.03	0.038	0.048	1.06
Mercury	mg/L	0.0001						0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.001	0.004	0.032	0.006	0.002	0.002	0.012	<0.001	<0.001	<0.001	0.001
Nickel	mg/L	0.001	0.001	0.004	<0.001	0.028	0.032	0.002	<0.001	0.001	0.002	0.039
Nitrate	mg/L	0.01	<0.01	0.01	<0.01	0.05	<0.01	0.02	0.05	0.02	0.01	0.02
Nitrite	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
pH <sup>a</sup>	pH	0.01	7.86	10.12	9.76	5.93	5.88	6.92	7.17	6.82	6.64	6.53
Phosphorus (total)	mg/L	0.01	0.77	0.41	0.4	0.09	0.11	0.11	0.1	0.17	0.13	0.02
Potassium	mg/L	1	46	56	42	17	14	12	2	3	3	2
Reactive Phosphorus	mg/L	0.01	0.47	<0.01	<0.01	<0.01	<0.01					
Redox potential <sup>a</sup>	mV	0.1	33.2	20.4	43.3	45.4	-31	75.6	92.8	107.4	79	-66.8
Selenium	mg/L	0.01	<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						14.6	18.8	14.8	11.5	35
Sodium	mg/L	1	113	131	162	1020	987	323	20	23	34	1140
Sodium Adsorption Ratio	ratio	0.01		7.59								
Standing water level	m AHD	-				Refer to table 5	Refer to table 5					Refer to table 5
Strontium (dissolved)	mg/L	0.001	0.391	0.272	0.171	0.993	1	0.063	0.082	0.07	0.086	6.48
Sulfate	mg/L	1	148	180	8	648	246	4	5	4	21	83
Toluene	ug/L	2			<2	<2	<2	<2	<2	<2	<2	<2
Total alkalinity	mg/L	1										427
Total dissolved solids	mg/L	10	562	527	507	4010	4480	228	170	183	302	5410
Total organic carbon	mg/L	1	23	36	41	6	8					
Total suspended solids	mg/L	5						17	11	15	6	
Uranium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
Vanadium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylene	ug/L	2			<2	<2	<2	<2	<2	<2	<2	<2
Zinc	mg/L	0.005				0.168	0.188	0.015	0.005	0.009	0.011	0.015

Shaded grey = not required to be analysed

<sup>a</sup> measured with calibrated field meter

na - not analysed as no sample collected



**Groundwater and surface water monitoring results**

**Table 4: November 2015 water monitoring results for monitoring points 40 – 52**

		Monitoring points														
		40	41	42	43	44	45	46	47	48	49	50	51	52		
		Location	TMB02	TMB03	S4MB01	TCMB01	TTMB02	SP1B <sup>b</sup>	SP2B <sup>b</sup>	SP4B <sup>b</sup>	SP6B <sup>b</sup>	SP7B <sup>b</sup>	SP8B <sup>b</sup>	SP9B <sup>b</sup>	SP10B <sup>b</sup>	
		Sampled date	17/11/2015	17/11/2015	19/11/2015	19/11/2015	19/11/2015	16/11/2015	16/11/2015	16/11/2015	16/11/2015	16/11/2015	16/11/2015	16/11/2015	16/11/2015	
		Date AGL obtained data	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	
Analyte	Units of measure	Limit of reporting														
Aluminium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	na	na	na	na	na	na	na	na	
Ammonia	mg/L	0.01	0.33	0.13	1.57	1.19	0.55	na	na	na	na	na	na	na	na	
Arsenic	mg/L	0.001	0.003	0.004	<0.001	<0.001	<0.001	na	na	na	na	na	na	na	na	
Barium	mg/L	0.001	0.209	0.906	4.2	7.65	0.706	na	na	na	na	na	na	na	na	
Benzene	µg/L	1	<1	<1	<1	<1	<1	na	na	na	na	na	na	na	na	
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	na	na	na	na	na	na	na	na	
Bicarbonate	mg/L	1														
Boron	mg/L	0.05	<0.05	<0.05	0.15	<0.05	<0.05	na	na	na	na	na	na	na	na	
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	na	na	na	na	na	na	na	na	
Calcium	mg/L	1	184	148	294	254	191	na	na	na	na	na	na	na	na	
Chloride	mg/L	0.1														
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	na	na	na	na	na	na	na	na	
Cobalt	mg/L	0.001	0.005	0.002	<0.001	<0.001	<0.001	na	na	na	na	na	na	na	na	
Copper	mg/L	0.001	<0.001	<0.001	<0.001	0.004	<0.001	na	na	na	na	na	na	na	na	
Dissolved oxygen <sup>a</sup>	mg/L	0.01	2.56	2.19	1.9	1.29	3.65	na	na	na	na	na	na	na	na	
Electrical conductivity	µS/cm	1	3840	5730	4840	3070	2390	na	na	na	na	na	na	na	na	
Ethyl benzene	µg/L	2	<2	<2	<2	<2	<2	na	na	na	na	na	na	na	na	
Iron	mg/L	0.05	1.31	6.97	0.8	1.66	2.11	na	na	na	na	na	na	na	na	
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	na	na	na	na	na	na	na	na	
Magnesium	mg/L	1	125	89	53	73	53	na	na	na	na	na	na	na	na	
Manganese	mg/L	0.001	1.75	1.08	0.177	0.03	0.098	na	na	na	na	na	na	na	na	
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	na	na	na	na	na	na	na	na	
Molybdenum	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	na	na	na	na	na	na	na	na	
Nickel	mg/L	0.001	<0.001	<0.001	0.002	0.002	<0.001	na	na	na	na	na	na	na	na	
Nitrate	mg/L	0.01	0.01	<0.01	0.03	0.02	0.02	na	na	na	na	na	na	na	na	
Nitrite	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	na	na	na	na	na	na	na	na	
pH <sup>a</sup>	pH	0.01	6.32	6.66	7.35	7.11	6.65	na	na	na	na	na	na	na	na	
Phosphorus (total)	mg/L	0.01	0.04	<0.01	0.06	0.02	0.28	na	na	na	na	na	na	na	na	
Potassium	mg/L	1	2	3	6	5	4	na	na	na	na	na	na	na	na	
Reactive Phosphorus	mg/L	0.01														
Redox potential <sup>a</sup>	mV	0.1	-27.1	-6.6	-179	-154.1	-114.3	na	na	na	na	na	na	na	na	
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	na	na	na	na	na	na	na	na	
Silica	mg/L	0.05	33.9	30.1	26.9	20.6	34.5	na	na	na	na	na	na	na	na	
Sodium	mg/L	1	836	461	673	290	240	na	na	na	na	na	na	na	na	
Sodium Adsorption Ratio	ratio	0.01														
Standing water level	m AHD	-	Refer to table 5	Refer to table 5	Refer to table 5	Refer to table 5	Refer to table 5	na	na	na	na	na	na	na	na	
Strontium (dissolved)	mg/L	0.001	5	3.82	21.3	13.3	2.88	na	na	na	na	na	na	na	na	
Sulfate	mg/L	1	21	229	70	<1	58	na	na	na	na	na	na	na	na	
Toluene	µg/L	2	<2	<2	<2	<2	<2	na	na	na	na	na	na	na	na	
Total alkalinity	mg/L	1	127	413	368	270	348	na	na	na	na	na	na	na	na	
Total dissolved solids	mg/L	10	2480	3360	3230	2430	1710	na	na	na	na	na	na	na	na	
Total organic carbon	mg/L	1														
Total suspended solids	mg/L	5														
Uranium	mg/L	0.001	0.012	<0.001	0.001	<0.001	<0.001	na	na	na	na	na	na	na	na	
Vanadium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	na	na	na	na	na	na	na	na	
Xylene	µg/L	2	<2	<2	<2	<2	<2	na	na	na	na	na	na	na	na	
Zinc	mg/L	0.005	0.018	0.011	<0.005	0.01	0.011	na	na	na	na	na	na	na	na	

Shaded grey = not required to be analysed

<sup>a</sup> measured with calibrated field meter

<sup>b</sup> No water present at this location at the time of sampling

na - not analysed as no sample collected







**Table 5: Continuous monitoring results for monitoring points 30, 31, 33, 34, 39 - 44**

Monitoring point	33	34	30	31	39	40	41	42	43	44
Location	CDE	CDW	TMB04	TMB05	TMB01	TMB02	TMB03	S4MB01	TCMB01	TTMB02
Data type	Electrical conductivity		Standing water level							
Units	µS/cm		mAHD							
Data date range	24/08/2015 – 17/11/2015		08/10/2015 – 16/11/2015		08/10/2015 – 17/11/2015			08/10/2015 – 19/11/2015		
Date data downloaded	17/11/2015	17/11/2015	16/11/2015	16/11/2015	17/11/2015	17/11/2015	17/11/2015	19/11/2015	19/11/2015	19/11/2015
Date data supplied to AGL	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015
Monitoring frequency required by EPL 20358	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
Actual monitoring frequency	Every 1 hour	Every 1 hour	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	2055	2055	159	159	162	163	163	170	170	170
Min. value	15	170	113.2	118.9	102.4	102.6	103.5	112.9	113.7	113.9
Mean value	226	490	113.3	119	102.7	102.7	103.6	113	113.7	114
Median value	233	460	113.3	119	102.7	102.7	103.6	113	113.7	113.9
Max. value	513	1010	113.3	119	103.4	102.9	103.7	113.1	113.8	114



## References

- AGL, 2012a. Water Management Plan for the Tiedman Irrigation Program AGL. Available online: <http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Gloucester/Plans%20and%20Proposals/2013/May/AGL%20WMP%20Tiedman%20Irrigation%20V1%203%20140512%20Final%20Compiled%20LowRes.pdf>
- AGL, 2012b. Soil Quality Monitoring and Management Program. Available online: <http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Gloucester/Plans%20and%20Proposals/2013/May/Gloucester%20Soil%20Management.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>
- 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: <http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Gloucester/Assessments%20and%20Reports/2012/January/PB%20Gloucester%20Groundwater%20Report%20Phase%202%20Appendices%20E-P.pdf>
- Parsons Brinckerhoff (PB) 2013a. Gloucester Gas Project – Tiedman Irrigation Trial Baseline Water Monitoring Program. Report dated January 2013, 2162406D PR\_6306. Available online: [http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Gloucester/Plans%20and%20Proposals/2013/May/Gloucester%20Irrigation\\_PR.pdf](http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Gloucester/Plans%20and%20Proposals/2013/May/Gloucester%20Irrigation_PR.pdf)
- Parsons Brinckerhoff (PB) 2013b. Tiedman Irrigation Trial – August 2013 Water Compliance Report, Gloucester Gas Project. Report dated August 2013, 2162406F-WAT-RTP-7408 RevC. [http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20Community%20News/Gloucester/Community%20Updates/2013/September/2162406F%20WAT%20RPT%207408%20FINAL\\_LowRes.pdf](http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20Community%20News/Gloucester/Community%20Updates/2013/September/2162406F%20WAT%20RPT%207408%20FINAL_LowRes.pdf)
- 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. Available online: [http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Gloucester/Assessments%20and%20Reports/2014/20140131\\_Tiedman%20Irrigation%20Program%20%20%20Water%20Compliance%20Report.pdf](http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Gloucester/Assessments%20and%20Reports/2014/20140131_Tiedman%20Irrigation%20Program%20%20%20Water%20Compliance%20Report.pdf)
- 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. Available online: [http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/Gloucester%20Document%20Repository/Irrigation%20Program/20140828\\_Tiedman%20Irrigation%20Program%20%20%20Water%20Compliance%20Report.pdf](http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/Gloucester%20Document%20Repository/Irrigation%20Program/20140828_Tiedman%20Irrigation%20Program%20%20%20Water%20Compliance%20Report.pdf)
- 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. Available online: [http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/Gloucester%20Document%20Repository/Irrigation%20Program/20150226\\_Tiedman%20Irrigation%20Program%20%20%20Water%20Compliance%20Report.pdf](http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/Gloucester%20Document%20Repository/Irrigation%20Program/20150226_Tiedman%20Irrigation%20Program%20%20%20Water%20Compliance%20Report.pdf)
- 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. Available online: [http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/Gloucester%20Document%20Repository/Irrigation%20Program/20150813\\_Tiedman%20Irrigation%20Program%20%20%20Water%20Compliance%20Report%20for%20the%20Period%201%20Jan%20to%2030%20June%202015.pdf](http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/Gloucester%20Document%20Repository/Irrigation%20Program/20150813_Tiedman%20Irrigation%20Program%20%20%20Water%20Compliance%20Report%20for%20the%20Period%201%20Jan%20to%2030%20June%202015.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/licensing/130742reqpubpmdata.pdf>