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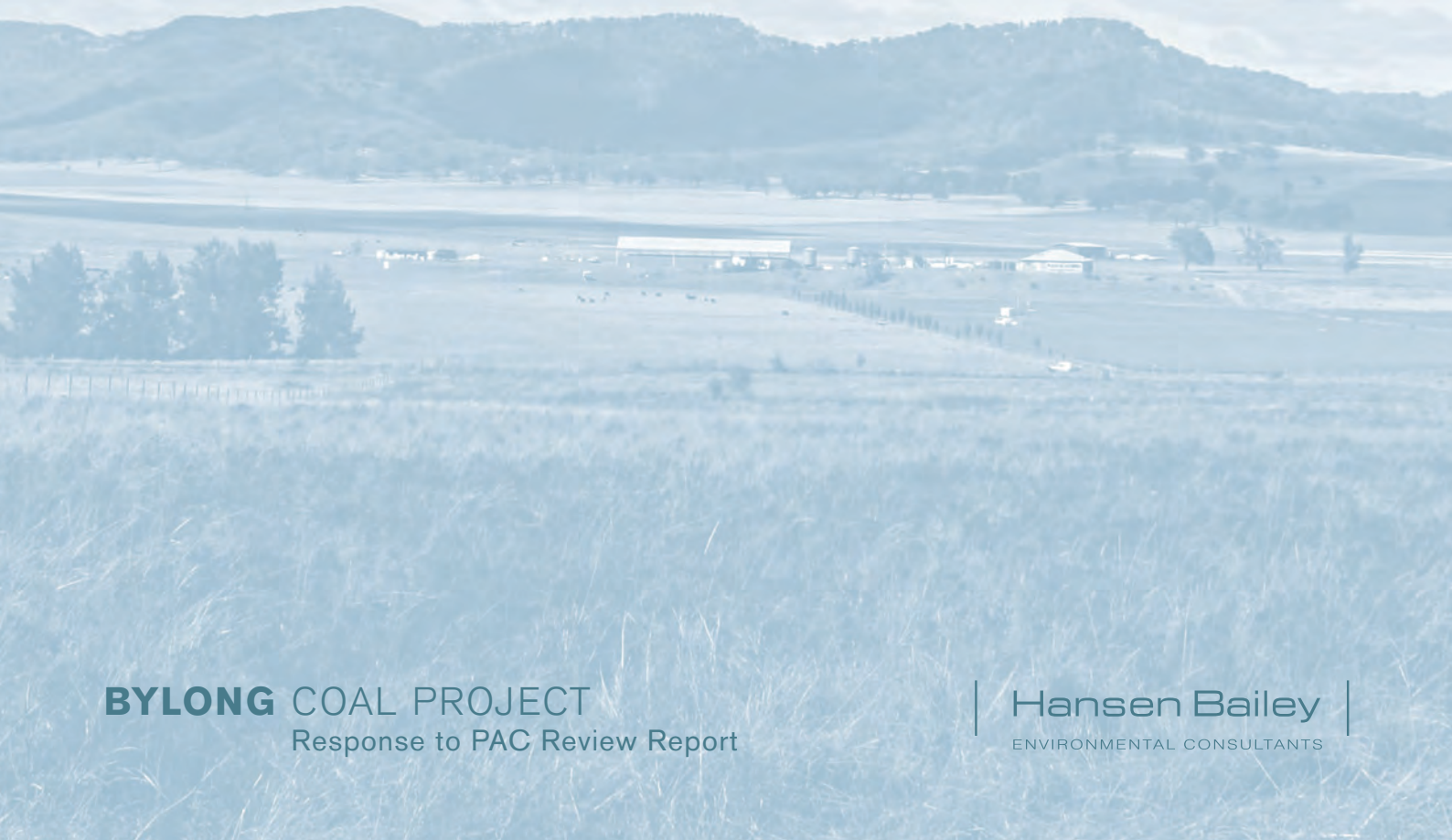
Water Management Plan



BYLONG COAL PROJECT
Response to PAC Review Report

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DRAFT WATER MANAGEMENT PLAN

BYLONG MINE

VERSION: 1

DATE: 18 DECEMBER 2017

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1 PREAMBLE

This draft Water Management Plan (WMP) has been prepared in support of the planning approvals process for the Bylong Coal Project (the Project). This draft Plan is one of a number of draft Environmental Management Plans which have been prepared to provide further information around the proposed management of potential environmental and social issues associated with the Project.

On 27 July 2017, the NSW Planning and Assessment Commission (PAC) issued the PAC Merit Review Report (PAC Review Report) for the Project, which identified a number of issues and concerns with the information provided to-date.

In this regard, the PAC in its Review Report sought further assurances in regard to the mitigation treatments for the Project.

To assist the relevant authorities in the determination stage of the Project, draft Environmental Management Plans have been prepared to provide further information on the proposed environmental management and mitigation measures that will be implemented throughout the life of the Project. The early development of the draft Environmental Management Plans should provide certainty and assurance that effective controls, procedures and processes (surpassing contemporary environmental management within the NSW coal mining industry) will be adequately implemented for the Project to negate any potential risks or impacts to the environment.

Should the Project be approved, the draft Environmental Management Plans will be reviewed and updated in accordance with any final Development Consent conditions issued for the Project. Furthermore, consultation with the relevant regulatory agencies will be undertaken during the review and this draft Plan updated to ensure that any outstanding matters or concerns are adequately addressed. The revised Plan will be submitted to the relevant regulatory agencies, as required, for approval.

2 INTRODUCTION

2.1 BACKGROUND

The Project is a proposed greenfield underground and open cut coal mine located in the Bylong Valley of NSW, which is seeking State Significant Development (SSD) approval to extract up to 6.5 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal for a period of 25 years. Approximately 71% of the coal resource will be extracted via the underground operation with the remaining 29% of coal output extracted via two open cut mining areas. The Project is fully owned by KEPCO Bylong Australia Pty Limited (KEPCO).

The Project is located within the Mid-Western Regional Council (MWRC) Local Government Area (LGA) approximately 55 km to the north-east of Mudgee or 95 km by road. The Project is approximately 230 km by rail from the Port of Newcastle. The regional setting for the Project is shown in **Figure 1**.

This Draft Water Management Plan (the Plan) describes the management and mitigation strategies to be implemented to manage potential impacts to water resources as a result of the Project. This Plan forms part of the Environmental Management Strategy (EMS) for the Project and will form the basis for the management of water reports for the Project.

Figure 1 Locality Plan

2.2 PROJECT DESCRIPTION

Mining is proposed to be undertaken in two open cut mining areas utilising open cut excavator mining techniques supported by trucks and other ancillary mining equipment. Underground mining, using contemporary longwall mining techniques, is anticipated to commence within 7 years from construction.

The key features and components of the proposed Bylong Mine are shown on **Figure 2** and include:

- Two open cut mining areas, Overburden Emplacement Areas (OEAs) and associated haul roads. Open cut mining will be undertaken 24 hours a day, 7 days a week over an approximate 10 year period;
- An administration, workshop, bathhouse, explosives magazine and other open cut mining related facilities;
- An underground coal mine operating 24 hours a day, 7 days a week for an approximate 20 year period, commencing within 7 years from the commencement of construction of the mine;
- Primary access to the underground mine via drifts constructed adjacent to the rail loop and Coal Handling and Preparation Plant (CHPP);
- Facilities to support underground mining operations including access roads, ventilation shafts, workshop, offices and employee amenities, fuel and gas management facilities;
- A CHPP with a designed throughput of approximately 6 Mtpa of ROM, equipped with dewatering technology to facilitate the dewatering of fine rejects material;
- Co-disposal of dewatered fine and coarse reject materials within OEAs and final open cut voids (avoiding the need for a tailings dam);
- A rail loop and associated rail load out facility and connection to the Sandy Hollow to Gulgong Railway Line to facilitate the transport of product coal to the Port of Newcastle;
- Surface and groundwater management and water reticulation infrastructure including diversion drains, dams (clean, dirty and raw water), borefield; pipelines, pumping stations and other required infrastructure;
- Communications and electricity reticulation infrastructure;
- Access road to the Project and related first aid and car parking facilities from the Bylong Valley Way; and
- A Mine Access Road to provide access to the site facilities.

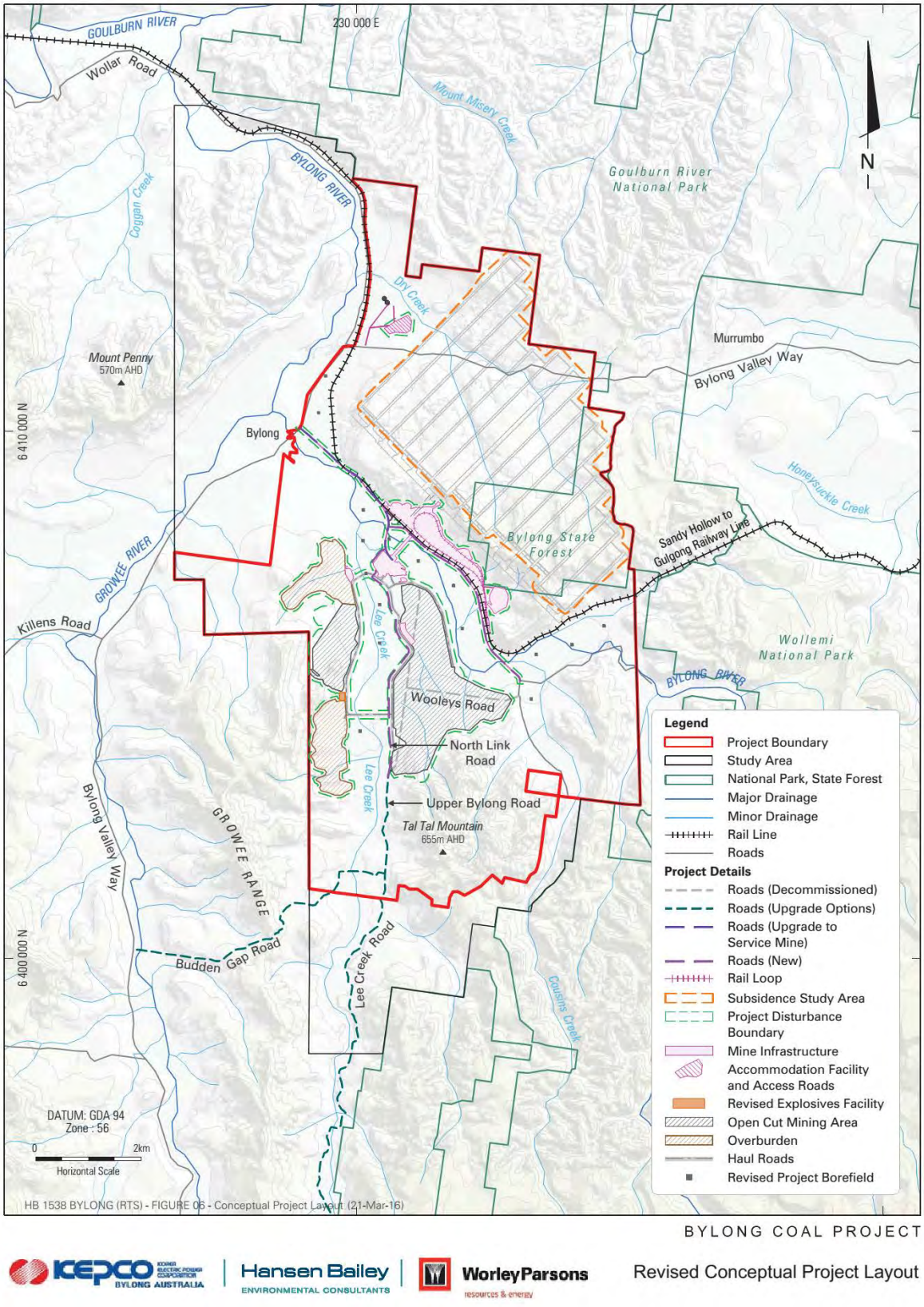

Figure 2 Bylong Mine Layout

2.3 STRUCTURE AND PURPOSE OF THIS DOCUMENT

This Management Plan describes the measures to be implemented to manage and mitigate the potential impacts of the Project on water resources.

This Management Plan is structured as follows:

- **Section 3** identifies where each of the relevant conditions of consent is addressed in the WMP;
- **Section 4** is the Surface Water Management Plan;
- **Section 5** presents the site water balance;
- **Section 6** is a salt balance for the Project;
- **Section 7** is the Groundwater Management Plan;
- **Section 8** provides details of reporting and review requirements for the WMP;
- **Section 9** describes roles and responsibilities for implementation of the WMP;
- **Section 10** provides the revision history of the WMP; and
- **Section 11** lists materials referenced within the WMP.

2.4 CONSULTATION DURING THE PREPARATION OF THIS DOCUMENT

In accordance with Condition 30 of Schedule 4 of the Recommended Development Consent Conditions, this Plan will be prepared in consultation with the NSW Environment Protection Authority (EPA), NSW Department of Primary Industries – Division of Water (DPI-Water), and the Project Community Consultative Committee (CCC).

The Plan will be submitted to the Department of Environmental and Planning (DP&E) for approval.

3 STATUTORY REQUIREMENTS

3.1 DEVELOPMENT CONSENT

This WMP has been developed to satisfy the requirements of the conditions of the Recommended Development Consent. **Table 1** details the conditions relevant to this management plan, and indicates where these have been addressed in the Plan.

Table 1
Development Consent Requirements

Condition	Section Where Addressed
The Water Management Plan, in addition to the standard requirements for management plans (see condition 3 of schedule 6), must include:	-
(b) detailed performance criteria and describe measures to ensure that the Applicant complies with the water management performance measures (see Table 9);	Section 4.7
(i) Site Water Balance that: • includes details of:	-
o sources and security of water supply, including contingency planning for future reporting periods;	Section 5.3, 5.4 & 5.5.3
o water use and management on site, including details of water sharing between neighbouring mining operations (if applicable);	Section 5.3 & 5.5
o any off-site water transfers and discharges;	Section 5.5
o reporting procedures, including the preparation of a site water balance for each calendar year; and	Section 5.5 & 8
• investigates and implements all reasonable and feasible measures to minimise water use on site;	Section 4.3 & 4.4
(ii) Salt Balance that: • includes details of:	Section 6
o sources of saline material on the site;	Section 6
o saline material and saline water management on site;	Section 6
o reporting procedures, including the preparation of a salt balance for each calendar year; and	Section 6 & 8
• investigates and implements all reasonable and feasible measures to minimise short term and long term discharge of saline water from the site;	Section 4.3 & 4.4
(ii) Surface Water Management Plan that includes:	-
• detailed baseline data on surface water flows and quality in the watercourses that could potentially be affected by the development;	Section 4.2
• a program to augment the baseline data over the life of the development;	Section 4.7
• a detailed description of the water management system on site, including the:	Section 4.4
o clean water diversion systems;	Section 4.4.4
o sediment dams and associated infrastructure;	Section 4.4

Condition	Section Where Addressed
o mine water management system;	Section 4.4.1
o flood management;	Section 4.4.5
o reject emplacement and mine water storage within the eastern open cut final void;	Section 4.4.6
• detailed objectives and performance criteria, including trigger levels for investigating any potentially adverse impacts associated with the development for:	Section 4.7
o downstream surface water quality;	Section 4.6
o stream and riparian health in the Growee River, Bylong River to the confluence of the Goulburn River, Lee Creek and Dry Creek;	Section 4.7
o channel stability;	Section 4.7
o design and management for the emplacement of coal reject material and saline, sodic and PAF materials;	Section 4.7
o reinstatement of drainage lines on the rehabilitated areas of the site;	Section 4.7
o control of any potential water pollution from the rehabilitated areas of the site;	Section 4.7
• a program to monitor and report on:	-
o the effectiveness of the mine water management system; and	Section 8
o surface water flows and quality, channel stability, stream and riparian vegetation health of the Growee River, Bylong River, Lee Creek and Dry Creek;	Section 4.7
o the performance measures listed in Table 9;	Section 8
o impacts on water users;	Section 7.3
• reporting procedures for the results of the monitoring program; and	Section 8
• a plan to respond to any exceedances of the trigger levels and/or performance criteria, and mitigate and/or offset any adverse surface water impacts of the development; including measures to provide compensatory water supply to any affected downstream water user under condition 27 of this schedule.	Section 4.8
iv) Groundwater Management Plan that includes:	Section 7
• detailed baseline data on groundwater levels, yield and quality in the region that could be affected by the development, including privately-owned groundwater bores and groundwater dependent ecosystems;	Section 7.2 and report in **Appendix A**
• groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts;	Sections 7.4.2, 7.4.3 & 7.4.4
• a program to monitor and report on:	-
o groundwater inflows to the open cut pits and underground workings, including allocating inflows to relevant water sources;	Section 7.3.6

Condition	Section Where Addressed
o the seepage/leachate from water storages, emplacements, backfilled voids, and final voids;	Section 7.3.5
o the impacts of the development on:	-
▪ regional and local (including alluvial) aquifers;	Section 7.4
▪ groundwater supply of potentially affected landowners;	Section 7.4.7
▪ groundwater dependent ecosystems, stygofauna and riparian vegetation;	Section 7.3.7
▪ base flow to surface water sources;	Sections 7.3.6
• a borefield management plan, that includes a detailed description of the borefield and measures to minimise the impact of the borefield on alluvial aquifers, groundwater users and the environment;	Sections 7.3.6
• a program to validate and peer review the groundwater model for the development every 3 years and compare monitoring results with modelled predictions; and	Sections 7.4.6
• a plan to respond to any exceedances of the trigger levels and/or performance criteria, and mitigate and/or offset any adverse groundwater impacts of the development, including measures to provide compensatory water supply to any affected groundwater users under condition 27 of this schedule.	Sections 7.4.7 & 7.4.8

4 SURFACE WATER MANAGEMENT PLAN

4.1 DRAINAGE NETWORK

The Project is located within the catchment of the Bylong River, a tributary of the Goulburn River, which in turn is a tributary of the Hunter River. The drainage network in the area of interest is shown in Figure 3. The Bylong River drains generally northwards, from the south-east, and passes between the proposed Eastern Open Cut Mining Area and the Coal Handling and Preparation Plant (CHPP) and the Underground Mine Infrastructure Area. A number of tributaries feed into the Bylong River in the vicinity of the Project, including:

- Cousins Creek;
- Lee Creek;
- Growee River;
- Dry Creek; and
- Coggan Creek.

The primary areas of disturbance for the Project are in the upper reaches of the Dry Creek catchment, where underground mining will occur, and within a small part of the Lee Creek and the Bylong River catchments where the open cut mining areas pits and associated infrastructure are located. The remaining tributaries are not affected by the Project.

The headwaters of the Bylong River catchment are typically steep and well vegetated and include areas of State Forest, such as the Nullo Mountain State Forest. In the lower portions of the catchment, extensive vegetation clearing has occurred for agricultural use, particularly in alluvial areas adjacent to the river channel. The lower reaches of Lee Creek and the Bylong River consist of a wide, flat floodplain, with a small low-flow channel with complete removal of riparian vegetation along substantial reaches. The main channel of Lee Creek is poorly defined at some locations with significant bank erosion evident in the mid-reaches. The Growee River is a major tributary of the Bylong River which joins the Bylong River just downstream of the Project.

Dry Creek is a tributary of the Bylong River and flows in a general easterly direction before entering the Bylong River approximately 3.1 km north-east of the junction of Bylong Valley Way and Upper Bylong Road. The upper reaches of Dry Creek are located in the Bylong State Forest. Dry Creek is discontinuous with intermittent flow and sections of the creek have no discernible channel. The tributaries of Dry Creek are incised with steep bed grades and minimal riparian vegetation due to clearing for agricultural use. Large sections of the downstream reach of Dry Creek show severe bank erosion and extensive vegetation clearing for agricultural use.

4.2 BASELINE DATA

4.2.1 Surface water monitoring locations

Surface water quality and quantity monitoring has been undertaken in the vicinity of the Project since 2012. Surface water monitoring locations are shown in **Figure 3**.

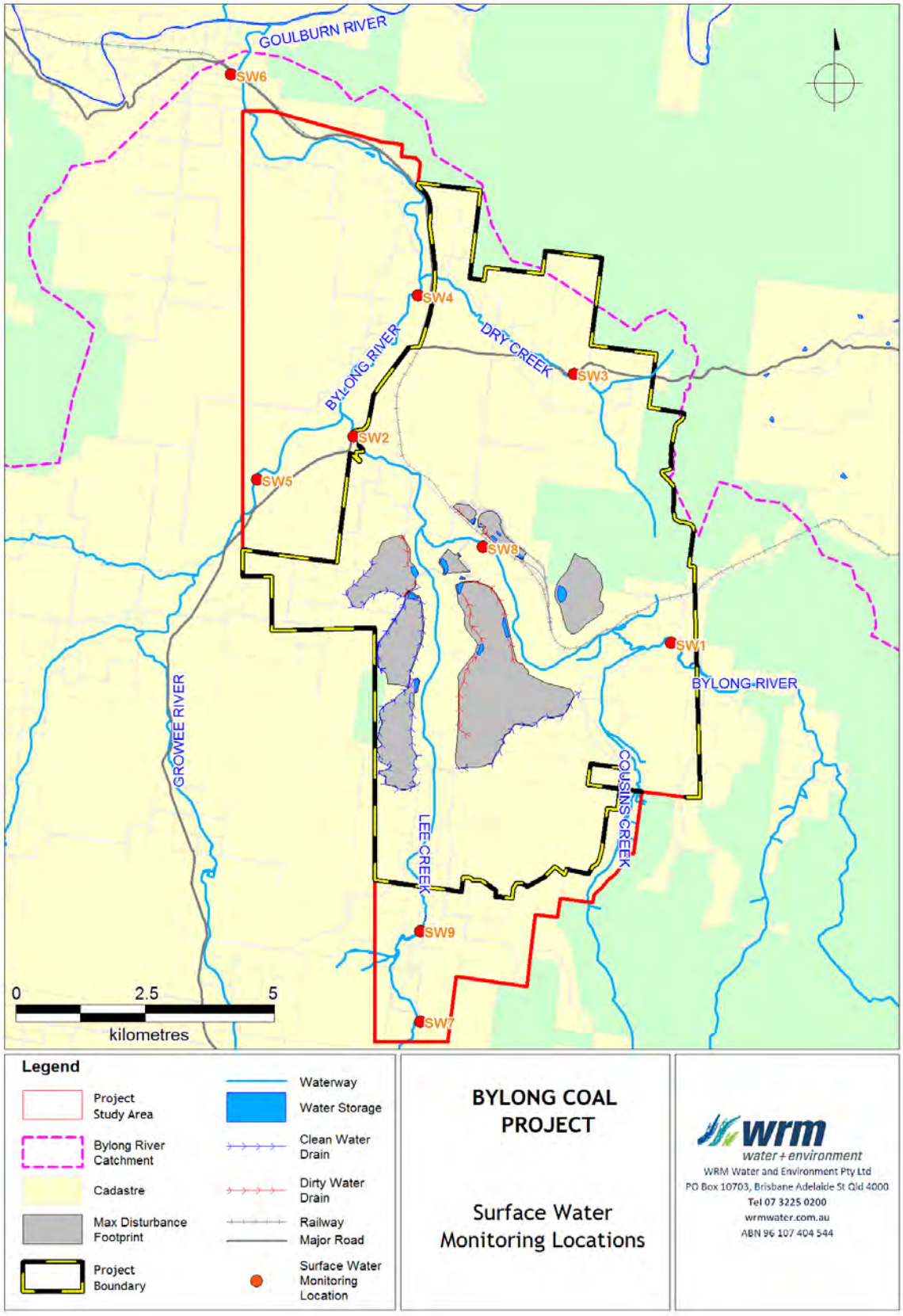

Figure 3 Surface water monitoring locations

4.2.2 Baseline surface water data – water quantity

Goulburn River

The flow-duration relationship for the Goulburn River is shown in **Figure 4** at Coggan (near the Bylong River confluence) and further downstream at Kerrabee (**Figure 5).**

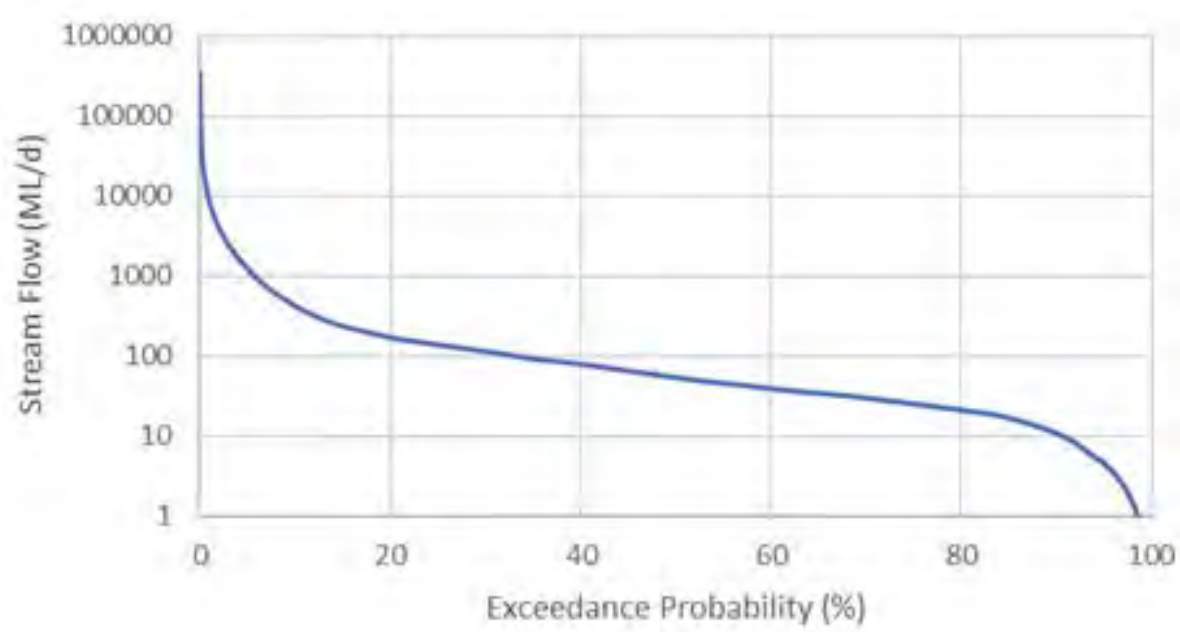

Figure 4 Flow-duration curve for Goulburn River at Coggan #210006, (1912-2017)

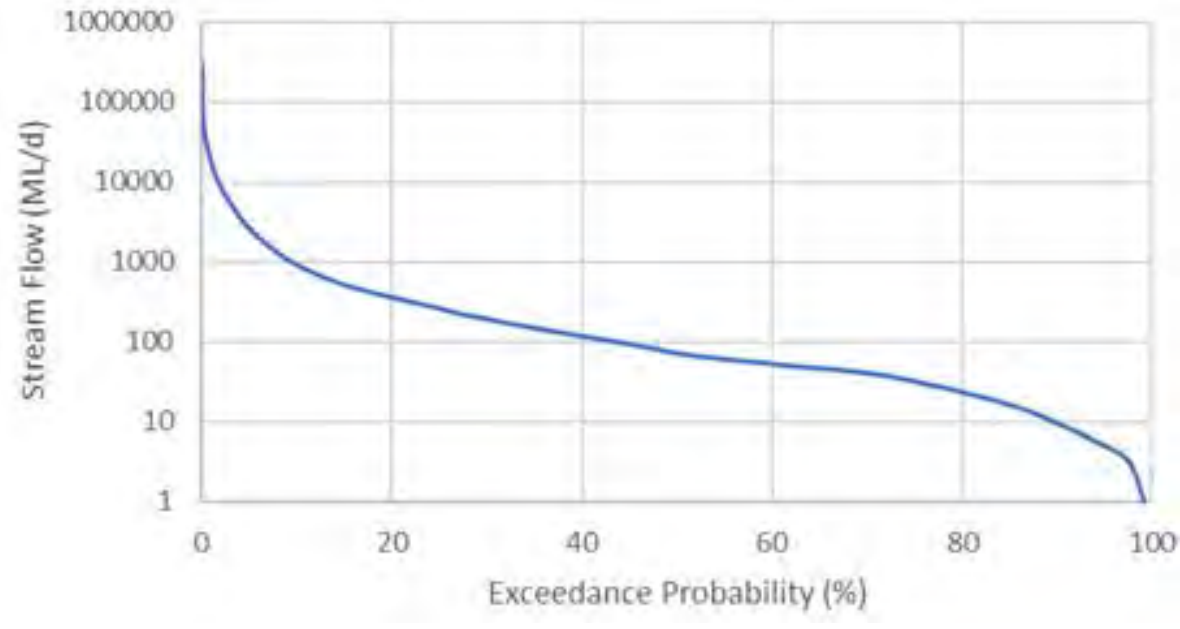

Figure 5 Flow-duration curve for Goulburn River at Kerrabee #210016, (1940-2017)

Bylong River

Surface water flow data has been collected since 2012. Data which has been recorded at three sites (SW4, SW8 and SW9) is shown in **Figure 6**, **Figure 7**, and **Figure 8**, respectively. The monitoring period has included extended times of dry weather with no flow recorded for many months. The dry conditions have affected the reliability of the monitoring equipment due to drying of sensors. As a result, the record of stream flow has numerous periods of missing data.

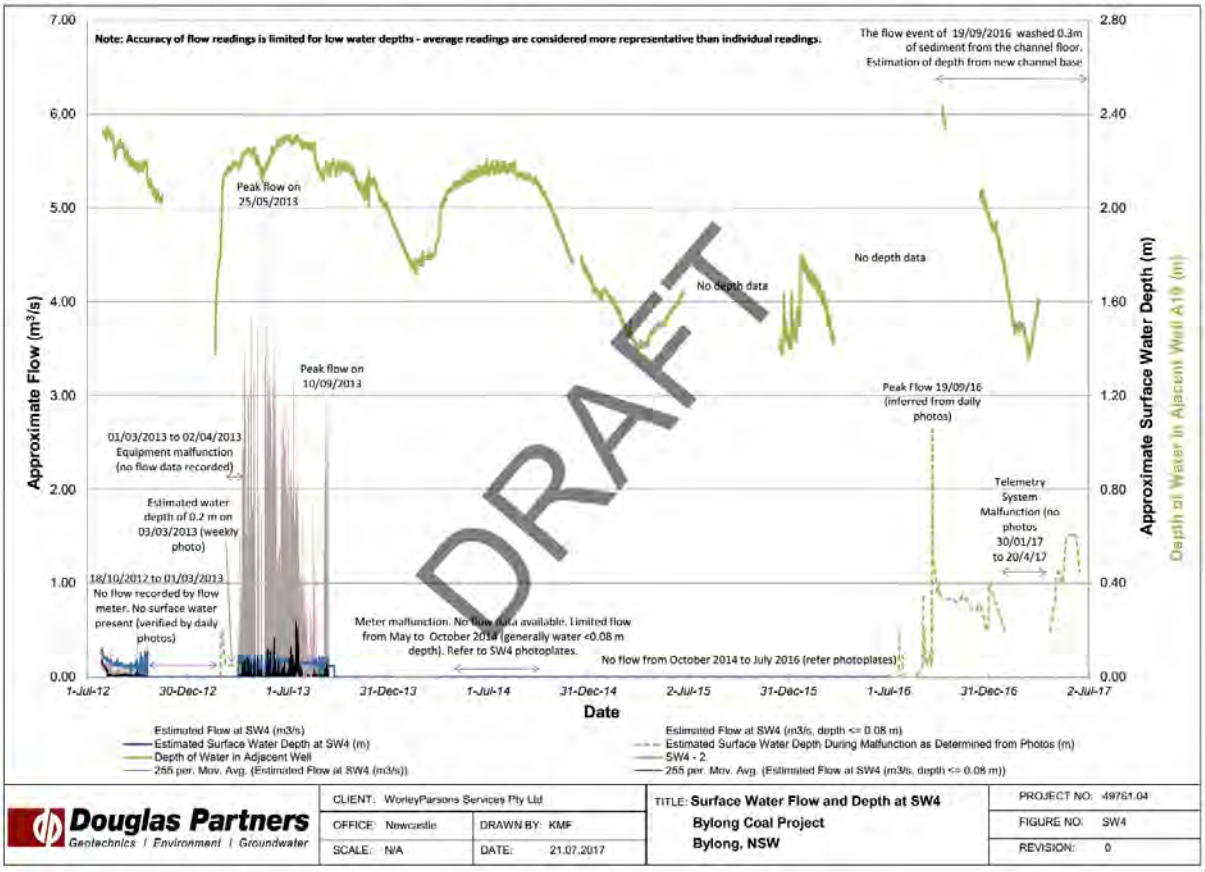

Figure 6 Surface flow monitoring data, SW4

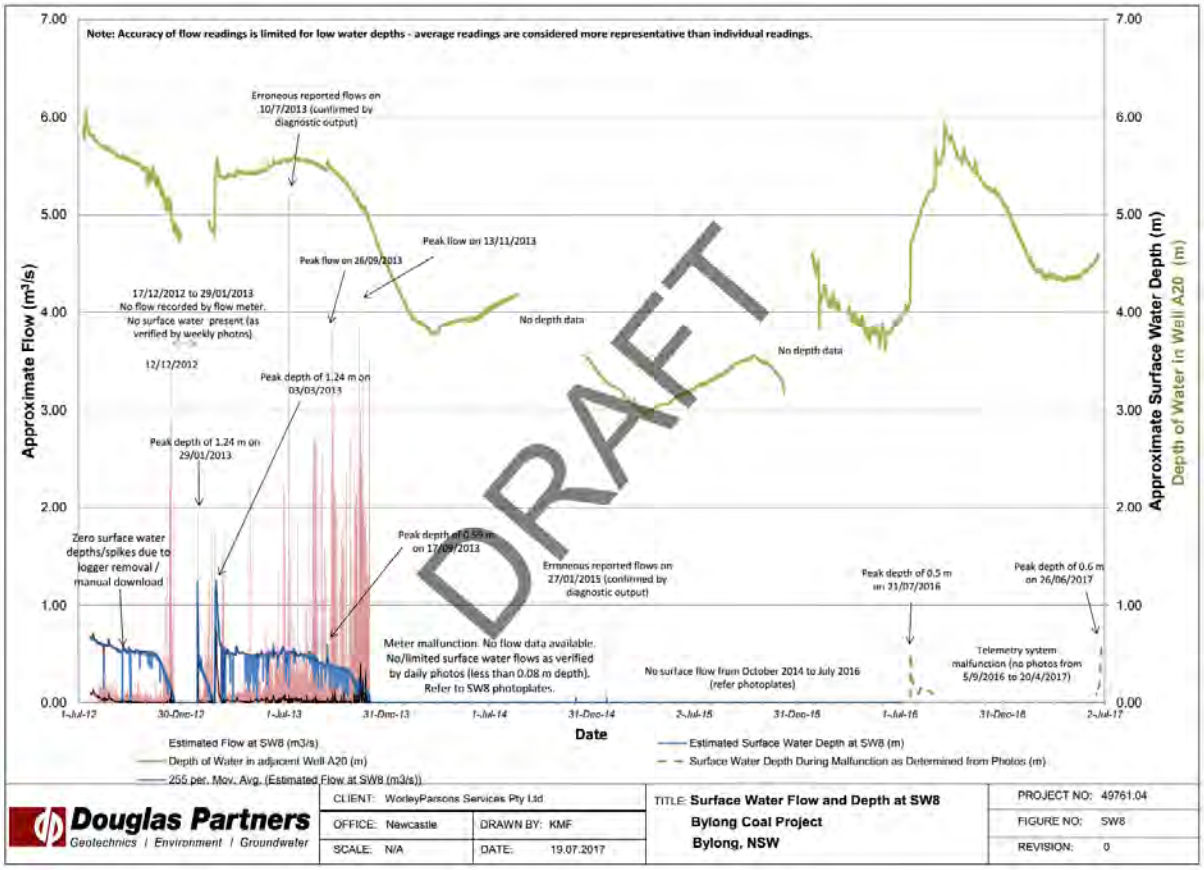

Figure 7 Surface flow monitoring data, SW8

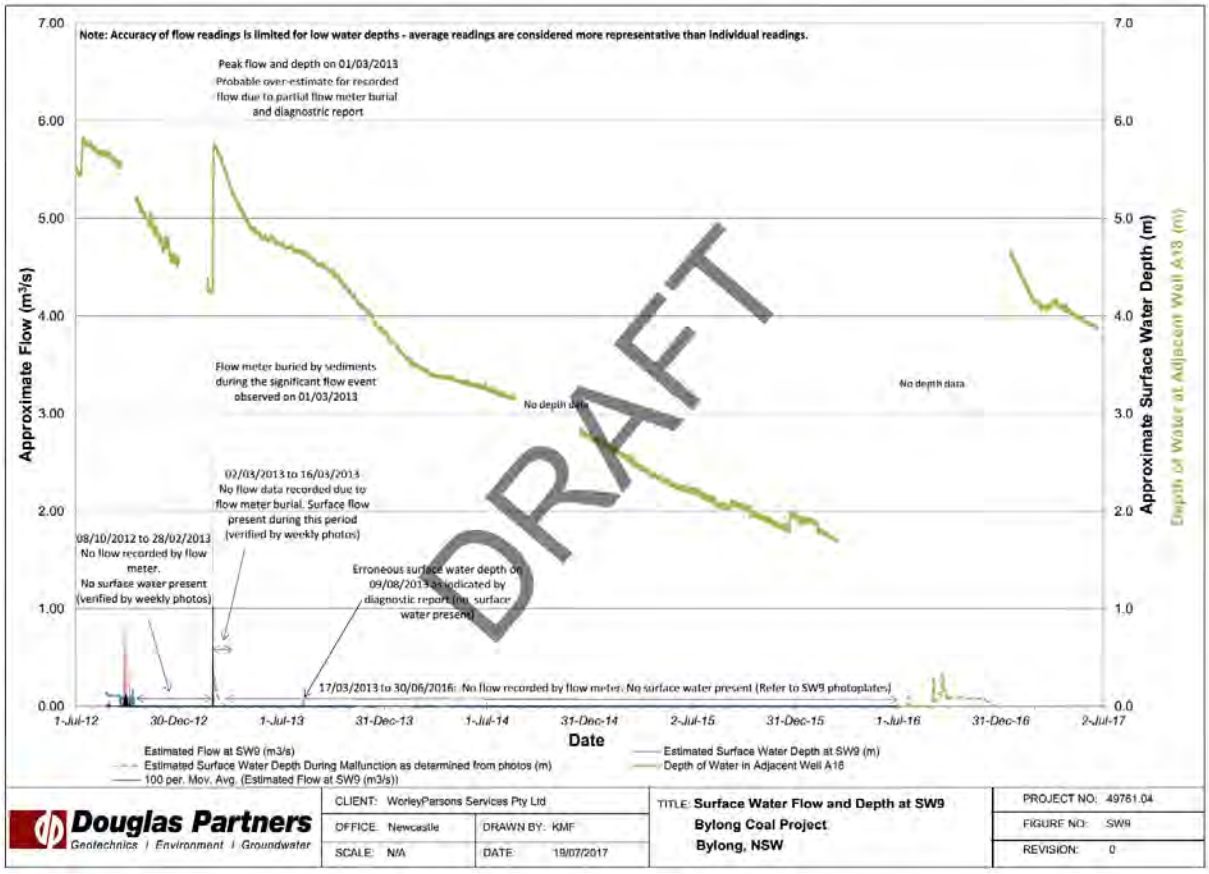

Figure 8 Surface flow monitoring data, SW9

4.2.3 Baseline surface water data – water quality

Goulburn River

Recorded electrical conductivity (EC) values for the Goulburn River at Coggan (near the Bylong River confluence) and at Kerrabee (further downstream) are provided in **Figure 9** and **Figure 10**. These figures also show the Australian and New Zealand Environment Control Council (ANZECC 2000) water quality objectives for ecosystem protection and irrigation.

Bylong River catchment

A statistical summary of recorded surface water quality data for the Bylong River and its tributaries is provided in **Table 2**.

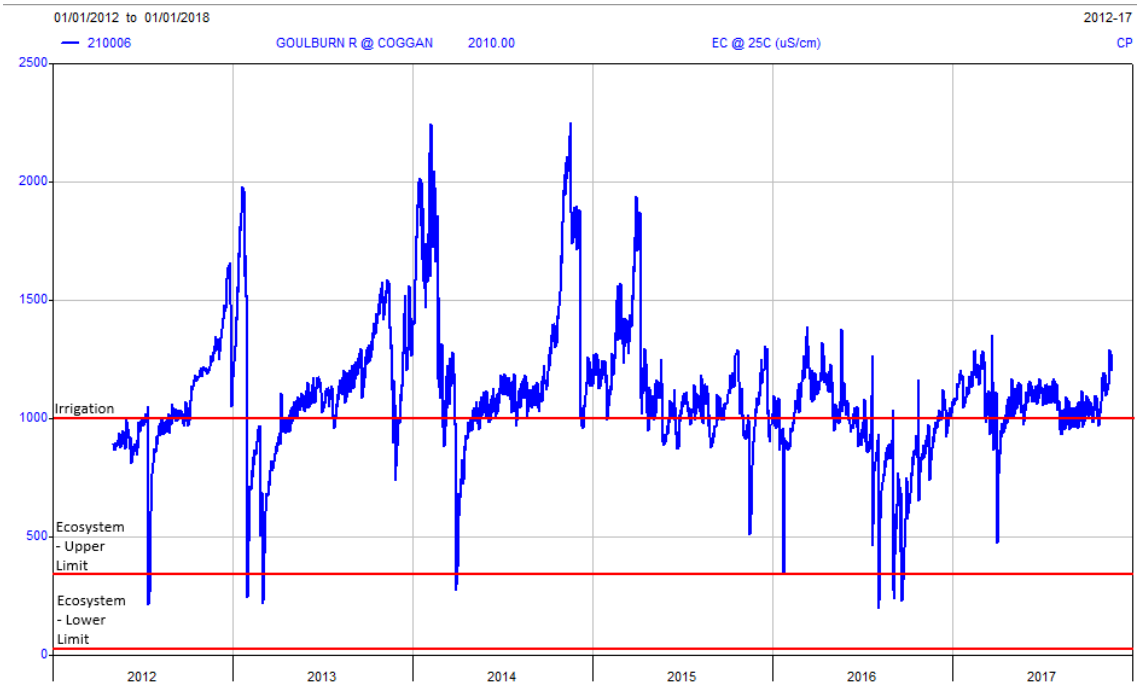

Figure 9 EC for Goulburn River at Coggan (2012-2017)

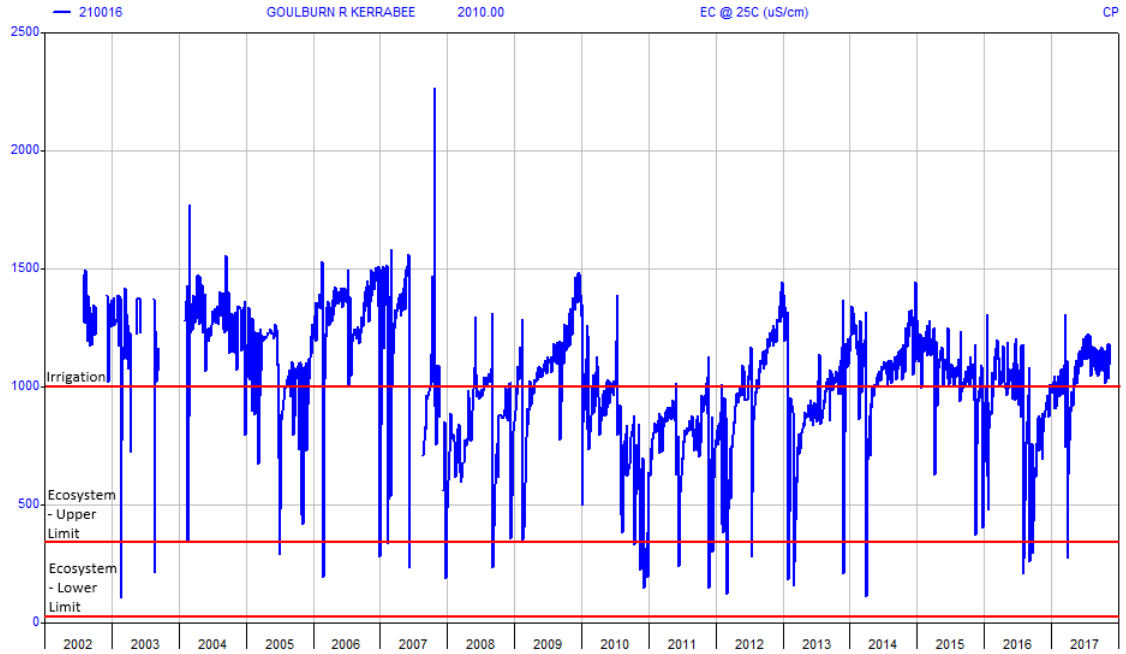

Figure 10 EC for Goulburn River at Kerrabee (2002-2017)

Table 2 Statistical summary of Bylong River surface water quality data (mg/L)

Water Quality Parameter		Sampling Site							
		Bylong River					Lee Creek		Dry Creek
		SW1	SW2	SW4	SW6	SW8	SW7	SW9	SW3
pH (field)	Min	6.8	7.3	6.2	7.2	6.8	7.0	7.0	7.4
	20%ile	7.0	7.5	7.3	7.7	7.3	7.3	7.1	7.7
	Median	7.5	7.9	7.6	8.0	7.6	7.6	7.4	8.1
	80%ile	7.9	8.3	8.0	8.3	8.0	8.0	7.7	8.5
	Max	8.5	8.5	8.3	8.6	8.2	8.3	7.8	8.6
	No. Samples	18	12	62	26	18	7	5	9
EC (field)	Min	120	240	380	480	240	160	160	330
	20%ile	157	336	1469	1319	347	174	207	694
	Median	201	560	1831	1766	578	237	280	933
	80%ile	244	784	2194	2213	809	300	353	1172
	Max	290	920	2300	2300	1000	360	370	1200
	No. Samples	18	12	62	26	18	7	5	9
Turbidity (NTU)	Min	0.6	1.4	0.6	0.9	0.5	1.4	1.5	0.8
	20%ile	1.5	2.1	<0	<0	<0	0.1	3.8	<0
	Median	6.3	6.0	12.4	18.2	19.1	13.1	17.3	20.9
	80%ile	11.0	9.9	31.8	43.5	74.0	26.1	30.8	49.5
	Max	26.0	16.0	150.0	160.0	280.0	36.0	40.0	99.0
	No. Samples	18	12	62	26	18	7	5	9
Hydroxide (OH^-)	Min	1	1	1	1	1	3	3	1
	20%ile	2	2	2	2	2	3	3	2
	Median	2	2	2	2	2	3	3	2
	80%ile	3	3	3	3	3	3	3	3
	Max	3	3	3	3	3	3	3	3
	No. Samples	18	12	61	26	18	7	5	9
Carbonate (CO_3^{2-})	Min	1	1	1	1	1	3	3	1
	20%ile	2	<0	1	<0	2	3	3	1
	Median	2	4	3	6	2	3	3	11
	80%ile	3	8	4	13	3	3	3	21
	Max	3	19	17	27	3	3	3	33
	No. Samples	18	12	61	26	18	7	5	9
Bicarbonate (HCO_3-)	Min	28	61	110	120	65	42	43	100
	20%ile	41	100	290	269	111	48	63	219
	Median	56	157	348	338	183	75	97	311
	80%ile	71	213	406	407	254	101	131	404
	Max	87	240	430	430	310	140	150	440
	No. Samples	18	12	61	26	18	7	5	9
Total Alkalinity	Min	28	61	110	120	65	42	43	100
	20%ile	41	100	291	272	111	48	63	220
	Median	56	158	348	342	183	75	97	320
	80%ile	71	217	406	412	254	101	131	420
	Max	87	240	430	430	310	140	150	470
	No. Samples	18	12	62	26	18	7	5	9
Chloride (Cl)	Min	16	23	47	64	26	17	17	41
	20%ile	20	38	223	215	37	19	18	68
	Median	25	70	290	302	67	22	21	99
	80%ile	30	101	357	390	96	26	24	129
	Max	35	120	400	440	140	27	27	140
	No. Samples	18	12	61	26	18	7	5	9

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Table 2 continued

Water Quality Parameter		Sampling Site							
		Bylong River					Lee Creek		Dry Creek
		SW1	SW2	SW4	SW6	SW8	SW7	SW9	SW3
Ammonia (NH_3) as N	Min	0.003	0.003	0.003	0.003	0.003	0.003	0.019	0.003
	20%ile	0.000	<0	<0	0.002	<0	0.006	0.021	<0
	Median	0.007	0.057	0.070	0.011	0.053	0.014	0.036	0.014
	80%ile	0.013	0.193	0.379	0.021	0.150	0.022	0.051	0.027
	Max	0.030	0.570	2.900	0.040	0.490	0.030	0.067	0.055
	No. Samples	18	12	62	26	18	7	5	9
NOx (NO_2-+NO_3-)	Min	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	20%ile	<0	<0	<0	0.003	<0	0.008	0.031	<0
	Median	0.123	0.087	0.356	0.028	0.100	0.080	0.107	2.092
	80%ile	0.280	0.190	2.300	0.054	0.277	0.153	0.182	6.293
	Max	0.77	0.40	18.00	0.10	0.83	0.20	0.20	15.00
	No. Samples	18	12	61	26	18	7	5	9
Sulphate (SO_4^{2-})	Min	2	8	19	29	4	3	3	6
	20%ile	2	13	181	130	5	4	7	3
	Median	4	26	244	184	12	9	13	19
	80%ile	6	40	307	238	20	15	20	36
	Max	10	51	370	260	45	18	24	69
	No. Samples	18	12	61	26	17	7	5	9
Calcium	Min	4	12	19	25	11	7	8	13
	20%ile	5	18	88	71	18	8	12	22
	Median	7	31	111	92	30	12	19	29
	80%ile	10	44	135	114	42	15	26	36
	Max	13	51	150	120	52	17	28	39
	No. Samples	18	12	61	26	17	7	5	9
Potassium	Min	2.3	4.6	5.3	5.3	4.3	2.5	2.8	3.2
	20%ile	2.5	4.8	6.3	6.8	4.5	2.7	3.4	4.7
	Median	2.9	5.9	8.4	8.4	5.9	3.0	4.8	6.7
	80%ile	3.4	6.9	10.5	10.0	7.3	3.2	6.2	8.7
	Max	4.5	8.9	17.0	13.0	11.0	3.4	7.4	12.0
	No. Samples	18	12	61	26	17	7	5	9
Sodium	Min	13	21	33	43	22	12	13	40
	20%ile	15	32	148	143	33	13	15	101
	Median	19	52	191	205	60	18	19	140
	80%ile	24	72	235	267	87	22	23	179
	Max	28	88	250	300	120	26	24	180
	No. Samples	18	12	61	26	17	7	5	9
Magnesium	Min	4	8	15	19	8	7	7	10
	20%ile	6	14	71	63	14	8	9	21
	Median	8	24	90	88	23	10	13	30
	80%ile	10	33	110	112	33	12	17	40
	Max	13	42	120	130	43	13	19	46
	No. Samples	18	12	62	26	18	7	5	9
Total Phospherus	Min	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	20%ile	0.03	0.03	<0	0.02	<0	0.03	0.03	0.01
	Median	0.03	0.07	0.25	0.05	0.12	0.03	0.06	0.03
	80%ile	0.03	0.12	0.94	0.09	0.24	0.03	0.08	0.05
	Max	0.03	0.2	6.3	0.2	0.6	0.03	0.1	0.1
	No. Samples	18	12	62	26	18	7	5	9

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Table 2 continued

Water Quality Parameter		Sampling Site							
		Bylong River					Lee Creek		Dry Creek
		SW1	SW2	SW4	SW6	SW8	SW7	SW9	SW3
Aluminium (Dissolved)	Min	0.0020	0.0040	0.0003	0.0008	0.0020	0.0030	0.0090	0.0020
	20%ile	<0	0.0025	0.0014	0.0014	0.0010	0.0062	0.0048	<0
	Median	0.0267	0.0148	0.0047	0.0053	0.0135	0.0164	0.0278	0.0667
	80%ile	0.0600	0.0270	0.0079	0.0092	0.0260	0.0266	0.0508	0.2070
	Max	0.15	0.044	0.019	0.018	0.042	0.036	0.071	0.51
	No. Samples	18	12	62	26	18	7	5	9
Arsenic (Dissolved)	Min	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	20%ile	0.0005	0.0004	0.0003	0.0003	0.0005	0.0005	0.0004	0.0005
	Median	0.0005	0.0005	0.0006	0.0007	0.0005	0.0005	0.0006	0.0005
	80%ile	0.0005	0.0007	0.0008	0.0010	0.0005	0.0005	0.0008	0.0005
	Max	0.0005	0.0010	0.0020	0.0020	0.0005	0.0005	0.0010	0.0005
	No. Samples	18	12	62	26	18	7	5	9
Barium (Dissolved)	Min	0.006	0.013	0.025	0.039	0.012	0.013	0.016	0.048
	20%ile	0.009	0.021	0.067	0.074	0.019	0.017	0.023	0.054
	Median	0.014	0.034	0.087	0.098	0.029	0.027	0.036	0.070
	80%ile	0.018	0.047	0.107	0.121	0.040	0.038	0.049	0.085
	Max	0.026	0.057	0.160	0.180	0.058	0.045	0.058	0.110
	No. Samples	18	12	62	26	18	7	5	9
Beryllium (Dissolved)	Min	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	20%ile	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0001	0.0001
	Median	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	80%ile	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	Max	0.0003	0.0001	0.0003	0.0001	0.0003	0.0001	0.0001	0.0001
	No. Samples	18	12	62	26	18	7	5	9
Cadmium (Dissolved)	Min	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	20%ile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
	Median	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	80%ile	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	Max	0.0001	0.0001	0.0001	0.0005	0.0002	0.0002	0.0001	0.0001
	No. Samples	18	12	62	26	18	7	5	9
Chromium (Dissolved)	Min	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	20%ile	0.0004	0.0004	0.0005	0.0004	0.0004	0.0005	0.0005	0.0001
	Median	0.0006	0.0006	0.0005	0.0005	0.0005	0.0005	0.0005	0.0008
	80%ile	0.0007	0.0007	0.0005	0.0006	0.0006	0.0005	0.0005	0.0015
	Max	0.0010	0.0010	0.0005	0.0010	0.0010	0.0005	0.0005	0.0030
	No. Samples	18	12	62	26	18	7	5	9
Cobalt (Dissolved)	Min	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	20%ile	0.0004	0.0001	0.0002	0.0005	0.0005	0.0005	0.0007	0.0002
	Median	0.0006	0.0007	0.0007	0.0005	0.0005	0.0005	0.0015	0.0007
	80%ile	0.0007	0.0013	0.0013	0.0005	0.0005	0.0005	0.0023	0.0011
	Max	0.0010	0.0030	0.0040	0.0005	0.0005	0.0005	0.0030	0.0020
	No. Samples	18	12	62	26	18	7	5	9
Copper (Dissolved)	Min	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	20%ile	<0	0.001	<0	0.000	0.001	0.000	<0	0.001
	Median	0.003	0.002	0.002	0.003	0.002	0.002	0.003	0.002
	80%ile	0.005	0.003	0.006	0.006	0.003	0.003	0.006	0.003
	Max	0.014	0.004	0.029	0.013	0.004	0.004	0.010	0.004
	No. Samples	18	12	62	26	18	7	5	9

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Table 2 continued

Water Quality Parameter		Sampling Site							
		Bylong River					Lee Creek		Dry Creek
		SW1	SW2	SW4	SW6	SW8	SW7	SW9	SW3
Iron (Fe^{2+}) (Dissolved)	Min	0.02	0.01	0.01	0.01	0.01	0.04	0.08	0.01
	20%ile	0.04	0.04	<0	0.00	0.03	0.07	0.17	<0
	Median	0.10	0.11	0.10	0.02	0.08	0.13	0.28	0.07
	80%ile	0.15	0.17	0.23	0.04	0.14	0.18	0.39	0.19
	Max	0.23	0.22	1.10	0.10	0.24	0.24	0.45	0.45
	No. Samples	18	12	62	26	18	7	5	9
Lead (Dissolved)	Min	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	20%ile	0.0005	0.0005	0.0002	0.0005	0.0005	0.0005	<0	0.0005
	Median	0.0005	0.0005	0.0006	0.0005	0.0005	0.0005	0.0014	0.0005
	80%ile	0.0005	0.0005	0.0010	0.0005	0.0005	0.0005	0.0031	0.0005
	Max	0.0005	0.0005	0.0030	0.0005	0.0005	0.0005	0.0050	0.0005
	No. Samples	18	12	62	26	18	7	5	9
Manganese (Dissolved)	Min	0.003	0.003	0.010	0.003	0.006	0.012	0.018	0.003
	20%ile	0.019	-0.067	0.066	0.007	-0.005	0.009	0.127	0.000
	Median	0.057	0.077	0.314	0.017	0.084	0.049	0.284	0.005
	80%ile	0.095	0.221	0.561	0.026	0.172	0.088	0.440	0.010
	Max	0.15	0.61	1.50	0.04	0.47	0.12	0.48	0.02
	No. Samples	18	12	62	26	18	7	5	9
Mercury (Dissolved)	Min	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
	20%ile	<0	0.00003	<0	<0	0.00002	0.00003	0.00030	0.00003
	Median	0.00004	0.00003	0.00005	0.00004	0.00003	0.00003	0.00030	0.00003
	80%ile	0.00008	0.00003	0.00013	0.00008	0.00003	0.00003	0.00030	0.00003
	Max	0.00024	0.00003	0.00062	0.00023	0.00005	0.00003	0.00003	0.00003
	No. Samples	18	12	62	26	18	7	5	9
Nickel (Dissolved)	Min	0.002	0.002	0.001	0.001	0.002	0.002	0.003	0.001
	20%ile	0.002	0.002	0.001	0.001	0.002	0.002	0.003	0.001
	Median	0.003	0.003	0.002	0.002	0.003	0.002	0.004	0.002
	80%ile	0.003	0.004	0.003	0.003	0.004	0.002	0.006	0.004
	Max	0.004	0.005	0.004	0.004	0.005	0.003	0.008	0.006
	No. Samples	18	12	62	26	18	7	5	9
Selenium (Dissolved)	Min	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	20%ile	0.0005	0.0005	0.0003	0.0004	0.0005	0.0005	0.0005	0.0005
	Median	0.0005	0.0005	0.0007	0.0005	0.0005	0.0005	0.0005	0.0005
	80%ile	0.0005	0.0005	0.0012	0.0007	0.0005	0.0005	0.0005	0.0005
	Max	0.0005	0.0005	0.0030	0.0010	0.0005	0.0005	0.0005	0.0005
	No. Samples	18	12	62	26	18	7	5	9
Vanadium (Dissolved)	Min	0.0005	0.0005	0.0005	0.0010	0.0005	0.0005	0.0005	0.0005
	20%ile	0.0003	0.0004	0.0003	0.0018	0.0002	0.0003	0.0004	0.0002
	Median	0.0006	0.0008	0.0006	0.0024	0.0008	0.0008	0.0009	0.0010
	80%ile	0.0009	0.0011	0.0009	0.0030	0.0014	0.0013	0.0014	0.0018
	Max	0.0020	0.0020	0.0020	0.0040	0.0030	0.0020	0.0020	0.0030
	No. Samples	18	12	62	26	18	7	5	9
Zinc (Dissolved)	Min	0.002	0.001	0.001	0.001	0.002	0.001	0.004	0.003
	20%ile	0.004	<0	<0	<0	0.005	0.002	<0	0.006
	Median	0.008	0.015	0.010	0.010	0.010	0.005	0.027	0.010
	80%ile	0.011	0.038	0.023	0.020	0.015	0.008	0.061	0.015
	Max	0.01	0.10	0.09	0.06	0.02	0.01	0.10	0.02
	No. Samples	18	12	62	26	18	7	5	9

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4.3 WATER MANAGEMENT STRATEGY

The proposed strategy for the management of surface water at the Project is based on the separation of water from different sources determined by anticipated water quality. The surface water generated within the Project Boundary is categorised into four types, based on water quality:

- 'mine water' – water that has generally come in contact with coal, such as captured groundwater inflows and surface runoff from the open cut mining area or the ROM coal stockpile. This water may contain higher concentrations of salts and other pollutants;
- 'dirty' – surface runoff water from areas that are disturbed by mining operations (including out-of-pit overburden and haul roads). This runoff does not come into contact with coal or other carbonaceous material and may contain high sediment loads, but does not contain contaminated material or high salt concentrations. This runoff must be managed to ensure adequate sediment removal prior to release to receiving watercourses;
- 'clean' – surface runoff from areas unaffected by mining operations and water from alluvial bores. Clean water includes runoff from undisturbed areas and any fully rehabilitated areas; and
- 'contaminated' – surface water from areas potentially containing chemicals of various types used in the mining operations. There are restrictions on the use and release of this water. Contaminated water areas include sumps, service bays and fuel storage areas. Rainfall and resulting runoff from these areas is also possibly contaminated and therefore must be managed to avoid discharge of potentially contaminated water into the natural watercourses. This type of surface water runoff is typically treated prior to being reused in the water management system or pumped out by licensed waste contractors.

The proposed water management strategy for the Project is based on diverting clean water around mining disturbance areas and retaining other types of water on site for recycling and reuse.

The general principles to manage surface water for the Project are as follows:

- maximise the diversion of clean water flows around the mining operations;
- minimise the volume of raw water required from external sources by maximising the recycling of mine affected water;
- achieve and maintain regulatory compliance;
- avoid the discharge of mine-affected water from the site;
- ensure safe and efficient dewatering of the underground mining operations;
- manage sediment affected water (not mine affected) within an Erosion and Sediment Control Plan; and

- seek to protect the environmental values of receiving waters.

Surface water runoff from undisturbed areas will be diverted, wherever possible, around areas disturbed by mining and released from the site, minimising the capture of clean surface runoff. Seepage, groundwater and surface runoff inflows to the open cut mining areas will be collected in onsite storages and used preferentially to satisfy mine site water demands. Surface runoff from OEAs is likely to have high concentrations of suspended sediment and will be captured in sediment dams to improve water quality prior to reuse in the mine water system, potentially released from the site if the water quality is suitable, or overflows when rainfall exceeds the design capacity of the sediment dams. Any controlled release or sediment dam overflow of water will be under an appropriate licence.

4.4 SITE WATER MANAGEMENT SYSTEM

4.4.1 Proposed water management infrastructure and system configuration

Figure 11 to **Figure 14** show indicative locations of the key features of the mine, including infrastructure related to the management of water on the Project site for four different phases of open cut mining (Years 3, 5, 7 and 9). The main components of water-related infrastructure include:

- sediment dams to collect and treat runoff from OEAs;
- dirty water drains to divert sediment-laden runoff from OEAs to sediment dams;
- clean water drains to divert runoff from undisturbed catchments around areas disturbed by mining; and
- a mine-affected water system to store water pumped out of the open cut mining areas and to collect runoff from the CHPP and coal stockpile area.

Note that the Year 9 configuration as shown in **Figure 14** represents conditions in the final years of open cut mining and has been assumed to represent conditions post-open cut mining and during the underground mining operations. However, all OEAs draining to sediment dams are assumed to be fully rehabilitated and runoff from these areas is assumed to be suitable for release to the downstream environment.

The Eastern Void within the Eastern open cut mining area and its associated catchment will remain at the completion of open cut mining for the emplacement of coarse and fine rejects materials by the underground operations from the CHPP and also for the storage of surplus mine water generated during the underground mining operations.

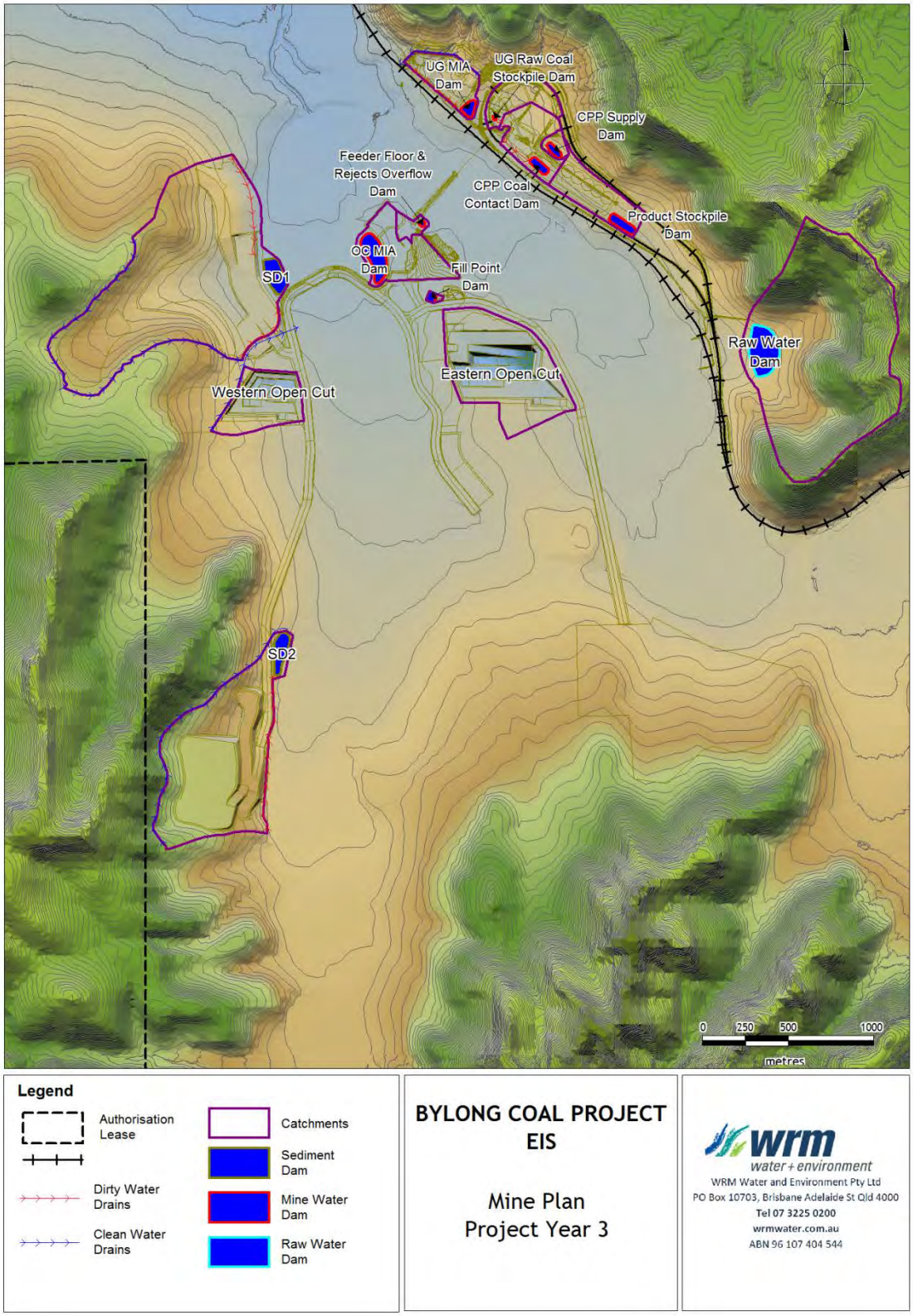

Figure 11 Project Year 3 mine plan

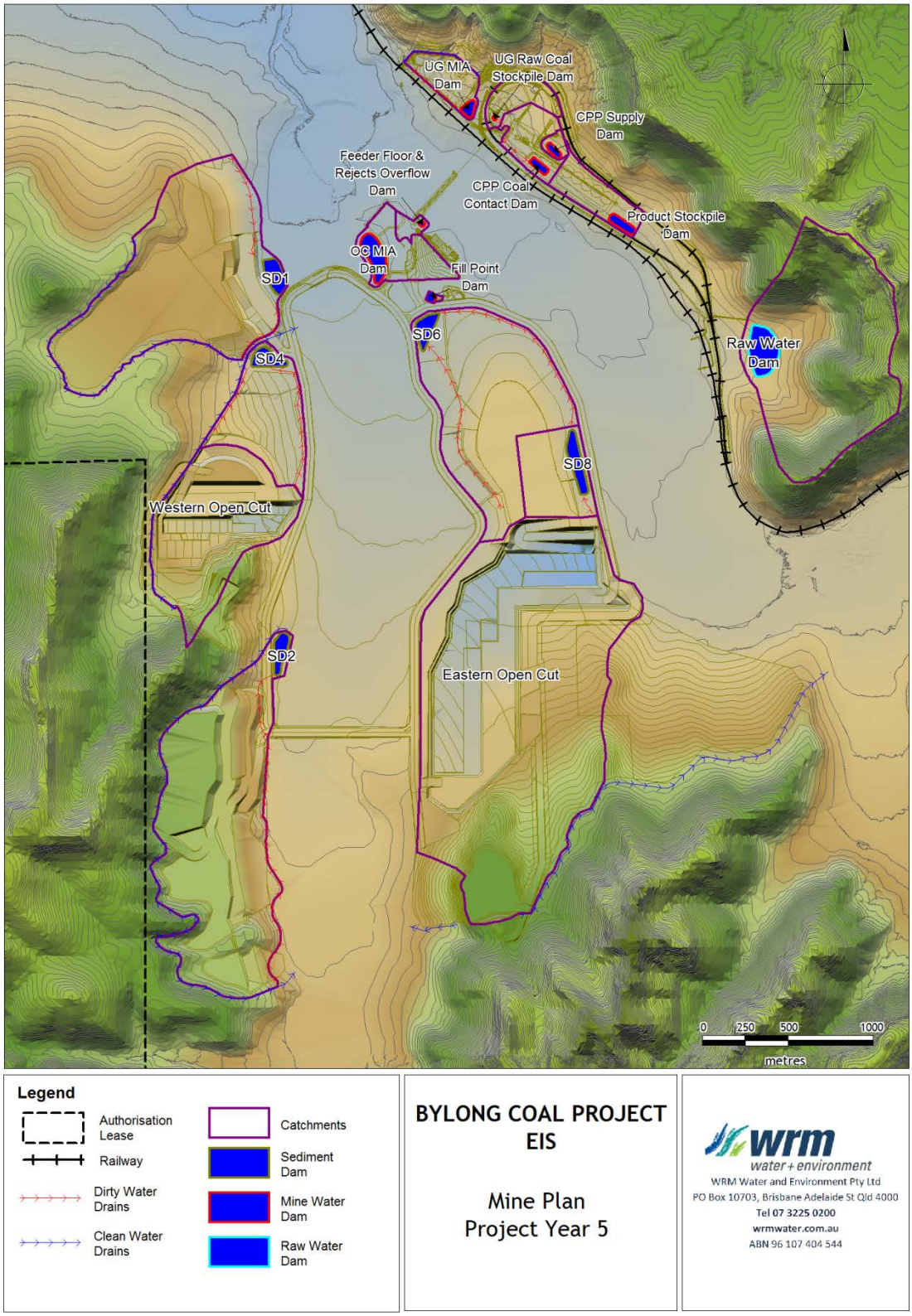

Figure 12 Project Year 5 mine plan

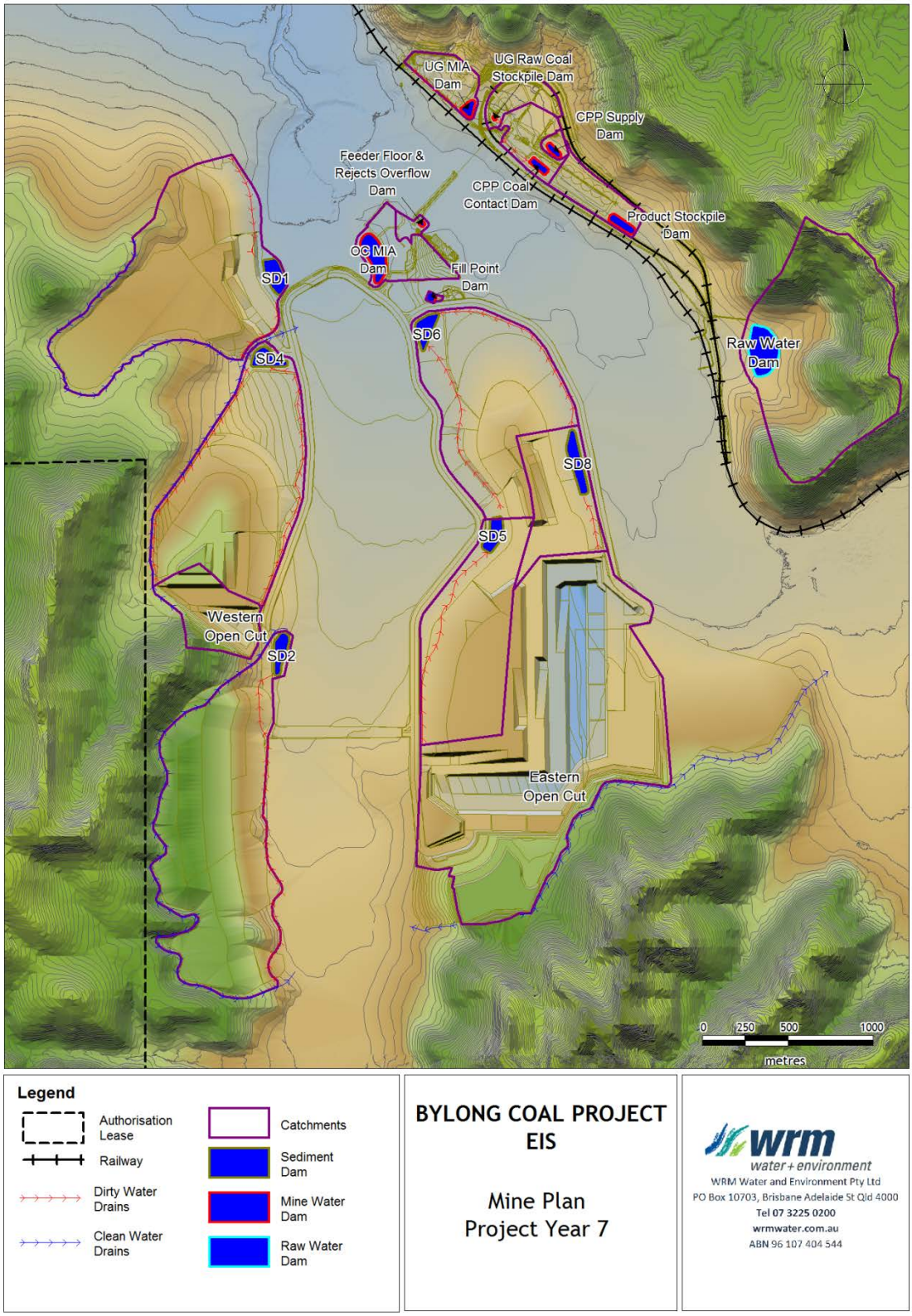

Figure 13 Project Year 7 mine plan

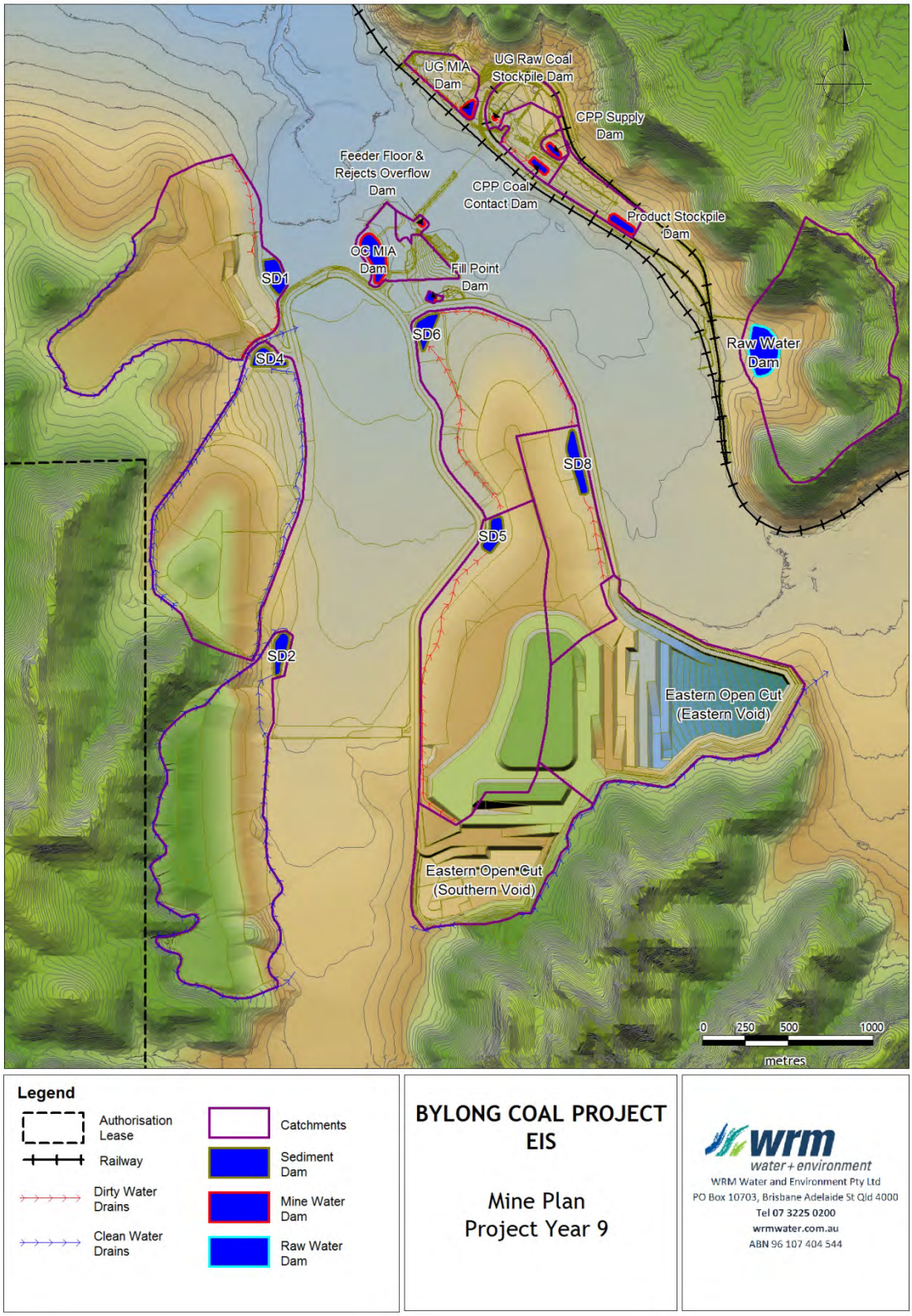

Figure 14 Project Year 9 mine plan

A schematised plan for the water management system configuration is shown in **Figure 15** and operating rules are provided in **Table 3**.

The proposed period of operation for each water storage is presented in **Figure 16**.

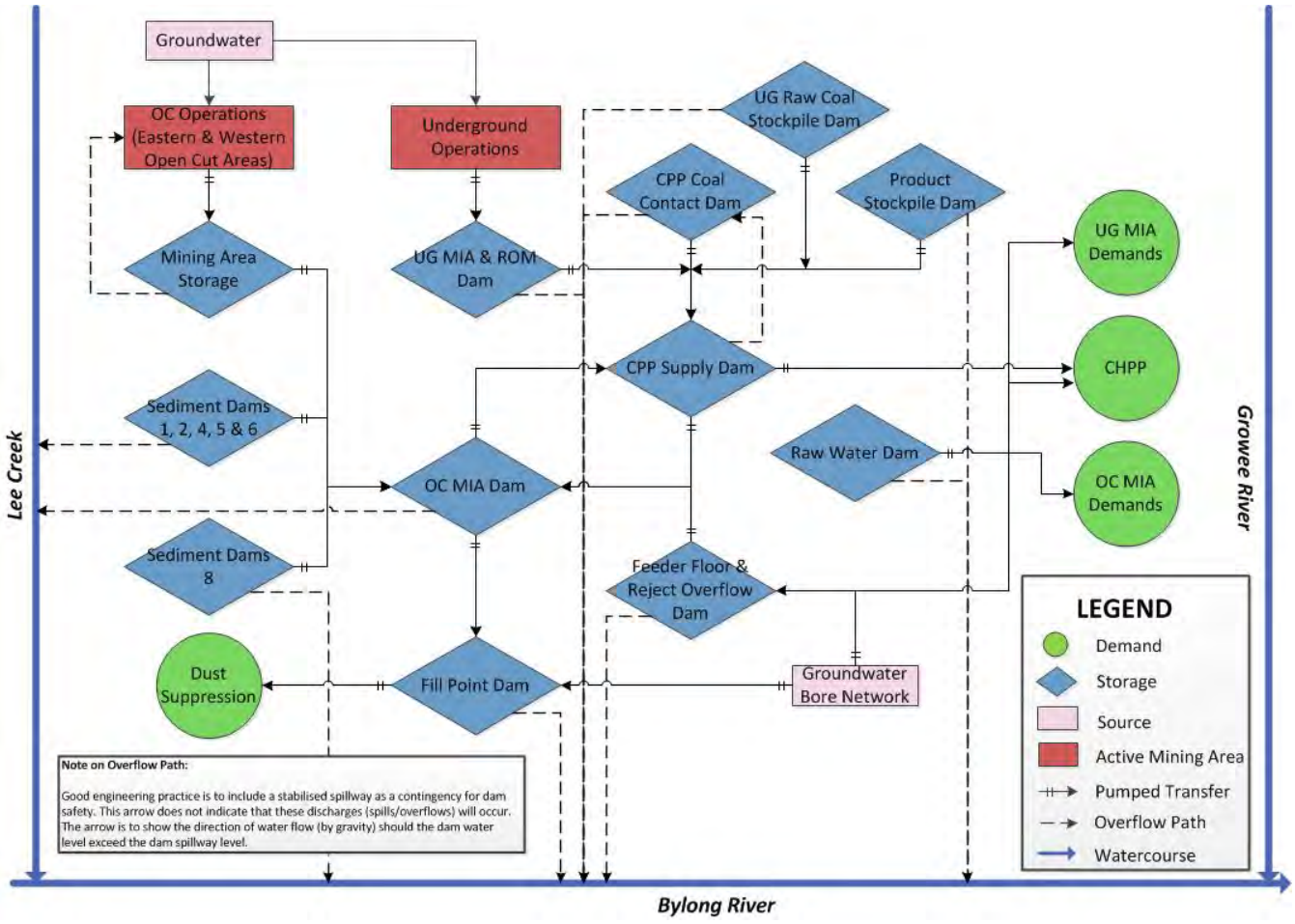

Figure 15 Water management system schematic

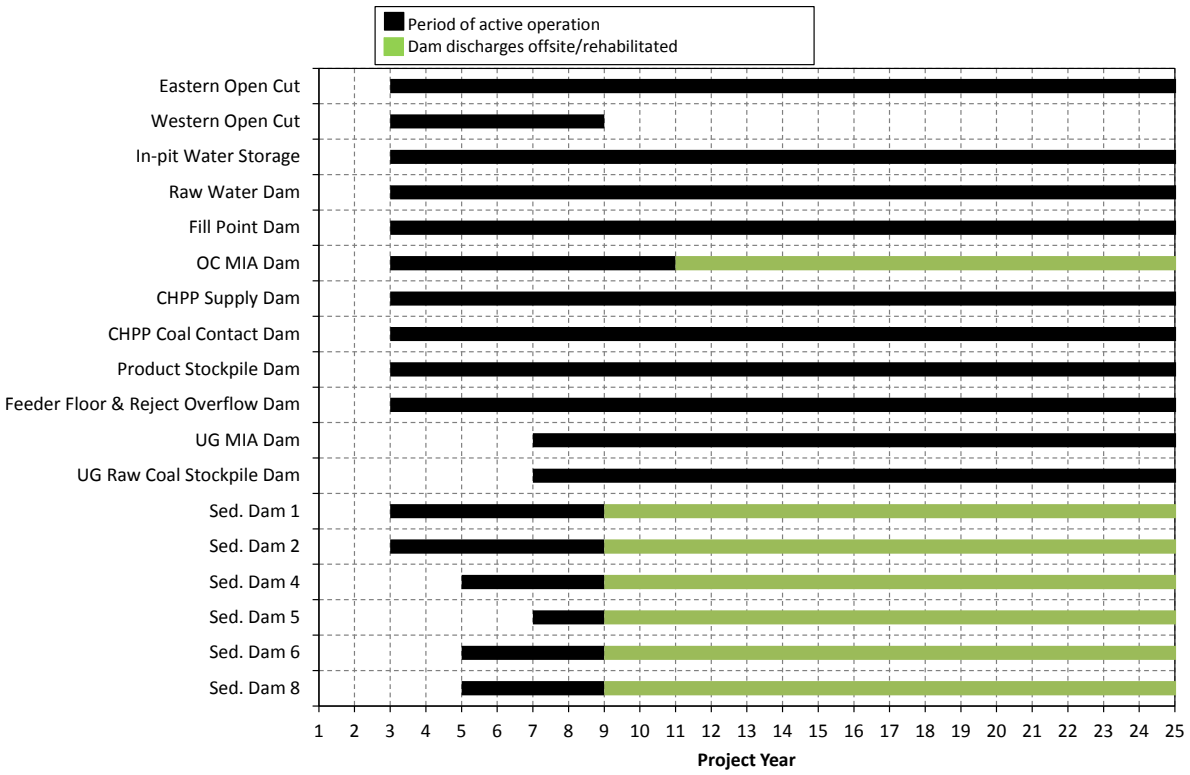

Figure 16 Project storages periods of operation

Table 3 Project water management system operating rules

Item	Name	Operating Rules
1	**External water supply**	
1.1	Groundwater bores network	• Primary supply to open cut (OC) Mine Industrial Area (MIA) • Secondary supply to Fill Point Dam • Supplies to Feeder Floor & Reject Overflow Dam to maintain operating levels
2	**Water demands**	
2.1	CHPP	• Receives supply from CHPP Supply Dam (100 L/s) • Secondary supply from Raw Water Dam (100 L/s) and Groundwater Bore Network (via Feeder Floor & Reject Overflow Dam) (100 L/s)
2.2	Haul road dust suppression	• Receives primary supply from Fill Point Dam (140 L/s) • Secondary supply from Groundwater Bore Network
2.3	Underground mine area infrastructure	• Supply from Raw Water Dam
2.3	Open cut mine area	• Supply from Groundwater Bore Network

Item	Name	Operating Rules
	infrastructure	
3	**Active mining areas**	
3.1	Open cut mining areas (Eastern & Western open cut mining areas)	• Continuous dewatering to Mine Water Storage within Mining Areas (200 L/s total) • Receives groundwater inflows
3.2	Underground mine	• Continuous dewatering to underground (UG) MIA Dam (200 L/s total) • Receives groundwater inflows
4	**Water Storages**	
4.1	Water Storage within Mining Areas	• Primary mine water storage for the Project • Dedicated section of Eastern Mining Area void which is used to store excess mine water • Supplies water to OC MIA Dam to meet demands (200 L/s) • Receives dewatering from mining areas (open cut and underground)
4.2	Raw Water Dam	• Receives runoff from local catchment • Supplementary water source for CHPP (100 L/s) • Supplementary water source for haul road dust suppression, CHPP demands and mine infrastructure demands including underground operations • Overflows to Bylong River

4.3	CHPP Supply Dam	• Receives runoff from a small local catchment
		• Supplies water to CHPP, haul road dust suppression and mine infrastructure demands including underground operations
		• Transfers back to the OC MIA Dam to prevent uncontrolled discharges
		• Receives pumped transfers from the following storages:
		  ◦ OC MIA Dam (100 L/s)
		  ◦ UG MIA Dam (100 L/s)
		  ◦ Product Stockpile Dam (100 L/s)
		  ◦ UG Raw Coal Stockpile Dam (100 L/s)
		  ◦ CHPP Coal Contact Dam (100 L/s)
		• Overflows to CHPP Coal Contact Dam

4.4	OC MIA Dam	• Receives runoff from open cut mine infrastructure areas • Receives transfers from the following storages: ◦ CHPP Supply Dam (100 L/s)

Item	Name	Operating Rules
		• Water Storage within Mining Areas (200 L/s) • Transfers back to In-pit Water Storage when high alarm level is reached (80%), to prevent uncontrolled spills • Supplies water to the CHPP Supply Dam to maintain operating levels • Receives pumped transfers from sediment dams as required • Overflows to Lee Creek
4.5	UG MIA Dam	• Receives runoff from the underground mine infrastructure areas • Transfers back to CHPP Supply Dam, to prevent uncontrolled spills • Overflows to Bylong River
4.6	Raw Coal Dam	• Receives runoff from the ROM stockpile pad • Transfers back to CPP Supply Dam, to prevent uncontrolled spills • Overflows to Bylong River
4.7	CHPP Coal Contact Dam	• Receives runoff from CHPP infrastructure area • Transfers to CHPP Supply Dam to prevent uncontrolled spills • Overflows to the Bylong River
4.8	Product Stockpile Dam	• Receives runoff from product stockpile area • Transfers back to CHPP Supply Dam to prevent uncontrolled spills • Overflows to Bylong River
4.9	Sediment Dams 1, 2, 4, 5 & 6	• Dewatered to OC MIA Dam following rainfall events • Overflows to Lee Creek
4.9	Sediment Dams 1, 2, 4, 5 & 6	• Dewatered to OC MIA Dam following rainfall events • Overflows to Bylong River
5	**Receiving Waters**	
5.1	Bylong River	• Receives storage overflows from UG MIA Dam, UG Raw Coal Contact Dam, Product Stockpile Dam, Fill Point Dam and Sediment Dam 8
5.2	Lee Creek	• Receives storage overflows from OC MIA Dam and Sediment Dams 1, 2, 4, 5 & 6
6	**General**	
6.1	Climate	• All storages and pits receive direct rainfall, local catchment runoff and lose water through evaporation

4.4.2 Storage sizes and open cut pit volumes

Table 4 shows approximate storage volumes for dams within the site water management system. Available storage volumes in the open cut pit will vary throughout the Project, as shown in **Table 5**. Following the completion of open cut mining, the East Pit void will be used for disposal of reject material generated from the processing of coal recovered from the underground mining areas. The volumes shown in **Table 5** do not account for the progressive reduction of available storage volume as rejects accumulate within the void. It has been estimated that 14 lcm of reject materials would be generated throughout the remaining life of the Project which will progressively fill around 11,700 ML of capacity within the East Pit void retaining 7,200 ML of capacity for mine water storage at the end of the mine life.

As discussed in **Section 5.6**, the design of the final East Pit void remaining at the cessation of open cut mining operations will be reviewed and refined based on future performance and simulation of the water management system to ensure that it facilitates the storage of excess mine water during the underground mining operations.

Table 4 Approximate Storage volumes

Storage	Volume (ML)
Raw Water Dam	300
CHPP Supply Dam	22
CHPP Coal Contact Dam	23
OC MIA Dam	106
UG MIA Dam	16
UG Raw Coal Stockpile Dam	3
Product Stockpile Dam	18
Feeder Floor & Reject Overflow Dam	6
Fill Point Dam	2

Table 5 Approximate Open cut pit volumes

Project year	West Pit volume (ML)	East Pit volume (ML)
3	756	1,973
4	1,984	3,117
5	362	8,374
6	446	9,032
7	485	11,607
8	0	12,930
9	0	17,412
10	0	19,232
11	0	18,937
12	0	18,937

4.4.3 Erosion and sediment controls

Locations of the proposed 6 sediment dams are shown in **Figure 11** to **Figure 14**.

The sediment dams have been sized in accordance with current recommended design standards in the following guidelines:

- Managing Urban Stormwater, Soils and Construction (Landcom, 2004); and
- Managing Urban Stormwater, Soils and Construction, Mines and Quarries (DECC, 2008).

The sediment dam volumes will be based on the following design standards and methodology:

- "Type F" sediment basins consistent with SD 6-4 (page 6-19, Landcom 2004);
- total sediment basin volume = settling zone volume + sediment storage volume. The sediment storage volume is the portion of the basin storage volume that progressively fills with sediment until the basin is de-silted. The settling zone is the minimum required free storage capacity that must be restored within 5 days after a runoff event;
- sediment basin settling zone volume based on 90th percentile 5-day duration rainfall at Scone (35.9 mm) with an adopted volumetric event runoff coefficient for disturbed catchments of 0.64; and
- solids storage volume = 50% of settling zone volume.

The adopted design standard does not provide 100% containment for runoff from disturbed areas. Hence, it is possible that overflows will occur from sediment dams if rainfall exceeds the design

standard. Increasing the design standard of the sediment basins to the 95th percentile 5-day rainfall (51.3 mm at Scone) would reduce the volume and frequency of sediment dam overflows. However, the estimated overflow volumes for a 90th percentile design are relatively small and hence there would be very small benefits in substantially increasing the sediment basin size to the higher standard.

Table 6 provides the adopted sediment dam volumes and the associated pump requirements to restore the settling zone capacity within 5 days. Note that current design guidelines, Managing Urban Stormwater Soils and Construction Guideline: Mines and Quarries (DECC, 2008), allow for the adoption of larger dam sizes to allow for dewatering over a longer period to reduce the required pumping rate.

The operating rules for the sediment dam collection system are based on the recommendations in the guidelines (DECC 2008). The operating rules are as follows:

- runoff from disturbed areas will be captured in a sediment dam and pumped to OC MIA Dam;
- pump capacities will be sized to empty sediment dams within 5 days of the rainfall event;
- runoff from rehabilitated areas established for more than two years will be directed to a sediment dam and released off-site; and
- water may be released from sediment dams if it meets the relevant water quality criteria specified under the Environment Protection Licence (EPL) and water is not required for use in the water management system.

Table 6 Sediment dam volumes and catchment areas

Sediment Dam	Maximum catchment area (ha)	Total Volume Required (ML)	5-day Pump Requirement (L/s)
SD1	100.5	34.6	80
SD 2	111.3	38.4	89
SD 4	103.7	35.7	83
SD 5	132.9	45.8	106
SD 6	73.5	25.3	59
SD 8	44.8	15.4	36

4.4.4 Clean water management system

The objective of the clean water management system is to prevent runoff from undisturbed areas entering the mine water management system. The clean water management system consists of clean

water drains located around the perimeter of open cut mining areas and OEAs. The locations of proposed clean water drains are shown in **Figure 11** to **Figure 14**.

Design of the clean water drains will be based on the following design criteria:

- Drain capacity = 100 year average recurrence interval (ARI) design rainfall event;
- Trapezoidal cross-section with 1V:3H batters, where possible;
- Hydraulic assessments will be undertaken for each drain to ensure non-erosive velocities based on Table 5.2 of Managing Urban Stormwater, Soils and Construction (Landcom, 2004);
- All drains to be revegetated as soon as possible after construction; and
- Rock lining required for steep channel sections where non-erosive velocity cannot be achieved for vegetated channel.

4.4.5 Flood management

By locating most infrastructure outside the 100 year ARI flood extent, the Project has been designed to minimise impacts on flooding in the Bylong River and Lee Creek.

Conceptual and feasibility study design of the Project has included detailed flood modelling for design events up to the 1,000 year ARI flood event which showed that floodwater will not enter the mining pits for an event of this magnitude. Flood investigations will be updated as detailed mine planning design progresses to ensure that the minimum pit crest level is a minimum of 0.5 m above the adjacent 1,000 year ARI design flood level.

4.4.6 Reject material emplacement

The management of reject materials for the Project is described in the Mining Waste Management Plan, to meet a commitment made in the EIS. This document describes the occurrence and distribution of materials with potential geochemical issues on site and includes procedures for handling and emplacement to minimise potential risks.

The Mining Waste Management Plan should also be referred to for details on the monitoring program put in place for testing of overburden materials, spontaneous combustion potential and the identification and management of potentially acid forming materials.

4.4.7 Rehabilitation and final landform

The progressive rehabilitation of land disturbed by mining activities is a key commitment for the Project. The Project components that will directly disturb the landscape are generally associated MIAs and the two open cut mining areas and OEAs, which are proposed to be developed up to Year 10 of the Project. Underground operations will continue to occur for the remainder of the life of the Project up to Year 25.

The program of rehabilitation works for the Project will include development of progressive rehabilitation for all open cut mining areas and OEAs, the establishment of an integrated, long-term final landform, soil management, the implementation of erosion and sediment controls and ongoing monitoring and maintenance work for revegetated areas.

Details on specific measures for the ongoing monitoring, management and assessment of Project rehabilitation and the development of the final landform are discussed in the site Rehabilitation Management Plan.

4.5 SURFACE WATER MONITORING

Monitoring of surface water, both within and external to the mine site, will form a key component of the surface water management system. Monitoring of upstream, onsite and downstream water quality will assist in demonstrating that the site water management system is effective in meeting its objective of minimal impact on receiving water quality and will allow for early detection of any impacts and appropriate corrective action.

The surface water monitoring program will:

- assess compliance with the EPL for the Project;
- characterise on-site and receiving water quality;
- identify impacts of the Project, if any, on receiving water quality;
- provide information on the performance of the water management system; and
- facilitate adaptive management of water resources on the site.

The surface water monitoring program will be based on:

- continuation of the existing surface water monitoring locations both upstream and downstream of the Project;
- addition of new monitoring locations on Bylong River downstream of the Lee Creek confluence and on Dry Creek upstream of the Bylong River confluence;
- monitoring of water quality in site water storages; and
- monitoring of water levels in key storages and transfer volumes from the open cut and underground mining areas and between storages to provide a basis for validating the water balance modelling to reflect operating experience.

Figure 17 shows the proposed stream monitoring locations. Details of the proposed monitoring locations, including sample collection frequency and key water quality parameters to be monitored, are shown in **Table 7** and **Table 8**.

Where more than 25 mm of rainfall is recorded in 24 hours, an inspection of the site water management system will be undertaken when it is safe to do so. In particular, inspections of

sediment control infrastructure will be undertaken. The post-event inspection will include field-based assessment of water quality (turbidity and total dissolved solids) for any sediment dam overflows. Relationships will be developed between turbidity and total suspended solids, and between total dissolved solids and EC, to enable quick determination of potential water quality issues without needing to wait for laboratory analysis of water samples.

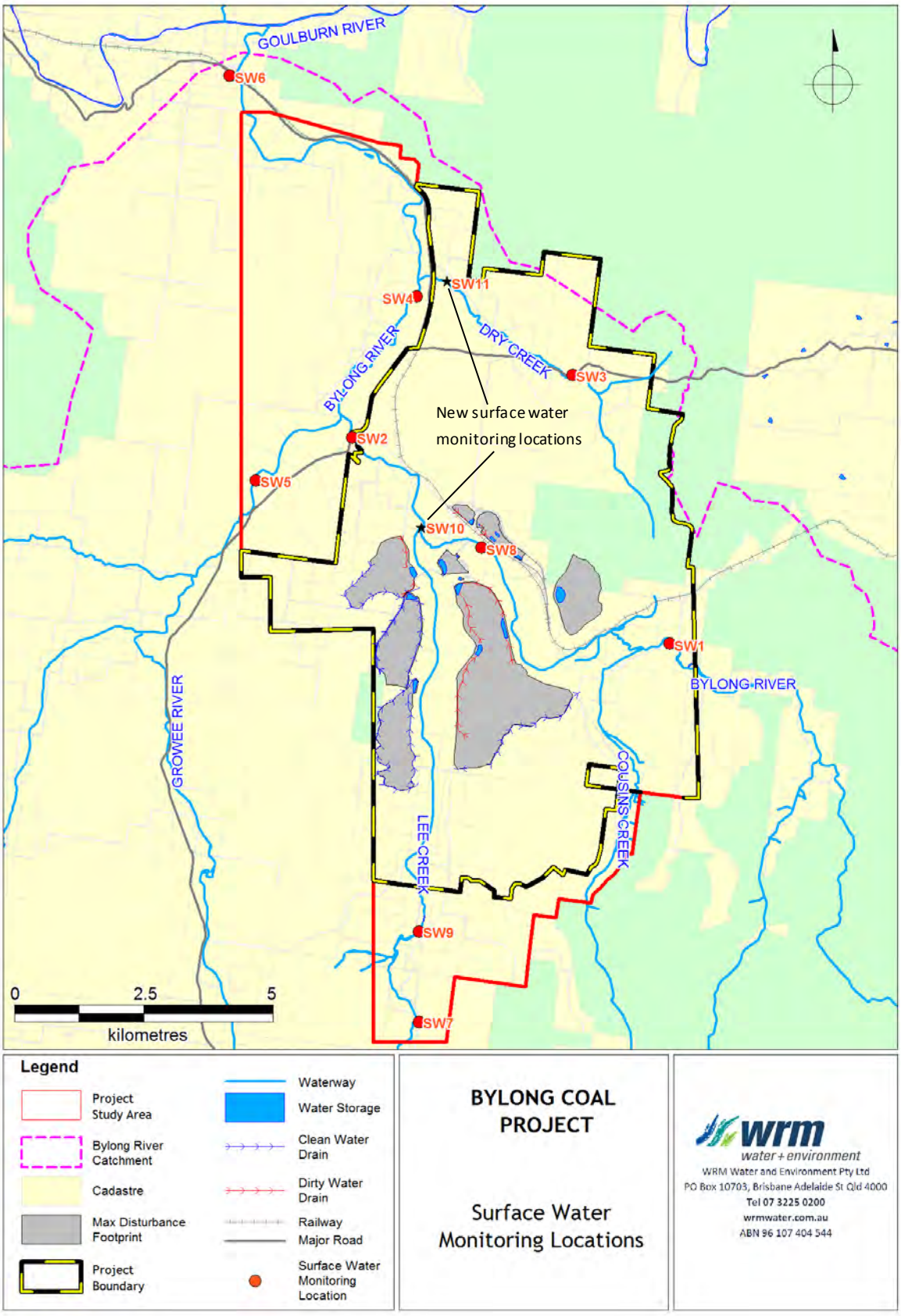

Figure 17 Proposed surface water monitoring locations

Table 7 Details of surface water monitoring points

Location				Parameters [a]	Frequency
Bylong River	SW1	234,825E	6,405,904N	Full suite	Monthly or rainfall >25mm/d
	SW2	228,686E	6,409,898N		
	SW4	229,930E	6,412,631N		
	SW6	226,317E	6,416,901N		
	SW8	231,187E	6,407,758N		
	SW10	230,019E	6,408,155N		
Lee Creek	SW7	229,979E	6,398,577N	Full suite	Monthly or rainfall >25mm/d
	SW9	229,979E	6,400,329N		
Growee River	SW5	226,819E	6,409,062N	Full suite	Monthly or rainfall >25mm/d
Dry Creek	SW3	232,948E	6,411,101N	Full suite	Monthly or rainfall >25mm/d
	SW11	230,513E	6,412,922N		
Raw Water Dam CHPP Supply Dam CHPP Coal Contact Dam				Field parameters	Monthly until baseline established, then quarterly
OC MIA Dam UG MIA Dam UG Raw Coal Stockpile Dam Product Stockpile Dam Feeder Floor & Reject Overflow Dam Fill Point Dam				Full suite	Quarterly until baseline established, then annually
Raw Water Dam CHPP Supply Dam OC MIA Dam UG MIA Dam				Water level	Weekly
Open cut pit				Pumped volume	Weekly

[a] *See **Table 8***

Table 8 Water quality monitoring parameters

Parameter Suite	Parameters		Unit of measurement
Full Suite	pH		-
	EC		µS/cm
	Turbidity		NTU
	Alkalinity		mg/L
	Chloride		mg/L
	Ammonia as N		mg/L
	NO_x (NO_2^- + NO_3^-)		mg/L
	Sulphate		mg/L
	Calcium		mg/L
	Potassium		mg/L
	Sodium		mg/L
	Magnesium		mg/L
	Total Dissolved Solids		mg/L
	Total Suspended Solids		mg/L
	Total Phosphorus		mg/L
	Total Metals	Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Se, Va, Zn	mg/L
	Dissolved Metals	Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Se, Va, Zn	mg/L
Field parameters	pH		-
	EC		µS/cm
	Turbidity		NTU

4.6 SURFACE WATER TRIGGER VALUES

ANZECC (2000) recommends that wherever possible site-specific data is used to define trigger values for physical and chemical factors which can adversely impact the environment. However, the default values provided by ANZECC (2000) can be used where there is insufficient baseline data available.

Table 9 compares ANZECC trigger values with data from the baseline monitoring program. **Table 9** also shows the proposed trigger value and the source of the proposed value (from ANZECC values or

site monitoring data). Whilst sampling has been undertaken since 2012, dry conditions have limited the number of samples able to be collected at some locations.

Table 9 Proposed trigger values for receiving water quality

Parameter	Unit	ANZECC Trigger Value				Baseline Data (80th %ile)								Proposed Trigger Value	Notes
						Bylong River					Lee Creek		Dry Creek		
		Irrigation	Livestock drinking	Eco-system[d]	Recreation	SW1	SW2	SW4	SW6	SW8	SW7	SW9	SW3		
						N = 18	N = 12	N = 62	N = 26	N = 18	N = 7	N = 5	N =9		
pH	pH	6.0 - 9.0	-	6.5 - 8.0	6.5 - 8.5	7.9	8.3	8	8.3	8	8	7.7	8.5	6.5-8.5	Lower limit ecosystem protection, upper limit SW3
EC	µS/cm	1,000 [a]	-	30-350[g]	-	244	784	2194	2213	809	300	353	1172	2200 (D/S Growee)	SW4/SW6
														1200 (Dry Creek)	SW3
														1000 (U/S Growee)	Irrigation
Turbidity	NTU	-	-	2 – 25	-	11	10	32	44	74	26	31	50	44	SW6
Calcium (Ca)	mg/L	-	1000	-	-	10	44	135	114	42	15	26	36	135	SW4
Sodium (Na)	mg/L	115[c]		-	300	24	72	235	267	87	22	23	179	267	SW6
Magnesium (Mg)	mg/L	-	2,000[b]	-	-	10	33	110	112	33	12	17	40	110	SW4
Sulphate as SO4	mg/L	-	1000	-	400	6	40	307	238	20	15	20	36	307	SW4
Chloride as Cl	mg/L	175[c]	-	-	400	30	101	357	390	96	26	24	129	400	Irrigation/SW6
Aluminium	mg/L	5[f]	5	-	0.2	0.06	0.027	0.0079	0.0092	0.026	0.0266	0.0508	0.207	0.2	Recreation/SW3
Arsenic	mg/L	0.1[f]	0.5[a]	0.013[ae]	0.05	0.0005	0.0007	0.0008	0.001	0.0005	0.0005	0.0008	0.0005	0.013	Ecosystem
Barium	mg/L	-	-	-	1	0.018	0.047	0.107	0.121	0.04	0.038	0.049	0.085	0.12	SW6
Beryllium	mg/L	0.1[f]	-	-	-	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.1	Irrigation
Cadmium	mg/L	0.01[f]	0.01	0.0002[e]	0.005	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	Ecosystem
Chromium	mg/L	0.1[f]	1	0.001[e]	0.05	0.0007	0.0007	0.0005	0.0006	0.0006	0.0005	0.0005	0.0015	0.001	Ecosystem
Cobalt	mg/L	0.05[f]	1	-	-	0.0007	0.0013	0.0013	0.0005	0.0005	0.0005	0.0023	0.0011	0.05	Irrigation

Parameter	Unit	ANZECC Trigger Value				Baseline Data (80th %ile)								Proposed Trigger Value	Notes
						Bylong River					Lee Creek		Dry Creek		
		Irrigation	Livestock drinking	Eco-system[d]	Recreation	SW1	SW2	SW4	SW6	SW8	SW7	SW9	SW3		
						N = 18	N = 12	N = 62	N = 26	N = 18	N = 7	N = 5	N =9		
Copper	mg/L	0.2[f]	0.4[a]	0.0014[e]	1	0.005	0.003	0.006	0.006	0.003	0.003	0.006	0.003	0.006	SW4/SW6
Iron	mg/L	0.2[f]	-	-	0.3	0.15	0.17	0.23	0.04	0.14	0.18	0.39	0.19	0.23	SW4
Lead	mg/L	2[f]	0.1	0.0034[e]	0.05	0.0005	0.0005	0.001	0.0005	0.0005	0.0005	0.0031	0.0005	0.0034	Ecosystem
Manganese	mg/L	0.2[f]	-	1.9[e]	0.1	0.095	0.221	0.561	0.026	0.172	0.088	0.44	0.01	0.56	SW4
Mercury	mg/L	0.002[f]	0.002	0.0006[e]	0.001	0.00008	0.00003	0.00013	0.00008	0.00003	0.00003	0.0003	0.00003	0.0006	Ecosystem
Nickel	mg/L	0.2[f]	1	0.011[e]	0.1	0.003	0.004	0.003	0.003	0.004	0.002	0.006	0.004	0.011	Ecosystem
Selenium	mg/L	0.02[f]	0.02	0.011[e]	0.01	0.0005	0.0005	0.0012	0.0007	0.0005	0.0005	0.0005	0.0005	0.011	Ecosystem
Vanadium	mg/L	0.1[f]	-	-		0.0009	0.0011	0.0009	0.003	0.0014	0.0013	0.0014	0.0018	0.0014	SW8
Zinc (Zn)	mg/L	2[f]	20	0.008[e]	5	0.011	0.038	0.023	0.02	0.015	0.008	0.061	0.015	0.038	SW2
Ammonia	mg/L	-	-	0.013	-	0.013	0.193	0.379	0.021	0.15	0.022	0.051	0.027	0.38	SW4
Total phosphorus	mg/L	0.05[f]	-	0.02	-	0.03	0.12	0.94	0.09	0.24	0.03	0.08	0.05	0.94	SW4

Notes:

- No Trigger Value recommended

a Lowest recommended value

b Cattle (insufficient information on other livestock)

c Sensitive crops

d Upland River

e 95% of species protected

f Long term trigger value

g compensated to 25 °C

4.7 WATER MANAGEMENT PERFORMANCE CRITERIA

Table 10 details the water management performance measures (Table 9 from the Recommended Development Consent conditions) and indicates how these measures are achieved by the Project.

Table 10

Compliance with performance measures for water management

Feature	Performance measure	Achieved by
General	Maintain separation between clean, dirty and mine water management systems.	Separation of different types of water on the site is incorporated in the design of the site water management system (see **Section 4.3** and **Section 4.4**).
	Minimise the use of clean water on site.	Recycling of water on site wherever possible. Using water within the site water management system as first priority for demands (see **Section 4.4**).
	Design, install, operate and maintain water management systems in a proper and efficient manner.	Complete detailed system design in accordance with principles outlined in the EIS and WMP. Operate and maintain in accordance with WMP and good engineering practice (see **Section 4.4**).
Alluvial aquifers	Negligible environmental consequences to the alluvial aquifer beyond those predicted in the EIS, including: • negligible change in groundwater levels beyond those predicted; • negligible change in groundwater quality beyond those predicted; and • negligible impact to other groundwater users beyond those predicted.	See Groundwater Management Plan (**Section 7**).
Bylong River, Lee Creek, Dry Creek and Growee River	Negligible environmental consequences to surface water resources beyond those predicted in the EIS, including: • negligible change in surface water flows beyond those predicted; • negligible change in surface water quality beyond those predicted; and • negligible impact to other surface water users beyond those predicted.	Operate and maintain water management system, including erosion and sediment controls, in accordance with WMP. Monitor wet weather receiving water quality in accordance with surface water monitoring plan (see **Section 4.5**) and Receiving Water Quality Trigger Action Response Plan (TARP) (**Section 4.8**).
	Maintain or improve baseline channel stability	Operate and maintain water management system, including erosion and sediment

Feature	Performance measure	Achieved by
		controls, in accordance with WMP.
Clean water diversion & storage infrastructure	Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site.	Complete detailed drainage design in accordance with principles outlined in the EIS and WMP. Operate and maintain in accordance with WMP and good engineering practice.
Sediment dams	Design, install and/or maintain sediment dams to ensure no discharges to surface waters, except in accordance with an EPL or in accordance with Section 120 of the POEO Act.	Comply with Erosion and Sediment Control Plan. Monitor sediment dam performance in accordance with Sediment Dams TARP.
Mine water storages	Design, install and/or maintain mine water storage infrastructure to ensure no discharge of untreated mine water off-site.	Comply with operating rules in WMP. Monitor system performance in accordance with Mine Water Storage TARP.
Flood mitigation measures	Design, install and maintain flood levees, as required, to exclude flood flows into the open cut mining areas and mine infrastructure areas for all flood events up to and including the 1 in 1,000 year ARI flood.	Complete detailed design of pit levels and mine infrastructure in accordance with flood studies presented in EIS and RTS.
Overburden, CHPP reject materials	Design, install and maintain emplacements to prevent or minimise the migration of pollutants due to seepage.	Design and maintain OEAs in accordance with the Mining Waste Management Plan (see Section 4.4.6).
Chemical and hydrocarbon storage	Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards.	Design and maintain chemical and hydrocarbon storage areas in accordance with Australian Standards.

4.8 SURFACE WATER RESPONSE PLAN

A plan to respond to exceedances of trigger levels is provided below for:

- Mine water storage (**Table 11**);
- Receiving water quality (**Table 12**); and
- Sediment dams (**Table 13**).

Table 11

TARP – Mine Water Storage

Level	Trigger	Action	Response
Level 1 (Normal)	All mine water dams <80% capacity	• Continue to monitor levels in accordance with monitoring plan	• No response required
Level 2 (Early warning)	Current or forecast heavy rainfall	• Ensure inter-dam transfer pumping network is operational • Review options for water transfer if required	• Post-event review to confirm event was well managed with appropriate resources in place
Level 3A (Exceedance of trigger level)	Mine water storage level exceeds 80% with inflows still occurring	• Reduce process inflows if practical • Commence transfer from storages with highest risk of spill	• Post-event review to confirm suitability of water transfer infrastructure & operational rules • Update operational rules if required • Prepare recommendations for modifications or upgrades to water transfer infrastructure
Level 3B (Possible discharge of mine water)	Mine water storage level exceeds 95% capacity with inflows still occurring	• Cease process inflows to storages with highest risk of spill • Maximise pumping capacity for dewatering of storages with highest risk of spill (e.g. relocate mobile pumps)	• Post-event review to confirm suitability of water transfer infrastructure & operational rules • Update operational rules if required • Implement required modifications or upgrades to water transfer infrastructure
Level 4 (Discharge of mine water)	Discharge of mine water from one or more mine water storages	• Complete required actions under Pollution Incident Response Management Plan • Advise regulator of spill • Collect water quality samples of spills at dam overflow point and in receiving watercourse • Remediate any environmental harm where possible	• Initiate investigation into reasons for system failure, including assessment of environmental harm • Take actions recommended by investigation to prevent recurrence

Table 12

TARP – Receiving water quality

Level	Trigger	Action	Response
Level 1 (Normal)	All surface water quality samples below trigger levels in Table 9	• No action	• Continue to monitor water quality in accordance with monitoring plan
Level 2 (Early warning)	Single value at downstream sampling site exceeds trigger level in Table 9	• Check upstream water quality to assess potential for impact from operations • Advise regulator of trigger exceedance	• If upstream pollutant concentration is higher or within 5% of downstream value, then no further action required • Otherwise, assess whether operation could potentially have affected water quality and take remedial action, if appropriate
Level 3A (Potential water quality impact – no discharge)	Two or more sequential samples at a downstream sampling site exceed trigger level in Table 9	• Check upstream water quality to assess potential for impact from operations • Report on likely causes of exceedance and any potential mitigation measures • Advise regulator of trigger exceedance	• If upstream pollutant concentration is higher or within 5% of downstream values then consider need for review of trigger levels • Implement appropriate mitigation measures
Level 3B (Potential water quality impact – sediment dam discharge)	Water quality at multiple downstream sampling sites exceeds trigger levels in Table 9 and discharge from site sediment dams has occurred	• Check upstream water quality to assess potential for impact from operations • Report on likely causes of exceedance and potential mitigation measures • Advise regulator of trigger exceedance •	• If upstream pollutant concentration is higher or within 5% of downstream values then no further action required • Implement appropriate mitigation measures
Level 4	Single value at	• Complete required	• Complete detailed incident review

Level	Trigger	Action	Response
(Likely water quality impact – mine water dam discharge).	downstream sampling site exceeds trigger level in Table 9 and discharge from mine water dam has occurred	actions under Pollution Incident Response Management Plan • Check upstream and downstream water qualities to confirm any impact to water quality from operations • Remediate any environmental harm where possible • Advise regulator of trigger exceedance	to identify cause of water quality exceedance • Review systems and update procedures as required to prevent recurrence • Implement any other appropriate mitigation measures

Table 13

TARP – Sediment dams

Level	Trigger	Action	Response
Level 1 (Normal)	No site runoff	• Continue ongoing inspection and maintenance of sediment dams in accordance with Section 4.5 of WMP	• No response required
Level 2 (Early warning)	Current or forecast heavy rainfall	• Ensure transfer pumping network is operational • Undertake inspection to check sediment accumulation	• If required and possible prior to forecasted event, de-silt sediment dam(s) • Post-event review to confirm event was well managed • Check post-event sediment dam levels in sediment dams and de-silt if required
Level 3 (Sediment dam discharge)	Discharge from sediment dam < 50 mg/L	• Collect sample of sediment dam outflow • Confirm TSS in dam outflow < 50 mg/L	• Post-event review to confirm rainfall exceeded design standard • Review system configuration to ensure operating as designed • Check post-event sediment levels in sediment dams and

			de-silt if required
Level 4 (Exceedance of water quality target)	Discharge from sediment dam with TSS > 50 mg/L	• Complete required actions under Pollution Incident Response Management Plan • Check if event rainfall exceeds design standard • Notify regulators if rainfall below design standard • Collect water quality samples of spills at dam overflow point and in receiving watercourse • Remediate any environmental harm where possible	• Check post-event sediment levels in sediment dams and de-silt if required • Initiate investigation into reasons for system failure, including assessment of environmental harm • Take actions recommended by investigation to prevent recurrence

5 SITE WATER BALANCE

5.1 OVERVIEW

A computer-based operational simulation model (OPSIM) was used to assess the dynamics of the mine water balance under conditions of varying rainfall and catchment conditions throughout the development of the Project. The OPSIM model dynamically simulates the operation of the water management system and keeps account of all site water volumes and representative water quality on a daily time step.

The model has been configured to simulate the operations of all major components of the water management system. The simulated inflows and outflows included in the model are given in **Table 14**.

Details of the site water management infrastructure and operating rules are provided in **Section 4.4.1**.

Table 14
Simulated inflows and outflows to the mine water management system

Inflows	Outflows
Direct rainfall on water surface of storages	Evaporation from water surface of storages
Catchment runoff	CHPP demand
Groundwater inflows to open cut pit / underground operations	Dust suppression demand
Raw (bore) water supply	Underground water supply
	Mine infrastructure area demand
	Off-site spills from storages

5.2 WATER BALANCE MODELLING METHODOLOGY

Open cut mining will be undertaken from approximately end of Year 2 to Year 10 of the 25 year mine life, with underground mining undertaken from approximately Year 7 to Year 25. Construction activities are proposed during Year 1 and Year 2 and these two years have not been included in the water balance modelling assessment. The representative year of mine progression is applied to a range of years as shown in **Table 15**.

The water balance results are generated by running multiple climate sequences through the model and taking a statistical representation of the results for the different climate cases modelled. These results more accurately reflect the actual performance of the system because they take into account

the dynamic nature of the mine phases, groundwater inflows and CHPP throughputs. In these runs, the model configuration changes over time to reflect the changes due to mine development.

Table 15
Application of representative mine stage to mine development

Project Modelling Phase	Applied Range of Mine Life
PY3	Year 3 – Year 4
PY5	Year 5 – Year 6
PY7	Year 7 – Year 8
PY9	Year 9 – Year 10
Underground mining only	Year 11 – Year 25

The forecast water balance model has been run on a daily time step for a 23 year period, corresponding to the period of proposed mining operation for the Project. The model was run for multiple climate sequences, each referred to as a "realisation". Each realisation is based on a 23 year operational sequence extracted from the historical rainfall data. The first of 102 realisations is based on rainfall data from 1889 to 1911. The second is based on data from 1890 to 1912, and so on. This approach provides the widest possible range of climate scenarios covering the full range of climatic conditions represented in the historical rainfall record.

The model configuration changes over the 23 year Project life, reflecting changes in the water management system over time. The different stages of the mine life are linked in the model to reflect variations over time such as catchments, ROM coal production and groundwater inflows. Four different representative stages of mine life were modelled (Years 3, 5, 7 and 9) as well as underground mining only after completion of open cut mining. Although the catchment areas will continuously change as the Project progresses, the adopted approach of modelling discrete stages will provide a reasonable representation of conditions over the 23 year period.

5.3 WATER SOURCES AND USES

5.3.1 Rainfall runoff

Rainfall runoff inflows to the mine water management system were estimated using the daily rainfall-runoff model Australian Water Balance Model (AWBM). Adopted model parameters are shown in **Table 16**.

The natural/undisturbed catchment parameters were calibrated to recorded rainfall and runoff data for Moolarben Creek, approximately 35 km to the north west of the Project site. Model parameters for the mining areas, hardstand and stockpile catchments were adopted based on previous experience with OPSIM modelling on these types of catchments. Model parameters for spoil

catchments were adopted from a previous study of runoff from disturbed mine catchments in the Hunter Valley region.

Table 16
Adopted AWBM parameters for different catchment types

Parameter	Natural/ Undisturbed	Roads/ Hardstand	Spoil	Mining Areas	Rehab Spoil	Stockpile
A1	0.2	0.1	0.1	0.1	0.2	0.1
A2	0.2	0.9	0.3	0.9	0.2	0.9
C1	45	4	15	4	45	4
C2	95	16	50	16	95	16
C3	150	-	110	-	150	-
BFI	0.55	0	0.2	0	0.55	0
kb	0.7	0	0	0	0.7	0
Long-term runoff coefficient	4%	32%	8%	32%	4%	32%

5.3.2 Groundwater inflow

Estimated groundwater inflows to the open cut mining areas and underground mine were obtained from the results of groundwater modelling undertaken by the Project groundwater consultants, AGE. The adopted groundwater inflows to the open cut mining areas and the underground mine over the Project life are shown in **Table 17**. It is noted that the adopted groundwater inflows represent the free water which is available for the mine water management system and excludes losses from evaporation, coal moisture and other losses.

Table 17
Adopted groundwater inflows

Project Year	Open cut groundwater inflow (ML/a)	Underground groundwater inflow (ML/a)
1	0	0
2	23	0
3	28	0
4	44	0
5	68	0
6	64	0
7	62	0
8	56	6

Project Year	Open cut groundwater inflow (ML/a)	Underground groundwater inflow (ML/a)
9	49	604
10	0	1173
11	0	1446
12	0	1268
13	0	1049
14	0	804
15	0	704
16	0	508
17	0	526
18	0	1030
19	0	1744
20	0	1943
21	0	2371
22	0	2099
23	0	2869
24	0	2241
25	0	2766

5.3.3 CHPP process water

Figure 18 shows the predicted net CHPP demand over the life of the Project.

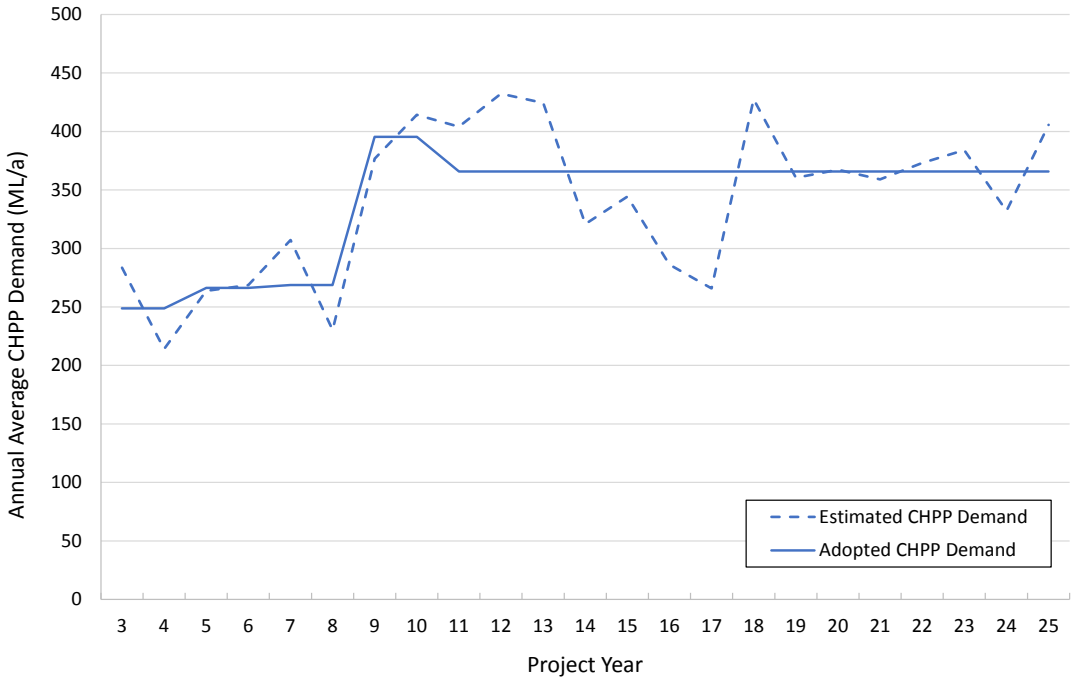

Figure 18 Adopted CHPP demands

5.3.4 Dust suppression

The estimated daily average dust suppression demand for the open cut operations is 2.85 ML/d (1,041 ML/yr). This includes dust suppression on haul roads, dumps, stockpiles and mine facility and hardstand areas.

The dust suppression demand will reduce once the open cut operations cease due to reduction in trucks hauling coal from the open cut. The adopted daily average dust-suppression demand for the surface facilities during underground operations is 1.37 ML/d (500 ML/yr).

5.3.5 Other water demands

Underground operations

The total daily underground operations demand for the Project has been estimated at 500 ML/a, at full underground production. This demand only applies from Year 9 onwards, however a demand of 50 ML/a has been applied during the ramp-up phase (Year 7 – Year 8).

Mine infrastructure

Estimates of open cut mine infrastructure area demand (administration buildings, bathhouse and workshops) are as follows:

- construction and ramp-up – 5.2 ML/a (Year 3);
- steady state operations – 6.5 ML/a (Year 5 –Year 7); and
- open cut wind-down – 1.6 ML/a (Year 9).

Estimates of underground mine infrastructure area demands are as follows:

- construction and ramp-up – 5.2 ML/a (Year 9)
- steady state operations – 6.5 ML/a (Post-open cut).

5.3.6 Demand summary

A summary of site water demands is provided in **Table 18**.

Table 18
Site water demand summary

Project Modelling Phase	Dust Suppression (ML/a)	CHPP Net Demand (ML/a)	Underground Operations (ML/a)	MIA Demand (OC & UG) (ML/a)	Other miscellaneous demand (ML/a)	Water Demand
Year 3	1,041	249	-	5.2	22	**1,317**
Year 5	1,041	266	-	6.5	22	**1,335**
Year 7	1,041	269	50	11.7	-	**1,372**
Year 9	1,041	395	500	6.8	-	**1,943**
Post-open cut	500	366	500	6.5	-	**1,373**

5.3.7 Potable water

A potable water treatment plant will be operated to meet potable water demands for the Project. Treated water will be stored in tanks to provide a minimum reserve of two days water supply.

5.3.8 Waste water

Project wastewater from the MIAs non-industrial uses will be treated at an onsite packaged sewage treatment facility. The sewage treatment plant will be designed in accordance with relevant Australian standards and regulatory requirements and will produce effluent of a suitable standard to be used as irrigation water (subject to the inclusion on an EPL), or alternatively be removed from the site for disposal by a licensed waste contractor.

5.4 WATER LICENCES

The Project is located within the Bylong River water source under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* (Hunter Unregulated WSP). According to the report card for the Bylong River water source under the Hunter Unregulated WSP, there are two surface water licences totalling 65 units.

The Project does not require any surface water licences under the Hunter Unregulated WSP to account for any takes resulting from the development of the open cut mining area and associated infrastructure within the Bylong River catchment.

Refer to **Section 7.2.3** in relation to the incidental baseflow takes from the surface water source as a result of the direct connection to the adjacent alluvial aquifer.

5.5 FORECAST SIMULATION RESULTS

5.5.1 Overall site water balance

A summary of the average site water balance over the life of the Project, showing the various water inputs and outputs is shown in **Table 19**.

5.5.2 Interpretation of stochastic results

In interpreting the results of the water balance assessment, it should be noted that the results provide a statistical analysis of the water management system's performance over the 23 years of mine life, based on 102 realisations with different climatic sequences.

The 50th percentile results represent the median of all realisations, the 10th percentile represents 10% exceedance (i.e. wet conditions) and the 90th percentile results represent 90% exceedance (i.e. dry conditions). There is an 80% chance that the result will fall within the 10th and 90th percentiles and a 98% chance the result will fall between the 1st and 99th percentiles. Importantly, note that a percentile trace shows the chance of a particular value on each day, and does not represent continuous results from a single model realisation e.g. the 50th percentile trace does not represent the model time series for median climatic conditions.

5.5.3 Borefield water requirements

Figure 19 shows the total annual modelled demand for water from groundwater bores over the Project period. The results indicate that the annual bore water requirements are generally highest during the period of open cut only operations (Year 3 to Year 6). The bore water requirements significantly reduce once underground operations commence due to the increase in groundwater inflows to the mine workings and the reduction in site water demands. A summary of bore water requirements for different periods of operation is shown in **Table 19**.

Table 19

Overall average site water balance

	PY 3	PY 5	PY 7	PY 9	PY11+
Water Inputs (ML/a)					
Rainfall/runoff yield	277	694	749	915	672
Groundwater inflows	42	68	55	822	1,541
Raw (bore) water intake	960	690	660	470	86
GROSS WATER INPUTS	**1,280**	**1,452**	**1,464**	**2,207**	**2,300**
Water Outputs (ML/a)					
Evaporation from storages	50	55	60	83	308
Dam overflows (offsite)					
Mine water system	0	0	0	0	0
Sedimentation system	7	31	43	41	143
Total	7	31	43	41	143
CHPP demand (loss)	249	263	266	391	362
Dust suppression	1,041	1,031	1,031	1,031	496
WAF	22	22	0	0	0
OC MIA Dam usage	5	7	7	1	0
UG MIA Dam usage	0	0	5	5	7
Underground operations Usage	0	0	50	495	495
GROSS WATER OUTPUTS	**1,373**	**1,408**	**1,461**	**2,047**	**1,810**
Water Balance (ML/a)					
Change in storage volumes	-94	43	3	159	490

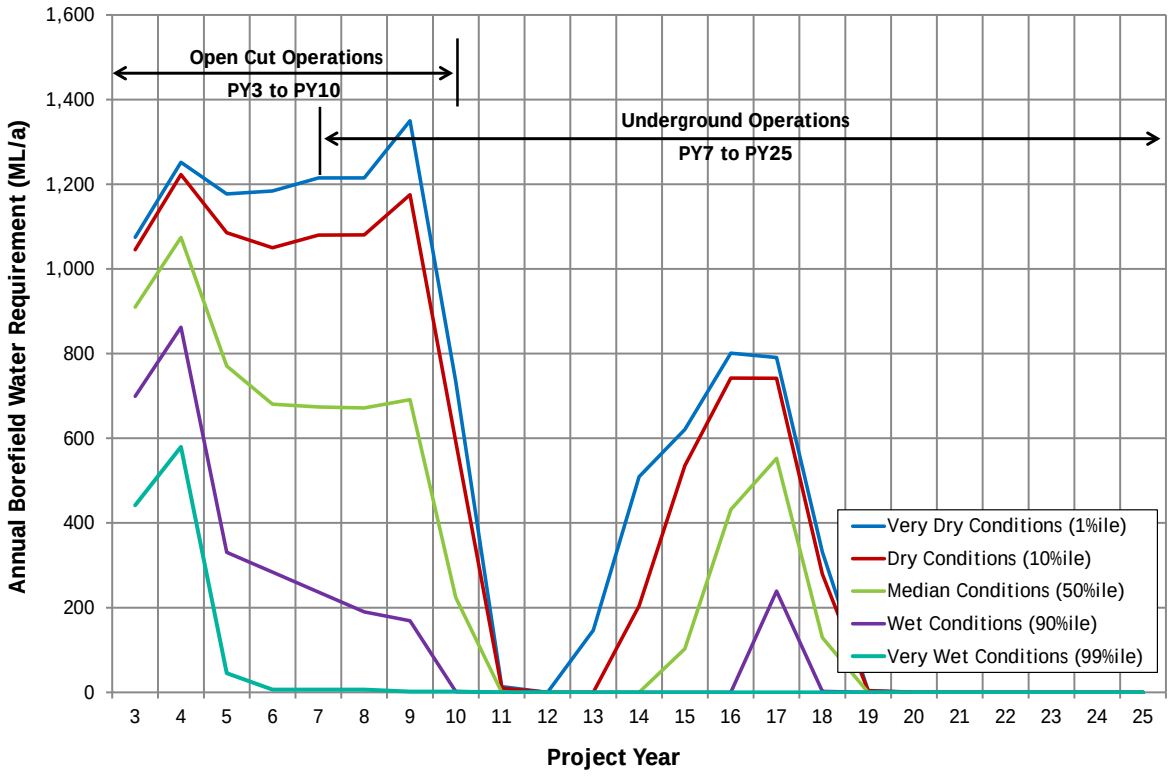

Figure 19
Annual borefield water requirements

5.5.4 Site water storage requirements

The water management system is configured to pump excess water to the open cut mining areas when the capacity of the mine water management system is exceeded. The stored water is available for re-use within the mine water management system as required and as the preferred supply of water.

Figure 20 shows the percentile plots of stored inventory in the combined mining areas over the Project life. **Figure 20** also shows the variation in available pit storage volume over the life of the Project. The progressive reduction in the void volume from Year 11 represents the effect of placing coarse and fine reject materials generated by the processing of coal from the underground mine following the completion of open cut mining. Additional water storage which has been conservatively estimated to be more than 1,000 ML becomes available within the underground goaf from Year 18. Depending upon the weather conditions experienced and the groundwater inflows to the underground mining area, there is also the ability to adjust the coarse and fine reject materials emplacement from Year 18 to retain further capacity within the Eastern void for surplus mine water.

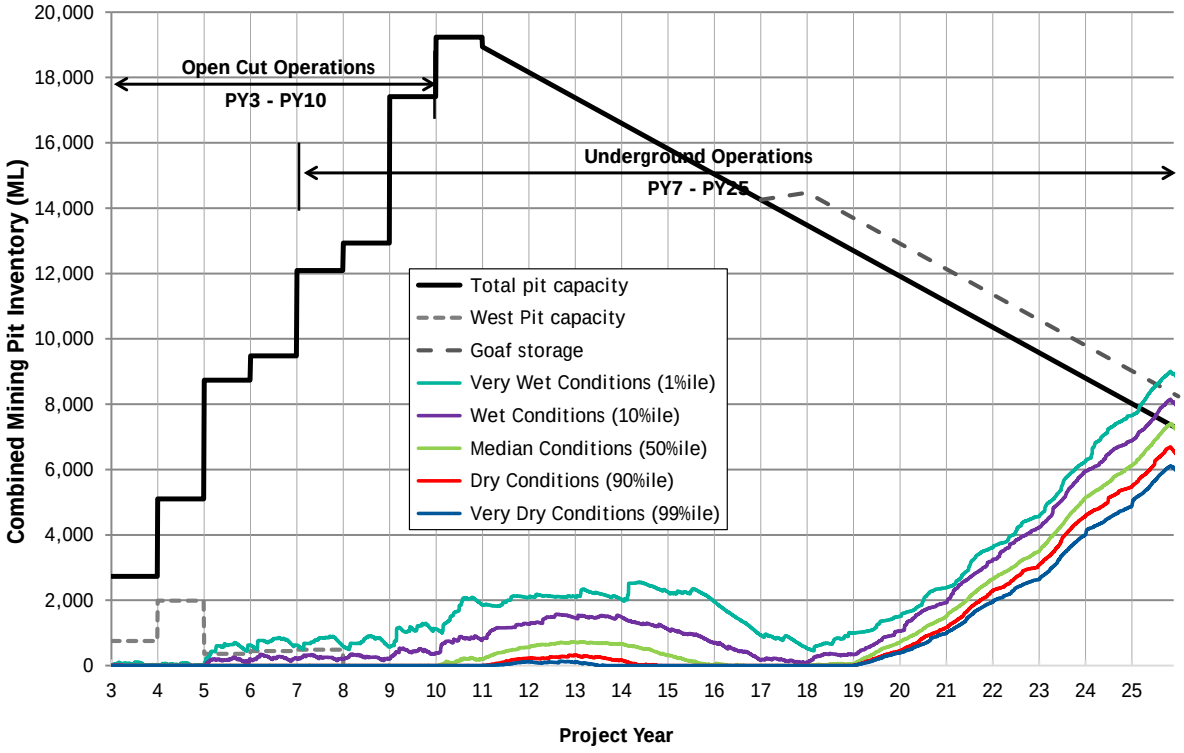

Figure 20
Combined open cut mining area stored water inventory

5.6 WATER BALANCE MODEL VALIDATION

The water balance model contains numerous assumptions about the likely performance of the site water management system. However, these assumptions are consistent with experience at similar operations in the region and hence are expected to provide a realistic representation of the performance of the site water management system. The model will be updated and validated at various times throughout the Project life when more suitable site specific data becomes available.

Collection of suitable data during the operational phase of the Project will enable the performance of the water balance model to be validated against site observations. This validation of the water balance model will be ongoing through the life of the Project.

Model validation will require at least one year of monitoring data following commencement of mining operations and should be undertaken on an annual basis in the early years of the Project to provide early feedback on the likely performance of the system. Once the performance of the model has been confirmed, the frequency of validation reviews could be reduced to once every three years. A key parameter for validation will be the groundwater inflows to the open cut operations, and later, to the underground mine.

An adaptive management approach will be implemented to optimise the design and operation of the site water management system. Particular attention will be given to groundwater inflow volumes which are likely to be a key component of the site water balance.

A focus of the water balance validation will be to facilitate consideration of contingency measures for management of excess water on the site, if this occurs either through unexpectedly wet conditions or unexpectedly high groundwater inflows. Potential contingency measures for excess water storage (over and above the considerable storage volumes which have been already been built into the mine water management system) include:

- Sealing of the gateroads between the 100 series and the 200 series longwall panels which would create an enormous storage volume more than capable of containing the potential volume of excess water;
- Modification of the eastern void to retain a larger void at the completion of open cut mining operations. This would potentially require the development of mounded areas on the Eastern OEA to assist in providing additional capacity for the reject materials and excess mine water. Under this scenario, KEPCO would still be committed to developing a final landform with no final void in the landscape, as is currently proposed.
- Further contingency measures which could be considered prior to commencing mining of the 200 series longwall panels may include adjustments to the proposed mine plan, such as:
    - Adjustments to longwall mining widths to minimise hydraulic fracturing and hence potential groundwater inflows;
    - Modifications to the sequencing and timing of mining the 200 series longwall panels;
    - Reorientation of the 200 series longwall panels; or
    - Sealing additional longwall panels within the 200 series to retain further underground capacity.

6 SALT BALANCE

Salt inputs to the Project include salts in the groundwater inflows, catchment runoff, direct rainfall, and bore water (see **Figure 21**). Salt outputs from the Project include salts which are lost through the CHPP in the rejects and product coal, site demands (including dust suppression, MIA usage and underground operations) and offsite discharges from the sediment water system (there are no predicted offsite discharges from the mine water system). The CHPP is a net user of water, as during the washing and sizing process the moisture content of the rejects material is increased. This process traps water (and salt) in the rejects material. The material is then disposed of in dedicated zones within the open cut mining areas.

Table 20 shows the average annual salt balance for the Project, for each phase. The results indicate the following:

- the largest contributor to the Project salt load varies between phases. In Year 3 and Year 5, the bore water inflows contribute the most. In later phases when underground mining operations commence, the largest contributor is groundwater inflows; and
- net loss from dust suppression contributes the greatest salt loss for all phases, with CHPP demand the next largest contributor.

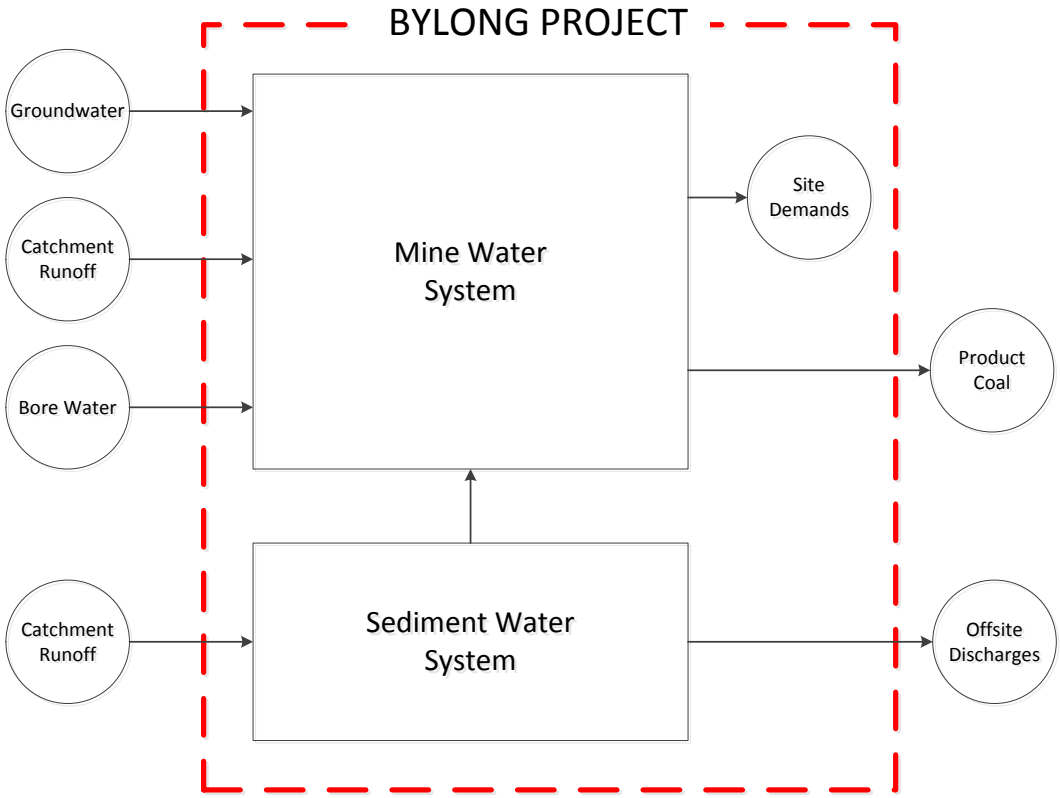

Figure 21
Surface water salt load schematic

Table 20

Average annual salt balance

	PY 3	PY 5	PY 7	PY 9	PY11+
Salt Inputs (t/a)					
Rainfall/runoff yield	189	518	562	657	357
Groundwater inflows	34	55	45	662	1,241
Raw (bore) water intake	773	555	531	378	70
GROSS SALT INPUTS	**996**	**1,128**	**1,137**	**1,697**	**1,667**
Salt Outputs (t/a)					
Evaporation from storages	-	-	-	-	-
Dam overflows (offsite)					
Mine water system	-	-	-	-	-
Sedimentation system	4	24	32	24	117
Total	4	24	32	24	117
CHPP demand (loss)	154	208	212	316	300
Dust suppression	813	839	841	827	415
WAF	14	17	-	-	-
OC MIA Dam usage	4	5	5	1	-
UG MIA Dam usage	-	-	4	4	5
Underground operations Usage	-	-	40	395	411
GROSS SALT OUTPUTS	**989**	**1,093**	**1,134**	**1,566**	**1,248**
Salt Balance (t/a)					
Change in salt load	**7**	**34**	**4**	**130**	**419**

7 GROUNDWATER MANAGEMENT PLAN

7.1 STATUTORY REQUIREMENTS AND COMMITMENTS

Section 3.1 presents the statutory requirements for groundwater management and indicates where these are addressed within this WMP. Within the EIS, RTS and Supplementary RTS, KEPCO committed to further investigate and/or monitor the:

- thickness and saturation of the Tertiary basalt;
- geology of Triassic overburden layers;
- water quality in the alluvial sediments adjacent to the overburden emplacements;
- connectivity between surface waters and the underlying alluvial aquifer; and
- water bores and wells that are situated on private properties surrounding the Project.

The sections belowsummarise these commitments and indicate where they are addressed in the WMP.

7.1.1 Tertiary basalt thickness and saturation

The RTS (AGE, 2016a) concluded that the Tertiary basalt was largely unsaturated, but recommended additional monitoring bores would be required to fully define the saturated and unsaturated characteristics of the basalt. These bores would target potentially deeper and thicker zones within the basalt where there is potential for groundwater to occur. It was noted the floor of the basalt appears to generally conform with the topography and therefore the highest potential for saturated zones was considered likely to be in topographically lower lying areas.

Additional monitoring bore sites have been selected to confirm the conceptual hydrogeological model for the basalt that it is unsaturated although may support short-term perching as part of normal recharge mechanisms as rainfall drains to deeper units. **Section 7.3.2** includes details on the additional bores to be installed to investigate the potential for saturation within the basalt.

7.1.2 Triassic units thickness and saturation

During the approvals process, a commitment was made to further define the boundaries of the formations that make up the Triassic sequence that overlies the longwall mining area. These surfaces will be defined by further interpretation of exploration datasets and the surfaces created using the geological model. This information will be used to update firstly the interpretation of which formations the monitoring bores are installed within, and secondly the numerical model. **Section 7.3.1** includes tables indicating the formation each monitoring site is constructed within and will be updated once the geological modelling is completed. **Section 7.4.6** describes the routine updates to the groundwater model and indicates how the information on the Triassic Formations will be utilised in future updates to the model.

7.1.3 Buffer zone between overburden emplacements and alluvial sediments

During the approvals processes, DPI-Water requested the WMP include monitoring of groundwater quality within the buffer zone between the overburden emplacements and the alluvial aquifer of Lee Creek. The purpose of the monitoring is to establish baseline conditions prior to construction of the overburden emplacements, and to provide a monitoring network that will detect any changes in groundwater quality due to runoff from the emplacements areas entering the alluvial groundwater systems. **Section 7.3.2** details the locations of the additional bores that will be installed adjacent to OEAs.

7.1.4 Stream aquifer connectivity

During the approvals process, a stakeholder requested an additional seepage meter be installed further downstream of the Western Open Cut to gauge whether the river is losing or gaining, and to determine if there is a correlation with water use by other users in the area. KEPCO committed to address this request within the Water Management Plan to be developed in consultation with DPI Water. **Section 7.3.6** describes the seepage meter monitoring that will be continued through the life of the Project. It includes locations for additional seepage meters to address this request.

7.1.5 Monitoring adjacent to private bores

During the approvals process, KEPCO committed to outline a program for monitoring water levels within the alluvial aquifer between the private property and the borefield to monitor changes over time and confirm private landholders are not impacted. **Section 7.3.2** describes the additional monitoring bores that will be installed within the alluvial aquifer to provide early warning of any drawdown moving towards areas where private landholders operate bores. **Section 7.3.2** details the locations of the additional bores that will be installed adjacent for this purpose.

7.2 GROUNDWATER REGIME

7.2.1 Hydrostratigraphic units

The documents prepared for the approvals process including the EIS (AGE 2015), RTS (AGE 2015a) and supplementary RTS (AGE 2015b) describes the geology and hydrogeology within the Project Boundary. The reader should refer to these documents for detail, with a summary provided below.

There are two main groundwater systems within the Project Boundary, being the shallow alluvial groundwater system, and the Permian coal measures, in particular the Coggan and Ulan coal seams. The Tertiary basalt cap in plateau area overlying the proposed underground extraction area was for a period considered to potentially contain a minor perched groundwater system at the base overlying the longwall mining area, however follow up work has identified this is unlikely (AGE 2015a).

Quaternary alluvium

Quaternary age alluvial sediments associated with local rivers and creeks infill the valley floors within and surrounding the Project Boundary. Investigative drilling has shown that these sediments consist of silt, clay, sand and gravel. Whilst the sequence is generally variable, the upper layers of the alluvium generally contain more fine sediments of silt and clay compared with the deeper basal layers, of which contain more sand and gravel, and form a productive aquifer. The alluvium in the Project Boundary is up to 16 m in thickness.

Tertiary volcanics

Tertiary igneous units are found across the region occurring primarily as basalts flows. A basalt flow caps the plateau above where longwall mining is proposed. The basalt cover is typically overlain by a thin layer of soil. The thickness of the basalt varies from 10 m to 40 m and unconformably overlies sediments of the Narrabeen Group.

Triassic/Permian Bedrock

The bedrock in the region comprises the Triassic age Narrabeen Group with overlies the Permian age Illawarra Coal Measures. The Permian Illawarra Coal Measures contain the economic coal seams proposed to be mined and are divided into subgroups, which are a succession of two or more formations with common lithologic properties. There are four subgroups occurring in the Project area described in descending stratigraphic order below:

- Wallerawang Subgroup;
- Charbon Subgroup;
- Cullen Bullen Subgroup; and
- Nile Subgroup.

The coal seams proposed for mining are the Ulan and Coggan coal seams that occur within the Cullen Bullen Subgroup.

The Ulan coal seam formation consists of predominantly dull coal with minor bright coal layers, thin claystone, carbonaceous and tuffaceous claystone and siltstone. The formation is subdivided into upper and lower sections by a thin tuffaceous claystone layer. Individual coal plies are generally <1 m thick with the total coal thickness around 7 m over a total interval of average 20 m. The Coggan coal seam is the major economic coal seam in the Project Boundary and has a thickness from approximately 2 m on the western margin of the Project Boundary to approximately 5 m near the eastern boundary. **Figure 22** presents a generalised stratigraphic column for the Project area, with **Figure 23** showing the mapped geological units occurring at the surface.

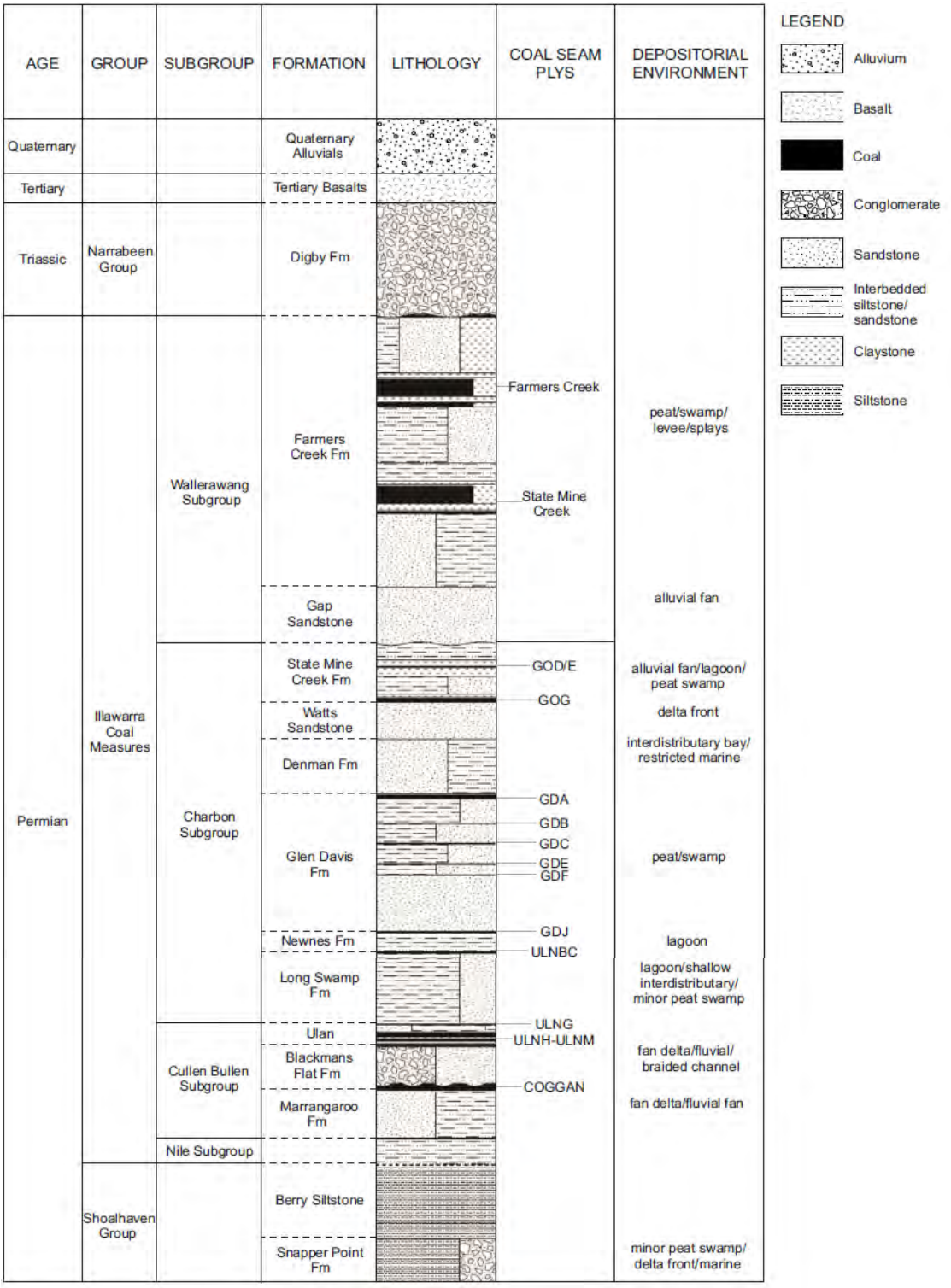

Figure 22
Stratigraphic column

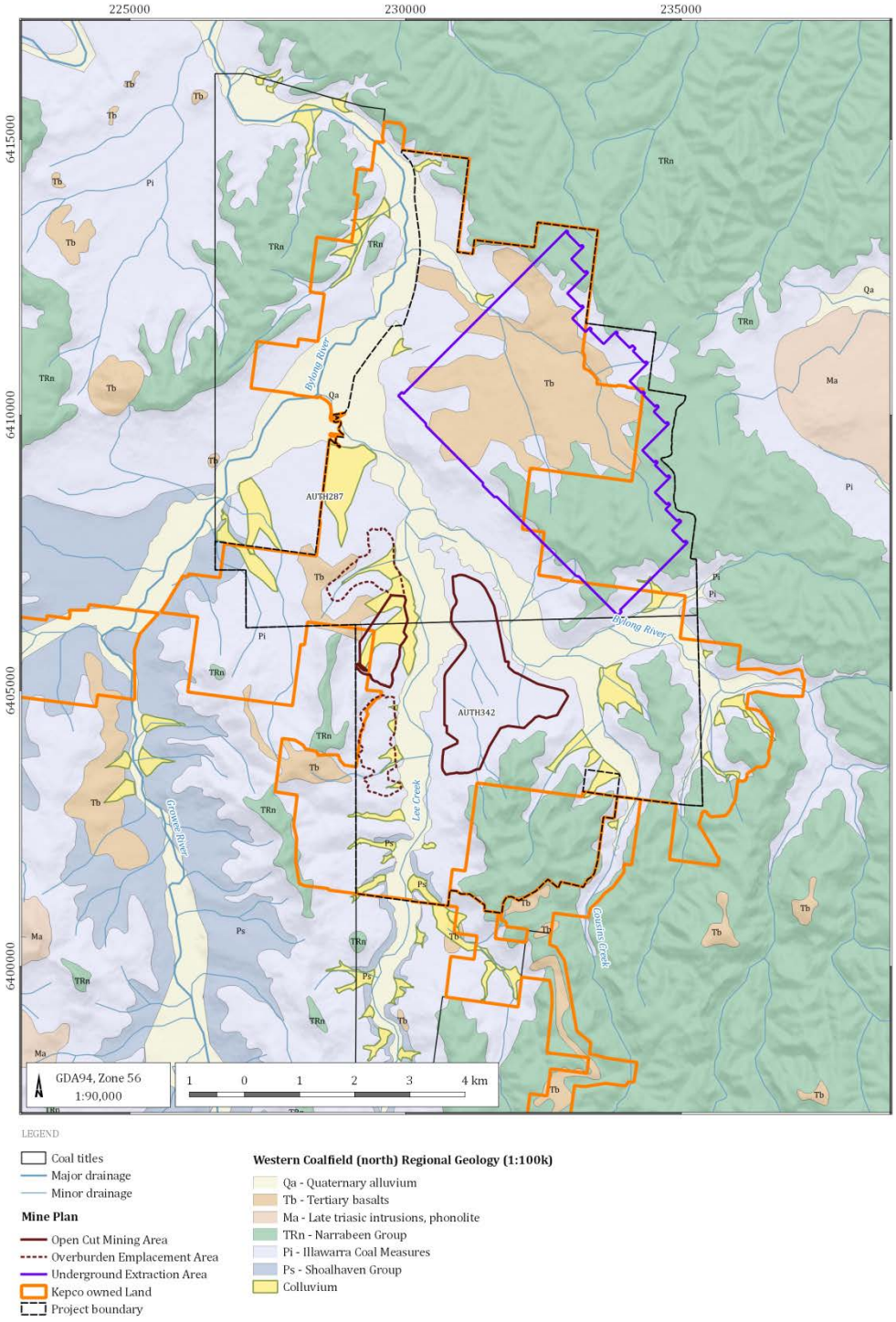

Figure 23
Surface geology

7.2.2 Groundwater systems

Groundwater systems occur within the Quaternary alluvium and also within the coal seams of the Illawarra coal measures. The sections below summarise the key aspects of the groundwater systems occurring in the Project area.

Quaternary alluvium

The Quaternary alluvium that occurs within the flood plain of the Bylong River, Growee River and Lee Creek forms a productive aquifer. The saturated thickness within the Quaternary alluvium varies spatially reaching a maximum of some 16 m within the Bylong River alluvium east of the open cut mining area and also in a separate area further downstream to the north-west of the underground area (refer AGE [2016] Figure 5-6). Areas of thicker alluvium are separated by buried rock bars that effectively create groundwater pools, separated by bedrock highs. The Lee Creek and the Growee River hold significantly less groundwater than the Bylong River with the saturated thickness, varying from around 2 m to 6 m and 2 m to 3 m respectively in each of these systems

The Bylong River and Lee Creek are ephemeral and only flow following rainfall events. In areas along the rivers and creeks the water table is above the land surface forming a chain of ponds that fluctuate in level along with the water table.

The hydraulic conductivity of the Quaternary alluvium has been measured by conducting rising and falling head tests within the monitoring bores and also via pumping tests in four production bores installed for makeup water supply purposes (refer Douglas Partners 2017). The testing indicates the majority of hydraulic conductivity estimates fall within the range 10 m/day to 100 m/day indicating the alluvium is highly permeable within the basal zone (refer AGE [2016b] – Section 4). Extended pumping tests conducted within the four pumping bores installed within the alluvium indicated bores can yield groundwater at rates in-excess of 5 L/sec with salinity less than 1,500 mg/L indicating the alluvium meets the NSW government criteria of *"highly productive"* under the *Aquifer Interference Policy 2012* (AIP). Samples of groundwater from the alluvium typically indicate neutral pH values, relatively fresh or slightly brackish water quality suitable for livestock and potable in some locations.

The highly productive nature of the alluvial aquifer combined with the relatively shallow water table means the Quaternary alluvium is utilised as a water supply by surrounding agricultural businesses and also potentially supports groundwater dependent vegetation. **Figure 24** shows the locations of private bores registered on the NSW Government PINEENA database and entitlements held to extract groundwater from the Quaternary alluvium (refer AGE 2015). It shows private properties utilising groundwater bores occur upstream of the Project on Lee Creek and to the west and north-west along the Growee River. There is also usage downstream of the Project along the Bylong River.

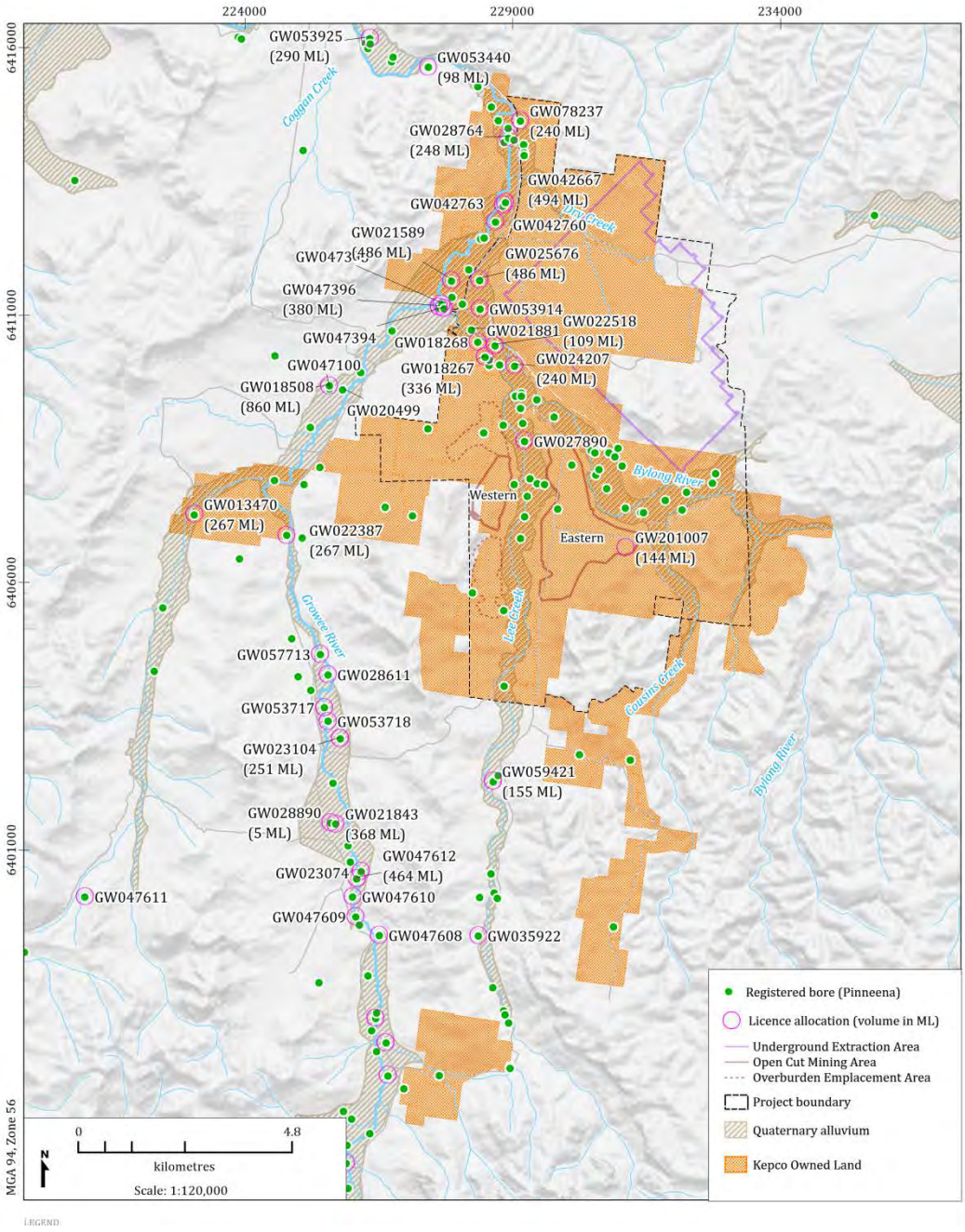

Figure 24
Groundwater users and entitlements

The ecology study for the EIS investigated the potential for groundwater dependent ecosystems (GDEs) to be present within the project site and surrounds. That study identified that three potential GDEs are present in thin riparian zones along creeks and drainage lines as follows:

- Blakely's River Red Gum / Apple Riparian Forest occurring along the lower to mid reaches of Dry Creek, and also in remnants along Lee Creek and Bylong River;
- Blakely's Red Gum / Paperbark Forest isolated on a plateau within the headwaters of Dry Creek; and
- River Oak / Redgum Riparian woodland, with the largest stand occurring at the confluence of Growee River and Bylong River.

Figure 25 shows the potential GDEs identified during the EIS. Further work during the RTS stage of the approvals process included installation of additional monitoring bores along Dry Creek (AGE, 2016a). This work did not identify the presence of an alluvial aquifer along Dry Creek and it was concluded the vegetation along this creek was unlikely to be a GDE. In contrast, the communities of mature trees along Lee Creek, Growee River and Bylong River were considered potentially dependent on groundwater as their roots may uptake water from the shallow water table within the alluvial aquifer. The Hunter Unregulated WSP does not list any High Priority GDEs within the Bylong River catchment.

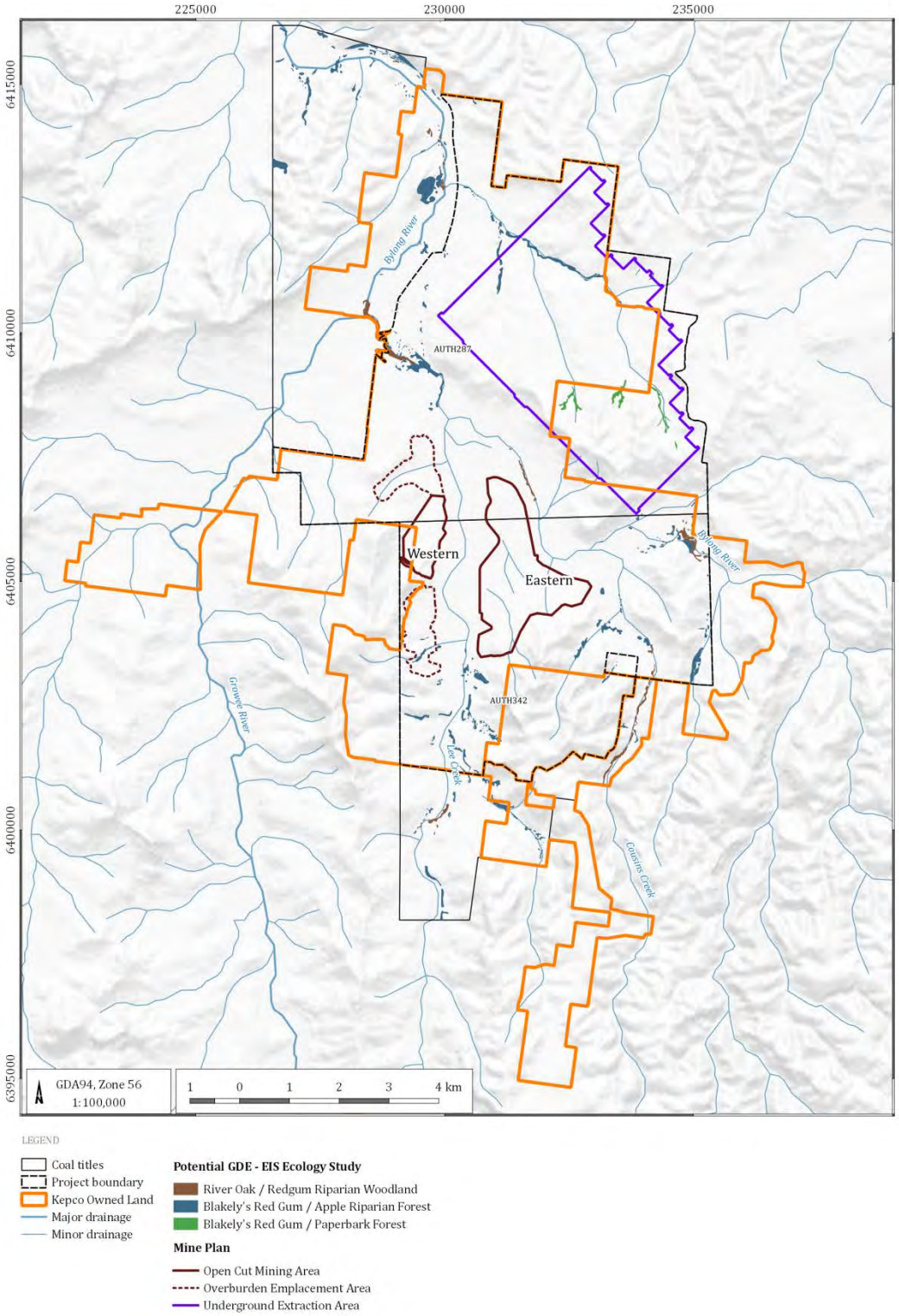

Figure 25

Groundwater dependent ecosystems

Permian Coal Measures

The Coggan and Ulan Coal Seams are the main economic targets for mining. These also represent the most permeable units within the Permian strata. There are several coal seams overlying the Coggan and Ulan Coal Seams, including the Farmers Creek, State Creek Mine and Goulburn Seams. These upper seams are unsaturated over most of the Project Boundary. The Permian interburden and overburden comprises of sandstones, interbedded siltstones, and claystones. These units typically form low permeability aquitards both when present close to the surface and therefore weathered, or at depth and therefore fresh. Whilst the Ulan and Coggan coal seams can form low to moderately permeable groundwater systems, the presence of the highly productive Quaternary alluvial aquifer that occurs along the main rivers and creeks, means there is no known usage of groundwater from the Triassic and Permian strata in the Project locality. Samples of groundwater from monitoring bores installed within the coal measures typically yield fresh to brackish water quality.

7.2.3 Water licensing

Table 21 below summarises the Water Access Licences held by KEPCO for the Bylong River Water Source which is regulated under the Hunter Unregulated WSP. It indicates KEPCO hold 3,045 units of groundwater within the Bylong River Water Source.

Table 21

Bylong River Water Source - Water Access Licences held by KEPCO

Water Access Licence	Units	Property
17731 (20AL206647)	486	Bylong Park - Taworri
17711 (20AL206637)	248	Sylvania Park
17716 (20AL206649)	240	Brigalow
17709 (20AL206625)	494	Bylong Station
17729 (20AL206629)	486	Bylong Station
17732 (20AL206665)	5	Renfrew Park
17712 (20AL206645)	240	Lonair Park
17713 (20AL206655)	336	Wallings Aggregation
17714 (20AL206663)	104	Tinka Tong
17720 (20AL206633)	155	Lee Creek
17726	251	Lee Creek
Total	3,045	

Table 22 below summarises the Water Access Licences held by KEPCO for the Sydney basin – North Coast Water Source which is regulated under the *Water Sharing Plan for the North Coast Porous and Fractured Rock Groundwater Sources 2016* (North Coast WSP). It indicates KEPCO hold 411 units of groundwater within the Sydney Basin – North Coast Water Source under the North Coast WSP.

Table 22

Sydney basin – North Coast Water Source - Water Access Licences held by KEPCO

Water Access Licence	Units	Property
39757	267	Torrie Lodge
40283	144	Helevtia

7.3 GROUNDWATER MONITORING PROGRAM

7.3.1 Monitoring Network – Existing

KEPCO engaged Douglas Partners Pty Ltd in 2011 to supervise and document the installation of the baseline monitoring network and the characterisation of the hydrogeological regime. Douglas Partners commenced monitoring of groundwater levels at the Project site in mid-2011 and has continued monitoring generally on a monthly or quarterly basis to the present time. At the time of writing about six years of baseline data is available. Water quality monitoring began in 2012 and the monitoring network has steadily grown to incorporate an extensive number of groundwater monitoring sites which have been installed during various exploration drilling campaigns.

Douglas Partners have prepared numerous reports to describe the data collected during the baseline characterisation and monitoring period. **Appendix A** includes a comprehensive report prepared by Douglas Partners intended to contain key information collected over the baseline monitoring period from 2011 to 2017. The report includes:

- details of the monitoring bore network including borehole logs;
- all the water level and chemistry records;
- information on permeability testing programs; and
- control charts that include calculated water level and water quality percentiles to be used as trigger levels for investigation.

The groundwater monitoring network currently consists of 97 open standpipe monitoring bores and 14 vibrating wire piezometers (VWPs). Groundwater level measurement is automated in the majority of the monitoring bores with water level data loggers installed within 70 of the monitoring bores and pore pressures recorded by data loggers in all 14 VWPs. Ten of the VWPs are downloaded automatically via telemetry, while the remaining four are manually downloaded on a monthly basis.

Groundwater levels are manually measured in the 27 bores without data loggers and as well as within the bores with loggers to cross check the electronic data. Samples are collected from a subset of 25 bores for an analysis of water quality in a NATA registered laboratory on a monthly basis. In

addition to the laboratory analyses, a further 15 bores havedata loggers that record electrical conductivity on a daily basis. Table 1 summarises the key details for the groundwater monitoring network including:

- bore type, coordinates and screened geological unit;
- frequency at which data is recorded;
- bores with automatic data loggers and those that are monitored manually; and
- bores are sampled for water quality and sampling frequency.

Table 23

Summary of groundwater monitoring network details

Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Unit	Lithology	Date installed	Bore type	Level logger	VWP Data logger	Level & EC logger	WQ sampling	Manual dipping
A01-D	230112	6412947	247.25	20.6	0.64	15.6-18.6	Alluvium – Lower	Gravel/Sand and Residual Clay	26/08/2011	MB	Yes	-	Yes	-	-
A01-S	230109	6412947	299.73	3.8	0.74	0.8-3.8	Alluvium – Upper	Clay and Gravel/Sand	26/08/2011	MB	Yes	-	Yes	Monthly	Monthly
A02-D	230426	6404123	299.76	8.5	0.73	5.5-8.5	Alluvium – Lower	Soil/Sandy Clay	28/02/2012	MB	Yes	-	Yes	Monthly	Monthly
A02-S	230425	6404123	299.73	3.8	0.74	0.8-3.8	Alluvium – Upper	Silty Clay/ Clayey Silt	28/02/2012	MB	Yes	-	Yes	Monthly	Monthly
A03-D	232475	6405317	288.08	9.4	0.84	6.4-9.4	Alluvium – Lower	Clay/Silty Clay/Clayey Silt	30/05/2012	MB	Yes	-	Yes	-	-
A03-S	232475	6405319	288.08	3.5	0.62	0.5-3.5	Alluvium – Upper	Sandy Clay/Clayey Sand	30/05/2012	MB	Yes	-	Yes	-	-
A04	233788	6405926	294.59	5.2	0.73	0.8-5.2	Alluvium – Upper	Sand	16/05/2012	MB	Yes	-	-	-	-
A06-D	231264	6407413	275.32	10	0.52	7.0-10.0	Alluvium – Lower	Sandy Clay and Gravelly Clay	28/02/2012	MB	Yes	-	Yes	Monthly	Monthly
A06-S	231263	6407411	275.34	4.5	0.6	1.5-4.5	Alluvium – Upper	Silty Clay and Silty Sand and Sand	28/02/2012	MB	Yes	-	Yes	Monthly	Monthly
A06-VW1	231259	6407410	262.66	12.5	na	12.5	Long Swamp Fm	Coal seam	12/09/2013	VWP	-	Yes	-	-	-
A06-VW2	231259	6407410	258.16	17	na	17	Ulan Coal Seam	Coal seam	12/09/2013	VWP	-	Yes	-	-	-
A06-VW3	231259	6407410	248.36	26.8	na	26.8	Coggan Coal Seam	Coal seam	12/09/2013	VWP	-	Yes	-	-	-
A06-VW4	231259	6407410	238.56	36.6	na	36.6	Marrangaroo Sandstone	Siltstone	12/09/2013	VWP	-	Yes	-	-	-
A08-D	230229	6408487	267.14	8.6	0.78	5.6-8.6	Alluvium – Lower	Clay/Sand	23/05/2012	MB	Yes	-	-	-	-
A08-S	230227	6408489	267.14	5	0.89	2.0-5.0	Alluvium – Upper	Clay/Sand	23/05/2012	MB	Yes	-	-	-	-
A09	228645	6409927	255.97	6.6	0.74	0.6-6.6	Alluvium – Upper	Alluvium	26/07/2012	MB	Yes	-	Yes	Monthly	Monthly
A10	230454	6406648	278.25	9	0.79	3.0-9.0	Alluvium – Upper	Sand/ Clay/ Sandy Clay	24/05/2012	MB	Yes	-	-	-	-
A11-D	230166	6402189	312.5	12.2	0.57	6.2-12.2	Alluvium – Lower	Sand and Sandy	1/03/2012	MB	Yes	-	-	-	-

Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Unit	Lithology	Date installed	Bore type	Level logger	VWP Data logger	Level & EC logger	WQ sampling	Manual dipping
								Clay/Clayey Sand							
A11-S	230166	6402187	312.52	3.9	0.55	0.9-3.9	Alluvium – Upper	Silty Clay and Sand and Sandy Gravel	1/03/2012	MB	Yes	-	-	-	-
A12	229871	6398593	341.8	6.2	0.8	0.2-6.2	Alluvium – Upper	Sand and Sandy Clay/Clayey Sand	17/05/2012	MB	Yes	-	Yes	Monthly	Monthly
A13	229512	6411279	251.58	7.6	0.66	1.2-7.2	Alluvium – Upper	Clay and Sand and Sand/Gravel	26/08/2011	MB	Yes	-	-	Monthly	Monthly
A14	225357	6406839	280.17	8.3	0.69	2.3-8.3	Alluvium – Upper	Alluvium	27/07/2012	MB	Yes	-	Yes	Monthly	Monthly
A15	234817	6405883	299.99	6.3	0.74	0.3-6.3	Alluvium – Upper	Alluvium	16/05/2012	MB	Yes	-	Yes	Monthly	Monthly
A16	226405	6416910	220.01	1.3	0.81	0.2-1.3	Alluvium – Upper	Alluvium	26/07/2012	MB	-	-	-	Monthly	Monthly
A17-D	230061	6401190	321.09	11.3	0.65	7.3-11.3	Alluvium – Lower	Alluvium	28/02/2012	MB	Yes	-	-	-	-
A17-S	230059	6401191	321.11	4.15	0.65	1.2-4.2	Alluvium – Upper	Alluvium	28/02/2012	MB	Yes	-	-	-	-
A18	229979	6400328	327.63	6.2	0.65	0.2-6.2	Alluvium – Upper	Sandy Silt/Gravelly Sand	21/05/2012	MB	Yes	-	Yes	Monthly	Monthly
A19	229995	6412728	246.29	5.2	0.74	2.2-5.2	Alluvium – Upper	Clay /Clayey Sand/ Gravelly Sand	24/07/2012	MB	Yes	-	Yes	Monthly	Monthly
A20	231186	6407756	273.73	7.2	0.68	1.2-7.2	Alluvium – Upper	Sandy Clay/Clay/Silty Clay	10/07/2012	MB	Yes	-	Yes	Monthly	Monthly
A21	233693	6403939	313.68	14.95	0.63	8.3-14.3	Alluvium – Upper	Alluvium	30/04/2013	MB	Yes	-	-	-	-
A22	230922	6412503	261.69	9.4	0.63	3.4-9.4	Alluvium – Upper	Clayey sand, clay & Sandstone	22/10/2012	MB	-	-	-	-	-
A23	230568	6401122	333.42	9.4	0.63	3.4-9.4	Alluvium – Upper	Clayey sand, sand, gravelly sand	15/10/2012	MB	Yes	-	-	-	-
A23W	230568	6401124	333.28	16.4	0.54	10.4-16.4	Illawarra C.M.	Weathered Zone	23/10/2012	MB	-	-	-	-	-
A24-D	230809	6400666	342.42	8.6	0.46	5.6-8.6	Alluvium – Lower	Alluvium	16/10/2012	MB	Yes	-	-	-	-
A24-S	230810	6400664	342.48	5.4	0.58	2.4-5.4	Alluvium – Upper	Gravelly sand and clay	16/10/2012	MB	-	-	-	-	-

Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Unit	Lithology	Date installed	Bore type	Level logger	VWP Data logger	Level & EC logger	WQ sampling	Manual dipping
A25	231231	6400352	351.49	5.5	0.61	2.5-5.5	Alluvium – Lower	Gravel, sand and sandstone	17/10/2012	MB	Yes	-	-	-	-
AGE01A-D	229452	6414925	237.36	9.4	0.6	6.4-9.4	Alluvium – Lower	Sandy gravel	22/10/2012	MB	Yes	-	-	-	-
AGE01A-S	229453	6414925	237.35	4.8	0.72	1.8-4.8	Alluvium – Upper	Clay and sandy gravel	15/10/2012	MB	Yes	-	-	-	-
AGE01-VW1	229455	6414924	209.56	27.7	na	27.7	Denman Fm	Carbonaceous siltstone with interbedded tuff	16/04/2013	VWP	-	Yes	-	-	-
AGE01-VW2	229455	6414924	170.16	67.1	na	67.1	Long Swamp Fm	Sandstone	30/04/2013	VWP	-	Yes	-	-	-
AGE01-VW3	229455	6414924	117.06	120.2	na	120.2	Ulan Coal Seam	Coal, sandstone and siltstone	30/04/2013	VWP	-	Yes	-	-	-
AGE01-VW4	229455	6414924	109.06	128.2	na	128.2	Coggan Coal Seam	Interburden and coal seam	30/04/2013	VWP	-	Yes	-	-	-
AGE01-VW5	229455	6414924	96.56	140.7	na	140.7	Marrangaroo Sandstone	Sandstone/ siltstone	30/04/2013	VWP	-	Yes	-	-	-
AGE01W	229451	6414925	237.38	20.5	0.51	14.45-20.45	Illawarra C.M.	Weathered siltstone/ sandstone	23/10/2012	MB	Yes	-	-	-	-
AGE02-D	230107	6413814	241.8	11.5	0.51	5.5-11.5	Alluvium – Lower	-	28/02/2012	MB	Yes	-	-	-	-
AGE02-S	230106	6413815	241.81	4.8	0.57	1.8-4.8	Alluvium – Upper	-	26/02/2011	MB	Yes	-	-	-	-
AGE02-VW1	230108	6413814	210.51	31.2	na	31.2	Glen Davis Fm	Sandstone	26/09/2013	VWP	-	Yes	-	-	-
AGE02-VW2	230108	6413814	196.21	45.5	na	45.5	Newnes Fm	Sandstone	26/09/2013	VWP	-	Yes	-	-	-
AGE02-VW3	230108	6413814	157.41	84.3	na	84.3	Long Swamp Fm	Coal seam	26/09/2013	VWP	-	Yes	-	-	-
AGE02-VW4	230108	6413814	147.71	94	na	94	Ulan Coal Seam	Coal seam	26/09/2013	VWP	-	Yes	-	-	-
AGE02-VW5	230108	6413814	138.71	103	na	103	Coggan Coal Seam	Coal seam	26/09/2013	VWP	-	Yes	-	-	-
AGE02-VW6	230108	6413814	125.71	116	na	116	Marrangaroo Sandstone	Sandstone	26/09/2013	VWP	-	Yes	-	-	-
AGE03-VW1	230108	6412878	246.93	30.5	na	30.5	Glen Davis Fm	Fresh Sandstone	30/04/2013	VWP	-	Yes	-	-	-
AGE03W	230108	6412878	246.93	24.15	0.65	18.0-24.15	Illawarra C.M.	Siltstone/ sandstone	16/10/2012	MB	-	-	-	-	-
AGE04	228635	6411382	257.08	66.17	0.68	57.17-	Coggan Coal Seam	Coal seam	16/10/2012	MB	-	-	-	-	Monthly

Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Unit	Lithology	Date installed	Bore type	Level logger	VWP Data logger	Level & EC logger	WQ sampling	Manual dipping
						63.17									
AGE04-D	228637	6411383	257.07	17.3	0.56	14.3-17.3	Alluvium – Lower	Sand and gravel	17/10/2012	MB	-	-	-	-	Monthly
AGE04-S	228638	6411383	257.05	11.3	0.52	5.3-11.3	Alluvium – Upper	Silty sand and sand	23/11/2012	MB	-	-	-	-	Monthly
AGE04W	228636	6411382	257.06	25.95	0.57	19.95-25.95	Illawarra C.M.	Siltstone, minor tuff and coal	23/11/2012	MB	-	-	-	-	Monthly
AGE05	227891	6410501	259.92	50.9	0.57	41.9-47.9	Coggan Coal Seam	Coal seam	29/11/2012	MB	-	-	-	-	Monthly
AGE05A	227890	6410500	259.91	8.4	0.57	5.4-8.4	Alluvium – Upper	Gravelly sand	29/11/2012	MB	-	-	-	-	Monthly
AGE05W	227891	6410503	259.88	15.7	0.62	9.7-15.7	Illawarra C.M.	Siltstone/ sandstone	29/11/2012	MB	-	-	-	-	Monthly
AGE07	228649	6409111	270.68	42.03	0.67	24.1-36.1	Coggan Coal Seam	Coal seam	9/05/2013	MB	Yes	-	-	-	-
AGE07W	228647	6409112	270.68	20	0.64	9.5-17.0	Illawarra C.M.	Weathered Zone	9/05/2013	MB	Yes	-	-	-	-
AGE08	231144	6407147	282.09	36.4	0.61	29.4-33.9	Coggan Coal Seam	Coal seam	13/12/2012	MB	Yes	-	-	Monthly	Monthly
AGE08W	231144	6407148	282.03	13.8	0.72	7.8-13.8	Illawarra C.M.	Sandstone and coal	13/12/2012	MB	Yes	-	-	-	-
AGE09	229945	6406680	285.69	36.45	0.63	24.1-28.6	Coggan Coal Seam	Coal seam	3/04/2013	MB	Yes	-	-	-	-
AGE09W	229945	6406678	285.81	18.06	0.69	7.56-15.06	Illawarra C.M.	Weathered Zone	2/05/2013	MB	Yes	-	-	-	-
AGE10	231810	6405356	298.3	54.24	0.5	41.0-45.5	Coggan Coal Seam	Coal seam	6/04/2013	MB	Yes	-	-	Monthly	Monthly
AGE10W	231809	6405353	298.47	20.98	0.54	12.0-18.0	Illawarra C.M.	Weathered Zone	30/04/2013	MB	Yes	-	-	-	-
AGE11-W	230634	6402142	326.05	14.2	0.63	5.2-14.2	Illawarra C.M.	Sandstone	4/12/2012	MB	Yes	-	-	-	Monthly
AGE12-W	230011	6400310	327.69	22.6	0.43	13.4-22.6	Illawarra C.M.	Siltstone	29/10/2012	MB	-	-	-	-	Monthly
AGE13	231057	6401937	354.97	45.1	0.6	37.6-43.6	Coggan Coal Seam	Sandstone and coal	6/12/2012	MB	Yes	-	-	Monthly	Monthly
AGE13W	231057	6401936	355.05	14.1	0.56	4.1-14.1	Illawarra C.M.	Siltstone	6/12/2012	MB	-	-	-	-	Monthly
AGE14	229440	6406002	309.36	27	0.54	22.7-25.7	Coggan Coal Seam	Coal seam	4/12/2013	MB	Yes	-	-	-	-
AGE15	229850	6405268	303.23	30.3	0.5	13.9-30.34	Illawarra C.M.	Sandstone	3/12/2013	MB	Yes	-	-	-	-
AGE16	231078*	6412159*	TBC	4.1	0.7	1.4-4.1	Alluvium	Sandy clay/clayey sand	8/03/2016	MB	Yes	-	-	-	-
AGE18	231567*	6411761	TBC	7.8	0.7	4.4-7.4	Alluvium	Gravelly sand	6/03/2016	MB	-	-	-	-	Monthly

Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56 *	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Unit	Lithology	Date installed	Bore type	Level logger	VWP Data logger	Level & EC logger	WQ sampling	Manual dipping
AGE19	231834*	6411591 *	TBC	2	0.7	0.85-1.95	Alluvium	Clayey gravelly sand	7/03/2016	MB	Yes	-	-	Monthly	Monthly
AGE20	232073*	6411477 *	TBC	1.5	0.6	0.6-1.5	Alluvium	Sandy clay	7/03/2016	MB	-	-	-	-	Monthly
AGE21P	230400	6407018	275.42	15.6	0.9	8.6 - 10.6	Alluvium	Gravel	19/03/2016	PU	-	-	-	-	-
AGE22M	230409	6406988	275.67	17	0.78	8 - 11	Alluvium	Gravel	21/03/2016	MB	Yes	-	-	-	-
AGE23M	230404	6407003	275.5	17	0.75	8 - 11	Alluvium	Gravel	23/03/2016	MB	-	-	-	-	-
AGE24P	230336	6408250	267.07	11.46	0.7	9.46 - 11.46	Alluvium	Gravel	23/03/2016	PU	-	-	-	-	-
AGE25M	230334	6408263	267.21	10	0.81	7 - 10	Alluvium	Gravel	30/03/2016	MB	-	-	-	-	-
AGE26M	230340	6408246	267.19	12	0.61	9 - 12	Alluvium	Gravel	1/04/2016	MB	Yes	-	-	Monthly	Monthly
AGE27M	230345	6408241	267.34	12	0.72	9 - 12	Alluvium	Gravel	2/04/2016	MB	-	-	-	-	-
AGE28P	232022	6406185	283.91	20	0.51	13 - 15	Alluvium	Gravel	2/04/2016	PU	Yes	-	-	-	-
AGE29M	232045	6406165	284.19	18	0.74	12 - 15		Sandstone	3/04/2016	MB	Yes	-	-	-	-
AGE30M	232034	6406175	284.03	18	0.85	12 - 15		Coal	5/04/2016	MB	Yes	-	-	-	-
AGE31M	231763	6406942	279.03	18	0.67	13 - 16	Alluvium	Gravel	13/04/2016	MB	-	-	-	-	-
AGE32P	231768	6406930	279.08	16	0.71	13 - 15	Alluvium	Gravel	15/04/2016	PU	-	-	-	-	-
AGE33M	231775	6406916	279.14	18.6	0.71	13 - 16	Alluvium	Gravel	16/04/2016	MB	Yes	-	-	Monthly	Monthly
B3-D	235106	6406728	310.61	18	0.5	15.7-18.0	Alluvium – Lower	-	28/11/2013	MB	Yes	-	-	Monthly	Monthly
B3-S	235106	6406727	310.61	13.7	0.5	10.15-13.65	Alluvium – Upper	-	27/11/2013	MB	Yes	-	-	Monthly	Monthly
B3-VW1	235106	6406726	267.38	43.2	na	43.2	Glen Davis Fm	Coal seam	14/11/2013	VWP	-	Yes	-	-	-
B3-VW2	235106	6406726	228.58	82	na	82	Long Swamp Fm	Coal seam	14/11/2013	VWP	-	Yes	-	-	-
B3-VW3	235106	6406726	202.08	108.5	na	108.5	Ulan Coal Seam	Coal seam	14/11/2013	VWP	-	Yes	-	-	-
B3-VW4	235106	6406726	190.08	120.5	na	120.5	Coggan Coal Seam	Coal seam	14/11/2013	VWP	-	Yes	-	-	-
B3-VW5	235106	6406726	175.58	135	na	135	Marrangaroo Sandstone	Sandstone	14/11/2013	VWP	-	Yes	-	-	-
BY0001	233577	6409321	375.4	195	0.84	185-191	Coggan Coal Seam	Coal seam	10/05/2011	MB	Yes	-	-	-	-
BY0007	230443	6410218	368.69	169.5	0.35	161-167	Coggan Coal Seam	Coal seam	1/11/2011	MB	Yes	-	-	-	-

Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Unit	Lithology	Date installed	Bore type	Level logger	VWP Data logger	Level & EC logger	WQ sampling	Manual dipping
BY0010	231893	6412110	301.35	139	0.74	133-139	Coggan Coal Seam	Coal seam	1/11/2011	MB	Yes	-	-	-	-
BY0011-VW1	232963	6411410	283.22	73.4	na	73.4	Watts Sandstone	Sandstone	17/05/2013	VWP	-	Yes	-	-	-
BY0011-VW2	232963	6411410	207.82	148.8	na	148.8	Long Swamp Fm	Sandstone	1/11/2011	VWP	-	Yes	-	-	-
BY0011-VW3	232963	6411410	166.22	190.4	na	190.4	Ulan Coal Seam	Sandstone, miNor coal	1/11/2011	VWP	-	Yes	-	-	-
BY0011-VW4	232963	6411410	154.22	202.4	na	202.4	Coggan Coal Seam	Coal seam	1/11/2011	VWP	-	Yes	-	-	-
BY0011-VW5	232963	6411410	136.62	220	na	220	Marrangaroo Sandstone	Sandstone	1/11/2011	VWP	-	Yes	-	-	-
BY0014	229611	6410330	259.38	56.2	0.73	50.2-56.2	Coggan Coal Seam	Coal seam	28/07/2011	MB	Yes	-	-	Monthly	Monthly
BY0015	230111	6412948	247.24	96	0.7	90-96	Coggan Coal Seam	Coal seam	1/11/2011	MB	-	-	-	Monthly	Monthly
BY0016	231315	6408236	292.89	47.5	0.69	39.8-45.8	Coggan Coal Seam	Coal seam	13/07/2011	MB	Yes	-	-	Monthly	Monthly
BY0020	230572	6401184	332.37	36	0.64	NA	Marrangaroo Sandstone	Sandstone	1/12/2011	MB	Yes	-	-	-	-
BY0077-VW1	230750	6411475	248.95	48.3	na	48.3	Newnes Fm	Sandstone, siltstone	1/11/2011	VWP	-	Yes	-	-	-
BY0077-VW2	230750	6411475	189.35	107.9	na	107.9	Ulan Coal Seam	Sandstone and coal	28/09/2012	VWP	-	Yes	-	-	-
BY0077-VW3	230750	6411475	178.45	118.8	na	118.8	Coggan Coal Seam	Coal seam	28/09/2012	VWP	-	Yes	-	-	-
BY0077-VW4	230750	6411475	157.75	139.5	na	139.5	Marrangaroo Sandstone	Sandstone	28/09/2012	VWP	-	Yes	-	-	-
BY0080-VW1	233295	6409002	228.53	177.2	na	177.2	Long Swamp Fm	Siltstone/ sandstone	28/09/2012	VWP	-	Yes	-	-	-
BY0080-VW2	233295	6409002	205.73	200	na	200	Ulan Coal Seam	Coal seam	5/11/2012	VWP	-	Yes	-	-	-
BY0080-VW3	233295	6409002	195.03	210.7	na	210.7	Coggan Coal Seam	Coal seam	5/11/2012	VWP	-	Yes	-	-	-
BY0080-VW4	233295	6409002	175.73	230	na	230	Marrangaroo Sandstone	Sandstone	5/11/2012	VWP	-	Yes	-	-	-

Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Unit	Lithology	Date installed	Bore type	Level logger	VWP Data logger	Level & EC logger	WQ sampling	Manual dipping
BY0091-B	231773	6410454	363.78	23	0.59	17.0-23.0	Tertiary Basalt	Basalt	21/11/2012	MB	Yes	-	-	-	-
BY0091-S	231773	6410454	363.79	36	0.64	30.0-36.0	Marrangaroo Sandstone	Sandstone	27/11/2012	MB	Yes	-	-	-	-
BY0091-VW1	231773	6410454	306.74	57	na	57	Denman Fm	Sandstone	23/11/2012	VWP	-	Yes	-	-	-
BY0091-VW2	231773	6410454	260.34	103.4	na	103.4	Newnes Fm	Sandstone/ siltstone	23/11/2012	VWP	-	Yes	-	-	-
BY0091-VW3	231773	6410454	191.24	172.5	na	172.5	Coggan Coal Seam	Coal seam	23/11/2012	VWP	-	Yes	-	-	-
BY0091-VW4	231773	6410454	178.74	185	na	185	Marrangaroo Sandstone	Sandstone	23/11/2012	VWP	-	Yes	-	-	-
BY0188	230858	6404064	326.48	35.5	0.62	26.5-32.5	Coggan Coal Seam	Coal seam	5/04/2013	MB	-	-	-	-	Monthly
BY0204	232616	6405079	296.75	62.5	0.74	55.0-61.0	Coggan Coal Seam	Coal seam		MB	Yes	-	-	-	-
BY0208-VW1	234269	6403672	289.78	37.3	na	37.3	Long Swamp Fm	Igneous	16/04/2013	VWP	-	Yes	-	-	-
BY0208-VW2	234269	6403672	267.08	60	na	60	Long Swamp Fm	Siltstone/ sandstone	16/04/2013	VWP	-	Yes	-	-	-
BY0208-VW3	234269	6403672	239.58	87.5	na	87.5	Coggan Coal Seam	Coal seam	16/04/2013	VWP	-	Yes	-	-	-
BY0208-VW4	234269	6403672	228.6	98.5	na	98.5	Marrangaroo Sandstone	Sandstone	16/04/2013	VWP	-	Yes	-	-	-
BY0513CH	231142	6408585	323.45	111.23	-	-	-	-	18/02/2017		-	-	-	-	-
BY0514CH	231229	6408494	308	93.21	-	-	-	-	22/02/2017		-	-	-	-	-
BY0516CH	231582	6409089	392.41	183.33	-	-	-	-	16/03/2017		-	-	-	-	-
BY0527CH	231937	6409489	377.43	174.31	-	-	-	-	21/05/2017		-	-	-	-	-
BY0531CH-VW1	231959	6409600	248.82	110	na	110	Sandstone	Sandstone	5/06/2017	VWP	-	Yes	-	-	-
BY0531CH-VW2	231959	6409600	221.82	137	na	137	Ulan Coal Seam	Coal seam	5/06/2017	VWP	-	Yes	-	-	-
BY0531CH-VW3	231959	6409600	213.82	145	na	145	Coggan Coal Seam	Coal seam	5/06/2017	VWP	-	Yes	-	-	-

Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Unit	Lithology	Date installed	Bore type	Level logger	VWP Data logger	Level & EC logger	WQ sampling	Manual dipping
BY0531CH-VW4	231959	6409600	205.82	153	na	153	Sandstone	Sandstone	5/06/2017	VWP	-	Yes	-	-	-
CPT13	231034	6406771	290.93	36.4	0.62	28.9-33.4	Coggan Coal Seam	Coal seam		MB	Yes	-	-	-	-
CPT15	231051	6405928	285.63	14.91	0.64	7.21-13.21	Illawarra C.M.	Weathered Zone	29/05/2013	MB	Yes	-	-	-	-
CPT18	230968	6405354	297.37	19	0.47	11.5-19.0	Illawarra C.M.	Coal	23/05/2013	MB	Yes	-	-	-	-
CPT18-VW1	230968	6405354	276.08	22.75	na	22.75	Coggan Coal Seam	Coal seam	23/05/2013	VWP	-	Yes	-	-	-
CPT36	232343	6404982	301.42	15.5	0.64	8.0-15.5	Illawarra C.M.	Weathered Zone	23/05/2013	MB	Yes	-	-	-	-
CPT36-VW1	232343	6404982	254.3	47.75	na	47.75	Ulan Coal Seam	Coal seam		VWP	-	Yes	-	-	-
CPT36-VW2	232343	6404982	245.3	56.75	na	56.75	Coggan Coal Seam	Coal seam		VWP	-	Yes	-	-	-
CPT39-VW1	231241	6405086	282.1	25	na	25	Ulan Coal Seam	Coal seam		VWP	-	Yes	-	-	-
CPT39-VW2	231241	6405086	274.1	33	na	33	Coggan Coal Seam	Coal seam		VWP	-	Yes	-	-	-
CPT39W	231241	6405086	306.47	22.1	0.63	16.0-22.1	Weathered Zone	Weathered Zone		MB	Yes	-	-	-	-
M1	227089	6408370	277.77	23	0.45	15.5-23.0	Illawarra C.M.	Sandstone	11/12/2013	MB	Yes	-	-	-	-
M2	227519	6409099	262.8	5.9	0.5	2.9-5.9	Alluvium	Alluvium	11/12/2013	MB	-	-	-	-	-
OPO32	229258	6400152	382.99	6.4	0.56	4.85-6.35	Illawarra C.M.	Weathered Zone	12/12/2012	MB	-	-	-	-	Monthly

Notes 1. Stickup (magl)_ - height of PVC bore casing in metres above ground level

2. Bore types – MB = monitoring bore, VWP = vibrating wire piezometer

Figure 26 shows the locations of the monitoring bores, with **Figure 27** displaying the VWPs network. The geological unit screened by the bore or VWP is indicated on the maps. The figures show the Quaternary alluvium contains the majority of monitoring points which is appropriate as this aquifer contains receptors (water bores and GDEs) and is therefore the most sensitive to potential changes in groundwater levels and quality. Whilst the monitoring bores provide information on groundwater levels and quality in discrete zones including the alluvium, the arrays of VWPs record the pore pressure within discrete geologic units through the bedrock profile. These provide groundwater pressure readings from multiple depths at the same location and give information on hydraulic connectivity vertically between the bedrock and the alluvium, as well as temporal water pressure changes within individual zones.

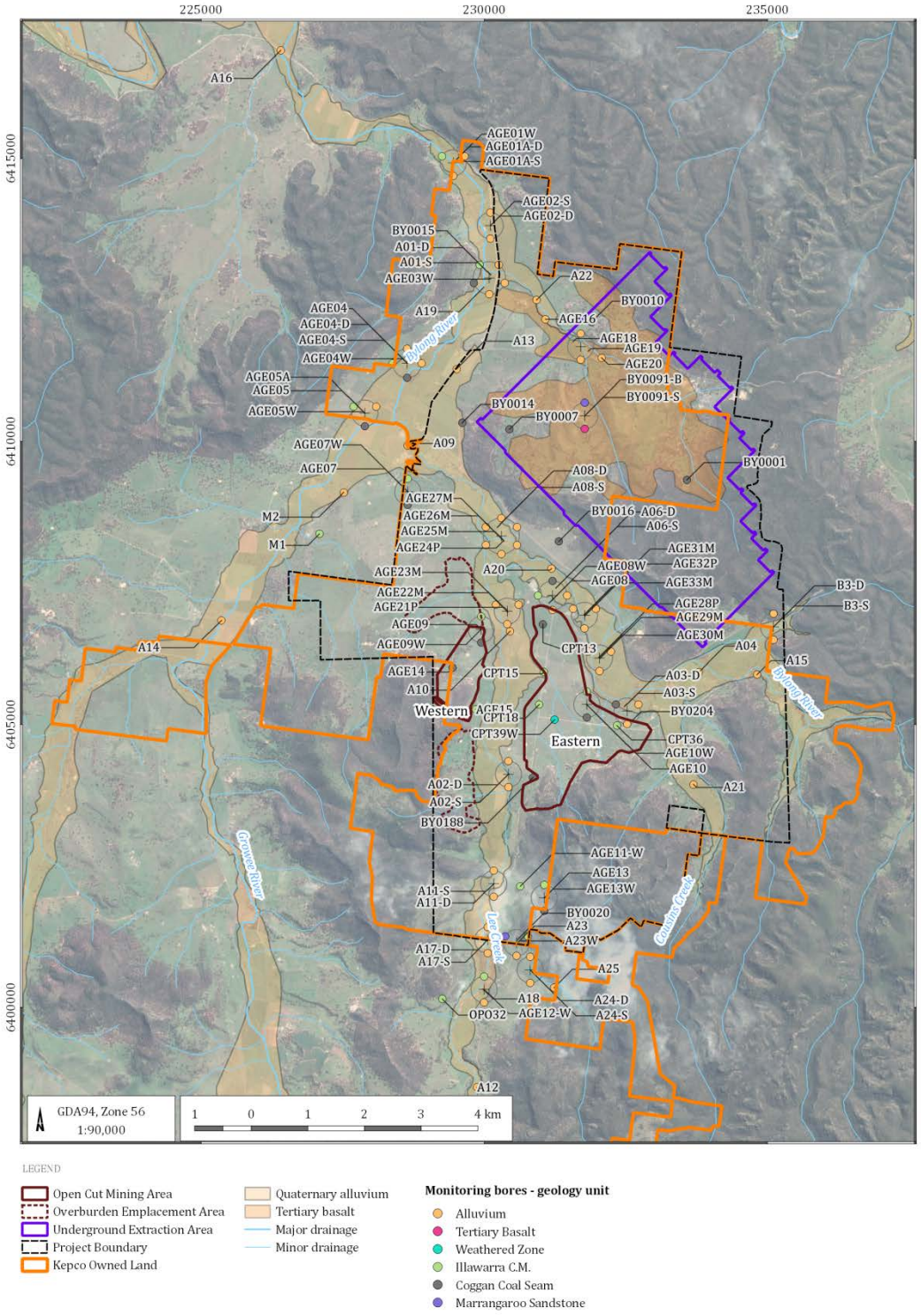

Figure 26
Monitoring bore network

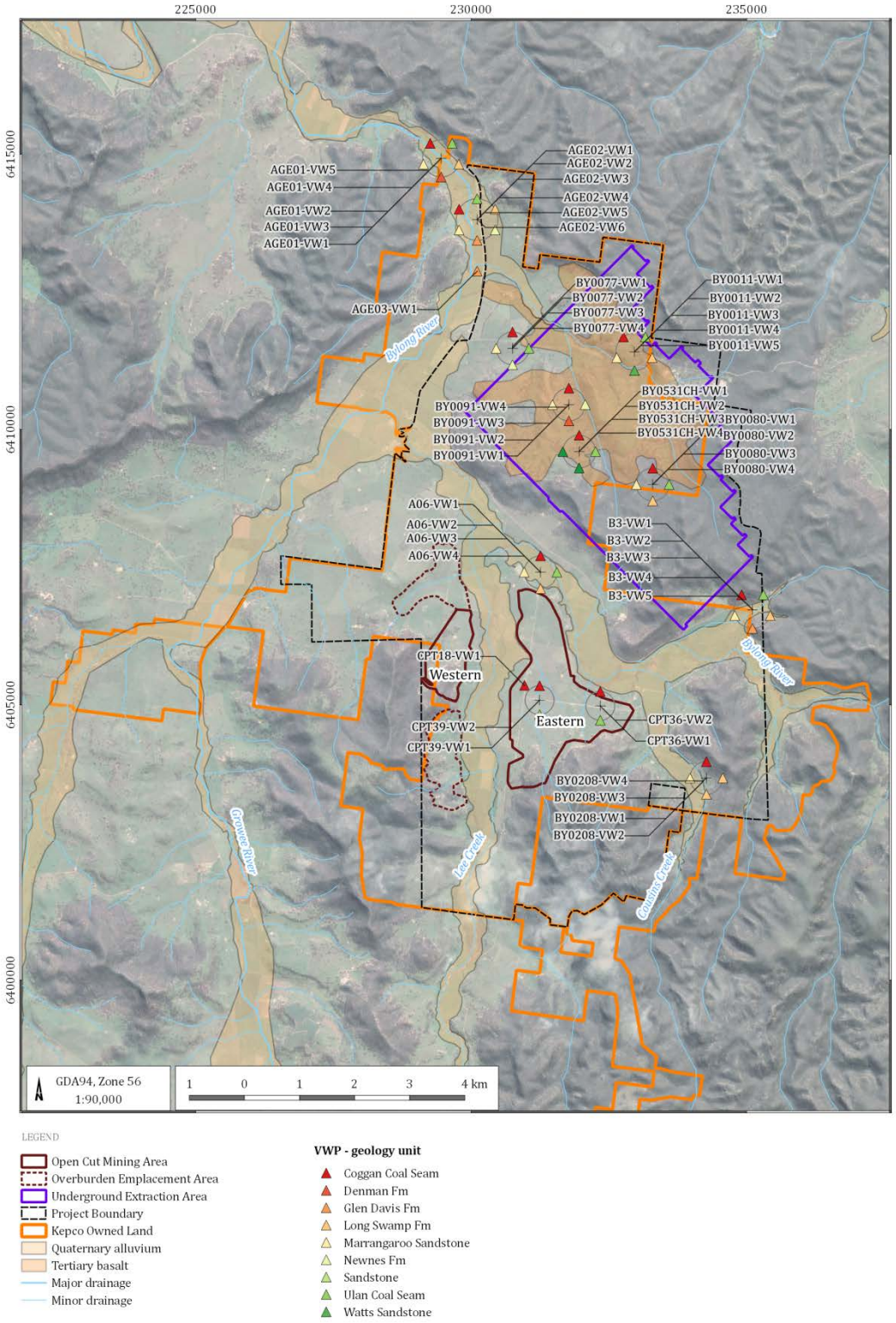

Figure 27
Vibrating wire piezometer network

7.3.2 Monitoring Network – Additional sites

As noted previously, within the EIS, RTS and supplementary RTS, KEPCO made a range of commitments including the installation of additional monitoring bores to investigate and monitor the:

- thickness and saturation of the Tertiary basalt;
- alluvial aquifer adjacent to the OEAs; and
- water bores and wells situated on private properties surrounding the Project.

Additional monitoring sites have been selected to achieve these commitments and are documented in the sections below. The proposed sites are shown in **Figure 28**, with **Table 24** including the coordinates and purpose of each monitoring site. The additional proposed bores have the following prefixes to identify the purpose of each group of bores:

- "OEA bores" are for monitoring any impacts resultant from the OEAs;
- "TB bores" are for investigating the presence of any saturated Tertiary basalt overlying the longwall mining areas; and
- "LMB bores" and for monitoring for impacts in the area of private landholder bores.

A total of eight monitoring bore sites are proposed within the Quaternary alluvium adjacent to the OEA. The bores will be installed prior to mining to collect baseline data on salinity and are situated to detect any impact from runoff or seepage from the emplacement areas. Salinity loggers will be installed in the bores to record any changes in salinity following rainfall events. A geophysical survey using the transient electromagnetic method (TEM) will also be undertaken to detect any areas of naturally elevated salinity occurring along the contact zone between the bedrock zone and the overlying Quaternary alluvium.

Five monitoring bore sites have been selected where the Tertiary basalt is mapped as potentially overlying the longwall mining area. The sites have been biased towards the lower lying elevations where there is more potential for the basalt to be saturated than in the elevated areas of longwall mining area where previous investigation has focussed (AGE, 2016a). The monitoring bores will be installed at the base of the basalt (if present) to determine if it is saturated, and if so to monitor groundwater levels and quality prior to and during longwall mining.

Six additional monitoring bore sites have been selected adjacent to private properties that utilise groundwater for agricultural purposes. The bores have been situated within the Council road reserve (subject to Mid-Western Regional Council approval) within the Growee River flood plain and are designed to be installed within the alluvial aquifer. The location within the road reserve will ensure

permanent access to the bores whilst remaining in proximity to private properties that utilise groundwater.

Table 24
Additional Monitoring Sites

Monitoring bore ID	Easting	Northing	Purpose
OEA1	229803	6403473	Monitoring alluvium adjacent to OEAs
OEA2	230126	6403548	Monitoring alluvium adjacent to OEAs
OEA3	230358	6403594	Monitoring alluvium adjacent to OEAs
OEA4	229838	6404996	Monitoring alluvium adjacent to OEAs
OEA5	230116	6405042	Monitoring alluvium adjacent to OEAs
OEA6	230439	6405148	Monitoring alluvium adjacent to OEAs
OEA7	229748	6407928	Monitoring alluvium adjacent to OEAs
OEA8	229899	6407464	Monitoring alluvium adjacent to OEAs
OEA9	230131	6407570	
TB1	231075	6411525	Investigation Tertiary basalt saturation and impacts
TB2	231668	6411509	Investigation Tertiary basalt saturation and impacts
TB3	232236	6412227	Investigation Tertiary basalt saturation and impacts
TB4	232348	6411264	Investigation Tertiary basalt saturation and impacts
TB5	231006	6410605	Investigation Tertiary basalt saturation and impacts
LMB1	226768	6408509	Monitoring alluvial aquifer adjacent to private landholders
LMB2	227483	6409091	Monitoring alluvial aquifer adjacent to private landholders
LMB3	228302	6409538	Monitoring alluvial aquifer adjacent to private landholders
LMB4	227977	6410391	Monitoring alluvial aquifer adjacent to private landholders
LMB5	225767	6400001	Monitoring alluvial aquifer adjacent to private landholders
LMB6	225106	6403038	Monitoring alluvial aquifer adjacent to private landholders
LMB7	225602	6401633	Monitoring alluvial aquifer adjacent to private landholders
LMB8	225044	6404886	Monitoring alluvial aquifer adjacent to private landholders

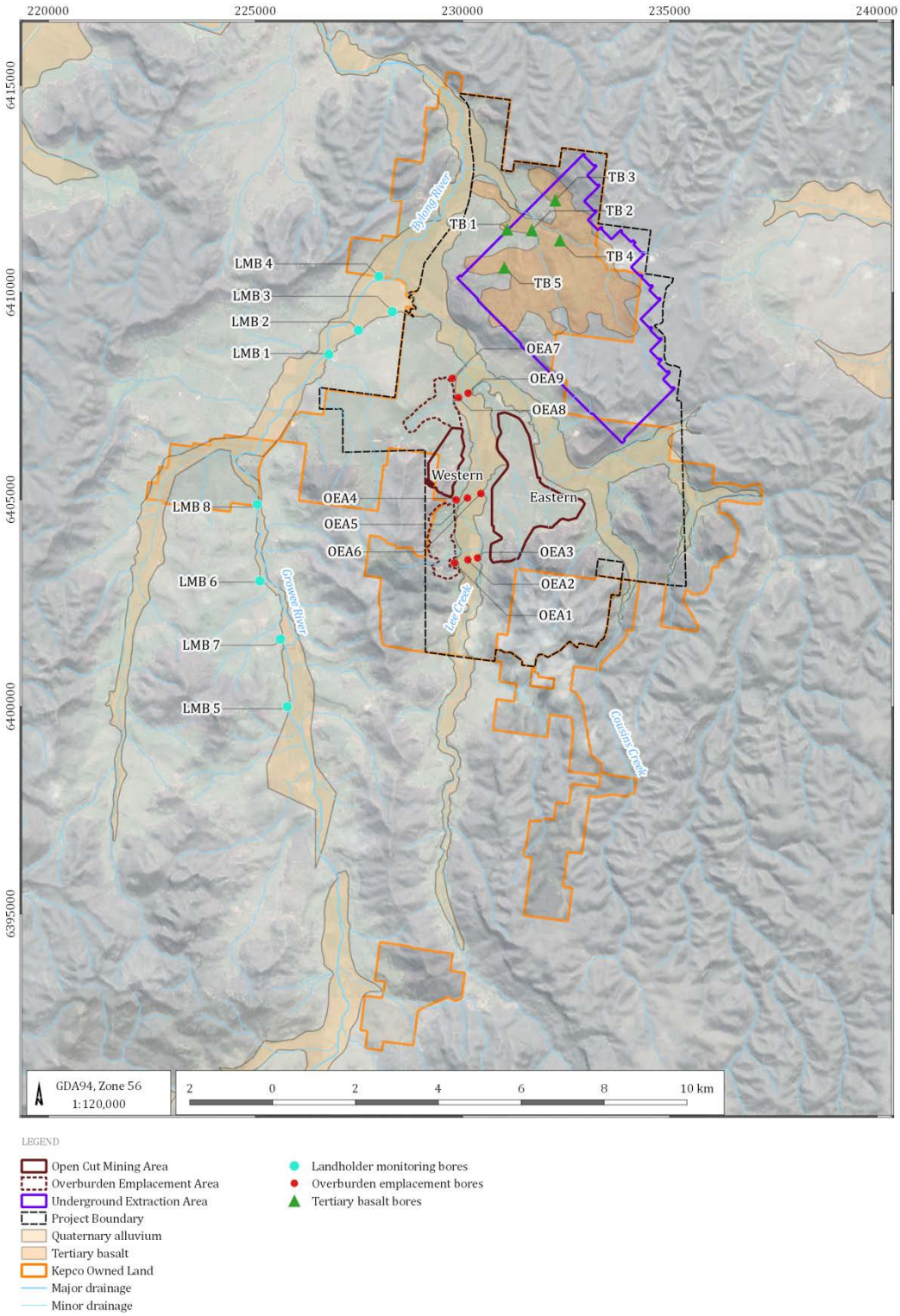

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Figure 28
Additional monitoring sites

7.3.3 Monitoring Network – NSW Government Monitoring Bores

DPI-Water have installed five monitoring bores within proximity to the Project. **Figure 29** shows the locations of the bores and the KEPCO land ownership. KEPCO recognises the purpose of these bores is to assist with implementation of the Hunter Unregulated WSP. KEPCO will maintain access to the monitoring bores that occur with the Project Boundary or on KEPCO owned land outside Project Boundary for the DPI-Water.

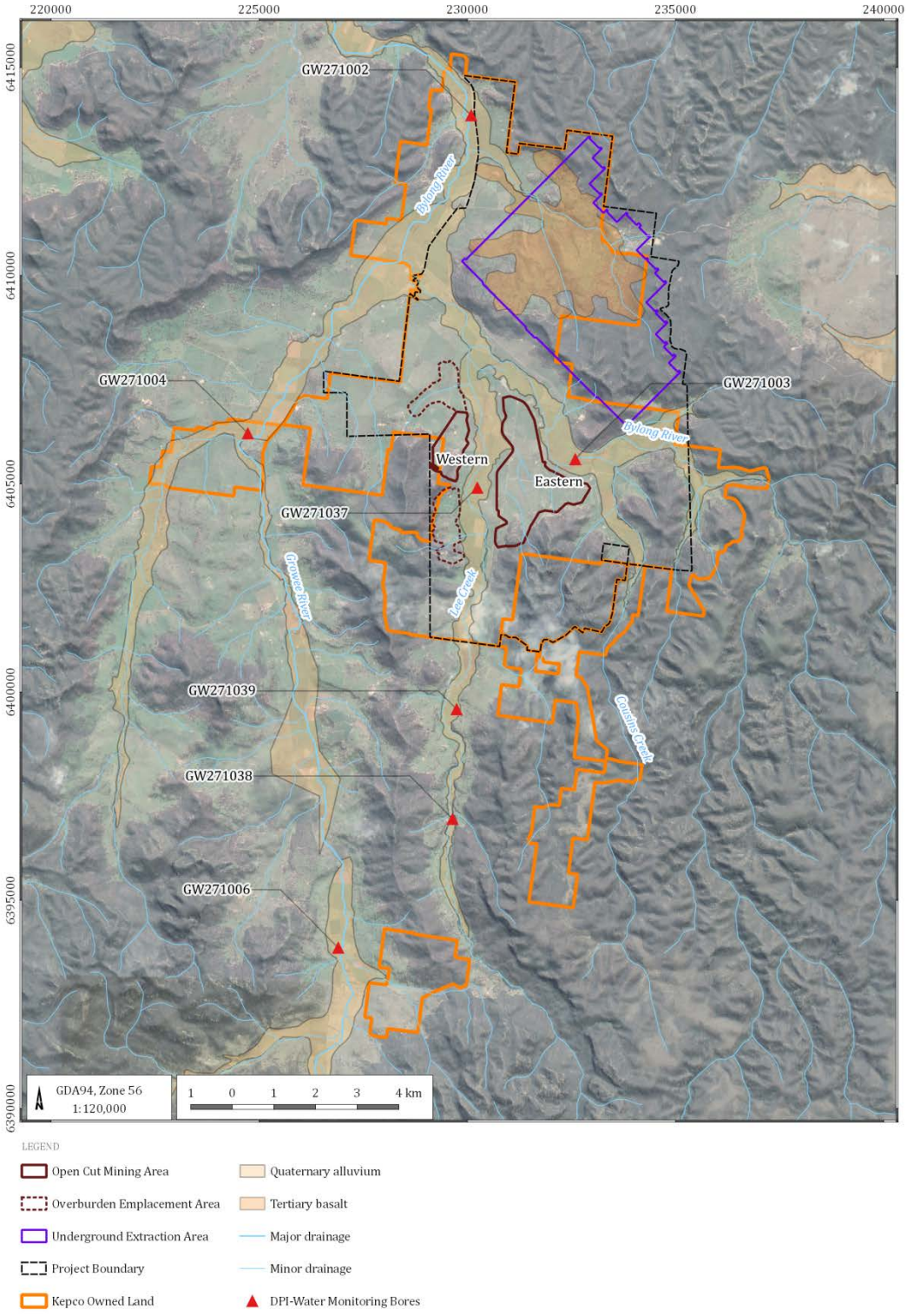

Figure 29
NSW Government groundwater monitoring sites

7.3.4 Water level monitoring

Continuous water level records are essential for capturing fluctuations and trends in groundwater levels over time. As noted in **Section 7.3.1**, much of the monitoring bore network is fitted with electronic water level loggers. Daily recording of groundwater levels using dataloggers will continue for the life of the Project and post mining. Bores without data loggers will continue to have groundwater levels measured on a monthly basis manually. Water levels will also be manually recorded in monitoring bores with dataloggers to enable the electronic measurements to be cross checked for any drift. The water levels will be measured according to the standard operating procedure (SOP) included in **Appendix B**. This will ensure a consistent approach to water level data collection over the life of the Project.

7.3.5 Water quality monitoring

KEPCO currently collect groundwater samples from a subset of 25 monitoring bores on a monthly basis for laboratory analysis. Groundwater samples are tested for:

- pH, EC, turbidity;
- major cations - calcium, magnesium, sodium and potassium;
- major anions - chloride, sulphate, carbonate / bicarbonate;
- minor anions – ammonia, nitrate, nitrite;
- total phosphorous; and
- 16 dissolved metals – Al, As, Ba, Be, Cd, Co, Cu, Fe, Pb, Mn, Hg, Ni, Se, V and Zn.

Table 23 indicates which bores are sampled for water quality analysis each month. The locations of the monitoring bores are shown on **Figure 30**.

For the operational period the baseline water quality sampling program will be reduced to a quarterly frequency, but the network increased to include the eight “OEA” bores and any private landholder bores that are subject to a Compensatory Water Supply Agreement. Salinity loggers will also be installed in selected monitoring bores in proximity to the open cut mining areas where rejects will be emplaced.

To ensure the water quality sampling is conducted in a manner that meets the Australian Standards, and all other relevant Australian guidelines, it will adhere to the SOP for conducting water quality sampling, low flow sampling and sample transport, found in **Appendix B**.

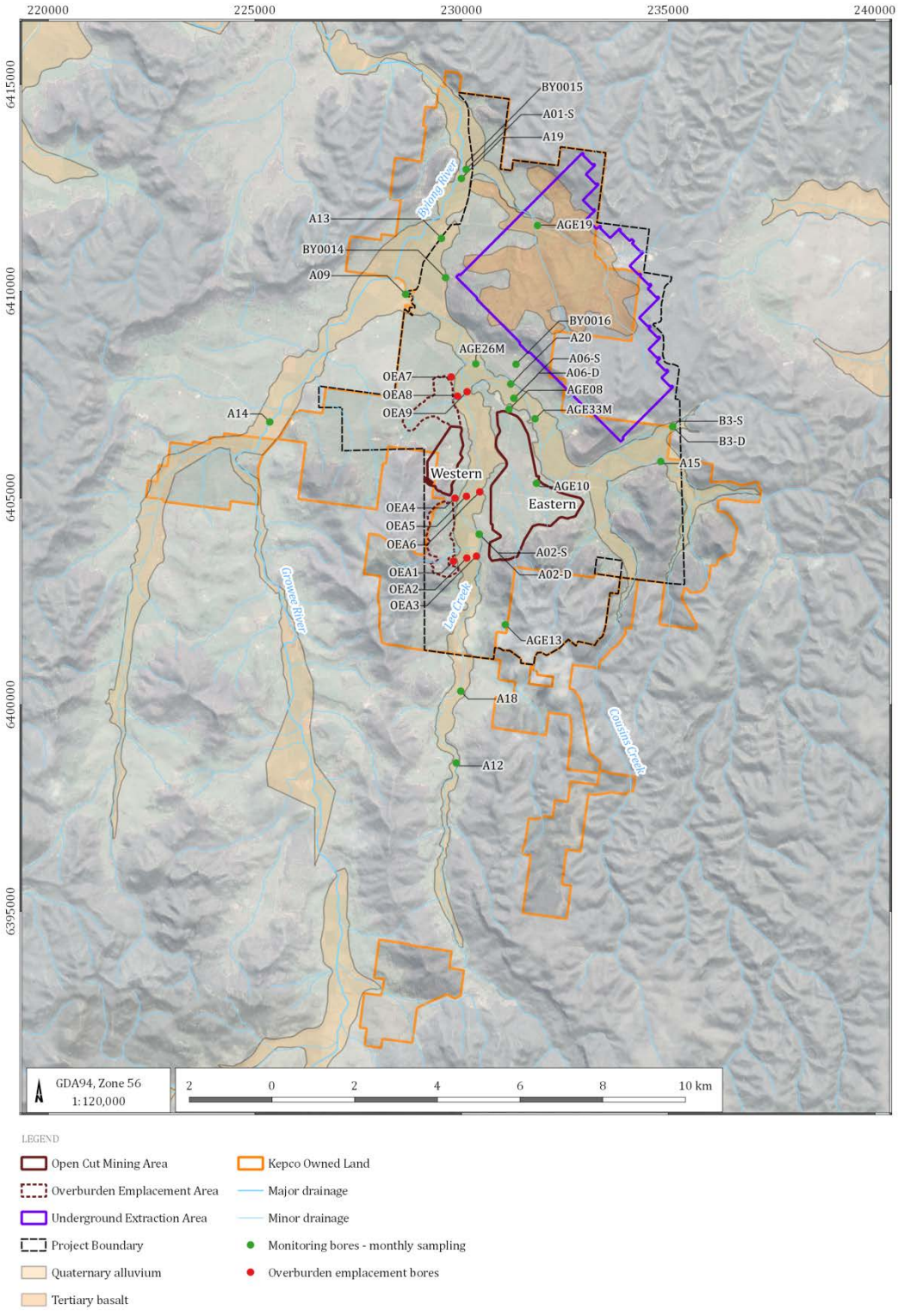

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Figure 30
Groundwater quality monitoring sites

7.3.6 Water use monitoring

The Project will directly abstract groundwater from the Permian coal measures that are intercepted due to mining, and also from a borefield within the Quaternary alluvium if make up water is required for mining operations. Mining will also indirectly influence the flow of groundwater to the alluvial aquifers. The sections below outline how the direct and indirect usages of groundwater from the bedrock and alluvial sources will be monitored.

Direct water use from borefield

If dry conditions result in a deficit of water for the Project, KEPCO will utilise a borefield within the alluvial aquifer to obtain make up water. During the approvals process four bores were installed to test the productivity of the alluvial aquifer (AGE, 2016b). Of these four bores, three will be utilised for pumping to make up water if required. In addition to these bores the locations for a further five pumping bores have been identified, as shown in **Figure 31** and **Table 25,** and will be installed if required. The locations of the pumping bores were selected by AGE (2016b) to maximise the yield from the borefield, whilst minimising the drawdown impacts at the private bores and potential GDEs.

Table 25
Borefield sites

Pumping Bore ID	Status	Easting	Northing	Ground elevation
AGE21P	Existing	230403	6407018	275.6
AGE24P	Existing	230335.7	6408249.8	267.3
AGE28P	Existing	232022.9	6406186.7	284.0
AGE34P	Proposed	230130	6408513	259.8
AGE35P	Proposed	230910	6407716	267.2
AGE36P	Proposed	232059	6406605	271.3
AGE37P	Proposed	233416	6405768	282.0
AGE38P	Proposed	233168	6405531	280.3

Coordinate system – GDA94 Z56

The use from each pumping bore making up the borefield to support mining operations will be recorded using Australian Standard flow meters. A licensed plumber will be used to install the flow meters to ensure they comply with Australian Standard AS4747 - Meters for non-urban water supply. To ensure accurate records from the flow meter, there must be a length of straight unobstructed pipe on the inlet side of the meter which is at least ten times the pipe diameter and has a length of straight unobstructed pipe on the outlet side of the meter which is at least five times the pipe diameter. The water meter must be installed upstream of any valves (except air valves), tees, take-offs, diversions or branches.

The flow meters will be connected to data loggers so pumping rates and timing of the usage is recorded electronically. The annual water use from each bore and from the borefield will be reported in the annual review as described in **Section 7.4.5**. The data loggers will be downloaded on a quarterly basis and the usage on the flow meters also recorded manually to cross check the accuracy of the electronic data. Pressure transducers will also be installed within all pumping bores to measure how water levels decline and recover when pumping is active.

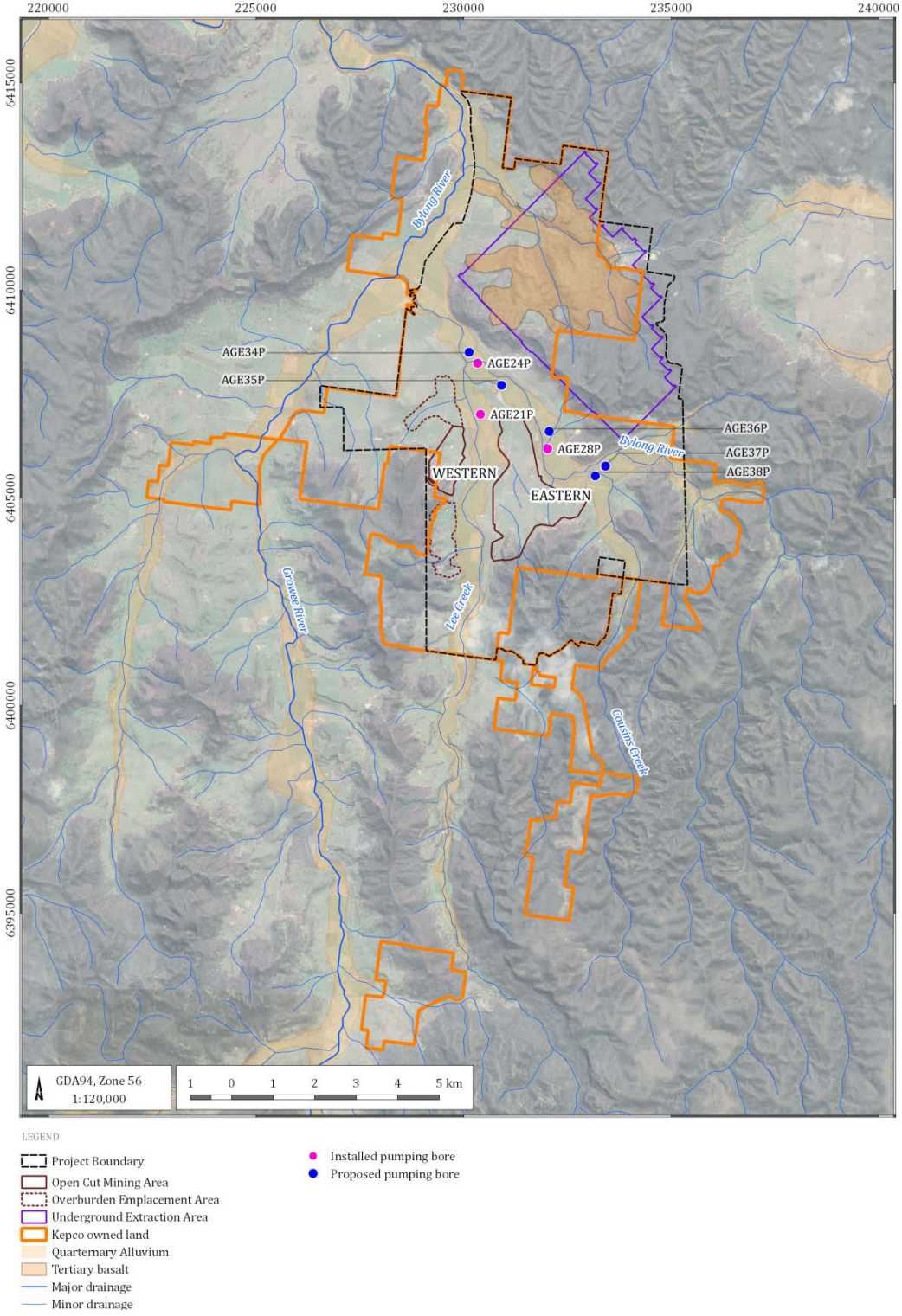


Figure 31
Pumping bore sites

Direct water use from agricultural bores

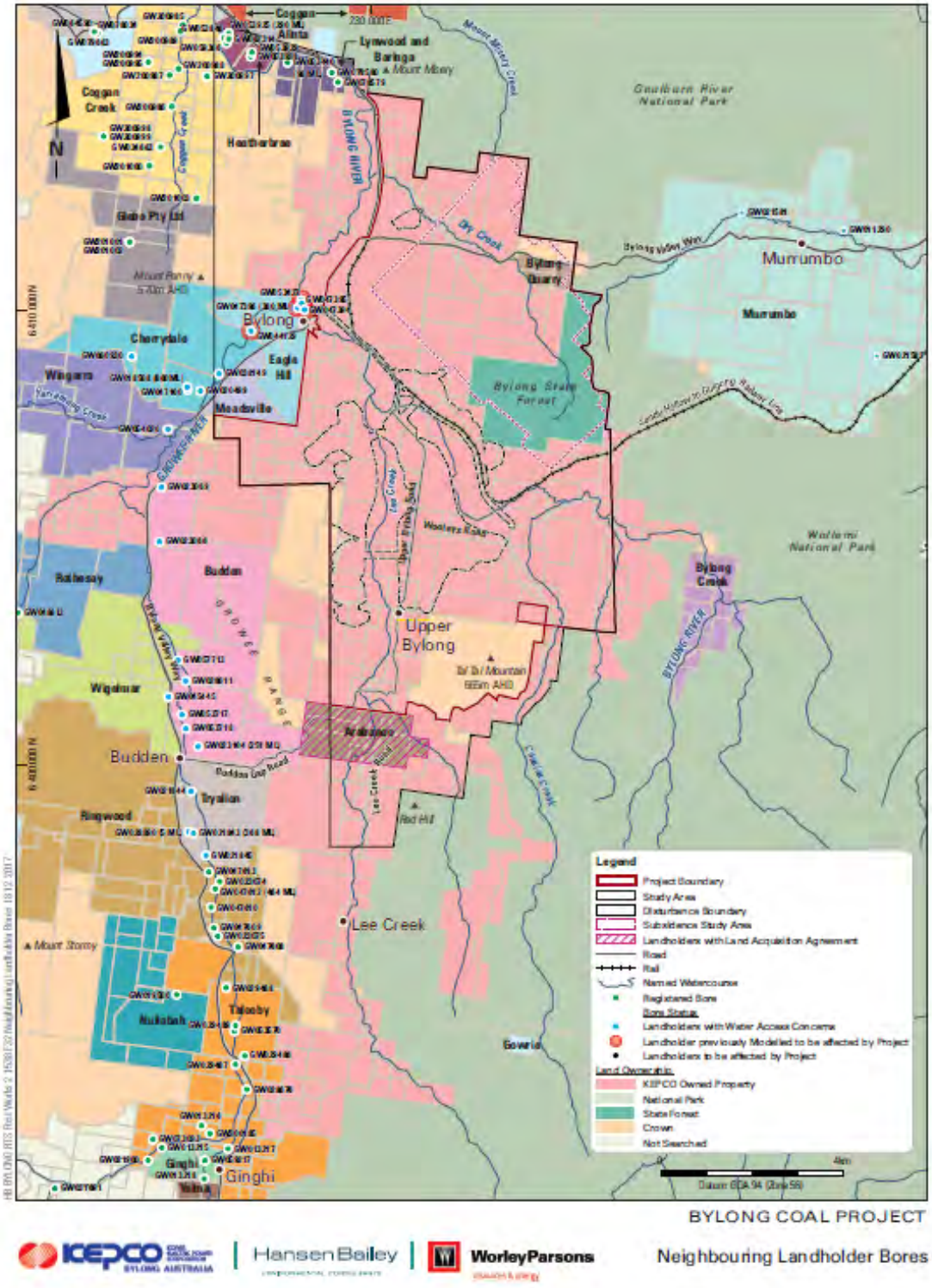
KEPCO is committed to coexisting with agricultural production both on the KEPCO agricultural company landholdings and on private properties surrounding the Project. To demonstrate this commitment KEPCO is entering into Compensatory Water Supply Agreements (or as previously committed Make Good Agreements) with property owners surrounding the mine to safeguard their water supplies (refer **Section 7.4.7**). Private bores subject to Compensatory Water Supply Agreements, as well as KEPCO bores used for agriculture, will have water use monitored with flow meters. The flow meters will be connected to data loggers so pumping rates and timing of the usage is recorded. The annual water use from each bore will be reported in the annual review as described in **Section 7.4.5**. The data loggers will be downloaded on a quarterly basis and the usage on the flow meters also recorded manually to cross check the accuracy of the electronic data. Pressure transducers will also be installed within all pumping bores to measure the influence of pumping on groundwater levels.

Table 26 contains the details of the private landholder bores and bores used by KEPCO agricultural company that have flow and level monitoring equipment installed. The production bores will also be sampled quarterly for the same water quality analytes as the KEPCO monitoring bores and will follow the same SOPs for water quality sampling (**Appendix B**).

Table 26
Agricultural bores being monitored

Bore ID	Easting (m)	Northing (m)	Property	Owner	Monitoring
LB1	225569	6401379	Wingelmar	Gunn	level only
LB2	222266	6403351	Wingelmar	Gunn	level only
LB3	225079	6404063	Rothesay	Perry	level only
BSM1	229628.3	6411251.3	Bylong Station	KEPCO	level and flow
BSM2	229343.7	6410642.4	Bylong Station	KEPCO	level and flow
Taworri 1	229432.0	6411616.8	Taworri	KEPCO	level and flow
Taworri 2	229099.9	6411022.2	Taworri	KEPCO	level and flow
Brigalow 1	230313.7	6413625.6	Sylvania	KEPCO	level and flow
Sylvania 1	229933.1	6414159.9	Sylvania	KEPCO	level and flow
Sylvania 2*	229637.3	6414580.4	Sylvania	KEPCO	level and flow

- *Bore installed by previous landholder not currently equipped, KEPCO is planning to commission the bore and install monitoring equipment in 2018.



BYLONG COAL PROJECT

Neighbouring Landholder Bores

FIGURE 32

Figure 32

Pumping bore sites

Direct inflow to mining areas

As described previously groundwater pumped from bores to support the mining operation will be directly measured through Australian standard flow meters. In contrast, the volume of groundwater removed from aquifers as ingress to the open cut or underground mines is much more difficult to directly measure because it is not collected at a single point, and is subject to a range of processes including evaporation, mixing with surface runoff and adhering to mined materials.

Two methods will be utilised to estimate the volume of groundwater extracted through the open cut and underground mining areas as follows:

- Water balance method; and
- Numerical modelling method.

A water balance will be used annually to estimate the volume of groundwater extracted via the open cut and underground mining areas. The water balance method requires recording the following water balance inputs and outputs from the open cut and underground mining areas:

- Inputs:
  - Direct rainfall on open cut areas;
  - Surface runoff into open cut areas;
  - Groundwater ingress to open cut areas (often not possible to measure); and
  - Water pumping into open cut and underground mining areas for dust suppression and machinery etc.
- Outputs:
  - Evaporation from mining areas;
  - Pumped outflows from mining areas;
  - Water vapour loss in ventilation airflows; and
  - Water removed as bound moisture in coal.

The volume of groundwater intercepted by mining is estimated using the water balance method by comparing the volume of inputs and outputs and assigning any difference to groundwater flow.

If seepage of groundwater is readily visible in mining areas the monitoring program will include:

- recording of the time, location and estimated volume of any unexpected increased groundwater outflow from the highwall, endwall, of the open cut mines, or underground mine;

- measurement of water pumped from the open cut and underground mining areas using flow meters;
- monitoring quality of water pumped from the mining areas (same analytical suite as groundwater);
- correlation of rainfall records (and catchments) with mining area seepage records so groundwater and surface water can be separated; and
- monitoring of coal moisture content.

The numerical groundwater flow model will be updated every three years and will also provide a second method to estimate groundwater inflow to mining areas. The numerical model estimates will be compared with the estimates from the water balance method and the water allocation limits and reported in the annual review as described in **Section 7.4.5**.

Post closure, pumping of water into the underground mine will cease and therefore water balance modelling will not be required. Post closure the water level within the backfilled open cut mining areas and the underground mining area will be monitored to forecast how quickly the system rebounds to a new equilibrium level.

Indirect influence on alluvial aquifers and connected surface water

The AIP requires the estimates of the volume of groundwater indirectly influenced by the mining activities. Mining will not directly excavate any alluvial sediments, however mining will lower the groundwater pressure within the Permian bedrock, reducing the flow of groundwater from the bedrock into the overlying alluvial aquifers. The reduced flux of groundwater from the bedrock to the alluvial aquifers will be estimated and accounted for with water licences. Changes in groundwater levels and pressures recorded by bores and VWPs within the Permian bedrock under the alluvial aquifers will indicate the potential for a reduced flow of groundwater to the alluvium. The existing monitoring bore network will be used to detect the any reduction in pressure. The numerical groundwater flow model will then be used to estimate the resultant changes in flow to the alluvium. The groundwater model will be updated every three years and the predictions for the next three year provided and utilised in the annual review for water licensing purposes.

The groundwater and surface water systems are highly connected and there is the potential that declines in groundwater levels will influence the flow of surface water. The potential for this is highest in the area that is adjacent the open cut and underground mining areas and where the borefield is planned. KEPCO currently use seepage meters to monitor the flow of water into and out of the permanent pools along the Bylong River. Six seepage meters were installed in sections of the Bylong River in June 2014. The purpose of the seepage meters was to measure the transfer of water across the stream bed, and determine if the streams are 'losing' or 'gaining' in nature. In losing

streams water flows from the stream to the underlying aquifer, whilst in gaining streams the transfer of water is from the aquifer to the stream.

Figure 33 shows the location of each seepage meter within the Bylong River, with **Table 27** providing coordinates for each instrument. The seepage meters were installed in clusters downstream of underground mining (ID3, ID6, ID2) and downstream of open cut mining (ID1, ID4 and ID5).

During the baseline monitoring period Douglas Partners continued to collect data from the seepage meters, typically on a twice monthly basis. The seepage meter monitoring results indicate generally gaining conditions, the most significant being within the pools immediately downstream of the Eastern open cut.

During the approvals process a stakeholder requested an additional seepage meter be installed further downstream to gauge whether the river is losing or gaining and if correlation exists with water use by other users in the area. To address this request an additional two sites for seepage meters have been selected, one further downstream and a second further upstream of the mining areas. **Figure 33** shows the location of the proposed additional seepage meters within the Bylong River, with **Table 27** providing coordinates. The results of the seepage meter monitoring will be included within the annual review and comment made on any trends, and correlation to climatic conditions and mining activities.

Table 26

Seepage meter monitoring sites

Seepage meter monitoring ID site	Easting	Northing	Elevation	Status
ID1	231113	6407829	269	buried in sediment
ID2	229374	6411702	246	existing
ID3	229907	6414657	235	existing
ID4	231098	6407841	269	existing
ID5	230961	6407900	269	existing
ID6	229957	6414640	236	existing
ID7	233678	6406112	*	proposed
ID8	229785	6408612	*	proposed

Notes –* elevation to be measured following installation of seepage meter

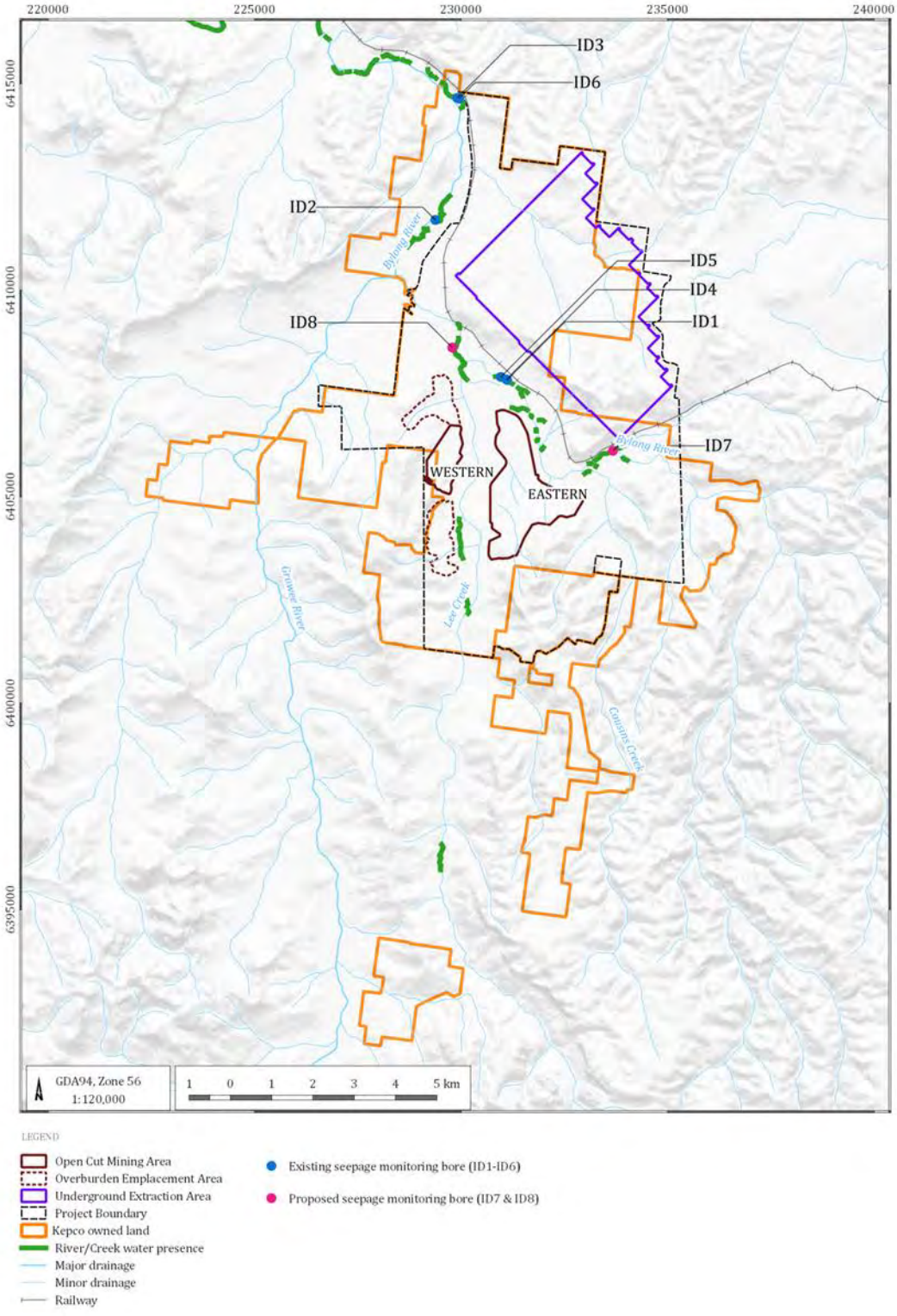


Figure 33
Seepage Meter Sites

7.3.7 Groundwater dependent ecosystems

The health of GDEs will be monitored by ecologists under the Biodiversity Management Plan. Groundwater level measurements from bores in proximity to the GDEs will be provided annually to assist with this analysis.

7.3.8 Post closure monitoring

At the cessation of mining, there will be a relatively steep hydraulic gradient between the underground mine and surrounding aquifers, inducing continued seepage into the mining area. As the underground mine slowly floods, the hydraulic gradient will reduce and the resultant rate of groundwater inflow will slow. Eventually a state of equilibrium will occur where inputs are balanced by outputs and the water levels will have stabilised.

The rate of recovery of groundwater levels in the aquifers will depend on rainfall, with years of below average rainfall extending the recovery period, and wet years reducing the time for stabilisation. There is no final void planned to remain for the open cut mining areas, so there will be no permanent loss of water. However, the groundwater levels will re-equilibrate at slightly different levels compared with pre-mining levels due to the change of the hydraulic properties which occurs within the footprint of the open cut and underground mining areas.

Groundwater monitoring will continue post mining to track the rebound in groundwater levels within and around the mining areas, and the evolution of groundwater quality. Monitoring will be continued until it can be demonstrated the mining areas do not present a long term risk to the groundwater systems and the landforms are non-polluting. The water quality monitoring will focus on the monitoring bores that surround the rejects emplacements and the OEAs. Groundwater level monitoring will be undertaken directly within the underground mining area, through shafts remaining open and within the monitoring bores that surround the mining areas.

7.4 DATA MANAGEMENT AND REPORTING

7.4.1 Data management

The secure long term storage and management of digital data is vitally important for the Project. A database will be developed (or a commercial product utilised) that will ensure the data quality is maintained. The database will also enable the automation of QA/QC checks comparison with trigger levels, which will ensure any trends in datasets are identified and spurious data flagged. The database will be used to generate the tables, graphs, figures for the annual review, which will ensure a consistent and repeatable process in the long term.

7.4.2 Data assessment – water quality

Trends in groundwater levels and water quality will be tracked using control charts developed for each bore. A control chart is an x-y chart plotting either water levels or water quality over time. The

control chart has control limits which are additional horizontal lines running parallel to the horizontal axis. If exceeded the control limits trigger further investigation into the monitoring dataset. A trigger event occurs when:

- one data point is greater than the mean + 3 x standard deviation; or
- two consecutive data points are greater than the mean + 2 x standard deviation; or
- or five successive data points are greater than the mean + 1 x standard deviation.

Figure 34 shows an example of a control chart and the trigger levels outlined above. Data points that exceed the control limits indicate a potentially rising trend and 'trigger' an investigation.

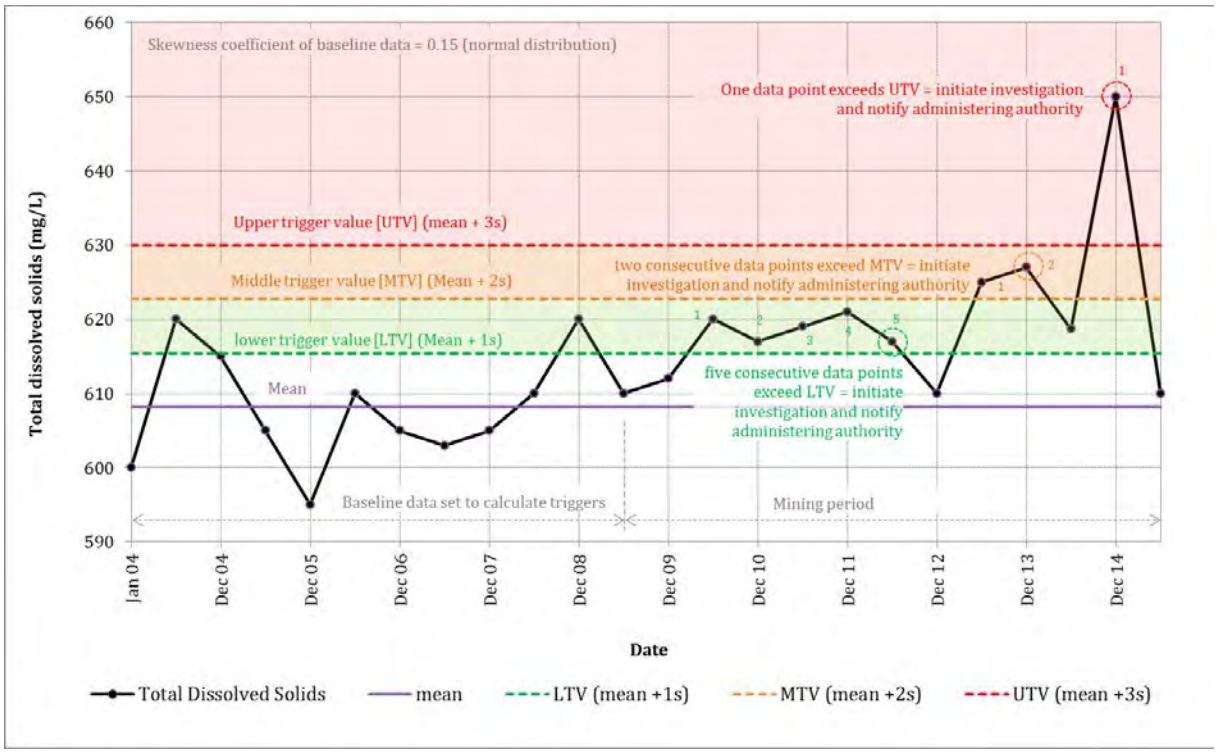


Figure 34

Example of a Control chart for Total Dissolved Solids concentrations in groundwater

It is possible the baseline environmental datasets are skewed, in which case the standard deviation cannot be applied equally either side of the mean. In this case, percentiles equivalent to the standard deviation are used as follows:

- one data point greater than the 99.87th percentile;
- two consecutive data points greater than the 97.73rd percentile; and
- five successive data points greater than the 84.13th percentile.

Figure 35 shows a control chart for a skewed distribution, which is the most suitable approach for the Project as it recognises the significant variability that occurs between bores and within the same bore.

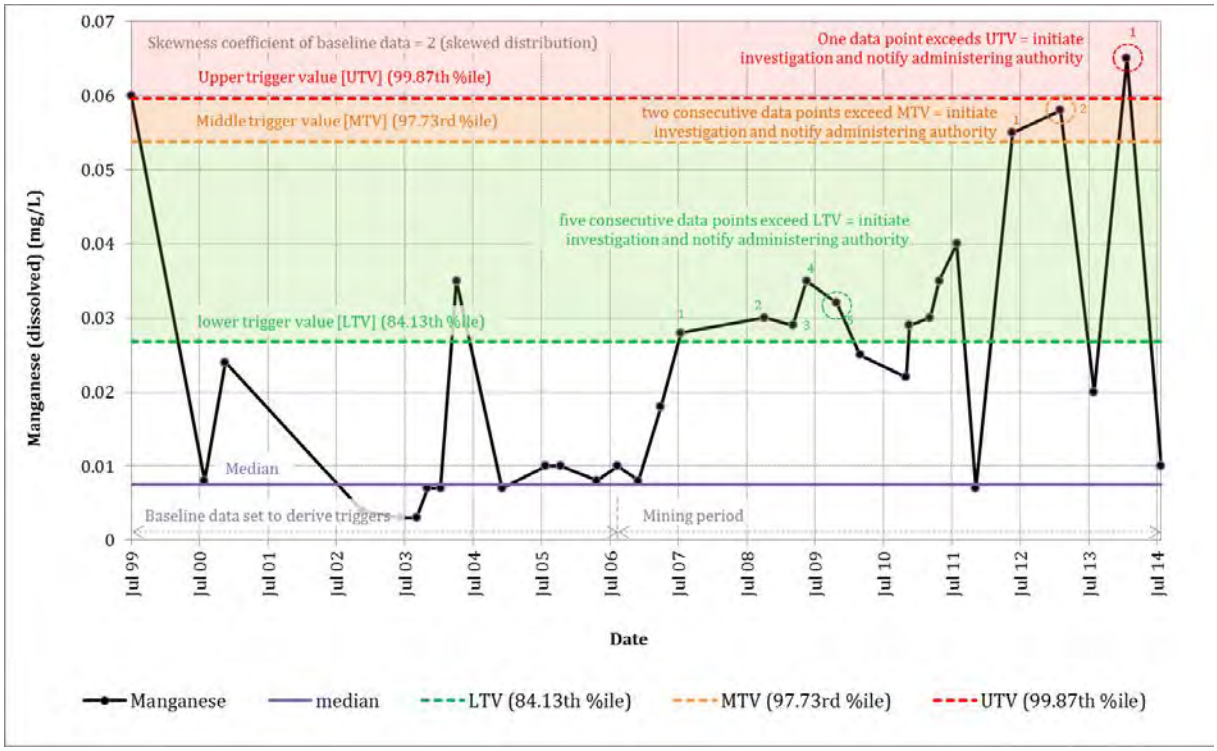


Figure 35
Example of a Control chart for Manganese concentrations in groundwater – skewed baseline dataset

The key water quality indicators for the Project are pH and electrical conductivity. The pH analysis can indicate impacts from oxidation of acid forming minerals, whilst electrical conductivity can indicate changes in the leaching and movement of salts (major ions). The following stepwise process will be followed each quarter in each monitoring bore:

1 Establish the 99.87th %ile, 97.73rd %ile and 84.13th %ile for each bore using the baseline dataset (refer to Douglas Partners, 2017) – note pH will include a lower level trigger of 0.13th %ile, 2.27th %ile and 15.87th %ile;
2 Prepare a control chart for each bore using the above format and determine if:
   a. one data point is greater than the 99.87th percentile; or
   b. two consecutive data points are greater than the 97.73rd percentile; or
   c. five successive data points are greater than the 84.13th percentile.
3 Determine if the measured concentrations trigger an investigation; and
4 Follow processes shown in the decision tree provided in **Figure 36**.

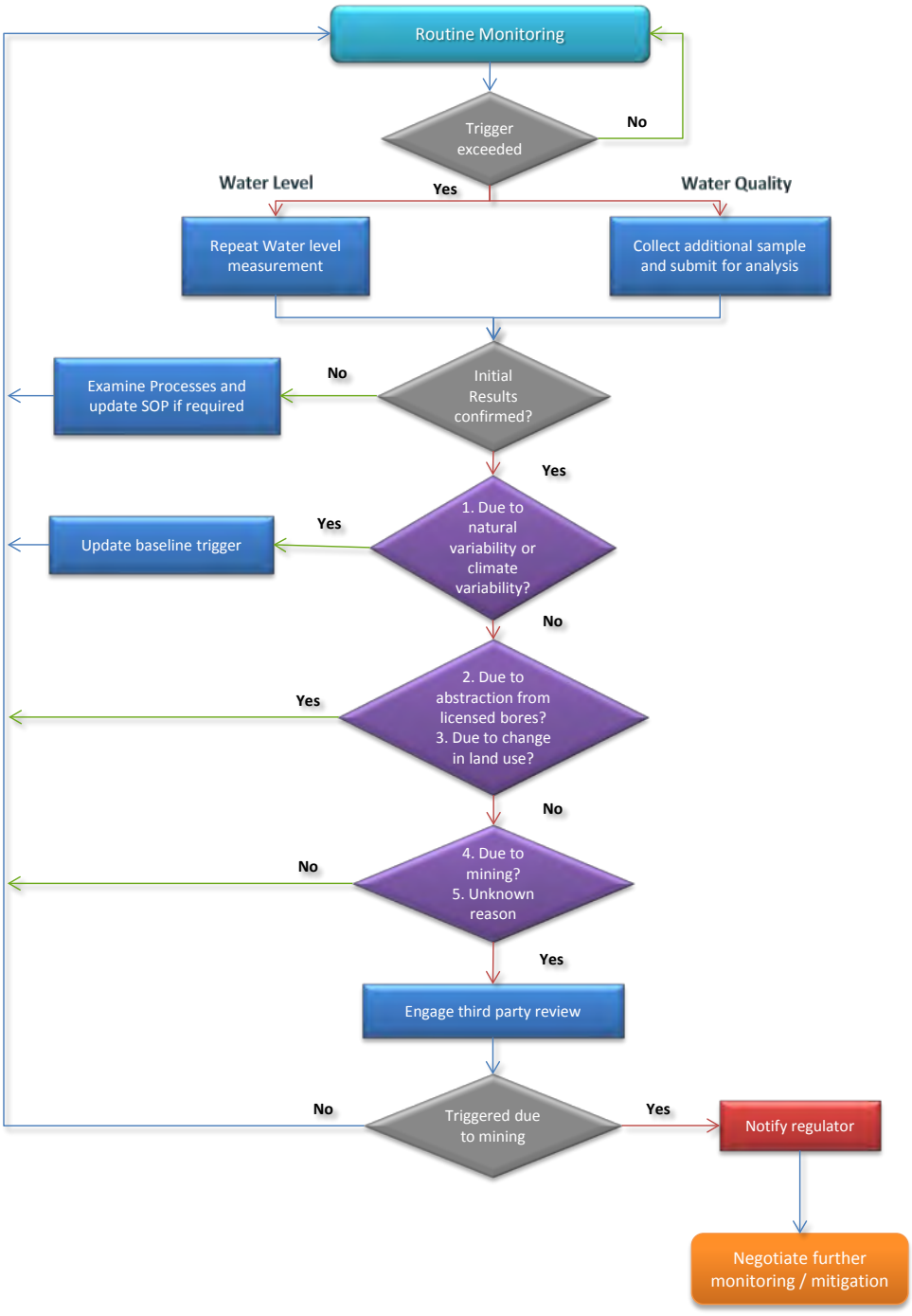


Figure 36
Decision tree for analysis of trigger exceedances

Figure 36 outlines the process of investigating water level and water quality data triggers events. The process requires review of all factors that can influence groundwater levels and quality including climatic conditions, agricultural water use/practices and mining activities. The purpose of the review is to identify if there is a unique influence that has resulted in the water level change or if it is a result of multiple factors.

If the review concludes the trigger limit was exceeded due to mining KEPCO will immediately notify the Secretary of the DPE and the DPI-Water. KEPCO will prepare a report outlining the trigger exceedance and provide this to DPE and the DPI-Water within seven days of the date the trigger exceedance was identified as being due to mining.

The results of the trigger investigations will be reported in each annual review as described in **Section 7.4.5**. Each year if there is a period of no alarms, the standard deviations will be recalculated and the control lines adjusted to improve the baseline statistics.

7.4.3 Data assessment – water level triggers

The groundwater models developed for the Project indicates areas where there is potential for drawdown to reduce groundwater levels, and also where no impacts are likely. If the decline in groundwater levels exceeds the range identified by groundwater modelling then this triggers KEPCO to investigate the reason and consequences. The following stepwise process will be followed each quarter for each monitoring bore:

1 Establish the 5th percentile groundwater level in Australian Height Datum (AHD) from the baseline monitoring dataset (provided within Douglas Partners [2017] – Appendix E4 and E5) – note if there is insufficient representative measurements do not proceed beyond this point until sufficient data is collected to adequately characterise baseline variability;
2 Subtract the 99th percentile maximum drawdown predicted by the latest version of the numerical model at that bore (note the groundwater model will be updated every three years and provide a three yearly forecast for each bore);
3 Determine if the groundwater level has declined below the trigger level; and
4 If a trigger event occurs follow the processes shown in the decision tree provided as **Figure 36**.

7.4.4 Data assessment – water usage triggers

Groundwater usage in NSW is regulated according to the financial year, also referred to as the water year. Data on groundwater usage will be reviewed each quarter during the water year and compared to limits imposed by water licences and announced allocations. The following datasets will be compiled quarterly:

1 Bylong River Water Source:
   a. Flow meter records from each bore within the borefield and total usage from the borefield;
   b. Indirect estimates of water take from the most up to date groundwater model;
2 Sydney Basin – North Coast Water Source:
   a. Estimates of groundwater inflow to underground mining area from water balance; and
   b. Estimates of groundwater inflow to open cut mining area from water balance and most up to date groundwater model.

If usage of groundwater exceeds 80% of the available allocation held by KEPCO, then this will trigger investigation of measures to ensure the Project does not exceed the limit. The TARPs in **Section 7.4.8** outline this process.

7.4.5 Annual reviews

Each year the water level, water quality and water usage data will be reviewed by a suitably qualified person. The review will be broken down into the following topics:

- Water level;
- Water quality; and
- Water usage.

The water level section will present all water level measurements including hydrographs for each monitoring bore. The hydrographs will show the measured water levels, the 5th percentile from baseline monitoring and the 99th percentile drawdown predicted by the latest groundwater model. The hydrographs will also show climatic trends as represented by the Cumulative Rainfall Departure (CRD). The report will indicate which bores are recording water levels within the range forecast by modelling, and any bores that have deviated from the predicted range. Using this data, the report will discuss how groundwater levels respond to climatic conditions (rainfall and streamflow) and agricultural pumping and mining over the baseline reporting period. If any investigations are triggered the results of the investigations will be summarised within the annual review. If there are no investigations triggered the standard deviations will be recalculated and the control lines adjusted to improve the baseline statistics.

The water quality section will present graphed trends in pH and electrical conductivity. The baseline monitoring also includes analysis of major cations and anions and 16 trace metals. The major cation and anion components of the salinity, which is represented by the electrical conductivity, will not need separate control charts. However, if there is a trend of increasing pH or electrical conductivity then the major ion datasets will be examined to assist in investigating the processes behind of the trend. The dissolved metals are commonly present at concentrations below the level of laboratory

detection and therefore are not suitable for a control chart process. The concentrations of dissolved metals will be compared with the ANZECC stock water guidelines. If the concentrations exceed the guidelines an investigation will be undertaken according to the process outlined in **Section 7.4.2** with the results summarised in the annual review.

The annual review will document the direct and indirect water usage from the groundwater systems. The direct water usage from the alluvial borefield will be presented as graphs or tables for each pumping bore and the borefield as a whole. The direct water usage from the alluvium via the borefield, along with the indirect water usage associated with depressurisation of bedrock, will be tabulated and compared with water license entitlements held for the Bylong River water source. As noted previously the groundwater taken indirectly from the alluvial aquifers as a result of bedrock depressurisation cannot be directly measured and will therefore be based on the most recent version of the groundwater model.

The water usage from the Permian bedrock will also be estimated for the open cut and underground mining areas as described in **Section 7.3.6** and tabulated to compare with water license entitlements and announced allocations for the Sydney Basin – North Coast Groundwater Source.

The annual review will also consider if the monitoring program is providing sufficient data to determine the impact of the Project and if any additional monitoring sites are required, or if optimisation of the existing monitoring sites, frequency of sampling and analytical suite should be undertaken.

7.4.6 Groundwater modelling updates

The conditions of consent require the groundwater model to be updated every three years. The first update will occur three years after the commencement of mining. For the first three years of the Project the actual impacts will be compared to the results presented by AGE (2016b). The updates to the groundwater model will follow the stages recommended in the Australian groundwater modelling guidelines (Barnett et al, 2012) which are reproduced in **Figure 37**. Whilst a groundwater model already exists for the Project, it is important for the updates to progress sequentially through the eight stages shown below to ensure that all appropriate updates are made to the model. The updated model will be peer reviewed to confirm it remains fit for purpose.

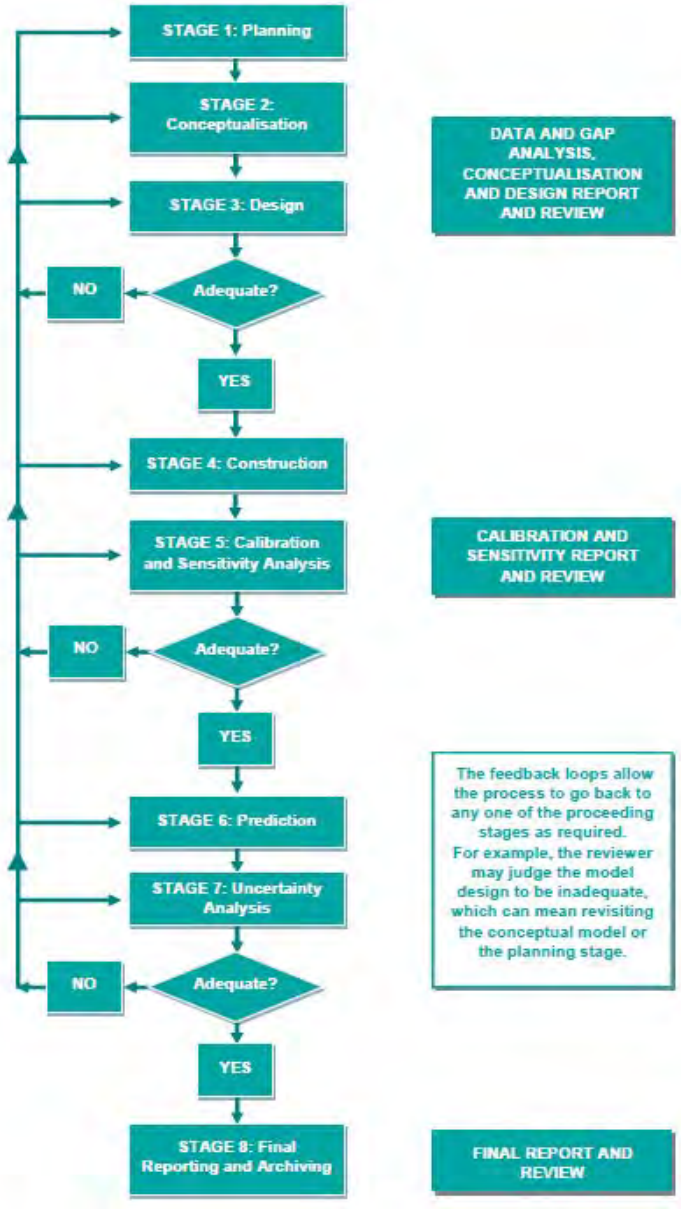


Figure 37

Stages in groundwater modelling (from Barnett et al, 2012)

Datasets used to update the groundwater model will include:

- any new datasets on geology including the elevation of Triassic layers;
- any new measurements of permeability with the alluvium or bedrock;
- plans showing the progress of mining;
- recharge estimates based on rainfall and soil moisture recorded at the Project's weather station;

- pumping recording from the borefield and private bores with Compensatory Water Supply Agreements;
- water levels measured in monitoring bores and VWPs;
- streamflow and levels recorded at the Project's gauging stations; and
- estimates of mine inflow from the open cut and underground mine water balances.

The above information will allow the model to be recalibrated and then provide updated forecasts of inflow to the mining areas, indirect water take from the alluvium and drawdown in monitoring and private bores. The forecasts will be for a three year period and will provide estimates of inflow and drawdown which will inform trigger levels.

7.4.7 Compensatory Water Supply Agreements

KEPCO acknowledges that despite a significant effort in investigation and modelling to forecast the impact of the Project on the groundwater regime, some adjoining landholders continue to have concerns for potential impacts on their water supplies. To address this, KEPCO is entering into Compensatory Water Supply Agreements (or as previously committed Make Good Agreements) with property owners surrounding the mine to safeguard their water supplies.

The Compensatory Water Supply Agreements provide an alternative supply of water that is equivalent to any loss attributable to the mine development. Equivalent water supply will be provided as soon as practicable from the loss being identified as a result of the Project, unless otherwise agreed with the landowner. The Compensatory Water Supply Agreements between KEPCO and private landholders are supported by the two internal guidelines prepared by KEPCO designed to ensure a consistent approach to the implementation of each agreement:

- Bore Assessment Guideline; and
- Bore Impact Assessment Guideline.

The first element is the Bore Assessment Guideline, which describes how baseline information is collected from water bores and wells located on private property in proximity to the Project. The Bore Assessment Guideline is followed prior to, or at the commencement of a Compensatory Water Supply Agreement. The second element is the Bore Impact Assessment Guideline which provides details of the procedures KEPCO will follow to assess if a private bore has been impacted by the Project. The Bore Impact Assessment Guideline will be followed when either KEPCO or the landholder issue a notification under the Compensatory Water Supply Agreements that a water supply has been adversely impacted. These guidelines are included within **Appendix C**.

At the time of writing (December 2017), KEPCO was consulting with landowners of properties surrounding the Project to discuss the Compensatory Water Supply Agreements. The following properties have been subject to preliminary discussions in this regard:

- Meadsville;
- Wingarra;
- Rothesay;
- Trialion;
- Wiglemar;

The triggers to investigate a change in water level or water quality in a private water bore with a Compensatory Water Supply Agreement will be the same as outlined in **Section 7.4.2** and **Section 7.4.3**.

7.4.8 Trigger action response plans

A plan to respond to exceedances of trigger levels is provided below for:

- Groundwater level change (**Table 28**);
- Groundwater quality (**Table 29**); and
- Groundwater usage (**Table 30**).

Table 27
Groundwater level TARP

Level	Trigger	Action	Response
Level 1 (Normal)	Groundwater level measurements within trigger limits	• Continue to monitor levels in accordance with monitoring plan	• No response required
Level 2a (Early warning)	Drought requires makeup water from Project borefield	• Ensure flow meters and water level loggers on pumping bores are operational	• Review pumping records monthly to calculate usage from borefield • Review impacts on groundwater levels
Level 2b (Early warning)	Water level records are trending towards an exceedance	• Continue to monitor levels in accordance with monitoring plan	• Conduct preliminary review of activities occurring in vicinity of subject bore(s)
Level 3a (Exceedance of trigger level)	Groundwater level measurements trigger investigation	• Engage suitably qualified person to conduct review • Review impacts in accordance with decision tree in Figure 36	• Report results in Annual Review
Level 3b (Exceedance identified as related to mining activities)	Groundwater level triggers due to mining activities	• Engage suitably qualified person to prepare report and identify potential for impacts on a receptor	• Provide report to regulator within seven days of identifying trigger exceedance is attributed to mining
Level 4 (Impact on receptor)	Water level drawdown impacts on a receptor (private water bore or GDE)	• For private bores refer to Compensatory Water Supply Agreement • For GDEs remediate any environmental harm where possible	• Initiate investigation into reasons for impact on receptor including assessment of environmental harm • Take actions recommended by investigation to prevent recurrence

Table 28

Groundwater quality TARP

Level	Trigger	Action	Response
Level 1 (Normal)	Groundwater quality measurements within trigger limits	• Continue to monitor levels in accordance with monitoring plan	• No response required
Level 2a (Early warning)	Rainfall events create runoff from OEAs to alluvium	• Ensure salinity loggers in OEA bores are calibrated and operating correctly	• Review monitoring records to identify influence of rainfall runoff on groundwater salinity
Level 2a (Early warning)	Water levels within open cut rejects emplacements rise above adjacent groundwater level	• Ensure salinity loggers in adjacent bores are calibrated and operating correctly	• Review monitoring records to identify influence of rejects emplacement on groundwater salinity
Level 3 (Exceedance of trigger level)	Groundwater quality measurements trigger investigation	• Engage suitably qualified person to conduct review • Review impacts in accordance with decision tree in Figure 36	• Report results in Annual Review
Level 3b (Exceedance identified as related to mining activities)	Groundwater quality triggers due to mining activities	• Engage suitably qualified person to prepare report and identify potential for impacts on a receptor	• Provide report to regulator within seven days of identifying trigger exceedance is attributed to mining
Level 4 (Impact on receptor)	Water quality changes impacts on a receptor (private water bore or GDE)	• For private bores refer to Compensatory Water Supply Agreement • For GDEs remediate any environmental harm where possible	• Initiate investigation into reasons for impact on receptor including assessment of environmental harm • Take actions recommended by investigation to prevent recurrence

Table 29

Groundwater usage TARP

Level	Trigger	Action	Response
Level 1 (Normal)	Groundwater use within license allocation	• Continue to monitor levels in accordance with monitoring plan	• No response required
Level 2 (Early warning)	Groundwater use trending to exceeding 80% of allocation	• Identify major contributor to water usage and feasible actions to prevent usage exceeding allocation including: o reduce abstraction from borefield o reduce abstraction from KEPCO agricultural bores o alter mining activities o reduce CHPP and dust suppression water usage	• Conduct preliminary review of groundwater usage and determine drivers for identified trend and potential for recurrence • Identify availability of additional water from relevant water source on the water market
Level 3a (Exceedance of trigger level)	Groundwater usage exceeds 80% of allocation	• Implement actions identified above if forecast indicates usage will exceed 100% of allocation	• Report results in Annual Review • Initiate purchase of additional water entitlements measures are unsuccessful
Level 3b (Exceedance of trigger level)	Groundwater modelling predicts usage will exceed 100% of allocation in the future	• Initiate purchase of additional water from relevant water source on the water market	• Report results in Annual Review
Level 4 (Exceedance of allocation)	Water usage exceeds 100% of allocation	• Formalise purchase water entitlements to account for exceedance	• Initiate investigation into reasons for exceedance and report reports in annual review • Notify DPI-Water and provide report on reasons for exceedance • Take actions recommended by investigation to prevent recurrence

8 REPORTING AND REVIEW

8.1 ANNUAL REVIEW

In accordance with Condition 11, Schedule 6 of the Recommended Development Consent conditions, an Annual Review of the environmental performance of the Mine will be completed by the end of March each year. The review will:

(a) describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;

(b) include a comprehensive review of the monitoring results and complaints records (see **Section 8.2**) of the development over the past year, which includes a comparison of these results against the:

- relevant statutory requirements, limits or performance measures/criteria;
- monitoring results of previous years; and
- relevant predictions in the EIS;

(c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;

(d) identify any trends in the monitoring data over the life of the development;

(e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and

(f) describe what measures will be implemented over the next year to improve the environmental performance of the development.

8.2 INCIDENTS AND COMPLAINTS

KEPCO will immediately notify the Secretary and any other relevant agencies of any incident (as specified within the Recommended Development Consent conditions). Within 7 days of the date of the incident, the Applicant must provide the Secretary and any relevant agencies with a detailed report on the incident and such further reports as may be requested.

KEPCO will also maintain a complaints register for any public complaints relating to the management of water quality or quantity for the Project.

8.3 AUDITING AND MANAGEMENT PLAN REVIEW

In accordance with Condition 5, Schedule 6 of the Recommended Development Consent conditions, this Plan will be reviewed within three months of the submission of an Annual Review, Incident Report or independent environmental audit.

Additional review of this Plan will be conducted following changes in statutory requirements, operational or management procedures or when triggered by any event, complaint or finding(s) that identify improvements in the controls that effectively manage the identified hazard.

8.4 ACCESS TO INFORMATION

In accordance with Condition 15, Schedule 6 of the Recommended Development Consent conditions the Applicant will:

(a) Make copies of the following information publicly available on its website:

- the EIS;
- current statutory approvals for the development;
- approved strategies, plans or programs required under the conditions of the consent;
- a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of the consent, or any approved plans and programs;
- a summary of complaints, which is to be updated monthly;
- minutes of CCC meetings;
- the last five annual reviews;
- any independent environmental audit, and the Applicant's response to the recommendations in any audit;
- any other matter required by the Secretary; and

(b) keep this information up to date.

9 ROLES AND RESPONSIBILITIES

Table 31 shows responsibilities for implementation of various aspects of the Water Management Plan.

Table 30 Management Plan Roles and Responsibilities

Role	Responsibilities
General Manager	• Ensure a site Water Management Plan is prepared, implemented & maintained. • Ensure water management projects are planned and budgeted for. • Ensure adequate storage is available consistent with Water Management Plan to enable ongoing production through wet & dry climatic conditions. • Manage implementation of water management improvement projects. • Ensure that water is managed in compliance with the Water Management Plan. • Ensure water storage dams are designed and maintained in accordance with this Water Management Plan. • Prevent spills, leaks and unlicensed discharges. • Design, budget for & arrange the construction of sediment, erosion control & mine water drains & dams. • Communicate the Water Management Plan to the Project Management team and other relevant stakeholders. • Ensure that planned infrastructure is in compliance with the Water Management Plan. • Ensure planned maintenance schedules are implemented to maximise the availability of fixed and mobile pumps in the mining area. • Ensure all water pipelines & control structures in the maintenance area are regularly inspected, maintained & promptly repaired. • Ensure adequate water licences are held for the Project.
CHPP Manager	• Ensure that water is managed in compliance with the Water Management Plan. • Ensure all water pipelines & control structures associated with the CHPP are regularly inspected, maintained & promptly repaired to: - Prevent spills, leaks and unlicensed discharges. - Maintain adequate dewatering capability for high rainfall events. - Maintain storage capacity in runoff capture dams. - Prevent spills, leaks and unlicensed discharges. - Ensure efficient recycling and preferential use of mine water. • Ensure water supply meets demands of the CHPP. • Ensure all storages are maintained and operated in accordance with

Role	Responsibilities
	the Environmental Protection Licence • Communicate the Water Management Plan to the CHPP team.
Environment Manager	• Preparation, implementation & maintenance of the site Water Management Plan. • Advise the General Manager on water management control & planning requirements. • Prepare site water balances to define water use, storage & discharges and to monitor and forecast site water management needs. • Arrange the inspection & maintenance of sediment, erosion control & mine water drains & dams. • Communicate requirements for incident reporting to Project team. • Advise General Manager on water metering requirements. • Design, implement and maintain the water monitoring program. • Report on and communicate performance against water plans and targets. • Coordinate reviews of the site water management system to maintain consistency with the Water Management Plan. • Maintain communications with regulator regarding exceedances and reporting/documentation of exceedances. • Maintain register of water-related complaints and investigate complaints where appropriate.

10 REVISION HISTORY

Internal Version History and Approval Register

Version	Version Date	Description of Changes	Approved By
1	18/12/2017	Draft WMP for approvals process	

External Version Approval Register

Agency	Nominated Representative	Version	Date Approved

11 REFERENCES

ANZECC (2000), Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment Control Council and Agricultural and Resource Management Council of Australia and New Zealand, Australia.

Australasian Groundwater and Environmental Consultants Pty Ltd (2015), Report on Bylong Coal Project – Groundwater Impact Assessment, prepared for Hansen Bailey Pty Ltd, Project No G1606, 10 June 2015.

Australasian Groundwater and Environmental Consultants Pty Ltd (2016a), Report on Bylong Coal Project – Response to Submissions on Groundwater, prepared for Hansen Bailey Pty Ltd, Project No G1606E, dated 22 March 2016.

Australasian Groundwater and Environmental Consultants Pty Ltd (2016b), Report on Bylong Coal Project – Response to Submissions on Groundwater, prepared for Hansen Bailey Pty Ltd, Project No G1606, dated 5 September 2016.

Barnett et al (2012), Australian groundwater modelling guidelines, Waterlines report, National Water Commission, Canberra

Douglas Partners (2017), Summary Report on Hydrogeological Investigation and Monitoring, November 2011 to June 2017, Bylong Coal Project, Bylong, NSW, Prepared for Worley Parsons Services Pty Ltd on behalf of KEPCO Bylong Australia Pty Ltd, Project No. 49761.04, October 2017.

APPENDIX A

Summary Monitoring Report

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Summary Report on Hydrogeological Investigation and Monitoring November 2011 to June 2017

Bylong Coal Project
Bylong, NSW

Prepared for
WorleyParsons Services Pty Ltd
On behalf of
KEPCO Bylong Australia Pty Ltd

Project 49761.04
November 2017

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	49761.04	Document No.	R.014.Rev0
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Site address	Bylong, NSW		
Report prepared for	WorleyParsons Services Pty Ltd		
File name	49761.04.R.014.Rev0		

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Rev 0	Kate Fulham	Stephen Jones / Chris Bozinovski	15 November 2017

Distribution of copies

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Draft A	1	0	Mr Tom Frankham, WorleyParsons Services Pty Ltd
Rev 0	1	0	Mr Tom Frankham, WorleyParsons Services Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		15 November 2017
Reviewer		15 November 2017

bsi. ISO 9001 Quality Management

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Summary Report on Hydrogeological Investigation and Monitoring November 2011 to June 2017 Bylong Coal Project, Bylong, NSW

1. Introduction

This summary report presents the results of ongoing hydrogeological investigation and monitoring over the period November 2011 to June 2017 for the 'Bylong Coal Project' (the Project) for Authorisations 287 (A287) and 342 (A342) in Bylong, New South Wales (NSW). The work was undertaken for WorleyParsons Services Pty Ltd (WorleyParsons) on behalf of KEPCO Bylong Australia Pty Ltd (KEPCO) with reference to Contract Agreement No. 201015-00276-PS-CNT-0004.

The Project site is located within the Bylong Valley and within the Mid-Western Regional Council Local Government Area (LGA) and comprises the proposed construction and operation of a coal mine and associated facilities utilising both open cut and underground mining methods.

The majority of the Project Boundary contains 'cleared agricultural land with native vegetation prevalent within the remaining area (predominantly within the Bylong State Forest and other portions of Crown Land)' (Hansen Bailey 2015, Ref 21). The Project Boundary comprises terrain which fluctuates greatly between the floors of the Bylong Valley up to the escarpments and steeper slopes of the eastern margins (Hansen Bailey 2015, Ref 21).

Hydrogeological monitoring at the site has been undertaken by Douglas Partners Pty Ltd (DP) since November 2011. Investigations from November 2011 to August 2014 were undertaken for Cockatoo Coal Limited, former Project Managers, and are listed as References 5 to 13 in Section 11. Investigations undertaken for WorleyParsons on behalf of KEPCO are listed as References 15 to 19. A list of Hydrogeological Data Reports undertaken by Douglas Partners for the project are summarised in Table A2, Appendix A.

Water level monitoring for the Project commenced in November 2011, with water quality monitoring commencing in February 2012. The monitoring program has been updated as access to the site became available, upon installation and commission of monitoring locations and progression of the hydrogeological studies. The monitoring program comprises an extensive network of groundwater piezometers, surface water locations and vibrating wire piezometer sites subject to routine monitoring, typically on a monthly or quarterly basis. It is noted that active water quality monitoring was not undertaken during the period of change over from Cockatoo Coal Limited to WorleyParsons (September, October and November 2014) as DP had not been engaged for this period, however automated equipment (including dataloggers and vibrating wire piezometers continued collecting data.

The scope of investigations and monitoring are based on DP's 'Preliminary Hydrogeological Assessment and Water Monitoring Plan' (Ref 14) which was revised in December 2014 following appointment of WorleyParsons as Project Managers for the Bylong Coal Project in October 2014. The plan was also revised in September 2017 to include an overview of hydrogeological study results as detailed in the Bylong Coal Project Environmental Impact Statement (EIS). The current plan is referenced as the 'Hydrogeological Assessment and Water Monitoring and Modelling Plan' (WMMP, Ref 20). A summary of revisions to the Hydrogeological Assessment and Water Monitoring and Modelling Plan is contained in Table A1, Appendix A.

This report provides a factual summary of monitoring data for the period November 2011 to June 2017 and includes information on the following:

- Monitoring of vibrating wire piezometers (VWP) in dedicated investigation bores;
- Automated logging of piezometric head and electrical conductivity (EC) in selected locations;
- Surface water and groundwater sampling and chemical analyses at selected locations;
- Automated logging of surface water flow velocity at three locations; and
- Flux monitoring at six seepage meter locations.

A statistical analysis of water levels and water quality results comprising:

- box and whisker plots of pH and EC for surface water, alluvium and coal seams;
- plots of pH and EC data with time (for alluvium, coal seams and surface water) showing 99.87, 97.73, 84.13 percentiles and ANZECC limits;
- piper diagrams of major ion relationships for surface water, alluvium and coal seams;
- plots of dissolved metals concentration with time; and
- plots of water level versus time/cumulative rainfall for each bore or nested group of bores including the 5th percentile for the data.

The surveyed monitoring locations are shown on Drawing 1 in Appendix H.

It is noted that the information detailed in Sections 3 to 9 is provided as a summary of the Project testing and monitoring. Reference should be made to the previous Hydrogeological Monitoring Reports (References 5 to 13 and 15 to 20) for detailed information as required.

2. Site Identification

The Project site is located within the Bylong Valley and within the Mid-Western Regional Council Local Government Area. The Project Boundary is located within A287 and A342 which was acquired by KEPCO. The Project Boundary subject of the Bylong Coal Project EIS is shown in Figure 1.

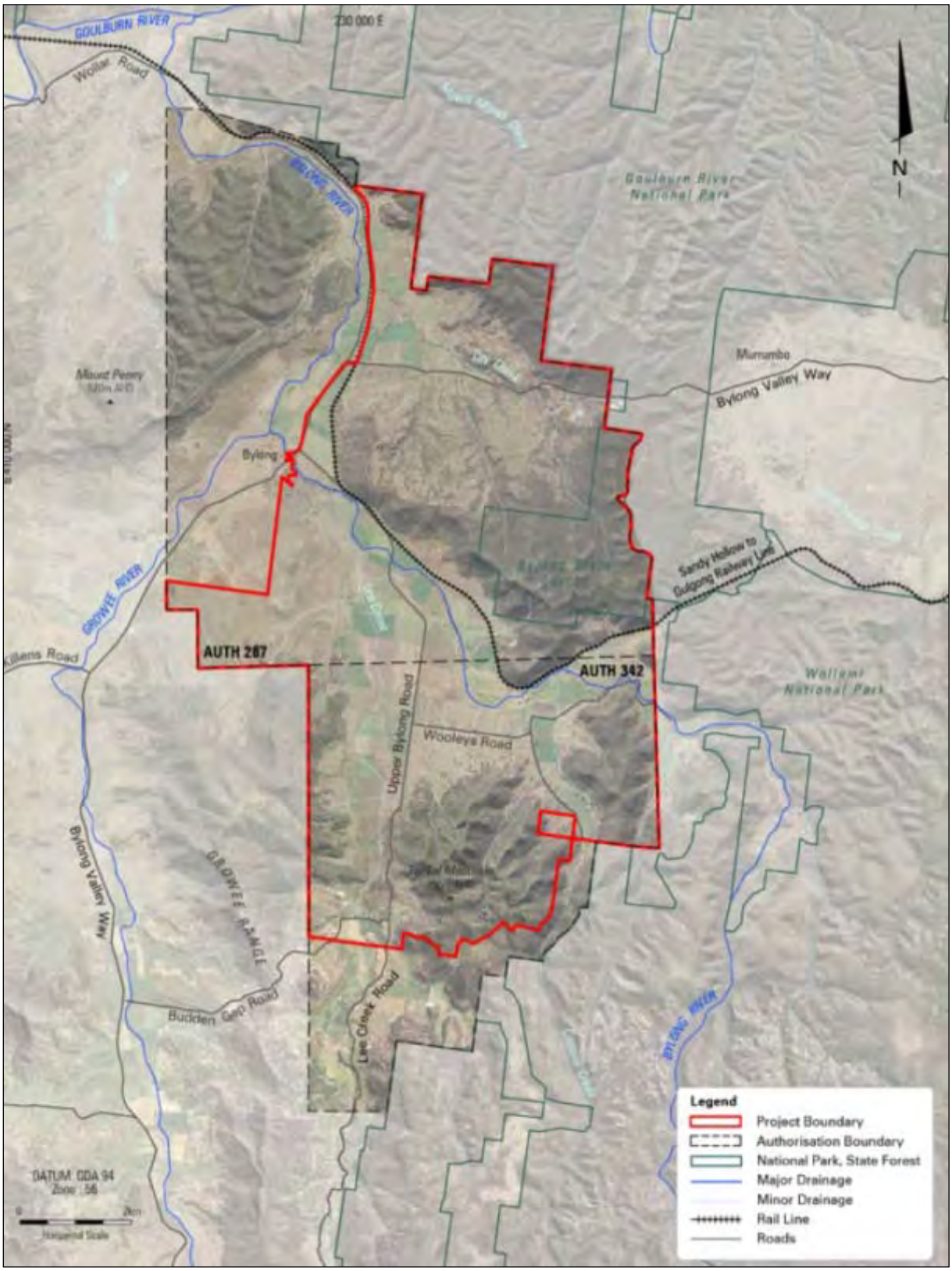

Figure 1: Authorisation Boundaries (Figure 3 from Bylong Coal Project EIS, Ref 21)

It is noted that several of the monitoring locations extend beyond the Project Boundary and Authorisations for the purposes of assessing up-stream and down-stream conditions. The surveyed monitoring locations are shown on Drawing 1 in Appendix H.

Reference should be made the Bylong Coal Project Environmental Impact Statement (EIS) compiled by Hansen Bailey (2015) for the full description of the site and locality.

3. Vibrating Wire Piezometer Monitoring

3.1 Overview

Monitoring was undertaken on vibrating wire piezometers (VWP) which were installed as part of previous works (Refs 5 to 13). These VWPs were installed generally to target higher permeability zones in locations where packer testing was undertaken, to allow assessment of vertical hydraulic gradients and aquifer connectivity as outlined in the WMP (Refs 14, 20). Multi-level vibrating wire piezometers were installed in selected bores.

The depths of installation were based on the results of packer testing. Multiple vibrating wires were installed in each bore in the Ulan Seam, Coggan Seam and the floor of the Coggan seam as well as relatively permeable stratum in the overlying coal measures. There are typically four to five piezometers installed in each of these bores. Data logging units were installed at piezometers with multiple vibrating wire installations.

The VWP dataloggers installed for the Project are RST Instruments (Multi Channel VW Logger DT2055B), which have the capacity for unattended monitoring of up to ten sensors (which are a mix of vibrating wire sensors and thermistors) as required. The vibrating wire sensors installed are HMA Geotechnical vibrating wire piezometers (Model 1200) which are suitable for long term monitoring.

The VWP installation details are summarised in Table B1, Appendix B (Excerpt from AGE (2016), 'Response to Submissions on Groundwater' within Hansen Bailey (2016) 'Bylong Coal Project Environmental Impact Statement: Response to Submissions March 2016' and updated by DP). The corresponding borehole logs are supplied in Appendix B (AGE (2016), Appendix A Excerpt from 'Response to Submissions on Groundwater' within Hansen Bailey (2016) 'Bylong Coal Project Environmental Impact Statement: Response to Submissions March 2016').

The depths of the installations, target stratum and monitoring methods are summarised in Table 1, below. The surveyed locations of the VWPs are shown on Drawing 1 in Appendix H.

The surveyed locations of the VWPs are shown on Drawing 1 in Appendix H.

Table 1: Summary of Vibrating Wire Piezometer Installations

Bore ID	Depth (m)	Elevation	Sensor Serial No.	Description	Monitoring Method
A06	Surface	275.16			Daily automated logging, downloaded quarterly Datalogger Serial Number: 2778
	12.5	262.66	18996	Coal	
	17.0	258.16	18997	Coal: Ulan Seam	
	26.8	248.36	19018	Coal: Coggan Seam	
	36.6	238.56	18829	Siltstone Floor	
AGE01	Surface	237.26			Daily automated logging, downloaded quarterly Datalogger Serial Number: 2304
	27.70	209.56	17745	Siltstone	
	67.10	170.16	17862	Sandstone	
	120.20	117.06	17804	Coal: Ulan Seam	
	128.20	109.06	17805	Coal: Coggan Seam	
	140.70	96.56	17806	Sandstone Floor	
AGE02	Surface	241.71			Daily automated logging, downloaded quarterly Datalogger Serial Number: 3110
	31.2	210.51	18477	Sandstone	
	45.5	196.21	18478	Sandstone	
	84.3	157.41	18963	Coal	
	94.0	147.71	18964	Coal: Ulan Seam	
	103.0	138.71	18965	Coal: Coggan Seam	
	116.0	125.71	18966	Sandstone Floor	
AGE03	Surface	246.93			Monthly manual reading
	30.50	216.43	17234	Sandstone	
B3	Surface	310.58			Daily automated logging, downloaded quarterly Datalogger Serial Number: 3288
	43.2	267.38	19065	Coal	
	82.0	228.58	19209	Coal	
	108.5	202.08	19147	Coal: Ulan Seam	
	120.5	190.08	19148	Coal: Coggan Seam	
	135.0	175.58	19149	Sandstone Floor	
BY0011CH	Surface	356.62			Daily automated logging, downloaded quarterly Datalogger Serial Number: 2306
	73.40	283.22	17390	Sandstone	
	148.80	207.82	17358	Sandstone	
	190.40	166.22	17361	Coal: Ulan Seam	
	202.40	154.22	17364	Coal: Coggan Seam	
	220.00	136.62	17499	Sandstone Floor	
BY0077CH	Surface	297.25			Daily automated logging, downloaded quarterly Datalogger Serial Number: 2611
	48.30	248.95	17233	Sandstone/siltstone	
	107.90	189.35	17599	Sandstone/coal: Ulan Seam	
	118.80	178.45	17645	Coal: Coggan Seam	
	139.75	157.50	17357	Sandstone Floor	
BY0080CH	Surface	405.73			Daily automated logging, downloaded quarterly Datalogger Serial Number: 2603
	177.20	228.53	17360	Siltstone/sandstone	
	200.00	205.73	17362	Coal: Ulan Seam	
	210.70	195.03	17365	Coal: Coggan Seam	
	230.00	175.73	17366	Sandstone Floor	
BY0091CH	Surface	363.74			Daily automated logging, downloaded quarterly Datalogger Serial Number: 2303
	57.00	306.74	17234	Sandstone	
	103.40	260.34	17598	Sandstone/siltstone	
	172.50	191.24	17359	Coal	
	185.00	178.74	17363	Sandstone Floor	
BY0208CH	Surface	327.08			Daily automated logging, downloaded quarterly Datalogger Serial Number: 2788
	37.30	289.78	18485	Siltstone	
	60.00	267.08	18421	Sandstone / Siltstone	
	87.50	239.58	18422	Coal: Coggan Seam	
	98.50	228.60	18423	Sandstone	
BY0531CH	Surface	358.82			Daily automated logging, downloaded quarterly Datalogger Serial Number: 6126
	110.00	248.82	23653	Sandstone	
	137.00	221.82	23724	Coal: Ulan Seam	
	145.00	213.82	23723	Coal: Coggan Seam	
	153.00	205.82	23722	Sandstone	
CPT18	Surface	297.83			Monthly manual reading
	21.75	276.08	18566	Coal	
CPT36	Surface	302.05			Monthly manual reading
	47.75	254.30	18541	Coal: Ulan Seam	
	56.75	245.30	18538	Coal: Coggan Seam	
CPT39	Surface	307.10			Monthly manual reading
	25.00	282.10	18539	Coal: Ulan Seam	
	33.00	274.10	18540	Coal: Coggan Seam	

3.2 Results

The results of quarterly download of RST Instrument dataloggers and monthly manual readings are provided as plots of piezometric head against cumulative rainfall departure in Appendix E3. The results of monthly field read out and automated piezometric head levels for VWPs were presented in factual biannual monitoring reports (Ref 5 to 13 and 15 to 19).

It is noted that piezometric head within the Coggan seam (210.7m depth) at BY0080 dropped from approximately 300 AHD to 285 AHD on 13 January 2017. The data collected indicates that the pressure and temperature thermistor readings are all within the calibrated parameters from installation.

Based on the assumptions above, the pressure dissipation may be due to the opening of a grouted fracture or an air bubble on the sensor. Additional data from on-going monitoring will be required for further assessment.

4. Piezometer Level Monitoring

4.1 Overview

Monitoring of groundwater levels in piezometers (wells) commenced in December 2011 with the number of regularly gauged locations increasing as additional piezometers were installed. The work to date has comprised the following:

- Manual gauging of water levels in standpipe piezometers using a Solinst Water Level Meter Tape, generally undertaken monthly in conjunction with groundwater sampling;
- Measurement of artesian pressure for piezometer BY0015 using a pressure gauge undertaken monthly in conjunction with groundwater sampling. The piezometer is capped with a ball valve;
- Installation of Solinst Leveloggers to automatically record piezometric head (i.e. water levels) at 20 minute intervals; and
- Installation of a Solinst Barologger to automatically record barometric pressure at 20 minute increments. The barometric pressure is used to correct Levelogger data for atmospheric pressure. The Solinst Barologger is installed at approximately 0.5 m depth (BGL) within piezometer A01-D.

The purpose of gauging and installation of automated loggers was to monitor water level fluctuations that may occur due to seasonal changes and rainfall influences, in both deep and alluvial screened piezometers.

The gauging and installation of loggers was undertaken with reference to the WMMP (Ref 20). Loggers are generally downloaded on a quarterly basis with manual gauging undertaken on a monthly basis only in bores subject to water quality sampling. A summary of the monitoring being undertaken at each location is shown in Table 2 below.

Table 2: Summary of Monitoring Program

Bore ID	Monthly Quality Monitoring	Monthly Water Level Gauging	Automated Water Level Monitoring (Quarterly)	Bore ID	Monthly Quality Monitoring	Monthly Water Level Gauging	Automated Water Level Monitoring (Quarterly)
A01-D			✓	AGE07			✓
A01-S	✓	✓	✓	AGE07W			✓
A02-D	✓*		✓	AGE08	✓	✓	✓
A02-S	✓	✓	✓	AGE08W		✓	✓
A03-D			✓	AGE09			✓
A03-S			✓	AGE09W			✓
A04			✓	AGE10	✓	✓	✓
A06-D	✓*		✓	AGE10W		✓	✓
A06-S	✓	✓	✓	AGE11W			✓
A08-D			✓	AGE12W		✓	
A08-S			✓	AGE13	✓	✓	✓
A09	✓**	✓	✓	AGE13W		✓	
A10			✓	AGE14			✓
A11-D			✓	AGE15			✓
A11-S			✓	AGE16		✓	✓
A12	✓**	✓	✓	AGE18		✓	
A13	✓	✓	✓	AGE19		✓	✓
A14	✓**	✓	✓	AGE20		✓	
A15	✓**	✓	✓	AGE22M			✓
A16	✓**	✓		AGE26M	✓	✓	✓
A17-D			✓	AGE28P			✓
A17-S			✓	AGE33M	✓	✓	✓
A18	✓**	✓	✓	B3-D	✓*		✓
A19	✓**	✓	✓	B3-S	✓	✓	✓
A20	✓**	✓	✓	BY0001			✓
A21			✓	BY0007			✓
A22	✓**	✓		BY0010			✓
A23		✓	✓	BY0014	✓	✓	✓
A23W		✓		BY0015	✓	✓	
A24-D		✓	✓	BY0016	✓	✓	✓
A24-S		✓		BY0020 / OP028		✓	
A25			✓	BY0091-B			✓
AGE01A-D			✓	BY0091-S			✓
AGE01A-S			✓	BY0188		✓	
AGE01W			✓	BY0204			✓
AGE02-D			✓	CPT13 / BY0174			✓
AGE02-S			✓	CPT15 / BY0173			✓
AGE03W		✓		CPT18		✓	

Table 2 Summary of Monitoring Program (Continued)

Bore ID	Monthly Quality Monitoring	Monthly Water Level Gauging	Automated Water Level Monitoring (Quarterly)	Bore ID	Monthly Quality Monitoring	Monthly Water Level Gauging	Automated Water Level Monitoring (Quarterly)
AGE04		✓		CPT36		✓	
AGE04-D		✓		CPT39W			✓
AGE04-S		✓		M1			
AGE04W		✓		M2			
AGE05		✓		OP032			✓
AGE05A		✓		BY0513		✓***	✓***
AGE05W		✓					

Notes to Table 2:
✓* - Sampled only when shallow well is dry
✓** - Sampled only when there is no surface water
✓*** - Installed October 2017 (no data)

The piezometer locations with loggers and the screened strata are summarised in Table 3.

Table 3: Summary of Loggers Installed in Piezometers

Alluvium	Weathered Zone	Basalt / Sandstone	Coal Measures
• A01-S* and A01-D* • A02-S* and A02-D* • A03-S* and A03-D* • A04-D • A06-S* and A06-D* • A08-S A08-D • A09* • A10 • A11-S and A11-D • A12* • A13 • A14* • A15* • A17-S and A17-D • A18*/SW9 • A19*/SW4 • A20*/SW8 • A21 • A23 • A24-D • A25 • AGE01-S and AGE01-D • AGE02-S and AGE01-D • AGE16 • AGE19 • AGE22M • AGE26M • AGE28P • AGE33M • B3-S and B3-D • M2	• AGE01-W • AGE07-W • AGE09-W • AGE10-W • AGE11-W • CPT15 • CPT36 • CPT39-W	• BY0091CH-B (Basalt) • BY0091CH-S (Sandstone) • AGE15 (Sandstone) • M1 (Sandstone)	• AGE07 (Ulan and Coggan) • AGE08 (Coggan) • AGE08-W (Illawarra CM) • AGE09 (Coggan) • AGE10 (Coggan) • AGE13 (Coggan) • AGE14 (Coggan) • CP035 / BY0001 (Coggan) • CP028 / BY0007 (Coggan) • CP014 / BY0010 (Coggan) • CP027 / BY0014 (Coggan) • CP045 / BY0016 (Coggan) • CPT13 (Coggan) • CPT18 (Illawarra CM) • CP063 / BY0204 (Coggan) • OP028 / BY0020 (Ulan and Coggan)

Notes to Table 3:

* Dual piezometric head and Electrical Conductivity logger (refer Section 4.2.2)

4.2 Results

4.2.1 Manual Gauging

The results of manual gauging of piezometric head within the piezometers for monthly or quarterly gauging are presented in the biannual factual reports (Ref 5 to 13 and 15 to 20) and shown graphically on the relevant water level plots in Appendix E5.

4.2.2 Automated Level Logging

Plots of water level versus time for installed loggers and manual gauging levels are shown in Appendix E5, reduced from piezometer survey levels. The data is shown against daily cumulative rainfall departure data recorded for the Bylong Coal Project weather station which is summarised in Appendix E3. It is noted that there were several periods in which no data was collected by the weather station as detailed in References 6 to 8, 10, 11 and 15.

The results of manual and automated water level monitoring indicated varied response to rainfall, with greater response in the alluvial aquifer.

It should be noted that groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

The results of automated EC logging are discussed in Section 5.

5. Automated Salinity Logging

5.1 Overview

Dual automated Electrical Conductivity (EC) and piezometric head (i.e. water level) loggers were installed in shallow and deeper alluvium screened piezometers to monitor changes in EC that may occur due to seasonal changes, rainfall influences and depth within the alluvium for the assessment of baseline groundwater conditions.

The loggers were installed in piezometers outlined in the WMMP (Ref 20) using stainless steel wire to monitor EC at a fixed depth at 20 minute intervals. The loggers were generally positioned within the central to lower section of the piezometer screen to account for fluctuating water levels (i.e. minimise the potential for the water table to fall below the depth of the logger). It is noted that groundwater levels at the site varied significantly and as such a number of loggers required re-installation at increased depth.

The piezometer locations with installed salinity loggers are summarised in Table 4.

Table 4: Summary of Salinity Loggers Installed in Piezometers

Alluvium	Shallow Alluvium Adjacent to Surface Water Feature
A01-S and A01-D	A18/SW9
A02-S and A02-D	A19/SW4
A03-S and A03-D	A20/SW8
A06-S and A06-D	
A09	
A12	
A14	
A15	

Notes to Table 4:

'-D' suffix indicates deeper alluvium piezometer (installed to the base of the Alluvium)

'-S' suffix indicates shallow alluvium piezometer

Loggers installed at locations A18, A19 and A20 were connected to the surface flow gauge telemetry systems as discussed in Section 6.

The results of water level logging are discussed in Section 4.

Loggers were downloaded on a quarterly basis with manual gauging generally undertaken on a monthly basis only in bores subject to water quality sampling.

5.2 Results

The results of quarterly logged EC are plotted against cumulative rainfall departure data collected at the Bylong Coal Project weather station and are included in Appendix E6. The data is also shown against the results of laboratory EC testing for samples included in the monthly groundwater monitoring program (Section 9). The range of EC measured by the loggers over the monitoring period of February 2012 to June 2017 is summarised in Table 5.

Table 5: Range of Measured Electrical Conductivity in Loggers (February 2012 to June 2017)

Location ID	Range of EC by Logger (µS/cm)
A01-S	1480 to 3380
A01-D	830 to 1200
A02-S	560 to 1300
A02-D	830 to 990
A03-S	360 to 7300
A03-D	1005 to 1450
A06-S	585 to 1775
A06-D	485 to 685
A09	175 to 2480
A12	95 to 360
A14	125 to 1670
A15	35 to 400
A18/SW9	140 to 580
A19/SW4	930 to 1855
A20/SW8	565 to 1725

The results indicate that for shallower screened locations (i.e. A01-S, A02-S, A03-S and A06-S) the EC of the groundwater fluctuates in apparent response to rainfall, generally with decreases in salinity following rainfall. For deeper screened locations, the EC is relatively consistent and generally lower than the EC for the shallow locations.

There is at times a slight difference between the logger readings and the manual readings and this is likely to be due to differences in the measurement method. Groundwater sampling using the low-flow pump also allows for some mixing of the water within the piezometer, whereas the logger measures EC at a specific and constant depth within the screen.

It is noted that apparent spikes/decline following sampling often occurs due to disturbance of the water column.

6. Surface Water Flow Monitoring

Figures of surface water flow and depth at SW4, SW8 and SW9 during the period July 2012 to June 2017 are included in Appendix E7. The velocity meters are rated for flow depths between 0.08 m and 1.5 m. At times when the water depths drop below 0.08 m, there is increased scatter in the output and the results are potentially unreliable. Such results should therefore be considered as approximate only. A line of best fit has been provided to assist with interpretation.

It is noted that low rainfall has generally occurred for most on the monitoring period and surface water flows have therefore been minimal. Location SW9 was dry for the majority of the total monitoring period.

The locations of the surface flow gauges at SW4, SW8 and SW9 are shown on Drawing 1 in Appendix H.

7. Seepage Flow Monitoring

7.1 Overview

Monitoring of seepage flow was undertaken at six seepage meters installed to measure fluxes of water between streams and subsurface aquifers. The purpose of the monitoring was to assist in the assessment of surface water and groundwater connectivity for the Bylong River. The monitoring was undertaken at six locations (ID1 to ID6) previously installed by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) in June 2014 (Ref 2) with reference to the methods outlined in the WMMP (Ref 20). The survey seepage meter locations ID1 to ID6 are shown on Drawings 1 and S1 to S3 in Appendix H.

A schematic of the seepage meter set up is shown in Figure 2.

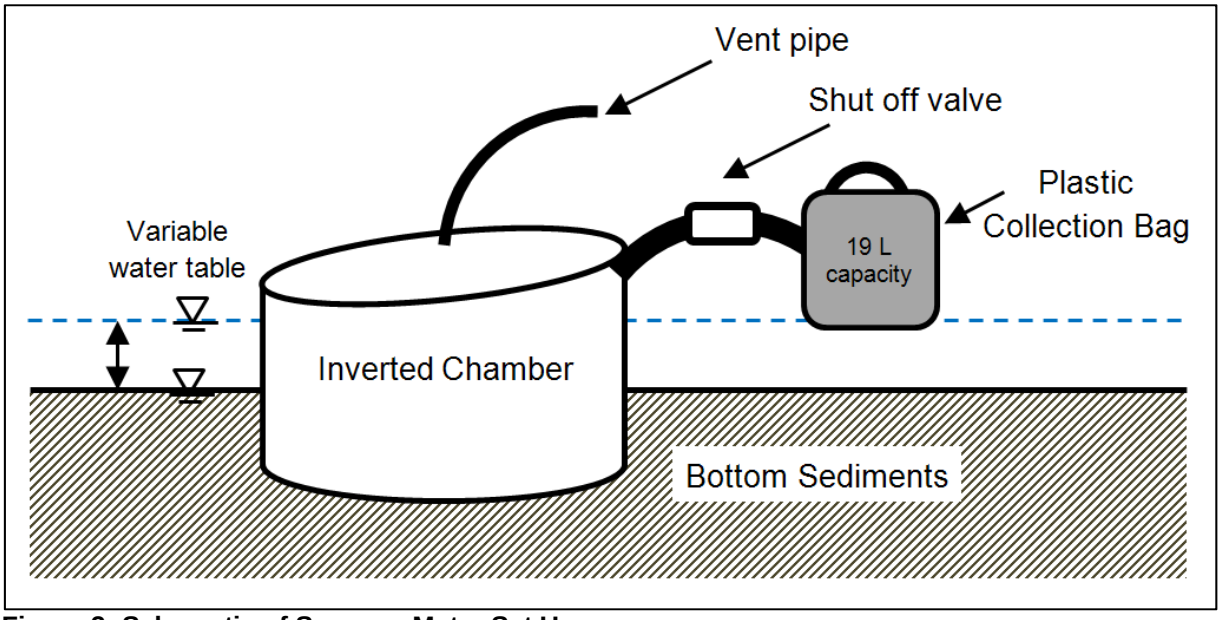

Figure 2: Schematic of Seepage Meter Set Up

Seepage meter monitoring was generally undertaken twice per month as follows:

- Mid-month in conjunction with water quality monitoring (Section 9); and
- At the end of the month as a separate task.

Seepage meter monitoring was undertaken on 53 occasions from January 2015 to June 2017. ID4 and ID5 were inaccessible from 21 July 2016 to 3 March 2017 and ID1 was been buried in sediment during the flood event of 21 July 2016.

7.2 Results

Seepage meter flux at each monitoring event was estimated using Equation 1 (Ref 3):

$$Q = \frac{Vf - \mathrm{Vo}}{\mathrm{tA}}$$ [Equation 1]

where: V_o is the initial volume of the bag
V_f is the final volume of the bag
t is the time elapsed between readings
A is the surface area of the chamber

It is noted that negative seepage flux indicates loss of recharge with a positive seepage flux indicating gaining discharge.

The results of seepage meter flux for January 2015 to June 2017 are shown against cumulative rainfall departure in Figure SM1 in Appendix E8.

8. In-situ Hydraulic Testing

8.1 Packer Testing

8.1.1 Overview

Packer testing was undertaken for selected bores to provide an estimate of the effective permeability of the rock mass at selected depth intervals. The field work was carried out over several periods from August 2011 to September 2017 to coincide with exploration drilling programs. The bores and test periods are summarised in Table 6.

Table 6: Summary of Packer Testing

Test Periods	Bores
August 2011	BY0014CH, BY0015CH, BY0016CH and BY0011CH (blocked)
June to July 2012	BY0077CH, BY0080CH, BY0091CH and BY0011CH (re-drilled)
September to November 2012	AGE01 (full profile), BY0011CH, BY0077CH, BY0080CH and BY0091CH (base section of bores only)
April 2013	BY0207CH and BY0208CH
May 2013 to June 2013	CPT18, CPT36, CPT39
October to November 2013	AGE02, A06 and B3
July 2017	BY0514, BY0516, BY0527

It is noted that the packer testing for selected bores commencing in July 2017 are due for completion. These test results are not yet available and are therefore not included in this draft report.

8.1.2 Methods

The packer system isolated a section of rock by inflating rubber membranes at either end of a chosen test section, typically a 6 m section. Water was then pumped into the test section through the drill rods. The pumping was carried out at successive rising and falling test pressures comprising five stages: three upward pressures followed by two downward pressures. At each stage, or pressure, water loss into the test section was measured and recorded at one minute intervals.

Peak pressures (in kPa) were initially set to a maximum of 15 times overburden depth (m). During the second stage of packer testing, which was generally undertaken on deeper bores at higher elevations it was observed that dilation of the rock was occurring at relatively shallow depth and therefore it was necessary to reduce peak pressured to 10 times the overburden, or less with some dilation still noted at times.

A number of the tests indicated increasing permeability over the five stages, suggesting that some wash-out of material was occurring due to the testing. In these instances the estimated in-situ hydraulic conductivity as well as the washed-out hydraulic conductivity was recorded.

8.1.3 Results

The estimated permeabilities from packer testing are summarised in Table F1, Appendix F.

8.2 Piezometer Development and Rising Head Testing

8.2.1 Overview

Following installation, piezometers were developed using airlifting techniques to remove the drilling fluids, fines and sediments from within the borehole associated with drilling and piezometer installation. The purpose of development is to provide a hydraulic connection between the piezometer and the screened formation.

In conjunction with development, rising head tests were undertaken for the majority of piezometers to provide an estimation of the hydraulic conductivity of the screened strata. Rising head tests were undertaken for a total of 61 piezometers.

It is noted that additional rising head testing for BY00513 is proposed for October 2017 and is due for completion in November 2017. These test results are not yet available and are therefore not included in this draft report.

8.2.2 Methods

Well development using air lifting techniques comprised the injection of compressed air via a tremie pipe to the base of a piezometer from a trailer-mounted compressor. This was generally undertaken until the expelled water appeared clean and absent of fines and sediment.

Following development, a similar process was undertaken for Rising Head Testing. Groundwater in the piezometer was removed by a single burst of compressed air through the tremie pipe. A datalogger installed at the base of the piezometer recorded the rise of the groundwater table to provide an estimate of groundwater recovery and soil or rock mass permeability. The process was repeated two to four times for each piezometer.

Falling head tests were undertaken for piezometers A21, CPT18 and OP020 (BY0188CH) as these locations contained minimal free standing water within the screen section. It is noted that falling head tests provide an estimate of the permeability of strata above the water table at the time of testing (i.e. unsaturated soils), whereas rising head tests estimate the permeability for strata below the water table (i.e. saturated soils).

Bore A21 was subject to both falling and rising head tests as the water table was near the base of the screen.

8.2.3 Results

The estimated permeabilities from Rising Head and Falling Head Testing are summarised in Tables F2 and F3, Appendix F.

8.3 Test Pumping Bores

An aquifer testing program was undertaken by AGE in early 2016 which comprised the installation of four trial pumping bores and monitoring piezometers to measure the yield of the alluvial aquifer. The results of the aquifer testing program, including the hydraulic property estimates, are reported in the Supplementary Response to Submissions (Ref 23).

9. Water Quality Monitoring

9.1 Overview

Groundwater and surface water quality monitoring was undertaken with reference to the sampling location and methods outlined in the WMMP (Ref 20). The purpose of the water monitoring was to assess the quality of water within the aquifer systems, namely: groundwater present within alluvial and coal measure aquifers; and surface waters present within surface water bodies.

Groundwater and surface water monitoring commenced in February 2012 and has generally been undertaken monthly and is proposed to continue on this basis. It is noted that monthly sampling was not undertaken for September, October and November 2014 as DP had not been engaged for this period.

Monitoring locations were selected on the basis of the conceptual model and the results of hydraulic testing and have developed throughout the investigation as access became available. Broadly, monitoring locations were selected as follows:

- **Groundwater:** Piezometers installed in the alluvial aquifer and the Coggan Seam to allow for collection of representative groundwater samples;
- **Surface Water:** At upstream, downstream, and central (Project) creek and river locations within the tenement based on the local and regional topography. Upstream locations were generally located in the northern areas of the tenement, downstream locations in southern areas, as well as central and eastern locations targeting mid-site surface water quality. Shallow piezometers installed at surface water locations allow collection of shallow groundwater at times when there is no surface water flow.

Groundwater and surface water sampling was undertaken on 59 occasions with 4 additional rounds (March 2012, March 2013, July 2016 and September 2016) for surface water sampling after extensive rain over the period February 2012 to June 2017 as outlined in the following sections. It is noted that access restrictions (i.e. privately owned properties) precluded monitoring at A12, A14 and A18 for some periods over the monitoring period.

9.2 Groundwater Monitoring

A total of 23 piezometers have been sampled on a monthly basis over the monitoring period of February 2012 to June 2017 for the continued assessment of baseline groundwater quality as shown in Table 7. It is noted that piezometers have been added to the monitoring program since February 2012 with the installation of additional piezometers (wells) in exploration boreholes, as discussed in the WMMP (Ref 20).

Table 7: Summary of Sampled Groundwater Piezometers: February 2012 to June 2017

Piezometer ID	Screened Stratum	Number of Monthly Sampling Events	Comment
A01-S	Alluvium	59	-
A02-S	Alluvium	31	A02-D as substitute when dry
A02-D	Alluvium	27	A02-S sampled as priority
A06-S	Alluvium	34	A06-D as substitute when dry
A06-D	Alluvium	24	A06-S sampled as priority
A09	Alluvium	50	SW2 sampled as priority
A12	Alluvium	26	Limited property access, SW7 sampled as priority
A13	Alluvium	58	-
A14	Alluvium	42	Limited property access, SW5 sampled as priority
A15	Alluvium	41	SW1 sampled as priority
A18	Alluvium	49	Limited property access, SW9 sampled as priority
A19	Alluvium	3	SW4 sampled as priority
A20	Alluvium	45	SW8 sampled as priority
B3-S	Alluvium	36	B3-D as substitute when dry
B3-D	Alluvium	13	B3-S sampled as priority
AGE08	Coggan Seam	46	-
AGE10	Coggan Seam	45	-
AGE13	Coggan Seam	45	-
AGE26M	Alluvium	6	-
AGE33M	Alluvium	6	-
BY0014CH	Coggan Seam	58	-
BY0015CH	Coggan Seam	58	-
BY0016CH	Coggan Seam	58	-

Piezometer A19 was generally not sampled during the monitoring period as surface water was available for sampling at SW4.

The piezometer sampling locations are shown on Drawing 1 in Appendix H.

A summary of the standard operating procedures for groundwater sampling is provided in Appendix D.

9.3 Surface Water Monitoring

9.3.1 Program

Nine surface water monitoring locations (SW1 to SW9) were selected to provide surface water quality baseline data. The locations were situated at upstream, downstream, and central creek and river locations within the tenement. Upstream locations were generally located in the northern areas of the tenement, downstream locations in southern areas, as well as central and eastern locations targeting mid-site surface water quality.

Shallow groundwater piezometers were installed in 2012 adjacent to all surface water sampling locations, with the exception of SW3 due to the presence of shallow rock. The purpose of these piezometers was to enable sampling of shallow groundwater when surface water was not present for the collection of baseline water quality information. When surface water was not present at the time of sampling, the piezometers were sampled where water was present (refer Section 9.2).

Surface water monitoring was undertaken monthly in conjunction with groundwater sampling as per the WMMP (Ref 20).

The surface water locations and alternative piezometers sampled from February 2012 to June 2017 are summarised in Table 8.

Table 8: Summary of Surface Water Sampling: February 2012 to June 2017

Surface Water		Alternative Piezometer	
Location ID	**Monthly Sampling Events - February 2012 to June 2017**	**Location ID**	**Monthly Sampling Events - February 2012 to June 2017**
SW1	18	A15	42
SW2	12	A09	51
SW3	9	A22	None: dry
SW4	62	A19	3
SW5	-	A14	43
SW6	26	A16	None: dry
SW7	7	A12	27
SW8	18	A20	46
SW9	5	A18	50

The surveyed sampling locations are shown on Drawing 1 in Appendix H.

A summary of the standard operating procedures for surface water sampling is provided in Appendix D.

9.4 Laboratory Testing

Laboratory testing was undertaken by Envirolab, a laboratory registered with the NATA. Analytical methods used are shown on the laboratory sheets, which have been previously provided (Ref 5 to 13 and 15 to 20).

Surface water and groundwater piezometer samples were analysed for the following:

- pH;
- Electrical Conductivity (EC);
- Turbidity;
- Alkalinity: Hydroxide (OH^-) as $CaCO_3$, Carbonate (CO_3^{2-}) as $CaCO_3$, Bicarbonate (HCO_3^-) as $CaCO_3$ and Total Alkalinity as $CaCO_3$;
- Anions: Chloride (Cl^-), Ammonia (NH_3) as Nitrogen (N), Nitrogen Oxides (NO_2^- and NO_3^-) and Sulphate (SO_4^{2-});
- Cations: Sodium (Na^+), Potassium (K^+), Calcium (Ca^{2+}) and Magnesium (Mg^{2+});
- Total Phosphorous (P); and
- Dissolved metals (16): Aluminium (Al), Arsenic (As), Barium (Ba), Beryllium (Be), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Mercury (Hg), Nickel (Ni), Selenium (Se), Vanadium (V) and Zinc (Zn).

Laboratory testing of pH was undertaken in addition to the field measurements using calibrated meters. The measurement of pH in the field is generally considered to be more reliable / representative as pH is highly sensitive and can change during sample transport, therefore field pH readings are generally presented.

For the purposes of QA/QC, one duplicate surface water sample was generally collected for each sampling event and analysed for the above suite. The results have been presented in the QA/QC reports from previous investigations (Ref 5 to 13 and 15 to 20).

It is noted that it is general industry practice to collect unfiltered surface water samples for metal analyses, therefore providing total analyte concentrations. At the request of NSW Office of Water (NOW), surface water samples were tested for dissolved metals (i.e. field filtered) to allow direct comparison of the results with dissolved metal concentrations in groundwater as outlined in the WMMP (Ref 20).

9.5 Results

9.5.1 Analytical Testing and Assessment Criteria

The summarised results tables for surface water analyses from February 2012 to June 2017 are included in Table C1, Appendix C. Detailed laboratory report sheets have been reported previously and can be found in Ref 5 to 13 and 15 to 20.

The DECC '*Guidelines for the Assessment and Management of Groundwater Contamination'* (Ref 4) state that the applicable guidelines for groundwater contaminants are the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) guidelines (Ref 1) in the case of protection of aquatic ecosystems. The groundwater investigation levels (GILs) for 95% protection of the aquatic ecosystem should be used.

Groundwater and surface water chemical analysis results were therefore compared to the ANZECC (2000) GILs (trigger values) for slightly to moderately disturbed systems for **fresh waters** for the assessment of groundwater and surface water quality.

The hierarchy of selecting appropriate ANZECC guideline values was as follows:

- The fresh water trigger levels for slightly to moderately disturbed ecosystems were adopted as the primary guideline value;
- Where no high reliability trigger value is given in ANZECC for fresh water conditions, the high reliability marine water value was adopted as the guideline value; and
- Where neither marine nor freshwater trigger values are given at high reliability, low reliability trigger values were adopted as the guideline value.

The adopted guideline for each tested analyte is highlighted in the summary tables, Table C1, in Appendix C.

The NSW EPA (2015) 'Guidelines on the Duty to Report Contamination' under the Contaminated Land Management Act 1997 (Ref 25) indicate that reference should be also made to the NHMRC & NRMMC *Australian Drinking Water Guidelines* (2011, Ref 24) with respect to groundwater. The laboratory test results were therefore assessed against the Australian Drinking Water Guidelines where there were no guidelines specified by ANZECC.

The results of water quality testing from February 2012 to June 2017 were plotted against time, separated for alluvium, Coggan and surface water for ease of distinction. The results of are included in Appendix E1 to E2. The plots enable a visual review of parameter concentrations, ranges and trends for individual piezometers and surface water sampling locations. Most parameters are plotted on a logarithmic scale due to the wide variation in values.

The pH and EC plots (Appendix E1) also show the ANZECC (2000) criteria for irrigation (Ref 1). For comparison, the most common laboratory practical quantitation limit (PQL) is shown on the graphs as a blue horizontal line. In general, the PQL should be lower than the ANZECC criteria. This was achieved for all analytes.

10. Discussion of Water Chemistry Results

10.1 Data Used in Statistical Assessment

All water monitoring data collected from November 2011 to June 2017 has been included in the assessment. The detailed data has been provided previously in Ref 5 to 13 and 15 to 20 as summarised in Table A2, Appendix A.
The data was evaluated with reference to the DECC *Guidelines for the Assessment and Management of Groundwater Contamination* (Ref 4). Some of the aspects considered were:

- Identification of the aquifers and regional hydrogeology (Ref 22 and 23); and
- Construction of the monitoring wells: the data is derived from a number of different wells installed by various consultants, including DP over a number of years. The information collected has been used at face value and the individual well construction details have not been verified.

Overall the possible effects of the above influences on the analysis of the results is considered secondary to the value of including most of the available data. The data was therefore used at face value.

10.2 Statistical Analysis of the Data

10.2.1 Data Grouping

The subsurface strata can be divided hydrogeologically into two groundwater aquifers: the alluvium aquifer and the coal measures aquifer. The coal measures aquifer is considered to recharge the alluvium (Ref 21) and has therefore not been considered as 'confined'. Details of the screened stratum for each well is summarised in Table B1, Appendix B.

The water quality sampling locations were divided into three groups to enable statistical comparison of alluvium, coal measures and surface water data sets. The numbers of monitoring locations corresponding to each category (surface water, alluvium and coal measures) are shown below in Table 9. Drawing 1 in Appendix C shows the locations of the wells associated with each data group.

The surface water locations and alternative piezometers sampled from February 2012 to June 2017 are summarised in Table 8.

Table 9: Number of Monitoring Locations in Each Group

Monitoring	Monitoring Location		
	Surface Water	Alluvium	Coal Measures
Water Quality Monitoring	9	17	6
Water Level Monitoring	-	41	16

The water quality parameters included in the assessment are listed in Table 10 below.

Table 10: Principal Parameters of Interest

Group	Parameter
General parameters	pH, Electrical Conductivity
Metals	Beryllium, Calcium, Mercury, Manganese, Nickel, Potassium, Selenium, Sodium, Vanadium, Zinc

10.2.2 Graphical Review

Dissolved metals, pH and EC were graphed against time for each monitoring well. This enabled a visual review of concentrations levels, ranges and trends for individual wells and groups of wells. The graphs are presented in Appendix E1. Most parameters are plotted on a logarithmic scale due to the wide variation in values.

For graphing (and statistical processing) purposes, entries that were recorded as less than PQL (practical quantitation limit, or detection level) were taken as half PQL. This is widely used approach were numerical processing is required, as the average “true” non-detectable value of a set of measurements would tend towards half of the detection limit, particularly for large data sets. It is noted that PQLs varied between monitoring rounds and sample sets, so the individual half values do not necessarily plot as the same value throughout. The graphs show the most common PQL as a horizontal (blue) line for comparison.

The graphs also show the relevant ANZECC criteria (irrigation for pH and EC) in a red horizontal line. Where no marine water criteria is given in ANZECC the corresponding fresh water criterion was used. Some parameters have no ANZECC criteria at all, and no line is plotted.

10.2.3 Statistical Analysis

Due to the wide variations in groundwater levels and water quality across the Project site, statistical analysis was conducted to determine appropriate percentiles based on estimating the existing mean, variance and standard deviation for each piezometer.

Determination of the standard deviations for groundwater levels and water quality have been undertaken assuming a normal distribution.

10.2.4 Method of Assessing Percentiles

The graphed data (see Appendix E1, E5 and E6) were reviewed to identify any atypical or unusual data records that could impact on the statistical evaluation of background concentrations for any of the parameters measured.

Several of the shallow ‘paired wells’ were dry over an extended period of the monitoring period, producing significantly higher 5th percentile values for the monitoring locations. Table G2 presents a summary of the statistical analysis results for the water level data, with recommended 5th percentile values for the shallow wells.

The output of the spreadsheet calculations for the water quality statistical analysis is shown in Appendix G, with summaries of the results included in the next section.

10.3 Results of Statistical Analysis

A summary of the calculated percentiles for water quality are shown in Table 11 to Table 13 for the three aquifers.

Table 11: Statistical Summary – Coal Measures

Group	Parameter	Number of Readings	Minimum	20th Percentile	Mean	Median	80th Percentile	Maximum
Metals	Aluminium (Al)	311	0.00025	<0	0.0068	0.00682	0.0158	0.1100
	Barium	311	0.0005	0.119	0.2126	0.213	0.307	0.4400
	Arsenic (As)	311	0.0005	<0	0.0038	0.00382	0.0118	0.0830
	Cadmium (Cd)	311	0.00005	0.00005	0.0000556	0.0000557	0.0000828	0.0003
	Chromium (Cr)	311	0.0005	0.0005	0.000510	0.00051	0.000593	0.0020
	Copper (Cu)	311	0.0005	<0	0.001264	0.00127	0.00336	0.0230
	Cobalt (Co)	311	0.0005	<0	0.00068	0.000684	0.00169	0.0140
	Iron (Fe)	311	0.005	0.135	0.3254	0.326	0.517	2.1
	Lead (Pb)	311	0.0005	0.0005	0.0005	0.000515	0.000656	0.0030
	Magnesium (Mg)	311	17	18.5	37.23	37.3	56.0	88
	Manganese (Mn)	311	0.02	0.0279	0.0595	0.0596	0.0913	0.26
	Beryllium (Be)	311	0.00005	0.0000500	0.0000730	0.000073	0.000118	0.0004
	Mercury (Hg)	311	0.000025	0.0000250	0.0000250	0.000025	0.000025	0.0000
	Nickel (Ni)	311	0.0005	<0	0.00511	0.00512	0.0135	0.0930
	Selenium (Se)	311	0.0005	0.0005	0.00053	0.000529	0.00077	0.0050
	Vanadium (V)	311	0.0005	0.0005	0.000527	0.000528	0.00069	0.0020
	Zinc (Zn)	311	0.0005	<0	0.0461	0.0462	0.359	6.5000
Non-Metals	pH	311	5.5	6.7	7.06	7.07	7.43	7.9
	Conductivity	311	880	1110	1576.0	1580	2050	3900
	Total Phosphorus	311	0.025	<0	0.0357	0.0357	0.0906	1.1000
	Ammonia	311	0.04	1.01	1.5187	1.52	2.04	3.7000
	Total Alkalinity	311	400	482	693.41	694	906	1200
	Hydroxide	311	<5	-	<5	-	-	<5
	Carbonate	311	2.5	<0	3.38	3.39	9.39	110
	Bicarbonate	311	400	482	692.35	693	904	1200
	Chloride	311	38	85.1	144.99	145	205	630
	NOx	311	0	<0	0.03	0.0311	0.14	1.8
	Sulphate (SO_4)	311	0.5	<0	21.06	21.1	44.30	310
	Calcium	311	26	32.5	44.1	44.2	55.8	80
	Potassium	311	8.8	12.30	16.37	16.4	20.6	31
	Sodium	311	100	186	325.7	326	466	740

Notes: Where a percentile value is shown as <0 this is due to a wide scatter (high standard deviation).
Percentiles presented to three significant figures.

Table 12: Statistical Summary – Alluvium

Group	Parameter	Number of Readings	Minimum	20th Percentile	Mean	Median	80th Percentile	Maximum
Metals	Aluminium (Al)	549	0.00025	<0	0.0123	0.0123	0.0682	1.0000
	Barium	549	0.005	0.0292	0.0851	0.0851	0.142	0.6500
	Arsenic (As)	549	0.0005	<0	0.0007	0.000702	0.0015	0.0190
	Cadmium (Cd)	549	0.00005	<0	0.0000684	0.0000684	0.000143	0.0006
	Chromium (Cr)	549	0.0005	<0	0.000626	0.000626	0.00147	0.0120
	Copper (Cu)	548	0.0005	<0	0.007687	0.00769	0.0472	0.7200
	Cobalt (Co)	548	0.0005	<0	0.00131	0.00131	0.00409	0.0380
	Iron (Fe)	549	0.005	<0	1.0526	1.06	5.61	59
	Lead (Pb)	549	0.0005	0.0005	0.0006	0.000576	0.00111	0.0120
	Magnesium (Mg)	548	4.9	21.7	52.03	52.1	82.5	160
	Manganese (Mn)	549	0.0025	<0	0.3989	0.399	1.27	12
	Beryllium (Be)	549	0.00005	0.0000500	0.0000525	0.0000525	0.0000697	0.0003
	Mercury (Hg)	549	0.000025	0.0000250	0.0000254	0.0000255	0.0000335	0.0003
	Nickel (Ni)	549	0.0005	0.0005	0.00422	0.00423	0.00811	0.0380
	Selenium (Se)	549	0.0005	<0	0.00164	0.00165	0.00397	0.0170
	Vanadium (V)	549	0.0005	0.0005	0.000823	0.000824	0.00145	0.0090
	Zinc (Zn)	549	0.002	<0	0.0237	0.0237	0.051	0.3600
Non-Metals	pH	548	4.8	6.19	6.66	6.66	7.14	8.1
	Conductivity	548	150	491	1089.2	1090	1690	3100
	Total Phosphorus	548	0.025	<0	0.1006	0.101	0.347	3.2000
	Ammonia	549	0.0025	<0	0.0760	0.076	0.396	5.3000
	Total Alkalinity	548	32	156	274.08	275	394	630
	Hydroxide	548	<5	-	<5	-	-	<5
	Carbonate	548	2.5	2.5	2.76	2.77	5.23	51
	Bicarbonate	548	32	155	273.81	274	393	630
	Chloride	548	9	46.8	153.95	154	262	570
	NOx	549	0.0025	<0	1.26	1.27	4.42	37
	Calcium	548	2.6	29.2	64.6	64.7	101	150
	Potassium	548	2	3.72	5.96	5.96	8.2	25
	Sodium	548	15	37.4	111.8	112	187	380

Notes: <0 this is due to a wide scatter (high standard deviation).
Percentiles presented to three significant figures.

Table 13: Statistical Summary – Surface Water

Group	Parameter	Number of Readings	Minimum	20th Percentile	Mean	Median	80th Percentile	Maximum
Metals	Aluminium (Al)	155	0.00025	<0	0.0140	0.014	0.051	0.5100
	Barium	155	0.006	0.0331	0.0645	0.0646	0.0961	0.1800
	Arsenic (As)	155	0.0005	0.0005	0.0006	0.000568	0.000788	0.0020
	Cadmium (Cd)	155	0.00005	0.00005	0.0000594	0.0000594	0.0000946	0.0005
	Chromium (Cr)	155	0.0005	0.0005	0.000535	0.000536	0.000722	0.0030
	Copper (Cu)	155	0.0005	<0	0.002361	0.00237	0.00529	0.0290
	Cobalt (Co)	155	0.0005	0.0005	0.00066	0.000659	0.00111	0.0040
	Iron (Fe)	155	0.005	<0	0.0881	0.0881	0.195	1.1
	Lead (Pb)	155	0.0005	0.0005	0.0006	0.000562	0.000946	0.0050
	Magnesium (Mg)	155	4.1	23.9	58.10	58.1	92.4	130
	Manganese (Mn)	155	0.0025	<0	0.1594	0.160	0.360	1.5
	Beryllium (Be)	155	0.00005	0.0000500	0.0000539	0.0000539	0.0000772	0.0003
	Mercury (Hg)	155	0.000025	<0	0.0000376	0.0000377	0.0000956	0.0006
	Nickel (Ni)	155	0.0005	0.0014	0.00235	0.00235	0.00331	0.0080
	Selenium (Se)	155	0.0005	0.0005	0.00059	0.000594	0.000885	0.0030
	Vanadium (V)	155	0.0005	0.0005	0.000990	0.000991	0.00169	0.0040
	Zinc (Zn)	155	0.0005	<0	0.0104	0.0105	0.0233	0.1000
Non-Metals	pH	155	6.2	7.33	7.71	7.72	8.1	8.6
	Conductivity	155	120	564	1220.4	1230	1880	2300
	Total Phosphorus	155	0.025	<0	0.1304	0.131	0.574	6.3000
	Ammonia	155	0.0025	<0	0.0439	0.0439	0.246	2.9000
	Total Alkalinity	155	28	146	258.58	259	372	470
	Hydroxide	155	<5	2.1	<5	2.43	2.75	<5
	Carbonate	155	0.5	<0	3.83	3.83	8.1	33
	Bicarbonate	155	28	145	257.03	258	370	440
	Chloride	155	16	71.4	188.21	189	306	440
	NOx	155	0.0025	<0	0.31	0.307	1.91	18
	Calcium	155	3.5	28.2	68.7	68.7	110	150
	Potassium	0	0	<0	0.00	<0	-	0
	Sodium	0	0	<0	0.0	<0	-	0

Notes: Where a percentile value is shown as <0 this is due to a wide scatter (high standard deviation).
Percentiles presented to three significant figures.

The recommended trigger levels based on 5th percentiles for groundwater levels are summarised in Table G2 in Appendix G.

10.4 Discussion

10.4.1 Water Quality Plots

The results of water quality testing from February 2012 to June 2017 were plotted against time, separated for alluvium, coal measures and surface water for ease of distinction, and are included in Appendix E1 and E2.

The plots enable a visual review of parameter concentrations, ranges and trends for individual piezometers and surface water sampling locations. Most parameters are plotted on a logarithmic scale due to the wide variation in values.

The observations regarding groundwater and surface water trends for February 2012 to July 2017 monitoring are summarised as follows:

Surface Water

- The pH of surface waters was generally higher than the pH of groundwater. pH values were reasonably consistent between pH 7.0 and 8.5, and were all above the ANZECC criteria of pH 6.0 for irrigation purposes;
- EC provides an indirect measure of water salinity. Surface waters were generally fresher than groundwater based on EC, with values ranging from 120 µS/cm to 2,300 µS/cm. ECs were lowest for the March 2012 event-based sampling following several consecutive days of rainfall including 76 mm recorded at the Bylong weather station on 1 March 2012. Similarly lower ECs were observed for the March 2013, July 2016 and September 2016 sampling events which also followed significant rainfall. Increasing salinity trends were apparent as sampling locations progress downstream, with upstream locations SW1, SW7 and SW9, all located on the upstream reaches with consistently lower EC than SW3, SW4 and SW6 which are located on the downstream reaches of the site;
- A similar trend in increasing concentration with distance downstream was also observed for the major anions and cations, in particular Sodium, Magnesium, Potassium, Chloride and Sulphate, which indicate increasing salinity;
- Turbidity varied between sampling events, however, was generally within the ANZECC criteria range of 1 to 50 NTU for most locations;
- Metals (Copper, Aluminium, Iron and Zinc and to a lesser extent Manganese) were found to be variable both spatially and temporally. Metals Copper and Zinc regularly exceeded ANZECC criteria for many sampling events. It is noted that the majority of sampling locations were dry; and
- Of the remaining metals only occasional exceedances of ANZECC criteria were found for Aluminium, Cadmium, Chromium, Cobalt and Mercury.

Groundwater

Groundwater sampling was undertaken for both the Alluvial Aquifer and the Coal Measures (Coggan Seam). Results for piezometers screened in the coal measures are plotted separately to the results for piezometers screened in alluvium. From the plots in Appendix E1, the following comments on the difference in groundwater quality between the two aquifers can be made:

- pH values for the coal measures were reasonably consistent between the range of pH 6.0 and 8.0 and were noticeably higher than pH for the wells screened in the alluvium. pH values for the alluvium were reasonably consistent between the range of pH 5.0 and 7.5, which consistently exceeded the ANZECC irrigation criteria of pH 6.0 (i.e. pH values of < pH 6) after September 2013.
- ECs generally ranged between 1,000 µS/cm to2,000 µS/cm for the piezometers screened in the coal measures and were generally evenly spread over this range. ECs generally ranged between500 µS/cm to 1,700 µS/cm for the piezometers screened in the alluvium. The most saline piezometers were BY0016CH which is screened in the coal measures and A01-S and A09 screened in the Alluvium.
- In terms of major cations, the results indicated a preference towards sodium and potassium over calcium and magnesium in the coal measures compared to the alluvium. In terms of major anions, the coal measures were generally relatively high in carbonate/bicarbonate;

- Piezometers A12, A15 and A18, respectively installed adjacent to surface water locations SW7, SW1 and SW9 and piezometer B3-S, were notably fresher than the remainder of alluvial piezometers. EC values ranged between 250 µS/cm to 400 µS/cm which is considered more representative of surface water quality at these locations (i.e. shallow screened wells). These locations are also located on the upstream reaches of the site;
- Metals Aluminium, Copper, Cobalt and Zinc and to a lesser extent Iron and Manganese were found to be highly variable both spatially and temporally. and were observed to regularly exceed ANZECC criteria at most of the alluvial locations. Occasional exceedances of ANZECC criteria were found for Dissolved Chromium, Nickel and Selenium;
- The concentrations of metals in the coal measures was generally less than the criteria, with the exception of BY0016CH and AGE13, which regularly exceeded for Dissolved Arsenic, Copper, Cobalt, Beryllium and Nickel. Piezometers AGE08 and AGE10 which were monitored from June/July 2013 also indicated occasional exceedances for these parameters. The majority of piezometers in the Coal measures regularly exceeded ANZECC criteria for Dissolved Zinc.
- A02-S exceeded ANZECC criteria for Dissolved Selenium for almost all sampling occasions;

10.4.2 Tri-Linear Analysis

A tri-linear diagram of major ionic composition was plotted for groundwater (alluvium and coal measures) and surface water to assess spatial variation in water chemistry and aquifer systems as shown in Figure P1, Appendix E2.

The plot indicates the following:

- Groundwater in the coal measures is spatially separate (i.e. clustered) from groundwater in the alluvium and surface water. Ionic composition is dominated by Sodium/Potassium and Carbonates, indicative of rock weathering in the coal measures.
- Groundwater in the alluvium generally shows slight cation dominance for sodium, potassium and magnesium. In terms of Anions, groundwater in the alluvium is lower in carbonates and higher chloride than the coal measures; and
- Similar ionic composition is apparent for surface water and groundwater in the Alluvium, indicating linkage of water quality.

10.4.3 Box and Whisker Analysis

Box and whisker plots for pH and EC were plotted for groundwater (alluvium and coal measures) and surface water to assess relationships between aquifer systems as shown in Figure 3 to Figure 4, below.

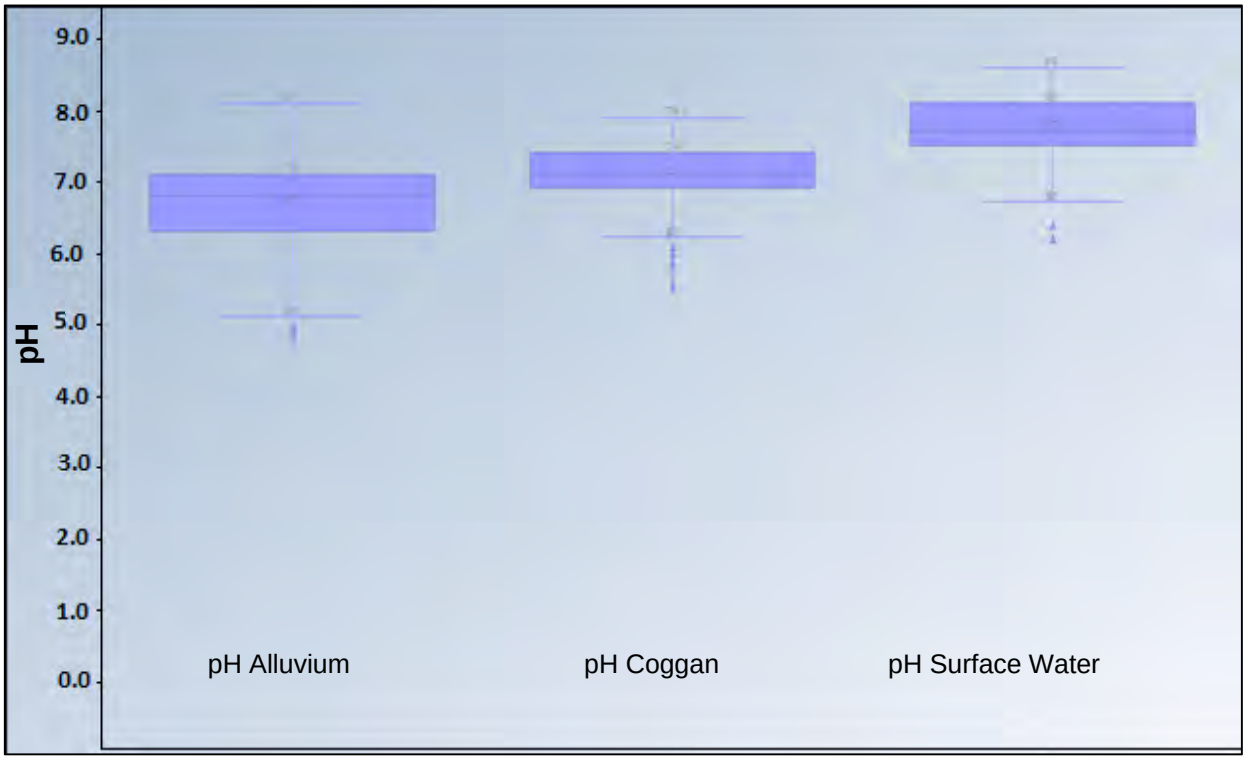

Figure 3: Box and Whisker Plot for pH

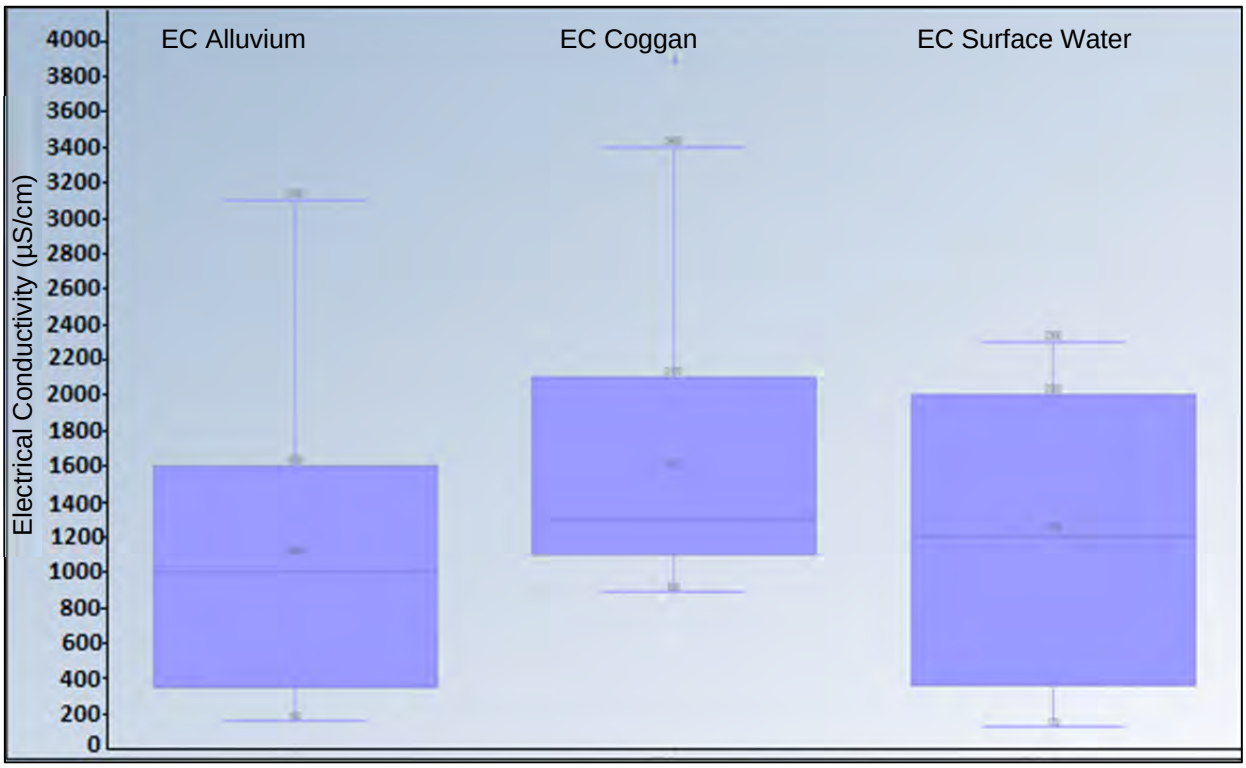

Figure 4: Box and Whisker Plot for Electrical Conductivity

The plots indicate the following:

- pH values for the coal measures generally fell between those measured for the surface water and the alluvium, with pH values for the surface water consistently higher than those from the alluvium piezometers and the coal measures;
- pH values for the coal measures, alluvium and surface water were reasonably consistent and ranged between pH 5.0 and 8.5;
- Surface water and alluvium piezometers were generally fresher than the coal measures based on EC, with values ranging from 120 µS/cm to 2,300 µS/cm;
- ECs generally ranged between 880 µS/cm to 2,050 µS/cm for the piezometers screened in the coal measures and were generally evenly spread over this range.

Outliers (i.e. values that fell outside the quartile ranges) are represented by a triangle.

10.5 General Comments

This report has presented the factual results of hydrogeological investigation and monitoring over the period November 2011 to June 2017 for the Bylong Coal Project.

It is noted that the monitoring of baseline site conditions is on-going as outlined in DP's (2014) 'Preliminary Hydrogeological Assessment and Water Monitoring Plan' (Ref 14) and subsequently revised 'Hydrogeological Assessment and Water Monitoring and Modelling Plan' (WMMP, Ref 20).

It is understood the reported data will be used by others for the purposes of the environmental assessment for the Bylong Coal Project.

11. References

1. ANZECC (2000), 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality', Australian and New Zealand Environment and Conservation Council, October 2000.
2. Australasian Groundwater and Environmental Consultants Pty Ltd (2014), 'Memorandum, RE: Seepage Meter Installation: Bylong Coal Project', 27 June 2014.
3. Brodie, R.S., Baskaran, S., Ransley, T., and Spring, J. (2009), 'The Seepage Meter: Progressing a Simple Method of Directly Measuring Water Flow Between Surface Water And Groundwater Systems', Bureau of Rural Sciences, Canberra ACT and Centre for Resource and Environmental Studies, Australian National University, Canberra ACT, Australian Journal of Earth Sciences.
4. DECC (2007), 'Guidelines for the Assessment and Management of Groundwater Contamination', Department of Environment and Conservation, March 2007.
5. Douglas Partners Pty Ltd (2012), 'Results of Cone Penetration Testing, Upper Bylong', Project 49761.00, April 2012.
6. Douglas Partners Pty Ltd (2012), 'Summary of Groundwater Assessment to Date, Proposed Coal Mine, Bylong', Project 49761.00-03, April 2012.

7. Douglas Partners Pty Ltd (2012), 'Interim Factual Report of Hydrogeological Investigation and Monitoring, Proposed Coal Mine, Bylong, Mid-Western NSW', Project 49761.03, Rev 0, 31 August 2012.
8. Douglas Partners Pty Ltd (2013), 'Addendum Report on Hydrogeological Investigation and Monitoring, August to December 2012', Project 49761.03-02, Rev 1, January 2013.
9. Douglas Partners Pty Ltd (2013), 'Preliminary Hydrogeological Assessment and Water Monitoring Plan, Proposed Coal Mine at Bylong, Mid-Western NSW', Project 49761.00-Rev 3, May 2013.
10. Douglas Partners Pty Ltd (2013), 'Report on Baseline Groundwater and Surface Water Quality Monitoring, February 2012 to May 2013', Project 49761.03-04, May 2013.
11. Douglas Partners Pty Ltd (2013), 'Addendum Report on Hydrogeological Investigation and Monitoring, January to July 2013', Project 49761.03-05, Rev 1, 26 July 2013.
12. Douglas Partners Pty Ltd (2013), 'Report on Hydrogeological Investigation and Monitoring: August 2011 to October 2013', Project 49761.03-07, Rev 0, 1 November 2013.
13. Douglas Partners Pty Ltd (2014), 'Addendum Factual Report on Hydrogeological Investigation and Monitoring, July to December 2013', Project 49761.03, Report 08, Rev 0, 28 January 2014.
14. Douglas Partners Pty Ltd (2014), 'Preliminary Hydrogeological Assessment and Water Monitoring Plan', Project 49761.04, Document Ref 49761.04.R.001, Rev 0, 19 December 2014.
15. Douglas Partners Pty Ltd (2015), 'Report on Hydrogeological Investigation and Monitoring, June to December 2014', Project 49761.04, Document Ref 49761.04.R.002, Rev 0, 23 January 2015.
16. Douglas Partners Pty Ltd (2015), 'Report on Hydrogeological Investigation and Monitoring, January 2015 to November 2015', Project 49761.04, Document Ref 49761.04.R.003.Rev0, 23 December 2015.
17. Douglas Partners Pty Ltd (2017), 'Report on Hydrogeological Investigation and Monitoring, December 2015 to June 2016', Project 49761.04, Document Ref 49761.04.R.008.Rev0, 26 April 2017.
18. Douglas Partners Pty Ltd (2017), 'Report on Hydrogeological Investigation and Monitoring, July 2016 to December 2016', Project 49761.04, Document Ref 49761.04.R.012.Rev0, 1 June 2017.
19. Douglas Partners Pty Ltd (2017), 'Report on Hydrogeological Investigation and Monitoring, January 2017 to June 2017', Project 49761.04, Document Ref 49761.04.R.013.Rev0, 28 July 2017.
20. Douglas Partners Pty Ltd (2017), 'Hydrogeological Assessment and Water Monitoring and Modelling Plan', Project 49761.04, Document Ref 49761.04.R.010.Rev2, 26 September 2017.
21. Hansen Bailey Environmental Consultants (2015), 'Bylong Coal Project, Environmental Impact Statement, September 2015', prepared for WorleyParsons Services Pty Ltd on behalf of KEPCO Bylong Australia Pty Ltd, September 2015
22. Hansen Bailey Environmental Consultants (2016), 'Bylong Coal Project, Environmental Impact Statement: Response to Submissions March 2016', Document Ref 160323 Bylong EIS RTS, 23 March 2016
23. Hansen Bailey Environmental Consultants (2016), 'Bylong Coal Project, Environmental Impact Statement, Supplementary Response to Submissions, August 2016', prepared for WorleyParsons Services Pty Ltd, 19 August 2016
24. NHMRC, NRMMC (2011), 'Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy', National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra, October 2011.
25. NSW EPA, (2015) 'Guidelines on the Duty to Report Contamination' under the Contaminated Land Management Act 1997', September 2015

12. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for the Bylong Coal Project in accordance with DP's proposal NCL170571.P.001.Rev0 dated 22 September 2017 and acceptance under Change Order CO-013 dated 3 October 2017. The work was carried out under agreed terms between DP and WorleyParsons Services Pty Ltd on behalf of KEPCO Bylong Australia Pty Ltd under Agreement No. 201015-00276-PS-CNT-0004 dated 31 October 2014.

The report is provided for the exclusive use of WorleyParsons Services Pty Ltd on behalf of KEPCO Bylong Australia Pty Ltd for this project only and for the purposes described in the report. It should not be used for other projects or by a third party. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions between sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion given in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the environmental components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

Table A1: Summary of Revision of the Douglas Partners Pty Ltd Hydrogeological Assessment and Water Monitoring and Modelling Plan

Table A2: List of Douglas Partners Pty Ltd Hydrogeological Data Reports for the Bylong Coal Project

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

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This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Table A1: Summary of Revision of the Douglas Partners Pty Ltd Hydrogeological Assessment and Water Monitoring and Modelling Plan

Report Title	Prepared For	Report Reference	Report Revision	Date
Preliminary Hydrogeological Assessment and Water Monitoring Plan	Cockatoo Coal Limited	49761	0	27 June 2011
			1	10 October 2011
			2	4 March 2013
			2A	7 March 2013
			3	22 May 2013
Preliminary Hydrogeological Assessment and Water Monitoring Plan	WorleyParsons Services Pty Ltd on behalf of KEPCO	49761.04.R.001	0	19 December 2014
Hydrogeological Assessment Water Monitoring Plan	WorleyParsons Services Pty Ltd on behalf of KEPCO	49761.04.R.010	DftA	30 January 2017
			DftB	3 February 2017
			DftC	6 February 2017
			DftD	14 March 2017
			DftE	22 March 2017
Hydrogeological Assessment and Water Monitoring and Modelling Plan	WorleyParsons Services Pty Ltd on behalf of KEPCO	49761.04.R.010	Rev0	18 May 2017
			Rev1	7 June 2017
			Rev2	22 September 2017

Table A2: List of Douglas Partners Pty Ltd Hydrogeological Data Reports for the Bylong Coal Project

Report Title	Prepared For	DP Project Number	DP Document Number	Date
Results of Cone Penetration Testing, Upper Bylong	Cockatoo Coal Limited	49761.00	49761.02 CPT	April 2012
Summary of Groundwater Assessment to Date, Proposed Coal Mine, Bylong	Cockatoo Coal Limited	49761.00	Project 49761.00-03	April 2012
Interim Factual Report of Hydrogeological Investigation and Monitoring, Proposed Coal Mine, Bylong, Mid-Western NSW	Cockatoo Coal Limited	49761.03	49761.03, Rev 0	31 August 2012
Addendum Report on Hydrogeological Investigation and Monitoring, August to December 2012	Cockatoo Coal Limited	49761.03	49761.03-02, Rev 1	January 2013
Report on Baseline Groundwater and Surface Water Quality Monitoring, February 2012 to May 2013	Cockatoo Coal Limited	49761.03	49761.03-04	May 2013
Addendum Report on Hydrogeological Investigation and Monitoring, January to July 2013	Cockatoo Coal Limited	49761.03	49761.03-05, Rev 1	26 July 2013
Report on Hydrogeological Investigation and Monitoring – August 2011 to October 2013	Cockatoo Coal Limited	49761.03	49761.03-07, Rev 0	1 November 2013
Addendum Factual Report on Hydrogeological Investigation and Monitoring, July to December 2013	Cockatoo Coal Limited	49761.03	49761.03-08, Rev0	28 January 2014
Report on Hydrogeological Investigation and Monitoring, June to December 2014	WorleyParsons Services Pty Ltd on behalf of KEPCO	49761.04	49761.04.R.002.Rev0	23 January 2015
Report on Hydrogeological Investigation and Monitoring, January 2015 to November 2015	WorleyParsons Services Pty Ltd on behalf of KEPCO	49761.04	49761.04.R.003.Rev0	23 December 2015
Report on Hydrogeological Investigation and Monitoring, December 2015 to June 2016	WorleyParsons Services Pty Ltd on behalf of KEPCO	49761.04	49761.04.R.008.Rev0	26 April 2017
Report on Hydrogeological Investigation and Monitoring, July 2016 to December 2016	WorleyParsons Services Pty Ltd on behalf of KEPCO	49761.04	49761.04.R.012.Rev0	1 June 2017
Report on Hydrogeological Investigation and Monitoring, January 2017 to June 2017	WorleyParsons Services Pty Ltd on behalf of KEPCO	49761.04	49761.04.R.013.Rev0	28 July 2017

Appendix B

Table B1: Summary table of groundwater monitoring network (Adapted from Excerpt from AGE (2016), 'Response to Submissions on Groundwater' within Hansen Bailey (2016) 'Bylong Coal Project Environmental Impact Statement: Response to Submissions March 2016')

Bore Logs (Some logs adapted from Excerpt from AGE (2016), 'Response to Submissions on Groundwater' within Hansen Bailey (2016) 'Bylong Coal Project Environmental Impact Statement: Response to Submissions March 2016')

Table B1 Summary table of groundwater monitoring network

Bore ID	Revised Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Bore type	Unit	Lithology	Date installed
A01-D	BY0015-D	230112.43	6412947.21	247.25	20.6	0.64	15.6-18.6	MB	Alluvium - Lower	Gravel/Sand and Residual Clay	26/08/2011
A01-S	BY0015-S	230108.66	6404123.10	299.73	3.8	0.74	0.8-3.8	MB	Alluvium - Upper	Clay and Gravel/Sand	26/08/2011
A02-D		230426.19	6404123.04	299.76	8.5	0.73	5.5-8.5	MB	Alluvium - Lower	Soil/Sandy Clay	28/02/2012
A02-S		230425.12	6404123.10	299.73	3.8	0.74	0.8-3.8	MB	Alluvium - Upper	Silty Clay/ Clayey Silt	28/02/2012
A03-D		232474.86	6405317.43	288.08	9.4	0.84	6.4-9.4	MB	Alluvium - Lower	Clay/Silty Clay/Clayey Silt	30/05/2012
A03-S		232474.91	6405318.87	288.08	3.5	0.62	0.5-3.5	MB	Alluvium - Upper	Sandy Clay/Clayey Sand	30/05/2012
A04		233787.53	6405925.52	294.59	5.2	0.73	0.8-5.2	MB	Alluvium - Upper	Sand	16/05/2012
A06-D		231263.58	6407412.54	275.32	10.0	0.52	7.0-10.0	MB	Alluvium - Lower	Sandy Clay and Gravelly Clay	28/02/2012
A06-S		231263.45	6407411.12	275.34	4.5	0.60	1.5-4.5	MB	Alluvium - Upper	Silty Clay and Silty Sand and Sand	28/02/2012
A06-VW1		231260	6407410	275.3	12.5	na	12.5	VWP	Long Swamp Fm	Coal seam	12/09/2013
A06-VW2		231260	6407410	275.3	17.0	na	17.0	VWP	Ulan Coal Seam	Coal seam	12/09/2013
A06-VW3		231260	6407410	275.3	26.8	na	26.8	VWP	Coggan Coal Seam	Coal seam	12/09/2013
A06-VW4		231260	6407410	275.3	36.6	na	36.6	VWP	Marrangaroo Sandstone	Siltstone	12/09/2013
A08-D		230228.54	6408487.47	267.14	8.6	0.78	5.6-8.6	MB	Alluvium - Lower	Clay/Sand	23/05/2012
A08-S		230227.13	6408489.10	267.14	5.0	0.89	2.0-5.0	MB	Alluvium - Upper	Clay/Sand	23/05/2012
A09	A09/SW2	228645.01	6409926.89	255.97	6.6	0.74	0.6-6.6	MB	Alluvium - Upper	Alluvium	26/07/2012

Bore ID	Revised Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Bore type	Unit	Lithology	Date installed
A10		230453.79	6406647.50	278.25	9.0	0.79	3.0-9.0	MB	Alluvium - Upper	Sand/ Clay/ Sandy Clay	24/05/2012
A11-D		230165.93	6402188.79	312.50	12.2	0.57	6.2-12.2	MB	Alluvium - Lower	Sand and Sandy Clay/Clayey Sand	1/03/2012
A11-S		230165.87	6402187.47	312.52	3.9	0.55	0.9-3.9	MB	Alluvium - Upper	Silty Clay and Sand and Sandy Gravel	1/03/2012
A12	A12/SW7	229870.65	6398592.86	341.80	6.2	0.80	0.2-6.2	MB	Alluvium - Upper	Sand and Sandy Clay/Clayey Sand	17/05/2012
A13		229512.16	6411279.12	251.58	7.6	0.66	1.2-7.2	MB	Alluvium - Upper	Clay and Sand and Sand/Gravel	26/08/2011
A14	A12/SW5	225357.07	6406838.83	280.17	8.3	0.69	2.1-8.3	MB	Alluvium - Upper	Alluvium	27/07/2012
A15	A12/SW1	234817.03	6405882.93	299.99	6.3	0.74	0.3-6.3	MB	Alluvium - Upper	Alluvium	16/05/2012
A16	A12/SW6	226405.21	6416909.90	220.01	1.3	0.81	0.2-1.3	MB	Alluvium - Upper	Alluvium	26/07/2012
A17-D		230059.46	6401190.67	321.11	11.3	0.65	7.3-11.3	MB	Alluvium - Lower	Alluvium	28/02/2012
A17-S		230060.51	6401190.43	321.09	4.15	0.65	1.2-4.2	MB	Alluvium - Upper	Alluvium	28/02/2012
A18	A18/SW9	229979.01	6400327.55	327.63	6.2	0.65	0.2-6.2	MB	Alluvium - Upper	Sandy Silt/Gravelly Sand	21/05/2012
A19	A19/SW4	229994.66	6412727.94	246.29	5.2	0.74	2.2-5.2	MB	Alluvium - Upper	Clay /Clayey Sand/ Gravelly Sand	24/07/2012
A20	A20/SW8	231186.36	6407756.08	273.73	7.2	0.68	1.2-7.2	MB	Alluvium - Upper	Sandy Clay/Clay/Silty Clay	10/07/2012
A21		233693.28	6403938.79	313.68	14.95	0.63	8.3-14.3	MB	Alluvium - Upper	Alluvium	30/04/2013
A22		230567.69	6401122.03	333.42	9.4	0.63	3.4-9.4	MB	Alluvium - Upper	Clayey sand, clay & Sandstone	22/10/2012

Bore ID	Revised Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Bore type	Unit	Lithology	Date installed
A23		230567.69	6401122.03	333.42	9.4	0.63	3.4-9.4	MB	Alluvium - Upper	Clayey sand, sand, gravelly sand	15/10/2012
A23W		230567.63	6401124.12	333.28	16.4	0.54	10.4-16.4	MB	Illawarra C.M.	Weathered Zone	23/10/2012
A24-D		230808.88	6400665.51	342.42	8.6	0.46	5.6-8.6	MB	Alluvium - Lower	Alluvium	16/10/2012
A24-S		230810.08	6400663.99	342.48	5.4	0.58	2.4-5.4	MB	Alluvium - Upper	Gravelly sand and clay	16/10/2012
A25		231231.06	6400351.88	351.49	5.5	0.61	2.5-5.5	MB	Alluvium - Lower	Gravel, sand and sandstone	17/10/2012
AGE01A-D		229452.11	6414924.63	237.36	9.4	0.60	6.4-9.4	MB	Alluvium - Lower	Sandy gravel	22/10/2012
AGE01A-S		229452.90	6414924.53	237.35	4.8	0.72	1.8-4.8	MB	Alluvium - Upper	Clay and sandy gravel	15/10/2012
AGE01-VW1		229453	6414926	237.3	27.7	na	27.7	VWP	Denman Fm	Carbonaceous siltstone with interbedded tuff	16/04/2013
AGE01-VW2		229453	6414926	237.3	67.1	na	67.1	VWP	Long Swamp Fm	Sandstone	30/04/2013
AGE01-VW3		229453	6414926	237.3	120.2	na	120.2	VWP	Ulan Coal Seam	Coal, sandstone and siltstone	30/04/2013
AGE01-VW4		229453	6414926	237.3	128.2	na	128.2	VWP	Coggan Coal Seam	Interburden and coal seam	30/04/2013
AGE01-VW5		229453	6414926	237.3	140.7	na	140.7	VWP	Marrangaroo Sandstone	Sandstone/ siltstone	30/04/2013
AGE01W		229450.88	6414924.81	237.38	20.5	0.51	14.45-20.45	MB	Illawarra C.M.	Weathered siltstone/ sandstone	23/10/2012
AGE02-D		230106.57	6413814.11	248.80	11.5	0.51	5.5-11.5	MB	Alluvium - Lower	-	28/02/2012
AGE02-S		230105.50	6413814.87	248.81	4.8	0.57	1.8-4.8	MB	Alluvium - Upper	-	26/02/2011
AGE02-VW1		230102	6413816	248.8	31.2	na	31.2	VWP	Glen Davis Fm	Sandstone	26/09/2013

Bore ID	Revised Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Bore type	Unit	Lithology	Date installed
AGE02-VW2		230102	6413816	248.8	45.5	na	45.5	VWP	Newnes Fm	Sandstone	26/09/2013
AGE02-VW3		230102	6413816	248.8	84.3	na	84.3	VWP	Long Swamp Fm	Coal seam	26/09/2013
AGE02-VW4		230102	6413816	248.8	94	na	94	VWP	Ulan Coal Seam	Coal seam	26/09/2013
AGE02-VW5		230102	6413816	248.8	103	na	103	VWP	Coggan Coal Seam	Coal seam	26/09/2013
AGE02-VW6		230102	6413816	248.8	116	na	116	VWP	Marrangaroo Sandstone	Sandstone	26/09/2013
AGE03-VW1		230106	6412878	247.7	30.5	na	30.5	VWP	Glen Davis Fm	Fresh Sandstone	30/04/2013
AGE03W		230107.64	6412878.03	246.93	24.15	0.65	18.0-24.15	MB	Illawarra C.M.	Siltstone/ sandstone	16/10/2012
AGE04		228634.90	6411382.00	257.08	66.17	0.68	57.17-63.17	MB	Coggan Coal Seam	Coal seam	16/10/2012
AGE04-D		228636.91	6411382.67	257.07	17.3	0.56	14.3-17.3	MB	Alluvium - Lower	Sand and gravel	17/10/2012
AGE04-S		228637.65	6411382.90	257.05	11.3	0.52	5.3-11.3	MB	Alluvium - Upper	Silty sand and sand	23/11/2012
AGE04W		228635.88	6411382.32	257.06	25.95	0.57	19.95-25.95	MB	Illawarra C.M.	Siltstone, minor tuff and coal	23/11/2012
AGE05		227890.76	6410501.47	259.92	50.9	0.57	41.9-47.9	MB	Coggan Coal Seam	Coal seam	29/11/2012
AGE05A		227889.84	6410500.11	259.91	8.4	0.57	5.4-8.4	MB	Alluvium - Upper	Gravelly sand	29/11/2012
AGE05W		227891.49	6,410502.59	259.88	15.7	0.62	9.7-15.7	MB	Illawarra C.M.	Siltstone/ sandstone	29/11/2012
AGE07		228648.82	6409111.16	270.68	42.03	0.67	24.1-36.1	MB	Coggan Coal Seam	Coal seam	9/05/2013
AGE07W		228647.04	6409111.72	270.68	20.00	0.64	9.5-17.0	MB	Illawarra C.M.	Weathered Zone	9/05/2013
AGE08		231144.41	6407146.65	282.09	36.4	0.61	29.4-33.9	MB	Coggan Coal Seam	Coal seam	13/12/2012
AGE08W		231144.14	6407147.66	282.03	13.8	0.72	7.8-13.8	MB	Illawarra C.M.	Sandstone and coal	13/12/2012
AGE09		229945.09	6406679.91	285.69	36.45	0.63	24.1-28.6	MB	Coggan Coal Seam	Coal seam	3/04/2013

Bore ID	Revised Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Bore type	Unit	Lithology	Date installed
AGE09W		229944.95	6406677.52	285.81	18.06	0.69	7.56-15.06	MB	Illawarra C.M.	Weathered Zone	2/05/2013
AGE10	BY0206	231810.02	6405355.85	298.30	54.24	0.50	41.0-45.5	MB	Coggan Coal Seam	Coal seam	6/04/2013
AGE10W		231809.03	6405352.84	298.47	20.98	0.54	12.0-18.0	MB	Illawarra C.M.	Weathered Zone	30/04/2013
AGE11W		230633.50	6402142.12	326.05	14.2	0.63	5.2-14.2	MB	Illawarra C.M.	Sandstone	4/12/2012
AGE12W		230011.41	6400310.11	327.69	22.6	0.43	13.4-22.6	MB	Illawarra C.M.	Siltstone	29/10/2012
AGE13		231057.20	6401937.49	354.97	45.1	0.60	37.6-43.6	MB	Coggan Coal Seam	Sandstone and coal	6/12/2012
AGE13W	AGE13	231057.16	6401936.48	355.05	14.1	0.56	4.1-14.1	MB	Illawarra C.M.	Siltstone	6/12/2012
AGE14		229440.46	6406002.33	309.36	27.0	0.54	22.7-25.7	MB	Coggan Coal Seam	Coal seam	4/12/2013
AGE15		229850.02	6405267.65	303.23	30.3	0.50	13.9-30.34	MB	Illawarra C.M.	Sandstone	3/12/2013
AGE16		231078.98	6412160.87	270.49	4.1	0.80	1.4-4.1	MB	Alluvium	Sandy clay/clayey sand	8/3/2016
AGE18		231566.11	6411759.34	280.49	7.8	0.63	4.4-7.4	MB	Alluvium	Gravelly sand	6/3/2016
AGE19		231832.89	6411591.18	284.39	2.0	0.77	0.85-1.95	MB	Alluvium	Clayey gravelly sand	7/3/2016
AGE20		232069.89	6411474.35	290.69	1.5	0.67	0.6-1.5	MB	Alluvium	Sandy clay	7/3/2016
AGE22M		230408.92	6406988.41	275.67	18.0	0.78	TBC	MB	Alluvium	-	21/03/2016
AGE26M		230340.37	6408245.85	267.19	12.0	0.61	TBC	MB	Alluvium	-	1/04/2016
AGE28P		232022.00	6406184.64	283.91	22.0	0.51	TBC	MB	Alluvium	-	4/04/2016
AGE33M		231774.97	6406915.71	279.14	19.0	0.71	TBC	MB	Alluvium	-	16/04/2016
B3-D		235107	6406726	300.55	18	0.5	15.7-18.0	MB	Alluvium - Lower	-	28/11/2013
B3-S		235109	6406728	300.55	13.7	0.5	10.15-13.65	MB	Alluvium - Upper	-	27/11/2013
B3-VW1		235109	6406728	300.55	43.2	na	43.2	VWP	Glen Davis Fm	Coal seam	14/11/2013
B3-VW2		235109	6406728	300.55	82	na	82	VWP	Long Swamp Fm	Coal seam	14/11/2013

Bore ID	Revised Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Bore type	Unit	Lithology	Date installed
B3-VW3		235109	6406728	300.55	108.5	na	108.5	VWP	Ulan Coal Seam	Coal seam	14/11/2013
B3-VW4		235109	6406728	300.55	120.5	na	120.5	VWP	Coggan Coal Seam	Coal seam	14/11/2013
B3-VW5		235109	6406728	300.55	135	na	135	VWP	Marrangaroo Sandstone	Sandstone	14/11/2013
BY0001	CP035	233581.28	6409309.91	375.92	195.0	0.84	185-191	MB	Coggan Coal Seam	Coal seam	10/5/2011
BY0007	CP028	230443.10	6410217.48	368.85	169.5	0.35	161-167	MB	Coggan Coal Seam	Coal seam	1/11/2011
BY0010	CP014	231893.40	6412109.72	301.40	139.0	0.74	133-139	MB	Coggan Coal Seam	Coal seam	1/11/2011
BY0011-VW1		232963	6411410	360.2	73.4	na	73.4	VWP	Watts Sandstone	Sandstone	17/05/2013
BY0011-VW2		232963	6411410	360.2	148.8	na	148.8	VWP	Long Swamp Fm	Sandstone	1/11/2011
BY0011-VW3		232963	6411410	360.2	190.4	na	190.4	VWP	Ulan Coal Seam	Sandstone, minor coal	1/11/2011
BY0011-VW4		232963	6411410	360.2	202.5	na	202.5	VWP	Coggan Coal Seam	Coal seam	1/11/2011
BY0011-VW5		232963	6411410	360.2	220	na	220	VWP	Marrangaroo Sandstone	Mudstone	1/11/2011
BY0014	CP027	229610.69	6410330.43	259.38	56.2	0.73	50.2-56.2	MB	Coggan Coal Seam	Coal seam	28/7/2011
BY0015	CP009	230110.74	6412947.42	247.28	96.0	0.70	90-96	MB	Coggan Coal Seam	Coal seam	1/11/2011
BY0016	CP045	231315.42	6408236.37	292.79	47.5	0.69	39.8-45.8	MB	Coggan Coal Seam	Coal seam	13/7/2011
BY0020	OP028	230574.00	6401202.00	332.37	36.00	0.64	NA	MB	Marrangaroo Sandstone	Sandstone	1/12/2011
BY0077-VW1		230750	6411475	297.3	48.3	na	48.3	VWP	Newnes Fm	Sandstone, siltstone	1/11/2011
BY0077-VW2		230750	6411475	297.3	107.9	na	107.9	VWP	Ulan Coal Seam	Sandstone and coal	28/09/2012
BY0077-VW3		230750	6411475	297.3	118.8	na	118.8	VWP	Coggan Coal Seam	Coal seam	28/09/2012

Bore ID	Revised Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Bore type	Unit	Lithology	Date installed
BY0077-VW4		230750	6411475	297.3	139.8	na	139.8	VWP	Marrangaroo Sandstone	Sandstone	28/09/2012
BY0080-VW1		233295	6409002	405.9	177.2	na	177.2	VWP	Long Swamp Fm	Siltstone/ sandstone	28/09/2012
BY0080-VW2		233295	6409002	405.9	200	na	200.0	VWP	Ulan Coal Seam	Coal seam	5/11/2012
BY0080-VW3		233295	6409002	405.9	210.7	na	210.7	VWP	Coggan Coal Seam	Coal seam	5/11/2012
BY0080-VW4		233295	6409002	405.9	230	na	230.0	VWP	Marrangaroo Sandstone	Sandstone	5/11/2012
BY0091-B		231771.61	6410453.69	363.78	23.0	0.59	17.0-23.0	MB	Tertiary Basalt	Basalt	21/11/2012
BY0091-S		231770.52	6410452.08	363.79	36.0	0.64	30.0-36.0	MB	Marrangaroo Sandstone	Sandstone	27/11/2012
BY0091-VW1		231773	6410454	363.9	57	na	57.0	VWP	Denman Fm	Sandstone	23/11/2012
BY0091-VW2		231773	6410454	363.9	103.4	na	103.4	VWP	Newnes Fm	Sandstone/ siltstone	23/11/2012
BY0091-VW3		231773	6410454	363.9	172.5	na	172.5	VWP	Coggan Coal Seam	Coal seam	23/11/2012
BY0091-VW4		231773	6410454	363.9	185	na	185.0	VWP	Marrangaroo Sandstone	Sandstone	23/11/2012
BY0188	OP020	230858.02	6404063.52	326.48	35.50	0.62	26.5-32.5	MB	Coggan Coal Seam	Coal seam	5/04/2013
BY0204	CP063	232615.78	6405078.96	296.75	62.50	0.74	55.0-61.0	MB	Coggan Coal Seam	Coal seam	
BY0208-VW1		234269	6403672	327.1	37.3	na	37.3	VWP	Long Swamp Fm	Siltstone	16/04/2013
BY0208-VW2		234269	6403672	327.1	60	na	60.0	VWP	Long Swamp Fm	Siltstone/ sandstone	16/04/2013
BY0208-VW3		234269	6403672	327.1	87.5	na	87.5	VWP	Coggan Coal Seam	Coal seam	16/04/2013
BY0208-VW4		234269	6403672	327.1	98.5	na	98.5	VWP	Marrangaroo Sandstone	Sandstone	16/04/2013
BY0513	BP614	231141.98	6408585.11	323.45	111.23	~0.75	95.35-99.85	MB	Coggan Coal Seam	Coal Seam	12/10/2017

Bore ID	Revised Bore ID	Easting (m) GDA94 Z56	Northing (m) GDA94 Z56	Elevation (mRL)	Total depth (mbgl)	Stickup (magl)	Screened interval (mbgl)	Bore type	Unit	Lithology	Date installed
BY0531-VW1	BP600-VW1	231959.42	6409600.25	358.82	110	na	110	VWP	Long Swamp Fm	Sandstone	20/07/2017
BY0531-VW2	BP600-VW2	231959.42	6409600.25	358.82	137	na	137	VWP	Ulan Coal Seam	Coal Seam	20/07/2017
BY0531-VW3	BP600-VW3	231959.42	6409600.25	358.82	145	na	145	VWP	Coggan Coal Seam	Coal seam	20/07/2017
BY0531-VW4	BP600-VW4	231959.42	6409600.25	358.82	153	na	153	VWP	Marrangaroo Sandstone	Sandstone	20/07/2017
CPT13	BY0174CH	231033.87	6406771.27	290.93	36.40	0.62	28.9-33.4	MB	Coggan Coal Seam	Coal seam	
CPT15	BY0173CH	231051.06	6405928.40	285.63	14.91	0.64	7.21-13.21	MB	Illawarra C.M.	Weathered Zone	29/05/2013
CPT18		230967.96	6405353.76	297.37	19.0	0.47	11.5-19.0	MB	Alluvium	Clayey Silty Sand	29/05/2013
CPT18-VW1		230967.96	6405353.76	297.37	21.75	0.47	21.75	VWP	Coggan Coal Seam	Coal seam	23/05/2013
CPT36		232343.35	6404982.41	301.42	15.50	0.64	8.0-15.5	MB	Illawarra C.M.	Weathered Zone	23/05/2013
CPT36-VW1		232278	6405003	302.8	47.75	na	47.75	VWP	Ulan Coal Seam	Coal seam	
CPT36-VW2		232278	6405003	302.8	56.75	na	56.75	VWP	Coggan Coal Seam	Coal seam	
CPT39-VW1		231241	6405086.0	306.5	25.0	na	25.0	VWP	Ulan Coal Seam	Coal seam	17/05/2013
CPT39-VW2		231241	6405086	306.5	33.0	na	33.0	VWP	Coggan Coal Seam	Coal seam	17/05/2013
CPT39W	CP129	231241.22	6405086.38	306.47	22.10	0.63	16.0-22.1	MB	Weathered Zone	Weathered Zone	17/05/2013
M1		227089.13	6408369.69	277.77	23.0	0.45	15.5-23.0	MB	Illawarra C.M.	Sandstone	11/12/2013
M2		227518.53	6409099.11	262.80	5.9	0.50	2.9-5.9	MB	Alluvium	-	11/12/2013
OP032		229258.08	6400152.31	382.99	6.4	0.56	4.8-6.35	MB	Illawarra C.M.	Weathered Zone	12/12/2012

Notes: *na – not applicable*

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 247.25 AHD
EASTING: 230112.43
NORTHING: 6412947.21
DIP/AZIMUTH: 90°/--

BORE No: A01-D
PROJECT No: 49761
DATE: 26/8/2011
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
247	0	SILTY CLAY - Dark Brown silty clay, M>Wp							
246	1								
245	2								
244	3								
	3.0	CLAY - Brown clay, trace fine grained sand, M>Wp							
243	4								
242	5								
241	6								
	6.2	GRAVEL/SAND - Undifferentiated, sandy clay in parts from 6.2m to 7.0m							
240	7								From 0.0m to 13.8m, grout
239	8								
238	9								

RIG: Hydrapower MDR105 **DRILLER:** Myers (Macquarie) **LOGGED:** Benson **CASING:** Deep HWT to 20.6m

TYPE OF BORING: 4¾ blade bit washbore

WATER OBSERVATIONS: Some water loss from 6.2m

REMARKS: Top of pipe RL 247.89 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 247.25 AHD
EASTING: 230112.43
NORTHING: 6412947.21
DIP/AZIMUTH: 90°/--

BORE No: A01-D
PROJECT No: 49761
DATE: 26/8/2011
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
237	11	GRAVEL/SAND - Undifferentiated, sandy clay in parts from 6.2m to 7.0m *(continued)*							
236	12								
235	13								
234	14								From 14.35m to 13.8m, bentonite
233	15								
232	16			D	16.0				
231	17								From 15.6m to 18.6m, screen From 13.8m to 20.6m, gravel
230	17.4	RESIDUAL CLAY - Grey, some completely weathered coal in returns from 17.4m to 18.0m							
229	18								
228	19								From 18.6m to 20.6m, sump

RIG: Hydrapower MDR105 **DRILLER:** Myers (Macquarie) **LOGGED:** Benson **CASING:** Deep HWT to 20.6m

TYPE OF BORING: 4¾ blade bit washbore

WATER OBSERVATIONS: Some water loss from 6.2m

REMARKS: Top of pipe RL 247.89 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 247.25 AHD
EASTING: 230112.43
NORTHING: 6412947.21
DIP/AZIMUTH: 90°/--

BORE No: A01-D
PROJECT No: 49761
DATE: 26/8/2011
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
227		RESIDUAL CLAY - Grey, some completely weathered coal in returns from 17.4m to 18.0m *(continued)*							End cap
	20.6	Bore discontinued at 20.6m, limit of investigation							
226	21								21
225	22								22
224	23								23
223	24								24
222	25								25
221	26								26
220	27								27
219	28								28
218	29								29

RIG: Hydrapower MDR105 **DRILLER:** Myers (Macquarie) **LOGGED:** Benson **CASING:** Deep HWT to 20.6m

TYPE OF BORING: 4¾ blade bit washbore

WATER OBSERVATIONS: Some water loss from 6.2m

REMARKS: Top of pipe RL 247.89 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 247.29 AHD
EASTING: 230108.66
NORTHING: 6412946.86
DIP/AZIMUTH: 90°/--

BORE No: A01-S
PROJECT No: 49761
DATE: 26/8/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
247	0	SILTY CLAY - Dark Brown silty clay, M>Wp		D	1.0				From 0.0m to 1.0m, grout
246	1								From 1.0m to 1.8m, bentonite
245	2								
244	3	3.0 CLAY - Brown clay, trace fine grained sand, M>Wp		D	4.0				
243	4								
242	5								From 1.9m to 7.9m, screen From 1.8m to 8.5m, gravel
241	6	6.2 GRAVEL/SAND - Undifferentiated, sandy clay in parts from 6.2m to 7.0m							
240	7								
239	8	8.6 Bore discontinued at 8.6m, limit of investigation							From 7.9m to 8.5m, sump End cap From 8.5m to 8.6m, backfil
238	9								

RIG: Hydrapower MDR105 **DRILLER:** Myers (Macquarie) **LOGGED:** Benson **CASING:**

TYPE OF BORING: 4¾ blade bit washbore

WATER OBSERVATIONS: Free groundwater observed at 6.2m

REMARKS: Location BY70015CH. Top of pipe RL 247.96 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 299.76 AHD
EASTING: 230426.19
NORTHING: 6404123.04
DIP/AZIMUTH: 90°/--

BORE No: A02-D
PROJECT No: 49761
DATE: 28/2/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
299	0.4	SANDY SILT - (Stiff), dark brown, fine to coarse grained sandy silt with some clay, trace rootlets, M<Wp							Stickup=0.8m
		SILTY CLAY/CLAYEY SILT - Very stiff to hard, brown silty clay/clayey silt, with slightly to some fine to coarse grained sand, M<Wp			1.0				
		From 1.0m, sandy silt in parts		pp	1.2		>450kPa		
				S	1.45		5,11,18 N = 29		
298									From 0m to 3.7m, backfill cuttings
		From 2.5m, trace fine to coarse grained sand, M~Wp			2.5				
297				pp	2.7		>450kPa		
				S	2.95		5,8,15 N = 23		
296	4.0	SANDY CLAY - Hard, grey mottled red brown fine to coarse grained sandy clay, M>Wp			4.0				
				pp	4.2		>450kPa		
				S	4.45		6,12,15 N = 27		From 3.7m to 5.1m, bentonite
295		From 5.3m, very stiff		pp	5.3		200kPa		
					5.5				
294				S			5,8,9 N = 17		
					5.95				
293					6.8				
				S			5,5,10 N = 15		From 5.1 to 8.53m, gravel
				pp	7.1		200kPa		From 5.53m to 8.53m, screen
		From 7.2m, hard		pp	7.2		>450kPa		
292					7.25				
		From 7.8m, trace coarse sized subrounded gravel							
	8.3	SANDSTONE - Extremely low strength, extremely weathered, grey mottled yellow brown, fine to coarse grained sandstone with trace fine to coarse sized subrounded gravel (soil-like properties)		S	8.3		11, 22, 25/100mm bouncing		End cap
291	8.75	Bore discontinued at 8.75m, limit of investigation			8.75				
290									

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** HW to 5.5m

TYPE OF BORING: Solid flight auger to 5.5m, wash boring to 8.3m

WATER OBSERVATIONS: Free groundwater observed at 5.3m (28/2/12), 4.4m (29/2/12)

REMARKS: Top of pipe RL 300.48 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 299.73 AHD
EASTING: 230425.12
NORTHING: 6404123.1
DIP/AZIMUTH: 90°/--

BORE No: A02-S
PROJECT No: 49761
DATE: 28/2/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
299.73	0.0	SANDY SILT - (Stiff), dark brown, fine to coarse grained sandy silt with some clay, trace rootlets, M<Wp							Stickup=0.8m
299.33	0.4	SILTY CLAY/CLAYEY SILT - Very stiff to hard, brown silty clay/clayey silt, with slightly to some fine to coarse grained sand, M<Wp							From 0m to 0.6m, bentonite
	1.0	From 1.0m, sandy silt in parts							
	2.5	From 2.5m, trace fine to coarse grained sand, M~Wp							From 0.6m to 3.8m, gravel From 0.8m to 3.8m, screen
295.93	3.8	Bore discontinued at 3.8m, limit of investigation							End cap

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** HW to 5.5m

TYPE OF BORING: Solid flight auger to 3.8m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bore located immediately adjacent A02-D. Strata inferred from A02-D Borehole Log. Top of pipe RL 300.47 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 288.08 AHD
EASTING: 232474.86
NORTHING: 6405317.43
DIP/AZIMUTH: 90°/--

BORE No: A03-D
PROJECT No: 49761.02
DATE: 30/5/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
288	0	CLAY - (Stiff to very stiff) dark brown clay, trace to some silt, trace fine to medium grained sand, M>Wp							From 0m to 0.3m, bentonite
287	1	From 1.0m, increasing sand content							
	1.5	CLAYEY SAND - Loose dark brown clayey fine to medium grained sand, trace to some silt, saturated		S	1.5		2,3,5 N = 8 200-300 kPa		
	1.8	CLAY - Very stiff dark brown mottled red clay, trace fine to medium grained sand, M>Wp		pp	1.85 1.95				
286	2								
	2.1	SANDY CLAY - (Soft) dark brown fine to medium grained sandy clay, some silt, M<Wp (inferred from cuttings on auger)							
	2.5				2.6				
	2.75	SANDY CLAY - Very stiff brown fine to coarse grained sandy clay, trace silt, M>Wp		S, pp pp	2.75 3.05		4,6,10 N = 16 200-290 kPa 290-350 kPa		From 0.3m to 5.7m, backfill cuttings
285	3	CLAY - Very stiff brown clay, M>Wp							
284	4								
	4.3	SILTY SAND - Loose light brown silty fine to medium grained sand with grey mottling, saturated		S	4.25		6,4,5 N = 9 160-200 kPa		
	4.6	CLAY - Stiff light brown clay with grey mottling, M>Wp		pp	4.6 4.7				
283	5								
					5.75				
	6.0	SILTY CLAY - Stiff to very stiff light brown silty clay with grey mottling, trace fine grained sand, M>Wp		S, pp	6.2		4,6,6 N = 12 170-240 kPa		From 5.7m to 6.2m, bentonite
282	6								
	6.5	CLAY - Stiff light brown clay, M>Wp							
281	7								
	7.25	CLAY - Very stiff to hard brown and grey clay, slightly gravelly (gravel subrounded up to 7mm diameter), trace to some fine to medium grained sand, M>Wp		S pp	7.25 7.3 7.7		6,8,10 N = 18 340-450 kPa		From 6.2m to 9.4m, gravel From 6.4m to 9.4m, 50mm diameter Class 18 machine slotted PVC screen
280	8								
	8.4	SILTY CLAY/CLAYEY SILT - Hard grey (and brown in parts) silty clay/clayey silt, trace fine grained sand, M>Wp			8.75				
279	9			S, pp pp	9.0 9.2		6,6,8 N = 14 250-310 kPa 300-600 kPa		End cap
	9.6	SANDSTONE - Extremely low strength, extremely weathered, brown, fine to coarse grained sandstone		S	9.75		24,17,9 N = 26		

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 9.75m

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Top of pipe RL 288.92 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 288.08 AHD
EASTING: 232474.86
NORTHING: 6405317.43
DIP/AZIMUTH: 90°/--

BORE No: A03-D
PROJECT No: 49761.02
DATE: 30/5/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
278	10.05	At 9.75m, refusal by drilling		S	10.2				
	10.2	CLAYSTONE - Extremely low strength, extremely weathered, grey claystone							
		Bore discontinued at 10.2m, limit of investigation							
277	11								
276	12								
275	13								
274	14								
273	15								
272	16								
271	17								
270	18								
269	19								

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 9.75m

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Top of pipe RL 288.92 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 288.08 AHD
EASTING: 232474.91
NORTHING: 6405318.87
DIP/AZIMUTH: 90°/--

BORE No: A03-S
PROJECT No: 49761.02
DATE: 30/5/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
288	0	CLAY - (Stiff to very stiff) dark brown clay, trace to some silt, trace fine to medium grained sand, M>Wp							From 0m to 0.3m, bentonite
287	1	From 1.0m, increasing sand content							
	1.5	CLAYEY SAND - Loose dark brown clayey fine to medium grained sand, trace to some silt, saturated		S	1.5		2,3,5 N = 8 200-300 kPa		
	1.8	CLAY - Very stiff dark brown mottled red clay, trace fine to medium grained sand, M>Wp		pp	1.85 1.95				From 0.3m to 3.5m, gravel From 0.5m to 3.5m, 50mm diameter Class 18 machine slotted PVC screen
286	2								
	2.1	SANDY CLAY - (Soft) dark brown fine to medium grained sandy clay, some silt, M<Wp (inferred from cuttings on auger)							
	2.5				2.6				
	2.75	SANDY CLAY - Very stiff brown fine to coarse grained sandy clay, trace silt, M>Wp		S, pp pp	2.75 3.05		4,6,10 N = 16 200-290 kPa 290-350 kPa		
285	3	CLAY - Very stiff brown clay, M>Wp							End cap From 6.2m to 9.4m, gravel
284	4	4.0 Bore discontinued at 4.0m, limit of investigation							
283	5								
282	6								
281	7								
280	8								
279	9								

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 4.0m

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Well in close proximity to A03D, soil profile inferred from log. Top of pipe RL 288.70 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 294.59 AHD
EASTING: 233787.53
NORTHING: 6405925.52
DIP/AZIMUTH: 90°/--

BORE No: A04
PROJECT No: 49761.02
DATE: 16/5/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
294	0.6	SANDY SILTY CLAY - (Very soft), dark brown fine to medium grained sandy silty clay, M<Wp (humid)							From -0.6m to 0.2m, Class 18 From 0m to 0.2m, bentonite
	1	SAND - Grey-brown fine to coarse grained sand, slightly silty, trace subrounded gravel up to 5mm diameter, wet From 0.8m, saturated							
293		From 1.5m, very loose		S	1.5 1.95		2,2,1 N = 3		
	2								
292	3				3.0				From 0.2m to 5.2m, 5mm gravel From 0.2m to 5.2m, screen
	3.2	SAND - Loose, light brown fine to medium sand, trace silt, saturated		S			3,2,4 N = 6		
291	4	From 4m, some to slightly silty			3.45				
290	4.7	SAND - Medium dense, brown, fine to coarse grained sand, trace silt, trace subrounded gravel up to 5mm diameter, saturated		S	4.5 4.95		5,7,9 N = 16		
	5								End cap
289	6	From 6m, loose		S	6.0		3,3,2 N = 5		
	6.45	Bore discontinued at 6.45m, limit of investigation			6.45				
288	7								
287	8								
286	9								
285									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 6.0m

WATER OBSERVATIONS: Free groundwater observed at 0.8m

REMARKS: Top of pipe RL 295.31 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 275.16 AHD
EASTING: 231258.75
NORTHING: 6407409.97
DIP/AZIMUTH: 90°/--

BORE No: A06
PROJECT No: 49761
DATE: 10 - 12/9/2013
SHEET 1 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
276	0.3	SILTY CLAY/CLAYEY SILT - (Stiff), dark brown silty clay/clayey silt, with some sand, M>Wp										
	1	SILTY SAND - Medium dense, brown silty fine to coarse grained sand, with some fine sized subrounded gravel, humid										
277	1.4	SILTY CLAY - Very stiff, brown silty clay with some fine to coarse grained sand, M<Wp										
	2											
	2.5	SILTY SAND - Loose, yellow brown silty, fine to coarse grained sand, with trace clay, saturated										
278	3											
279	4											
	4.0	SAND - Loose, brown, fine to coarse grained sand with some silt, saturated										
280	5											
	5.0	CLAYEY SAND - Loose, fine to coarse grained clayey sand with interbedded sandy clay, saturated										
281	6											
282	7											
	7.0	SANDY CLAY - Soft to firm, grey mottled yellow brown, fine to coarse grained sandy clay with trace fine sized subrounded gravel, M>Wp From 7.3m, hard										
283	8											
284	9											
	9.3	GRAVELLY CLAY - Hard, yellow brown, slightly sandy, fine to medium sized subangular gravelly clay with some coarse sized, subrounded gravel and subrounded										
	10.0											

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 10.6m

TYPE OF BORING: Solid flight auger to 10.5m, rock roller to 10.85m, HQ3 to 53.86m

WATER OBSERVATIONS: Free groundwater observed at 3.0m

REMARKS: 50% water loss at 13.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 275.16 AHD
EASTING: 231258.75
NORTHING: 6407409.97
DIP/AZIMUTH: 90°/--

BORE No: A06
PROJECT No: 49761
DATE: 10 - 12/9/2013
SHEET 2 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		cobbles, M>Wp										
		SANDSTONE - Extremely low strength, extremely weathered, grey mottled yellow brown/red brown, fine to coarse grained sandstone										
286	10.85											
	11	SANDSTONE - High strength, slightly weathered, light orange, fine to medium grained sandstone							C	100	100	PL(A) = 1.82 PL(D) = 1.41
287		From 11.8m, interbedded with siltstone										
	12											
	12.08	COAL - Hight strength, fresh, fractured black coal						12m: J, 80°, Pl, ro, Fe From 12.08m to 12.65m, fractured	C	86	20	
		From 12.65m, mudstone						12.49m: J, 45°, Pl, Sm, Pyrite				
288	12.89	CORE LOSS: 0.16m (12.89m - 13.05m)						12.89m: CORE LOSS: 160mm				
	13											
	13.05	SILTSTONE - Medium strength, fresh, grey siltstone							C	100	100	PL(A) = 0.64 PL(D) = 0.59
289		From 13.7m, high strength with some sandstone laminations										
	14											
	14.4	CARBONACEOUS SILTSTONE - High strength, fresh, dark brown carbonaceous siltstone										
290								From 14.82m to 15.09m, J, sv, un, ro, Pyrite				
	15							From 15.52m to 15.66m, J, 45°-80°, ir, sm, Pyrite				
291	15.91											PL(A) = 1.99
	16	COAL - High strength, fresh, black coal						15.97m: P, sh, ir, ro From 16.1m to 16.31m, fractured	C	100	93	
		From 16.15m to 16.30m, tuffaceous laminations										
292		From 16.80m to 17.08m, carbonaceous siltstone band										
	17											PL(A) = 1.91
	17.57	TUFFACEOUS CLAYSTONE - High strength, fresh, light grey tuffaceous claystone						From 17.3m to 17.48m, J, sv, Pl, ti, Pyrite				
293	18	From 17.77m to 18.07m, carbonaceous siltstone band							GT001			PL(A) = 1.24
	18.47	COAL - High strength, fresh, black coal						From 18.63m to 18.9m, 2 x J, sv, un, ro, Pyrite	C	100	100	
294												
	19											
	19.51	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone							C	100	100	PL(A) = 2.17 PL(D) = 1.25

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 10.6m

TYPE OF BORING: Solid flight auger to 10.5m, rock roller to 10.85m, HQ3 to 53.86m

WATER OBSERVATIONS: Free groundwater observed at 3.0m

REMARKS: 50% water loss at 13.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 275.16 AHD
EASTING: 231258.75
NORTHING: 6407409.97
DIP/AZIMUTH: 90°/--

BORE No: A06
PROJECT No: 49761
DATE: 10 - 12/9/2013
SHEET 3 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
296	21	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone *(continued)*							C	100	100	
												PL(A) = 2.84
												PL(D) = 1.64
									GT002			
297	22							>>				
									C	100	100	
298	23	From 23.05m, medium strength, course grained										
									GT003			
												PL(A) = 1.08
299	24	From 24.05m, some fine to medium sized gravel										
300	25							24.68m: P, 5°, ir, ro	C	100	100	
	25.08	COAL - High strength, fresh, black coal										
301	26							>>				
												PL(A) = 2.12
302	27											
												PL(A) = 1.77
303	28							From 27.88m to 28.08m, J, sv, cu, ro				
									C	100	100	PL(A) = 1.35
	28.67	SANDSTONE - High strength, fresh, dark grey, medium to coarse grained sandstone										PL(A) = 1.97
304	29											PL(D) = 1.71
									GT004			
		From 29.33m, grey, fine to medium grained										
												PL(A) = 2.29
												PL(D) = 1.83

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 10.6m

TYPE OF BORING: Solid flight auger to 10.5m, rock roller to 10.85m, HQ3 to 53.86m

WATER OBSERVATIONS: Free groundwater observed at 3.0m

REMARKS: 50% water loss at 13.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 275.16 AHD
EASTING: 231258.75
NORTHING: 6407409.97
DIP/AZIMUTH: 90°/--

BORE No: A06
PROJECT No: 49761
DATE: 10 - 12/9/2013
SHEET 4 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
306	31	SANDSTONE - High strength, fresh, dark grey, medium to coarse grained sandstone *(continued)*						>>	C	100	100	PL(D) = 2.64
307	32							From 32.37m to 32.52m, J, 45°, ir, ti	C	100	100	
308	32.7	SILTSTONE - High strength, fresh, grey siltstone with some sand										PL(A) = 1.93 PL(D) = 1.2
	33											
309	34							>>	C	100	100	
310	35											PL(A) = 2.28 PL(D) = 1.11
311	36								GT005			PL(A) = 2.41 PL(D) = 1.63
312	36.83	SANDSTONE - High to very high strength, fresh, grey fine to medium grained sandstone						36.61m: P, 5°, ir, ro 36.67m: BP, 2°, un, ro 36.7m: BP, 40°, un, ro 36.72m: BP, 4°, un, ti 36.75m: BP, 3°, un, ti 37.12m: BP, 2°, un, ti	C	100	95	
	37											
313	38											PL(A) = 3.78 PL(D) = 2.6
314	39							39.53m: BP, 2°, cu, ti	C	100	100	

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 10.6m

TYPE OF BORING: Solid flight auger to 10.5m, rock roller to 10.85m, HQ3 to 53.86m

WATER OBSERVATIONS: Free groundwater observed at 3.0m

REMARKS: 50% water loss at 13.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 275.16 AHD
EASTING: 231258.75
NORTHING: 6407409.97
DIP/AZIMUTH: 90°/--

BORE No: A06
PROJECT No: 49761
DATE: 10 - 12/9/2013
SHEET 5 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
316	41	SANDSTONE - High to very high strength, fresh, grey fine to medium grained sandstone *(continued)* From 40.19m to 40.3m, sideritic From 40.3m, interbedded with siltstone						40.28m: BP, sh, cu, ti 40.91m: BP, 5°, un, ti	C	100	100	PL(A) = 3.94 PL(D) = 1.67
	41.29	SILTSTONE - High strength, fresh, grey siltstone										PL(A) = 1.74 PL(D) = 1.12
317	41.92 42	MUDSTONE - High strength, fresh, grey mudstone						From 42.26m to 42.71m, J, 60°-90°, ir, ti, ca (micro-fractures)				
318	43	From 42.70m, tuffaceous band 110mm thick						42.81m: BP, sh, pl, ro				PL(A) = 1.61 PL(D) = 1
319	44	From 43.5m to 43.97m, interbedded with sandstone						43.53m: P, sh, pl, sl	C	100	100	PL(A) = 1.85
320	44.8 45	SANDSTONE - High strength, fresh, grey, fine grained sandstone						From 45.0m to 45.32, 2 x J, 60°, ir, ti, ca				
321	46											PL(A) = 2.26 PL(D) = 1.71
322	47							>>	C GT006	100	100	PL(A) = 1.21
323	48	From 48.21m, interbedded with mudstone laminations up to 15mm thick										
324	49							From 48.77m to 48.87m, J, 80°, ir, ti, ca	C	100	91	
	49.19	MUDSTONE - High strength, fresh, brown and grey mudstone with fine grained sandstone laminations up to 10mm thick						From 49.25m to 49.44m, J, 60°, un, ti, ca From 49.40m to 49.46m, 3 x J, 10°, pl, ti, ca 49.71m: P, sh, pl, sm,				

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 10.6m

TYPE OF BORING: Solid flight auger to 10.5m, rock roller to 10.85m, HQ3 to 53.86m

WATER OBSERVATIONS: Free groundwater observed at 3.0m

REMARKS: 50% water loss at 13.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 275.16 AHD
EASTING: 231258.75
NORTHING: 6407409.97
DIP/AZIMUTH: 90°/--

BORE No: A06
PROJECT No: 49761
DATE: 10 - 12/9/2013
SHEET 6 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
326	50.32	SANDSTONE - High strength, fresh, grey fine grained sandstone										
	50.67	MUDSTONE - High strength, fresh, grey and brown mudstone with some interbedded siltstone						clay From 49.79m to 50.16m, 4 x J, 45°-sv, ir, ti, ca From 50.43m to 50.59m, 4 x J, 45°-80°, pl, ti, ca 50.67m: J, 45°, pl, ti From 50.83m to 51.0m, J, 45°-80°, ir, ti, ca	C	100	91	PL(A) = 1.21
	51							51.28m: J, 30°, pl, ti, ca 51.34m: P, 2°, pl, ro				
327	52							51.84m: P, sh, un, sm, clay, infill 5mm thick From 51.9m to 52.24m, J, 45°-90°, ir, ti, ca	C	100	93	PL(A) = 1.35
328	53							From 52.58m to 52.64m, 4 x P, 2°-10°, pl, ti, ca From 52.85m to 53.0m, J, 80°, un, ti				
329	53.86	Bore discontinued at 53.86m, limit of investigation										
	54											
330	55											
331	56											
332	57											
333	58											
334	59											

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 10.6m

TYPE OF BORING: Solid flight auger to 10.5m, rock roller to 10.85m, HQ3 to 53.86m

WATER OBSERVATIONS: Free groundwater observed at 3.0m

REMARKS: 50% water loss at 13.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 275.32 AHD
EASTING: 231263.58
NORTHING: 6407412.54
DIP/AZIMUTH: 90°/--

BORE No: A06-D
PROJECT No: 49761
DATE: 28/2/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
275	0.0								Stickup=0.7m
	0.3	SILTY CLAY/CLAYEY SILT - (Stiff), dark brown silty clay/clayey silt, with some sand, M>Wp							
		SILTY SAND - Medium dense, brown silty fine to coarse grained sand, with some fine sized subrounded gravel, humid		S	1.0		5,6,8 N = 14		
274	1.4	SILTY CLAY - Very stiff, brown silty clay with some fine to coarse grained sand, M<Wp			1.45				
273	2.5	SILTY SAND - Loose, yellow brown silty, fine to coarse grained sand, with trace clay, saturated		S	2.5 2.95		3,2,3 N = 5		From 0m to 5.7m, backfill cuttings
272	4.0	SAND - Loose, brown, fine to coarse grained sand with some silt, saturated		S	4.0 4.45		3,3,3 N = 6		
271	5.0	CLAYEY SAND - Loose, fine to coarse grained clayey sand with interbedded sandy clay, saturated		pp S	5.5 5.6 5.95		50kPa (sandy clay ~50mm) 3,1,1 N = 2		From 5.7m to 6.9m, bentonite
270	7.0	SANDY CLAY - Soft to firm, grey mottled yellow brown, fine to coarse grained sandy clay with trace fine sized subrounded gravel, M>Wp From 7.3m, hard		pp S pp	7.0 7.1 7.3 7.45		50kPa 3,7,12 N = 19 >450kPa		
269	8.5			S	8.5 8.95		2,17,17 N = 34		From 6.9m to 10m, gravel From 7m to 10m, screen
268	9.3	GRAVELLY CLAY - Hard, yellow brown, slightly sandy, fine to medium sized subangular gravelly clay with some coarse sized, subrounded gravel and subrounded cobbles, M>Wp							
267	10.0								

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 10.0m

WATER OBSERVATIONS: Free groundwater observed at 2.4m

REMARKS: Top of pipe RL 275.84 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 275.32 AHD
EASTING: 231263.58
NORTHING: 6407412.54
DIP/AZIMUTH: 90°/--

BORE No: A06-D
PROJECT No: 49761
DATE: 28/2/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
265	10.27	SANDSTONE - Extremely low strength, extremely weathered, grey mottled yellow brown/red brown, fine to coarse grained sandstone		S	10.0		21, 45/120mm		End cap
		Bore discontinued at 10.27m, limit of investigation			10.27				
264	11								11
263	12								12
262	13								13
261	14								14
260	15								15
259	16								16
258	17								17
257	18								18
256	19								19

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 10.0m

WATER OBSERVATIONS: Free groundwater observed at 2.4m

REMARKS: Top of pipe RL 275.84 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 275.34 AHD
EASTING: 231263.45
NORTHING: 6407411.12
DIP/AZIMUTH: 90°/--

BORE No: A06-S
PROJECT No: 49761
DATE: 28/2/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
275	0.3	SILTY CLAY/CLAYEY SILT - (Stiff), dark brown silty clay/clayey silt, with some sand, M>Wp							Stickup=0.7m
		SILTY SAND - Medium dense, brown silty fine to coarse grained sand, with some fine sized subrounded gravel, humid							From 0m to 1.2m, bentonite
274	1.4	SILTY CLAY - Very stiff, brown silty clay with some fine to coarse grained sand, M<Wp							
273	2.5	SILTY SAND - Loose, yellow brown silty, fine to coarse grained sand, with trace clay, saturated							From 1.2m to 4.54m, gravel From 1.54m to 4.54m, screen
272	4.0	SAND - Loose, brown, fine to coarse grained sand with some silt, saturated							
271	4.54	Bore discontinued at 4.54m, limit of investigation							End cap

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 4.54m

WATER OBSERVATIONS: Free groundwater observed at 2.4m

REMARKS: Bore located immediately adjacent A06-D. Strata inferred from A06-D Borehole Log. Top of pipe RL 275.94 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 267.14 AHD
EASTING: 230228.54
NORTHING: 6408487.47
DIP/AZIMUTH: 90°/--

BORE No: A08-D
PROJECT No: 49761.02
DATE: 23/5/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
267	0.0	SAND - (Very loose) brown fine to medium grained sand, some silt, humid							Stickup = 0.6m From 0m to 0.2m, bentonite
	0.4	From 0.1m, increase clay content							
		CLAY - Very stiff, dark grey-brown clay, trace to some silt, trace fine to medium grained sand, M>Wp			1.5				
266	1			S	1.6		3,5,7 N = 12		1
				pp	1.85		200-250 kPa		
265	2				1.95				2
					2.6				From 0.2m to 5m, backfill cuttings and gravel
				S, pp			4,4,6 N = 10		
264	3						160-250 kPa		3
	3.0	CLAYEY SAND - Loose brown clayey fine to coarse grained sand, trace to some subrounded gravel up to 5mm diameter, trace silt, saturated			3.05				
	3.6	CLAY - (Soft) dark brown-grey clay, trace silt, M>Wp							
263	4								4
	4.15	SAND - Loose to medium dense fine to medium grained sand, slightly clayey, trace silt, saturated			4.1				
				S			3,4,6 N = 10		
	4.85	CLAY - Very soft dark brown-grey clay, trace silt, M>Wp			4.85				
262	5								5
									From 5m to 5.4m, bentonite
	5.65				5.6				
	5.8	CLAYEY SAND - Very loose light brown fine to medium grained sand, trace to some silt, trace subrounded gravel up to 5mm diameter, saturated		S			3,2,1 N = 3		
261	6				6.05				6
		SILTY SAND - Very loose light brown fine to medium grained silty sand, saturated							
	6.6	CLAY - Very stiff light brown clay, M>Wp							
260	7								7
	7.15				7.1				From 5.4m to 8.6m, gravel From 5.6m to 8.6m, 50mm diameter Class 18 machine slotted PVC screen
	7.3	SAND - Medium dense light grey fine to medium grained sand, saturated		S, pp	7.3		4,3,6 N = 9		
		CLAY - Stiff light brown and grey clay, M>Wp		pp	7.55		230-280 kPa 150-200 kPa		
	7.8	SAND - Medium dense brown-yellow fine to coarse grained sand, trace subrounded gravel up to 10mm diameter, saturated							
259	8								8
									End cap
					8.6				
				S			10,12,16 N = 28		
	9.0								9
258	9.05	SANDSTONE - Extremely weathered, extremely low strength, brown, fine to coarse grained sandstone			9.05				
		Bore discontinued at 9.05m, limit of investigation							

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 8.6m

WATER OBSERVATIONS: Free groundwater observed at 3.0m

REMARKS: Top of pipe RL 267.92 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 267.14 AHD
EASTING: 230227.13
NORTHING: 6408489.1
DIP/AZIMUTH: 90°/--

BORE No: A08-S
PROJECT No: 49761.02
DATE: 23/5/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
267	0.0	SAND - (Very loose) brown fine to medium grained sand, some silt, humid							Stickup = 0.6m
	0.4	From 0.1m, increase clay content							From 0m to 0.3m, bentonite
		CLAY - Very stiff, dark grey-brown clay, trace to some silt, trace fine to medium grained sand, M>Wp			1.5				
266	1			S	1.6		3,5,7 N = 12		From 0.3m to 1.5m, backfill cuttings and gravel
				pp	1.85		200-250 kPa		
					1.95				From 1.5m to 1.8m, bentonite
265	2				2.6				
				S, pp			4,4,6 N = 10		
264	3						160-250 kPa		
	3.0	CLAYEY SAND - Loose brown clayey fine to coarse grained sand, trace to some subrounded gravel up to 5mm diameter, trace silt, saturated			3.05				From 1.8m to 5.0m, gravel
	3.6	CLAY - (Soft) dark brown-grey clay, trace silt, M>Wp							From 2.0m to 5.0m, 50mm diameter Class 18 machine slotted PVC screen
263	4								
	4.15	SAND - Loose to medium dense fine to medium grained sand, slightly clayey, trace silt, saturated			4.1				
				S			3,4,6 N = 10		
	4.85				4.85				
	5.0	CLAY - Very soft dark brown-grey clay, trace silt, M>Wp							End cap
262		Bore discontinued at 5.0m, limit of investigation							
261	6								
260	7								
259	8								
258	9								

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 5.0m

WATER OBSERVATIONS: Free groundwater observed at 3.0m

REMARKS: Well in close proximity to A08D, soil profile inferred from A08D Log. Top of pipe RL 268.03 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 255.97 AHD
EASTING: 228645.01
NORTHING: 6409926.89
DIP/AZIMUTH: 90°/--

BORE No: A09
PROJECT No: 49761.02
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
255	0.0	SAND - (Loose) dark brown fine to medium grained sand, trace silt, humid		A	0.5				Stickup = 0.6m From 0m to 0.4m, bentonite
	1.0	SAND - (Loose) brown fine to medium grained sand, trace subrounded gravel up to 20mm, trace silt, wet From 1.3m, increasing gravel content		A	1.0				
	1.5	From 1.5m, saturated		S	1.5		3,3,3 N = 6		
254	2.0	GRAVELLY SAND/SANDY GRAVEL - (Loose) dark brown fine to coarse grained sandy gravel/gravelly sandy gravel, subrounded up to 40mm, some silt, trace clay, saturated From 2.0m, some boulders up to 300mm			1.95				
		From 2.5m, increasing clay content		A	2.5				
253	3.0	GRAVELLY CLAYEY SAND - Medium dense, brown gravelly clayey fine to coarse grained sand, gravel subrounded up to 20mm, trace silt, saturated		S	3.1		11,11,12 N = 23		From 0.4m to 6.6m, gravel From 0.6m to 6.6m, 50mm diameter Class 18 machine slotted PVC screen
					3.55				
252	4.0	From 4.6m, gravelly sand, trace to some clay		S	4.6		12,13,10 N = 23		
251	5.0				5.05				
250	6.0			S	6.1		9,17,18 N = 35		
	6.6				6.55				End cap
	6.85	SANDSTONE - Extremely low strength, extremely weathered, brown mottled grey fine to medium grained sandstone		S	6.75 6.85		20, 20 for 60mm/150mm,-		
249	7.0	Bore discontinued at 6.85m, limit of investigation							
248	8.0								
247	9.0								

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 6.75m

WATER OBSERVATIONS: Free groundwater observed at 1.5m

REMARKS: Top of pipe RL 256.71 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 278.25 AHD
EASTING: 230453.79
NORTHING: 6406647.5
DIP/AZIMUTH: 90°/--

BORE No: A10
PROJECT No: 49761.02
DATE: 23/5/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
278	0.0	SILTY CLAY - (Stiff), dark brown silty clay, some sand, M>Wp							From 0m to 0.2m, bentonite
	0.4	SAND - (Loose), brown fine to medium grained sand, slightly silty, trace clay, humid							
	1.0	CLAY - Very stiff, dark brown clay, some silt, M>Wp		pp	1.5		340-440 kPa		From 0.2m to 2.3m, backfill cuttings
	1.75	SAND - Medium dense, grey fine to medium grained sand, trace silt, moist		S	1.6		4,7,8 N = 15		
277	2.1	CLAY - Very stiff, dark brown clay, trace silt, M>Wp			1.95				
				pp	2.6		230-240 kPa		From 2.3m to 2.8m, bentonite
	2.75	SAND - Medium dense, grey fine to medium grained sand, trace silt, some clay, saturated		S	2.75		4,7,9 N = 16		
276	3.3	SANDY CLAY - Firm, dark brown sandy clay, trace silt, M<Wp			3.05				
	4.15	SAND - Medium dense, brown, fine to medium grained sand, some clay, trace silt, saturated		S	4.1		5,6,7 N = 13		
275	5.0	SANDY CLAY - (Soft), brown, fine to medium sandy clay, M<Wp (inferred from drill cuttings)			4.55				
	5.55	CLAYEY SAND - (Medium dense), clayey fine to medium sand, saturated (inferred from cuttings)		S	5.5		3,3,5 N = 8		From 2.8m to 9m, gravel
274	6.4	CLAYEY SAND - (Medium dense), clayey fine to medium grained sand, saturated (inferred from cuttings)			6.05				From 3m to 9m, 50mm diameter Class 18 machine slotted PVC screen
	6.8	SAND - Medium dense, brown fine to coarse grained sand, some to slight subrounded gravel up to 30mm diameter, trace to some clay, trace silt, saturated		S	7.1		4,8,12 N = 20		
273		From 6.8m to 8m, bands of clay and sandy clay observed in cuttings			7.55				
	8.0	SANDY CLAY - Medium dense, grey fine to coarse grained sandy clay, trace subrounded gravel, trace silt, M>Wp			8.6				
272	8.65	CLAY - Very stiff, grey clay, trace silt, M>Wp		pp	8.65		200-250 kPa		
	8.85	GRAVELLY SAND - Medium dense, brown gravelly fine to coarse grained sand, subrounded gravel up to 40mm diameter, trace silt, saturated		S	8.85		5,5,18 N = 23		End cap
271		From 9.1m to 9.6m, bands of clay observed in cuttings			9.05				
270	9.8	GRAVELLY CLAY / CLAYEY GRAVEL - Hard,							
269	10.0								

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 10.1m

WATER OBSERVATIONS: Free groundwater observed at 4.5m

REMARKS: Top of pipe RL 279.04 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 278.25 AHD
EASTING: 230453.79
NORTHING: 6406647.5
DIP/AZIMUTH: 90°/--

BORE No: A10
PROJECT No: 49761.02
DATE: 23/5/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
268		yellow-brown slightly fine to coarse sandy gravel, subrounded to 20mm diameter, M>Wp		S	10.1		29,27,24 N = 51		
	10.55	SANDSTONE - Extremely low strength, extremely weathered, yellow / light brown mottled red-brown, fine to coarse grained sandstone			10.55				
	11	Bore discontinued at 10.55m, limit of investigation							
267									
	12								
266									
	13								
265									
	14								
264									
	15								
263									
	16								
262									
	17								
261									
	18								
260									
	19								
259									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 10.1m

WATER OBSERVATIONS: Free groundwater observed at 4.5m

REMARKS: Top of pipe RL 279.04 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 312.50 AHD
EASTING: 230165.93
NORTHING: 6402188.79
DIP/AZIMUTH: 90°/--

BORE No: A11-D
PROJECT No: 49761
DATE: 1/3/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
312	0	SANDY SILT - (Stiff), dark brown, fine to coarse grained sandy silt, M<Wp (humid)							Stickup=0.6m
	1.0	SAND - Medium dense, brown/grey brown, slightly silty, fine to coarse grained sand, humid		S	1.0		6,7,4 N = 11		
311		At 1.4m, medium to coarse grained sand			1.45				
	2								From 0m to 4.8m, backfill cuttings
310		From 2.5m, fine to coarse grained sand with trace silt and fine sized subrounded gravel		S	2.5		3,4,2 N = 6		
	3				2.95				
309	3.8	SANDY CLAY / CLAYEY SAND - Stiff, brown/grey brown, fine to coarse grained sandy clay/clayey sand, M>Wp		pp	4.15		100kPa		
	4			S	4.2		3,3,3		
308	4.4	SILTY CLAY - Stiff, grey brown silty clay with thin clayey sand and sand lenses, M>Wp		pp	4.4		N = 6 150kPa		
	5				4.6				
307									From 4.8m to 6.1m, bentonite
	6	From 5.65m to 5.9m, predominantly silt with slightly to some fine grained sand		pp	5.65		80kPa		
				S	5.7		3,4,4		
				pp	5.95		N = 8		
306					6.1		180kPa		
	7								
	7.3	From 7.15m, very stiff		pp	7.15		300kPa		
305		SAND - Medium dense, grey, fine to medium grained sand with some coarse grained sand, trace silt, saturated		S	7.2		5,8,11 N = 19		
					7.6				
	8	From 8.0m, some fine to medium sized subrounded gravel							
304					8.65				
		From 8.65m, fine to coarse grained sand, sandy clay in parts, trace coarse sized subrounded gravel		S			13,10,8 N = 18		
	9				9.1				From 6.1m to 12.2m, gravel From 6.2m to 12.2m, screen
303									

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 13.15m

WATER OBSERVATIONS: Free groundwater observed at 1.7m

REMARKS: Top of pipe RL 313.07 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 312.50 AHD
EASTING: 230165.93
NORTHING: 6402188.79
DIP/AZIMUTH: 90°/--

BORE No: A11-D
PROJECT No: 49761
DATE: 1/3/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
302	10.2	SANDY GRAVEL - Dense, yellow brown, fine to coarse grained sandy, fine sized subrounded gravel with some medium sized subrounded gravel, trace coarse sized subrounded gravel, trace silt, saturated		S	10.1		25/100mm (no recovery)		
				S	10.2		11,11,16 N = 27		
	11				10.65				11
301					11.65		7, 15/20mm bouncing (no recovery)		
	12			S	12.1				12 End cap
300	13								13
	13.15			S	13.15		25/100mm		
	13.25	SILTSTONE - Extremely low strength, extremely weathered, grey siltstone			13.25				
299		Bore discontinued at 13.25m, limit of investigation							
	14								14
298									
	15								15
297									
	16								16
296									
	17								17
295									
	18								18
294									
	19								19
293									

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 13.15m

WATER OBSERVATIONS: Free groundwater observed at 1.7m

REMARKS: Top of pipe RL 313.07 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 312.52 AHD
EASTING: 230165.87
NORTHING: 6402187.47
DIP/AZIMUTH: 90°/--

BORE No: A11-S
PROJECT No: 49761
DATE: 1/3/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
312	0	SANDY SILT - (Stiff), dark brown, fine to coarse grained sandy silt, M<Wp (humid)							Stickup=0.6m From 0m to 0.8m, bentonite
311	1.0	SAND - Medium dense, brown/grey brown, slightly silty, fine to coarse grained sand, humid At 1.4m, medium to coarse grained sand							From 0.8m to 3.9m, gravel From 0.9m to 3.9m, screen
310	2	From 2.5m, fine to coarse grained sand with trace silt and fine sized subrounded gravel							
309	3								
	3.8								End cap
	3.9	SANDY CLAY / CLAYEY SAND - Stiff, brown/grey brown, fine to coarse grained sandy clay/clayey sand, M>Wp Bore discontinued at 3.9m, limit of investigation							
308	4								
307	5								
306	6								
305	7								
304	8								
303	9								

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 3.9m

WATER OBSERVATIONS: Free groundwater observed at 1.7m

REMARKS: Bore located immediately adjacent A11-D, strata inferred from A11-D Borehole Log. Top of pipe RL 313.06 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 341.80 AHD
EASTING: 229870.65
NORTHING: 6398592.86
DIP/AZIMUTH: 90°/--

BORE No: A12
PROJECT No: 49761.02
DATE: 17/5/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
341	0.1	SAND - (Very loose), grey fine sand, trace silt, humid							Stickup = 0.6m
		SAND - Loose, grey-brown fine to coarse sand, trace silt, humid							From 0m to 0.2m, bentonite
		From 0.5m, wet							
	1	From 0.8m, saturated							1
		From 1.5m, trace subrounded gravel up to 10mm diameter		S	1.5		1,2,2 N = 4		
340	2				1.95				2
339	3	From 3.0m to 3.1m, brown-orange clay lense		S	3.0		1,2,5 N = 7		3
	3.35	SAND - Loose, light grey fine to medium grained sand, trace to some clay, trace silt, saturated			3.45				From 0.2m to 6.2m, gravel
338	3.7	CLAY - (Soft), dark grey clay, (inferred from drill cuttings), M>Wp							From 0.2m to 6.2m, 50mm diameter Class 18 machine slotted PVC screen
	4 4.0	SANDY CLAY - Soft, brown, fine to coarse sandy clay, trace silt, M>Wp		S,pp	4.0		3,2,2 N = 4 30-50 kPa		4
		From 4.1m to 4.45m, clay and clayey fine to coarse sand bands			4.45				
337		From 4.5m, increasing clay content							
	5				5.5				5
	5.7	From 5.5m to 5.7m, clay with some fine to coarse sand, M>Wp		S,pp			4,4,5 N = 9 30 kPa		
336	6	SANDY CLAY / CLAYEY SAND - Loose to stiff, light grey fine to medium grained sandy clay / clayey sand, trace silt, M>Wp (saturated)			5.95				6 End cap
	6.5	CLAY - Stiff to very stiff, light brown clay, trace subrounded gravel up to 10mm diameter, trace fine to medium grained sand, M>Wp							
335	7			S,pp	7.0		3,4,8 N = 12 160-250 kPa		7
		From 7.35m to 7.45m, light grey fine to medium grained sand band			7.45				
334	8								8
	8.6	SAND - Medium dense, light grey fine to coarse grained sand, trace subrounded gravel up to 7mm diameter, trace silt, saturated		S	8.5		7,8,9 N = 17		
333	9				8.95				9
		From 9.2m, orange and light brown clay and sandy clay in parts							
332	9.8								
	10.0	GRAVELLY SAND - Medium dense, orange gravelly fine							

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 10m

WATER OBSERVATIONS: Free groundwater observed at 0.8m

REMARKS: Top of pipe RL 342.59 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 341.80 AHD
EASTING: 229870.65
NORTHING: 6398592.86
DIP/AZIMUTH: 90°/--

BORE No: A12
PROJECT No: 49761.02
DATE: 17/5/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		to coarse grained sand, trace silt, gravel subrounded up to 30mm diameter, saturated		S	10.0		13,10,8 N = 18		
331	10.45	SANDSTONE - Very low strength, extremely weathered, orange and light brown, fine to coarse grained sandstone			10.45				
		Bore discontinued at 10.45m, limit of investigation							
	11								11
330	12								12
329	13								13
328	14								14
327	15								15
326	16								16
325	17								17
324	18								18
323	19								19
322									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 10m

WATER OBSERVATIONS: Free groundwater observed at 0.8m

REMARKS: Top of pipe RL 342.59 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 251.58 AHD
EASTING: 229512.16
NORTHING: 6411279.12
DIP/AZIMUTH: 90°/--

BORE No: A13
PROJECT No: 49761
DATE: 26/8/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
251	0	SILTY CLAY - Dark brown-brown silty clay, trace fine to coarse grained sand, trace subangular, fine sized gravel							From 0.0m to 1.2m, grout
	1								From 0.9m to 1.4m, bentonite
250	1.5	CLAY - Brown-pale brown clay, trace fine grained sand, M>Wp		D	1.5				
	2								
249	3								
	3.0	SAND - Pale brown, fine to coarse grained sand, trace silt, trace gravel		D	3.5				
248	4								
	4.3	SAND/GRAVEL - Undifferentiated		D	4.5				From 1.2m to 7.2m, screen From 1.4m to 7.6m, gravel
247	5								
246	6								
245	7								
	7.6	Bore discontinued at 7.6m, limit of investigation							From 7.2m to 7.6m, sump End cap
244	8								
243	9								
242									

RIG: Hydrapower MDR105 **DRILLER:** Myers (Macquarie) **LOGGED:** Benson **CASING:** HWT to 7.6m

TYPE OF BORING: 4¾ blade bit washbore

WATER OBSERVATIONS: Some water loss from 6.2m

REMARKS: Top of pipe RL 252.23 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 280.17 AHD
EASTING: 225357.07
NORTHING: 6406838.83
DIP/AZIMUTH: 90°/--

BORE No: A14
PROJECT No: 49761.02
DATE: 27/7/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
280	0	SILTY CLAY - (Stiff) dark brown silty clay, trace fine to medium grained sand, M>Wp		A	0.5				Stickup = 0.6m From 0m to 0.2m, bentonite
				A	1.0				From 0.2m to 1.8m, backfill
279	1				1.5				
	1.4	CLAY - Hard, brown clay, trace silt, trace fine to medium grained sand, M>Wp		S pp	1.6 1.95		4,8,11 N = 19 390-550 kPa		
278	2	From 2.1m, trace silt and subangular gravel up to 10mm		A	2.5				From 1.8m to 2.1m, bentonite
		From 2.6m, very stiff		pp	2.6		300-370 kPa		
	2.8	CLAYEY SAND - Medium dense, brown clayey fine to medium grained sand, trace silt, trace subangular and subrounded gravel up to 10mm		S	2.8 3.05		5,10,5 N = 15		
277	3								
	3.75	GRAVELLY CLAY - Very stiff, brown gravelly clay, gravel subangular and subrounded up to 20mm, M>Wp							
276	4			S	4.1		5,9,15 N = 24		
	4.45	CLAYEY GRAVELLY SAND - Dense, brown clayey gravelly fine to coarse grained sand, gravel subangular to subrounded up to 20mm, trace silt, saturated			4.55				
	4.75	GRAVELLY SAND - Dense, brown mottled red gravelly fine to coarse grained sand, gravel subangular to subrounded up to 40mm, some clay, trace silt, saturated							
275	5								From 2.1m to 8.3m, gravel From 2.3m to 8.3m, 50mm diameter Class 18 machine slotted PVC screen
		From 5.75m, seepage (water loss)		S	5.6		9,18,20 N = 38		
274	6				6.05				
					7.1				
273	7			S			12,23,17 N = 40		
					7.55				
272	8								End cap
	8.6	SILTY CLAY - Firm to stiff, yellowish brown silty clay, some fine to medium grained sand, M>Wp		pp S	8.6 8.78		90-150 kPa 10,5,7 N = 12		
271	9								
	9.75								

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 11.45m

WATER OBSERVATIONS: Free groundwater observed at ~4.0m

REMARKS: Top of pipe RL 280.87 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 280.17 AHD
EASTING: 225357.07
NORTHING: 6406838.83
DIP/AZIMUTH: 90°/--

BORE No: A14
PROJECT No: 49761.02
DATE: 27/7/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
270	10.2	GRAVELLY SAND - Medium dense, gravelly fine to coarse grained sand, gravel subangular to subrounded up to 40mm, some clay, trace to some silt, saturated *(continued)*		S	10.1		8,10,8 N = 18		
	10.3				10.4				
269	11	SILTY SAND - Medium dense, light grey silty fine to medium grained sand, some subangular to subrounded gravel up to 20mm, saturated							11
	11.25	SAND - Medium dense, brown fine to coarse grained sand, trace silt, saturated			11.45				
	11.75	SANDSTONE - Extremely low strength, extremely weathered, grey fine to coarse grained sandstone From 11.45m, drilling refusal		S	11.75		27,18,24 N = 42		
268	12	Bore discontinued at 11.75m, limit of investigation							12
267	13								13
266	14								14
265	15								15
264	16								16
263	17								17
262	18								18
261	19								19

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 11.45m

WATER OBSERVATIONS: Free groundwater observed at ~4.0m

REMARKS: Top of pipe RL 280.87 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 299.99 AHD
EASTING: 234817.03
NORTHING: 6405882.93
DIP/AZIMUTH: 90°/--

BORE No: A15
PROJECT No: 49761.02
DATE: 15 - 16/5/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
299	0.7	SANDY SILTY CLAY - (Very soft to soft), dark brown fine to medium sandy silty clay, M<Wp (humid)							From 0m to 0.1m, bentonite
	1	SAND - Brown, fine to coarse grained sand, trace to some silt, trace subrounded gravel up to 10mm, wet From 0.8m, saturated							
298	2								
297	3								From 0.1m to 6.2m, gravel From 0.3m to 6.3m, 50mm diameter Class 18 machine slotted PVC screen
296	4								
295	5								
294	6								
	6.3	Bore discontinued at 6.3m, limit of investigation							End cap
293	7								
292	8								
291	9								

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 6.3m

WATER OBSERVATIONS: Free groundwater observed at 0.8m

REMARKS: Top of pipe RL 300.73 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 220.01 AHD
EASTING: 226405.21
NORTHING: 6416909.9
DIP/AZIMUTH: 90°/--

BORE No: A16
PROJECT No: 49761.02
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
220	0	SANDY CLAY - (Soft) brown fine to medium grained sandy clay, some silt, M>Wp							Stickup = 0.6m From 0m to 0.1m, bentonite From 0.2m to 0.6m, casing From 0.1m to 1.3m, gravel From 0.2m to 1.3m, 50mm diameter Class 18 machine slotted PVC screen End cap
219	1	From 0.5m, some cobbles up to 200mm thick							
	1.3	Bore discontinued at 1.3m, limit of investigation							
218	2								
217	3								
216	4								
215	5								
214	6								
213	7								
212	8								
211	9								

RIG:
DRILLER: Foody
LOGGED: Holden
CASING: Uncased

TYPE OF BORING: Shovel - by hand

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Top of pipe RL 220.81 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 321.09 AHD
EASTING: 230060.51
NORTHING: 6401190.43
DIP/AZIMUTH: 90°/--

BORE No: A17-D
PROJECT No: 49761
DATE: 28/2/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
321	0.0	SANDY SILT - Stiff, dark brown, fine to coarse grained sandy silt, M<Wp							Stickup=0.65m
	0.7	CLAYEY SILT - Stiff to very stiff, dark brown clayey silt with some fine to coarse grained sand, M>Wp			1.0				
320	1			pp	1.2		250kPa		
				S			2,3,1		
	1.4	SAND and CLAY - Soft to firm, grey, fine to coarse grained sand and clay, M>>Wp (wet to saturated)		pp	1.4 1.45		N = 4 <50kPa		
319	2								From 0m to 4.7m, backfill cuttings
	2.6	SILTY SAND - Loose, grey, fine to medium grained silty sand with trace coarse grained sand, saturated			2.6				
				S			6,2,1		
318	3				3.05		N = 3		
317	4								
	4.1	SANDY CLAY - Stiff to very stiff, grey, fine to coarse grained sandy clay with trace fine sized subrounded gravel, M>Wp		pp	4.1		130kPa		
				S	4.1		3,4,5		
				pp	4.5		N = 9		
316	5				4.55		200 kPa		
		From 5.6m to 6.05m, firm, sandy clay with fine to coarse grained silty sand and sandy silt bands			5.6				
				S			3,1,2		
315	6				6.05		N = 3		From 4.7m to 7.1m, bentonite
314	7								
	7.1	SILTY CLAY - Stiff, grey silty clay with some fine grained sand with thin sandy lenses (fine to medium grained), M>Wp		pp	7.1		140kPa		
				pp	7.1		200kPa		
				S	7.3		3,4,5		
313	8			pp	7.5 7.55		N = 9 100kPa		
	8.6	CLAYEY SAND and SANDY CLAY - Medium dense/stiff, grey mottled yellow brown/brown, fine to coarse grained clayey sand and sandy clay with some fine to medium sized subrounded gravel, (saturated), M>Wp			8.6				
				S			6,6,8		
312	9	From 9.3m to 9.5m, some fine to coarse sized, subrounded gravel			9.05		N = 14		From 7.1m to 11.3m, gravel From 7.3m to 11.3m, screen

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 11.6m

WATER OBSERVATIONS: Free groundwater observed at 1.5m

REMARKS: Top of pipe RL 321.74 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 321.09 AHD
EASTING: 230060.51
NORTHING: 6401190.43
DIP/AZIMUTH: 90°/--

BORE No: A17-D
PROJECT No: 49761
DATE: 28/2/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
311					10.1				
		From 10.2m to 10.3m, fine to medium grained sand band		S			4,3,9		
	10.5			pp	10.4		N = 12		
		GRAVELLY SAND - Medium dense, brown, fine to coarse sized subrounded gravelly fine to coarse grained sand, with some silt and clay, saturated			10.55		150kPa		
310	11								11 End cap
					11.6				
	11.7	SILTSTONE - Extremely low strength to very low strength, extremely weathered, grey siltstone		S			10, 20, 30/80mm bouncing		
309	12 11.98	Bore discontinued at 11.98m, limit of investigation			11.98				12
308	13								13
307	14								14
306	15								15
305	16								16
304	17								17
303	18								18
302	19								19

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 11.6m

WATER OBSERVATIONS: Free groundwater observed at 1.5m

REMARKS: Top of pipe RL 321.74 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 321.11 AHD
EASTING: 230059.46
NORTHING: 6401190.67
DIP/AZIMUTH: 90°/--

BORE No: A17-S
PROJECT No: 49761
DATE: 28/2/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
321	0	SANDY SILT - Stiff, dark brown, fine to coarse grained sandy silt, M<Wp							Stickup=0.65m From 0m to 0.6m, bentonite
	0.7	CLAYEY SILT - Stiff to very stiff, dark brown clayey silt with some fine to coarse grained sand, M>Wp							
320	1								1
	1.4	SAND and CLAY - Soft to firm, grey, fine to coarse grained sand and clay, M>>Wp (wet to saturated)							
319	2								2 From 0.6m to 4.15m, gravel From 1.15m to 4.15m, screen
	2.6	SILTY SAND - Loose, grey, fine to medium grained silty sand with trace coarse grained sand, saturated							
318	3								3
317	4								4 End cap
	4.1 4.2	SANDY CLAY - Stiff to very stiff, grey, fine to coarse grained sandy clay with trace fine sized subrounded gravel, M>Wp Bore discontinued at 4.2m, limit of investigation							
316	5								5
315	6								6
314	7								7
313	8								8
312	9								9

RIG: Envirodrill **DRILLER:** Total Drilling (Foody) **LOGGED:** Semmler **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 4.2m

WATER OBSERVATIONS: Free groundwater observed at 1.5m

REMARKS: Bore located immediately adjacent A17-D. Strata inferred from A17-D Borehole Log. Top of pipe RL 321.77 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 327.63 AHD
EASTING: 229979.01
NORTHING: 6400327.55
DIP/AZIMUTH: 90°/--

BORE No: A18
PROJECT No: 49761.02
DATE: 21/5/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
327	0	SANDY SILT - Dark brown, fine to medium grained sandy silt, abundant organics, M<Wp (humid)							Stickup +0.6m From 0m to 0.2m, bentonite
		From 0.5m, increasing clay content							
	1.0	SILTY CLAY - Dark brown silty clay, some to slightly (fine to medium) sandy, M>Wp							
326	1.5	SAND - Very loose, fine to coarse grained sand, trace silt, trace subrounded gravel up to 5mm diameter, saturated		S	1.5		1,1,1 N = 2		
	1.9	SANDY CLAY - Very soft, dark brown fine to coarse grained sandy clay, some silt, M>>Wp			1.95				
325		From 2.5m, increasing sand content, trace subrounded gravel up to 5mm diameter		S	2.7		0,1,0 N = 1		
	3.1	SAND - Very loose, dark brown fine to coarse grained sand, some clay, trace silt, trace subrounded gravel up to 5mm diameter, saturated			3.15				From 0.2m to 6.2m, gravel From 0.2m to 6.2m, 50mm diameter Class 18 machine slotted PVC screen
324				S	4.2		2,4,4 N = 8		
	4.45	SAND - Loose, grey fine to coarse grained sand, trace silt, trace subrounded gravel up to 5mm diameter, saturated			4.65				
323	4.8	GRAVELLY SAND - Medium dense, brown gravelly fine to coarse grained sand, gravel subrounded up to 30mm diameter, trace silt, saturated							
322				S	5.7		6,6,6 N = 12		
					6.15				End cap
321	7.1	SILTY SAND - Loose, brown silty fine to medium grained sand, saturated		S	7.2		2,2,3 N = 5		
320					7.65				
	8.5	SANDY SILT - Stiff, grey sand brown fine to medium grained sandy silt, trace clay, M>Wp		S	8.7		4,4,5 N = 9		
319	9.0	GRAVELLY SAND - Medium dense, brown gravelly fine to coarse grained sand, gravel, subrounded up to 20mm diameter, trace silt, saturated			9.15				
318									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 11.7m

WATER OBSERVATIONS: Free groundwater observed at 1.6m

REMARKS: Top of pipe RL 328.28 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 327.63 AHD
EASTING: 229979.01
NORTHING: 6400327.55
DIP/AZIMUTH: 90°/--

BORE No: A18
PROJECT No: 49761.02
DATE: 21/5/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
317	11	GRAVELLY SAND - Medium dense, brown gravelly fine to coarse grained sand, gravel, subrounded up to 20mm diameter, trace silt, saturated *(continued)*			10.2				
		From 10.3m to 10.33m, yellow-brown, fine to medium sand band		S			6,6,8 N = 14		
		From 10.5m to 10.53m, grey clay band, M>Wp			10.65				
316	12				11.7				
				S			100mm, bouncing		
	12.1 12.15	SANDSTONE - Extremely low strength, extremely weathered, yellow- light brown mottled red-brown, fine to coarse grained sandstone			12.15				
315	13	Bore discontinued at 12.15m, limit of investigation							
314	14								
313	15								
312	16								
311	17								
310	18								
309	19								
308									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 11.7m

WATER OBSERVATIONS: Free groundwater observed at 1.6m

REMARKS: Top of pipe RL 328.28 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 246.29 AHD
EASTING: 229994.66
NORTHING: 6412727.94
DIP/AZIMUTH: 90°/--

BORE No: A19
PROJECT No: 49761.02
DATE: 24/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
246	0.3	CLAY - (Soft to firm) dark brown clay, some silt, M>Wp							Stickup = 0.6m
		SILTY SAND - (Very loose to loose) dark brown silty fine to medium sand, some clay, humid							From 0m to 1.7m, backfill and bentonite
245	1.3	CLAY - Hard, dark brown clay, some silt, trace fine to medium grained sand, M>Wp			1.5				
				pp			>400 kPa		
				S	1.9		8,11,18		
					1.95		N = 29		From 1.7m to 2.0m, bentonite
244					2.54				
				pp			350-450 kPa		
	2.87			S	2.87		8,7,7		
	3.0	CLAYEY SAND - Medium dense, light grey and brown clayey fine to medium grained sand, trace silt, wet			2.99		N = 14		
243		GRAVELLY SAND - Medium dense, brown gravelly fine to coarse grained sand, gravel subrounded up to 20mm, some to slightly clayey in parts, wet							From 2.0m to 5.2m, gravel
		From 3.5m to 3.85m, light grey clay band (inferred from cuttings)							From 2.2m to 5.2m, 50mm diameter Class 18 machine slotted PVC screen
					4.04				
242				S			8,11,11		
	4.4	GRAVELLY SANDSTONE - Extremely low strength, extremely weathered, red fine grained gravelly fine to coarse grained sandstone			4.49		N = 22		
241	5.0	CLAYSTONE - Extremely low strength, extremely weathered, grey claystone							End cap
					5.54				
				S			6,10,14		
240					5.99		N = 24		
	6.6	From 6.6m, drilling refusal Bore discontinued at 6.6m, limit of investigation							
239									
238									
237									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 6.6m

WATER OBSERVATIONS: Free groundwater observed at ~3.5m

REMARKS: Top of pipe RL 247.04 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 273.73 AHD
EASTING: 231186.36
NORTHING: 6407756.08
DIP/AZIMUTH: 90°/--

BORE No: A20
PROJECT No: 49761.02
DATE: 9/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
273	0	SAND - (Loose), dark brown fine to medium grained sand, some silt, trace clay, humid							Stickup = 0.6m
	0.6	CLAYEY SAND - (Loose) dark brown clayey fine to medium grained sand, some silt, humid to wet							From 0m to 0.9m, bentonite
	1.0	SANDY CLAY - (Soft) dark brown fine to medium grained sandy clay, some silt, M>Wp							
272	1	From 1.5m, sandy clay / clayey sand (M>Wp)			1.5				
				pp			50-100 kPa		
				S	1.85		2,2,2		
	2	From 2.0m, saturated			1.95		N = 4		
	2.5	CLAY - Stiff, dark brown clay, trace to some silt, trace fine to medium grained sand, M>Wp			2.67				
271				S, pp			3,4,5		
	3	From 3.0m, trace fine grained subrounded gravel up to 5mm			3.12		N = 9		
							180-200 kPa		
270	4				4.17				From 0.9m to 7.2m, gravel
	4.3				4.3				From 1.2m to 7.2m, 50mm diameter Class 18 machine slotted PVC screen
	4.43	SILTY CLAY - Very soft, light brown silty clay, trace fine to medium grained sand, M>>Wp		pp	4.43		0-40 kPa		
				S			2,1,6		
269		CLAY - Very stiff, brown mottled red and light grey clay, slightly silty, trace to some fine to medium grained sand, M>Wp		pp	4.62		N = 7		
	5						250-330 kPa		
	5.5	SANDY CLAY - Hard, light brown mottled red and light grey fine to medium grained sandy clay, trace to some silt, M>Wp			5.67				
268				S, pp			6,11,14		
	6				6.12		N = 25		
							350->400 kPa		
267	6.7	SANDSTONE - Extremely low strength, extremely weathered, brown fine to coarse grained sandstone							
	7				7.17				End cap
	7.4			S			11, 33, bouncing		
	7.47	CLAYSTONE - Extremely low strength, extremely weathered, brown mottled light grey claystone			7.47				
266		Bore discontinued at 7.47m, limit of investigation							
	8								
265	9								
264									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Holden **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash boring to 7.17m

WATER OBSERVATIONS: Free groundwater observed at 2.0m

REMARKS: Top of pipe RL 274.41 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 313.68 AHD
EASTING: 233693.28
NORTHING: 6403938.79
DIP/AZIMUTH: 90°/--

BORE No: A21
PROJECT No: 49761
DATE: 29-30/4/13
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
313	0.2	TOPSOIL - Brown silty sand topsoil, generally comprising fine to medium grained sand, abundant rootlets, humid							Stickup = 0.63m
		SILTY SAND - Medium dense, brown, fine to medium grained silty sand with trace to some fine sized gravel, with some clay, humid		D	0.5				
	1			S	1.0		6,10,13 N = 23		
312					1.45				
	2	From 2.0m, with some fine to coarse grained sand, fine to coarse sized subangular to angular gravel		S	2.5		6,12,16 N = 28		
311	3.0				2.95				
		SAND - Yellow brown, fine to medium grained sand with trace to some silt, trace clay, some fine to medium sized subrounded, subangular gravel, humid		D	3.0				From 0m to 7.0m, grout
310	4			S	4.0		5,7,6 N = 13		
					4.45				
309	5								
				S	5.5		4,5,8 N = 13		
308	6				5.95				
		From 6.5m, with some clay lense		D	6.0				
307	7	From 7.1m to 7.4m, very stiff, brown clay, M<Wp		S,pp	7.0		3,7,10 N = 17 230-300 kPa		
					7.45				From 7.0m to 8.05m, bentonite
306	7.8	CLAYEY SAND - Medium dense, brown, fine to coarse grained clayey sand, damp							
	8								
305				S	8.5		4,12,10 N = 22		
	9				8.95				
	9.0	SAND - Brown, fine to coarse grained sand with some clay lenses, trace fine sized gravel, damp			9.0				
304				D					
	10.0				10.0				

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** Uncased

TYPE OF BORING: Solid flight auger TC to 14.95m

WATER OBSERVATIONS: Free groundwater observed at 11.25m

REMARKS: Top of pipe RL 314.31 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 313.68 AHD
EASTING: 233693.28
NORTHING: 6403938.79
DIP/AZIMUTH: 90°/--

BORE No: A21
PROJECT No: 49761
DATE: 29-30/4/13
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
303	11	CLAYEY SAND - Medium dense, brown, fine to coarse grained clayey sand, damp		S	10.0 10.45		4,5,9 N = 14		From 8m to 14.3m, 5mm gravel From 8.3m to 14.3m, Class 18 PVC Screen
302	12			S	11.5 11.95		3,3,8 N = 11		
301	13			S	13.0 13.45		4,7,8 N = 15		
300	14								End cap
	14.2	SANDSTONE - Extremely low strength, extremely weathered, brown, fine to medium grained sandstone with trace to some fine sized gravel		S	14.5		12,22,23 N = 45		From 14.3m to 14.95m, bentonite
299	14.95	Bore discontinued at 14.95m			14.95				
298	15								
297	16								
296	17								
295	18								
294	19								

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** Uncased

TYPE OF BORING: Solid flight auger TC to 14.95m

WATER OBSERVATIONS: Free groundwater observed at 11.25m

REMARKS: Top of pipe RL 314.31 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 261.69 AHD
EASTING: 230922.13
NORTHING: 6412502.54
DIP/AZIMUTH: 90°/--

BORE No: A22
PROJECT No: 49761.02
DATE: 22/10/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
261	0	SAND - (Very loose), brown, fine grained sand with trace to some clay, humid		A	0.1				Stickup = 0.63m From 0m to 0.3m, asphalt and concrete
		From 0.5m, slightly clayey with trace fine sized subangular gravel, damp		A	0.5				
	1	From 1.0m, trace coal and gravel		S	1.0 1.45		3,4,4 N = 8		From 0.3m to 1.7m, backfill and cuttings From 0m to 2.2m, Class 18 PVC
260	1.6	GRAVELLY SAND - (Medium dense), brown, fine to medium sized subangular gravelly fine to medium grained sand, trace to some clay, damp							
	2	2.0 CLAYEY SAND - Dense, brown, fine to medium grained clayey sand, humid		S	2.5		4,17,25 N = 42		From 1.7m to 2.0m, bentonite
259	3				2.95				
		From 3.3m, white fine to medium sized subangular gravel, dry to humid (slow drilling progress)		A	3.3				
258	4	From 3.8m, moist to wet		S,pp	4.0 4.45		8,15,19 N = 34 >600 kPa		From 2.0m to 7.2m, 5mm gravel From 2.2m to 7.2m, 50mm diameter Class 18 machine slotted PVC screen
257	5	5.0 CLAY - Hard, brown clay, slightly sandy with some sandstone in parts, M<Wp							
				S	5.5		9,13,21 N = 34		
256	6				5.95				
	6.5	SANDSTONE - Low to medium strength, highly to moderately weathered, brown and grey, fine to medium grained sandstone with some clay in parts							
255	7			S	7.2		10,16,29 N = 45		End cap
254	7.65	Bore discontinued at 7.65m, limit of investigation			7.65				
	8								
253	9								
252									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 2.6m

TYPE OF BORING: Solid flight auger to 7.0m, wash bore to 7.2m

WATER OBSERVATIONS: Free groundwater observed at 3.4m during drilling

REMARKS: Top of pipe RL 262.32 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 333.42 AHD
EASTING: 230567.69
NORTHING: 6401122.03
DIP/AZIMUTH: 90°/--

BORE No: A23
PROJECT No: 49761.02
DATE: 15-16/10/12
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
333	0	SAND - (Very loose), brown, fine grained sand with some silt and trace fine to medium sized subrounded gravel, humid		A	0.1				Stickup = 0.63m From 0m to 0.3m, asphalt and concrete
		At 0.5m, humid to damp		A	0.5				
	1	From 1.0m, loose		S	1.0 1.45		3,3,3 N = 6		From 0.3m to 2.9m, backfill and cuttings From 0m to 3.4m, Class 18 PVC
332	2	From 2.1m, fine to coarse grained sand							
331	2.6	SANDY CLAY - Firm to stiff, dark brown, fine to coarse grained sandy clay with some fine sized gravel, M>Wp		S,pp	2.68 3.13		2,3,2 N = 5 90-130 kPa		From 2.9m to 3.2m, bentonite
330	3	From 3.8m, trace gravel							
	4	From 4.18m, stiff		S,pp	4.18 4.5		3,6,4 N = 10 120-170 kPa		
329	5								
328	5.9	SAND - Loose to medium dense, brown, fine to medium grained sand, slightly clayey with trace silt, saturated		S	5.65 5.95		4,2,3 N = 5		
	6								
327	6.25	GRAVELLY SAND - Very dense, brown, fine to coarse sized, subangular gravelly fine to coarse grained sand with some clay in parts, saturated							From 3.2m to 9.4m, 5mm gravel From 3.4m to 9.4m, 50mm diameter Class 18 machine slotted PVC screen
	7			S	7.15 7.45		15,15,18 N = 33		
326	8								
325	8.0	SANDY GRAVEL - (Very dense), brown, fine to medium grained sandy fine sized subangular gravel, saturated							
	9								End cap
324	9.6								From 9.4m to 10.1m, backfilled

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 2.7m

TYPE OF BORING: Solid flight auger to 3.13m, wash boring to 10.15m

WATER OBSERVATIONS: Free groundwater observed at 5.0m

REMARKS: Top of pipe RL 334.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 333.42 AHD
EASTING: 230567.69
NORTHING: 6401122.03
DIP/AZIMUTH: 90°/--

BORE No: A23
PROJECT No: 49761.02
DATE: 15-16/10/12
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.12 10.15	SANDSTONE - Medium to high strength, highly to moderately weathered, brown, fine to coarse grained sandstone *(continued)*		S	10.1 10.15		40/150mm		with bentonite
		BASALT - Medium to high strength, fresh, black/dark brown, fractured basalt Bore discontinued at 10.15m, limit of investigation							

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 2.7m

TYPE OF BORING: Solid flight auger to 3.13m, wash boring to 10.15m

WATER OBSERVATIONS: Free groundwater observed at 5.0m

REMARKS: Top of pipe RL 334.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 333.28 AHD
EASTING: 230567.63
NORTHING: 6401124.12
DIP/AZIMUTH: 90°/--

BORE No: A23-W
PROJECT No: 49761.02
DATE: 23/10/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
334	0	SAND - (Very loose), brown, fine grained sand with some silt and trace fine to medium sized subrounded gravel, humid							Stickup = 0.52m
		At 0.5m, humid to damp							From 0m to 0.4m, asphalt and concrete
	1	From 1.0m, loose							
335									
	2	From 2.1m, fine to coarse grained sand							
	2.6								
336		SANDY CLAY - Firm to stiff, dark brown, fine to coarse grained sandy clay with some fine sized gravel, M>Wp							
	3								
337		From 3.8m, trace gravel							
	4	From 4.18m, stiff							
338									From 0.4m to 8.8m, backfill and cuttings
	5								From 0m to 10.4m, Class 18 PVC
339									
	5.9								
	6	SAND - Loose to medium dense, brown, fine to medium grained sand, slightly clayey with trace silt, saturated							
	6.25								
340		GRAVELLY SAND - Very dense, brown, fine to coarse sized, subangular gravelly fine to coarse grained sand with some clay in parts, saturated							
	7								
341									
	8								
	8.0	SANDY GRAVEL - (Very dense), brown, fine to medium grained sandy fine sized subangular gravel, saturated							
342									
	9								
	9.06	CORE LOSS - 9.06m to 10.53m		C	9.06				
				C	9.52				From 8.8m to 10.35m, bentonite

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 11m

TYPE OF BORING: Solid flight auger to 9.06m, HQ3 to 16.5m

WATER OBSERVATIONS:

REMARKS: Top of pipe RL 333.81 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 333.28 AHD
EASTING: 230567.63
NORTHING: 6401124.12
DIP/AZIMUTH: 90°/--

BORE No: A23-W
PROJECT No: 49761.02
DATE: 23/10/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CORE LOSS - 9.06m to 10.53m *(continued)*							
	10.53			C	10.64		PL(A) = 0.09 PL(D) = 0.07		
344	10.79	SANDSTONE - Very low strength, extremely to highly weathered, grey and brown, fine grained sandstone			10.79				
	11	CORE LOSS - 10.79m to 11.81m		C					
345	11.81				11.91		PL(A) = 0 PL(D) = 0		
	12	SANDSTONE - Extremely low to very low strength, extremely to highly weathered, grey and brown, fine grained sandstone			12.17		PL(A) = 0.07 PL(D) = 0.02		
	12.31	CORE LOSS - 12.31m to 12.52m			12.31				
	12.52			C	12.65		PL(A) = 0.13 PL(D) = 0.03		
346	12.68	SANDSTONE - Extremely low to very low strength, extremely to highly weathered, grey and brown, fine grained sandstone			12.8		PL(A) = 0.2		
	12.91				12.86				
	13	CORE LOSS - 12.86m to 12.91m		C					
	13.33	SILTSTONE - Low strength, highly to moderately weathered, grey and brown siltstone with interbedded very low to low strength bands up to 80mm long		C	13.29				
	13.43			C	13.33		PL(A) = 0.78 PL(D) = 0.61		
347		CORE LOSS - 13.33m to 13.43m		C	13.62 13.67				
	13.87				13.83				
	14 13.95	SILTSTONE - Medium strength, moderately weathered, grey and orange-brown siltstone							
		From 13.72m, slightly weathered with some highly weathered bands		C	14.46		PL(A) = 1.26 PL(D) = 1.08		
348		CORE LOSS - 13.87m to 13.95m							
	15	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone with trace highly weathered bands up to 30mm thick			15.08				
		From 14.2m, some siltstone laminations up to 30mm thick			15.39		PL(A) = 1.07 PL(D) = 0.52		
349				C					
	16								
	16.5	Bore discontinued at 16.5m, limit of investigation			16.5				
350									
	17								
351									
	18								
352									
	19								

Well Construction Details: From 10.35m to 16.4m, 5mm gravel. From 10.4m to 16.4m, 50mm diameter Class 18 machine slotted PVC screen. End cap.

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 11m

TYPE OF BORING: Solid flight auger to 9.06m, HQ3 to 16.5m

WATER OBSERVATIONS:

REMARKS: Top of pipe RL 333.81 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 342.42 AHD
EASTING: 230808.88
NORTHING: 6400665.51
DIP/AZIMUTH: 90°/--

BORE No: A24-D
PROJECT No: 49761.02
DATE: 16/10/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
342	0	SAND - (Very loose), brown, fine grained sand with some silt and trace rootlets, humid		A	0.1				Stickup = 0.45m
				A	0.5				From 0m to 0.5m, concrete
	1.2	SANDY SILT / SILTY SAND - Very loose, dark brown, fine to medium grained silty sand / sandy silt		S,pp	1.2 1.4		2,1,1 N = 2 30-60 kPa		
341	2	From 2.0m, some fine to medium sized subangular gravel							
340					2.55		4,5,4 N = 9 220-240 kPa		From 0m to 5.6m, Class 18 PVC From 0.5m to 4.8m, backfill and cuttings
	2.8	GRAVELLY SAND - Loose, light brown, fine to medium sized subangular gravelly fine to coarse grained sand, trace silt, humid		S,pp	3.0				
339	4	From 4.1m, wet, slightly clayey			4.1				
	4.4	From 4.25m, saturated		S pp	4.4		5,3,6 N = 9 80-120 kPa		
338		CLAY - Stiff, dark brown clay with trace to some fine grained sand and trace silt, M>Wp			4.45				
337	5	From 5.3m, trace to some fine sized subangular gravel							From 4.8m to 5.3m, bentonite
	5.65	CLAYEY SAND - Very loose, brown, fine grained clayey sand with trace fine to medium sized gravel in parts, saturated		S	5.6 5.95		8,2,2 N = 4		
336	6								
	7	From 7.2m, medium dense with firm to stiff sandy clay in parts		S,pp	7.2 7.65		3,5,4 N = 9 50-140 kPa		From 5.3m to 8.6m, 5mm gravel From 5.6m to 8.6m, 50mm diameter Class 18 machine slotted PVC screen
335	7.8	SANDSTONE - Medium strength, highly to moderately weathered, red and brown fine to coarse grained sandstone							
334	8								
	8.55			S	8.55		31,27,23 N = 50		End cap
	8.6	BASALT - High strength, moderately weathered to fresh, dark grey basalt Bore discontinued at 8.6m, limit of investigation			8.6				
333	9								

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 2.4m

TYPE OF BORING: Solid flight auger to 2.55m, wash boring to 8.6m

WATER OBSERVATIONS: Free groundwater observed at 4.4m

REMARKS: Top of pipe RL 342.88 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 342.48 AHD
EASTING: 230810.08
NORTHING: 6400663.99
DIP/AZIMUTH: 90°/--

BORE No: A24-S
PROJECT No: 49761.02
DATE: 16/10/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
342	0	SAND - (Very loose), brown, fine grained sand with some silt and trace rootlets, humid		A	0.1				Stickup = 0.58m From 0m to 0.4m, concrete
				A	0.5				
	1								
	1.2	SANDY SILT / SILTY SAND - Very loose, dark brown, fine to medium grained silty sand / sandy silt		S,pp	1.2		2,1,1 N = 2 30-60 kPa		From 0.4m to 1.9m, backfill and cuttings From 0m to 2.4m, Class 18 PVC
341					1.4				
	2	From 2.0m, some fine to medium sized subangular gravel							From 1.9m to 2.2m, bentonite
340					2.55				
	2.8	GRAVELLY SAND - Loose, light brown, fine to medium sized subangular gravelly fine to coarse grained sand, trace silt, humid		S,pp			4,5,4 N = 9 220-240 kPa		
	3				3.0				
339									
	4	From 4.1m, wet, slightly clayey			4.1				From 2.2m to 5.4m, 5mm gravel From 2.4m to 5.4m, 50mm diameter Class 18 machine slotted PVC screen
	4.4	From 4.25m, saturated		S pp	4.4		5,3,6 N = 9 80-120 kPa		
338		CLAY - Stiff, dark brown clay with trace to some fine grained sand and trace silt, M>Wp			4.45				
	5								
	5.4	From 5.3m, trace to some fine sized subangular gravel							End cap
337		Bore discontinued at 5.4m, limit of investigation							
	6								
336									
	7								
335									
	8								
334									
	9								
333									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 5.4m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Top of pipe RL 343.06 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 351.49 AHD
EASTING: 231231.06
NORTHING: 6400351.88
DIP/AZIMUTH: 90°/--

BORE No: A25
PROJECT No: 49761.02
DATE: 17/10/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
351	0	SAND - (Very loose), dark brown, fine grained sand with some silt and organics, humid		A	0.1				Stickup = 0.60m From 0m to 0.4m, concrete
		From 0.5m, trace organics, damp		A	0.5				
	1	From 1.0m, trace fine to medium sized subrounded gravel, some silt, damp to moist		S	1.0 1.45		3,1,2 N = 3		From 0.4m to 2.0m, backfill and cuttings From 0m to 2.5m, Class 18 PVC
350	2								From 2.0m to 2.3m, bentonite
349		From 2.5m, medium dense, slightly silty, some gravel		S	2.5 2.8		4,7,6 N = 13		
	3								
	3.2	GRAVELLY SAND - Light brown, fine to medium sized subangular gravelly fine to medium grained sand with trace clay							
348	4								From 2.3m to 5.5m, 5mm gravel From 2.5m to 5.5m, 50mm diameter Class 18 machine slotted PVC screen
	4.0	SANDY CLAY - Hard, brown, fine to medium grained sandy clay, M≫Wp		S,pp	4.0		9,14,22 N = 36 550->600 kPa		
	4.4	SANDY CLAY / CLAYEY SAND - Dense, light grey, fine to medium grained sandy clay / clayey sand			4.45				
347	5	From 4.6m, some fine to medium sized subangular to subrounded gravel, damp							
	5.3	SANDSTONE - Medium strength, highly to moderately weathered, brown, fine to medium grained sandstone with some fragmented basalt in parts and some fine to medium sized subangular gravel		S	5.5		27,25/30mm		End cap
346	5.68	Bore discontinued at 5.68m, limit of investigation			5.68				
345	6								
344	7								
343	8								
342	9								

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m, wash bore to 5.68m

WATER OBSERVATIONS:

REMARKS: Top of pipe RL 352.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.36 AHD
EASTING: 229452.11
NORTHING: 6414924.63
DIP/AZIMUTH: 90°/--

BORE No: AGE01A-D
PROJECT No: 49761.02
DATE: 17/10/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
237	0.15	SAND - (Loose), brown, fine to medium grained sand, slightly clayey, damp		A	0.1				Stickup = 0.62m
		CLAY - Very stiff to hard, dark brown clay, trace to some fine grained sand, M≤Wp		A	0.5		300-500 kPa		From 0m to 0.4m, concrete
236	1.6			S,pp	1.0 1.45		450->500 kPa		
		SANDY GRAVEL - (Medium dense), brown, fine to medium grained sandy fine to medium sized subangular to subrounded gravel with trace to some silt							
235	2.7	GRAVELLY SAND - Medium dense, brown, fine to medium sized gravelly fine to medium grained sand, slightly clayey, wet From 2.95m, saturated with some cobbles up to 40mm (basalt + sandstone)		S	2.9 3.2		9,13,12 N = 25		From 0.4m to 5.9m, backfill and cuttings From 0m to 6.4m, Class 18 PVC
234	3.6	SANDY GRAVEL - Medium dense to dense, brown, fine to medium grained sandy fine to medium sized subangular to subrounded gravel, slightly cobbly (with basalt and sandstone up to 40mm), some to slightly clayey, saturated		S	4.0 4.2		13,18,12 N = 30		
233	4.9	CLAY - (Stiff), brown clay with trace cobbles		(S)	5.55 5.73		12,15/30mm (bouncing)		
232	6.3	SANDY GRAVEL - Medium dense, brown, fine to medium grained sandy fine to medium sized subangular to subrounded gravel, slightly clayey with some cobbles up to 40mm, saturated		S	6.95 7.15		5,11,12 N = 23		From 5.9m to 6.2m, bentonite From 6.2m to 9.4m, 5mm gravel From 6.4m to 9.4m, 50mm diameter Class 18 machine slotted PVC screen
229	9.4			(S)	8.9 9.05		27/150mm (bouncing)		End cap
228	10.0	CLAYEY GRAVELLY SAND - Dense to medium dense, brown clayey fine to medium sized subangular to subrounded gravelly fine to coarse grained sand, moist, grading to rock		S	9.6 9.75		4, 29, 10/20mm		

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 2.45m

TYPE OF BORING: Solid flight auger to 2.45m, wash bore to 11.25m

WATER OBSERVATIONS: Free groundwater observed at 2.95m during drilling

REMARKS: Top of pipe RL 237.96 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.36 AHD
EASTING: 229452.11
NORTHING: 6414924.63
DIP/AZIMUTH: 90°/--

BORE No: AGE01A-D
PROJECT No: 49761.02
DATE: 17/10/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
227	11	SANDSTONE - High strength, moderately weathered, fine to medium grained sandstone							11
226	11.25	Bore discontinued at 11.25m, limit of investigation		(S)	11.2 11.25		5, 10, 32/50mm (bouncing)		
225	12								12
224	13								13
223	14								14
222	15								15
221	16								16
220	17								17
219	18								18
218	19								19

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 2.45m

TYPE OF BORING: Solid flight auger to 2.45m, wash bore to 11.25m

WATER OBSERVATIONS: Free groundwater observed at 2.95m during drilling

REMARKS: Top of pipe RL 237.96 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.35 AHD
EASTING: 229452.9
NORTHING: 6414924.53
DIP/AZIMUTH: 90°/--

BORE No: AGE01A-S
PROJECT No: 49761.02
DATE: 17/10/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
237	0.15	SAND - (Loose), brown, fine to medium grained sand, slightly clayey, damp		A	0.1				Stickup = 0.76m
		CLAY - Very stiff to hard, dark brown clay, trace to some fine grained sand, M≤Wp		A,pp	0.5		300-500 kPa		From 0m to 0.3m, concrete
236	1.6	SANDY GRAVEL - (Medium dense), brown, fine to medium grained sandy fine to medium sized subangular to subrounded gravel with trace to some silt		S,pp	1.0 1.45		450->500 kPa		From 0.3m to 1.3m, backfill and cuttings From 0m to 1.8m, Class 18 PVC From 1.3m to 1.6m, bentonite
235	2.7	GRAVELLY SAND - Medium dense, brown, fine to medium sized gravelly fine to medium grained sand, slightly clayey, wet From 2.95m, saturated with some cobbles up to 40mm (basalt + sandstone)		S	2.9 3.2		9,13,12 N = 25		From 1.6m to 4.8m, 5mm gravel From 1.8m to 4.8m, 50mm diameter Class 18 machine slotted PVC screen
234	3.6	SANDY GRAVEL - Medium dense to dense, brown, fine to medium grained sandy fine to medium sized subangular to subrounded gravel, slightly cobbly (with basalt and sandstone up to 40mm), some to slightly clayey, saturated		S	4.0 4.2		13,18,12 N = 30		End cap
233	4.8	Bore discontinued at 4.8m, limit of investigation							
232	5								
231	6								
230	7								
229	8								
228	9								

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 2.45m

TYPE OF BORING: Solid flight auger to 4.8m

WATER OBSERVATIONS:

REMARKS: Top of pipe RL 238.07 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 1 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
237	0.15	TOPSOIL - Brown silty sand topsoil, generally comprising fine grained sand, trace clay, abundant rootlets										
		CLAY - Hard, brown clay, M<<Wp										
236	1	From 1.0m, with some fine sized subrounded gravel										
		From 1.5m, orange brown										
235	2											
	2.5	SANDY GRAVEL - Brown sandy gravel, fine to coarse grained sand, fine to medium sized, subrounded gravel, moist to wet										
234	3	From 2.8m, saturated										
233	4											
232	5											
231	6											
230	7											
229	8											
228	9	From about 9.5m, with some cobbles										

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 2 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
227		SANDY GRAVEL - Brown sandy gravel, fine to coarse grained sand, fine to medium sized, subrounded gravel, moist to wet *(continued)*										
226	11											
	11.53	SANDSTONE - Medium strength, moderately to slightly weathered, yellow brown, fine to medium grained sandstone							C	100	100	PL(A) = 2.74 PL(D) = 2.38
	12											
	12.1	From 12.01m to 12.1m, granite						12.1m: CORE LOSS: 130mm	C	65	0	
225	12.23											
	12.32							12.32m: CORE LOSS: 70mm	C	65	0	
	12.39	CORE LOSS - 0.13m							C	50	100	
	12.79	SANDSTONE - Medium strength, moderately to slightly weathered, yellow brown, fine to medium grained sandstone						12.79m: CORE LOSS: 60mm	C	0	0	
	12.85											
	13											
224		CORE LOSS - 0.07m										
	13.5	BASALT - High to very high strength, fresh, grey basalt							S			25/85mm
	13.59							13.59m: CORE LOSS: 160mm				
	13.75	CORE LOSS - 0.06m							C	51	0	
	14	Casing advanced rotary drilling, no sample recovered						13.75m-13.86m, Fg 13.92m: P,sh,pl,ro 13.92m-13.98m, cy				PL(A) = 0 PL(D) = 0.02
223		SILTSTONE - Very low to low strength, slightly weathered to fresh, grey siltstone, trace fine to medium grained sand and clay						14.35m: P,sh,pl,ro 14.47m-14.49m, cy 14.5m: P,sh,pl,ro 14.65m: P,sh,pl,ro 14.68m-14.94m, J,sv,pl,ro	C	100	57	
	15	CORE LOSS - 0.16m										
222		SANDSTONE - Very low to low strength, fresh, grey, fine grained sandstone with some clay and silt						14.77m: P,sh,pl,ro 14.86m: P,sh,pl,ro 14.94m: P,sh,pl,ro 14.98m: P,sh,pl,ro 15.62m: P,sh,pl,ro	GT001			PL(A) = 0.14 PL(D) = 0.08
		From 13.92m to 13.98m, extremely low strength, extremely weathered, clay seam										
	16	From 14.14m to 14.16m, extremely low strength, extremely weathered										
221		From 14.47m to 14.49m, extremely low strength, extremely weathered, clay seam						16.37m: P,sh,pl,ro 16.47m: P,sh,pl,ro	C	100	100	
		From 16.3m to 16.45m, carbonaceous siltstone, medium to high strength, fresh, dark grey										
	17	From 16.93m to 17.12m, high strength						16.97m: J,70°,pl, cl, calcite 17.07m: J,80°,pl, cl, calcite				
220								17.66m: P,sh,pl,ro 17.67m: P,sh,pl,ro 17.77m: P,sh,pl,ro				
	18											PL(A) = 0.1 PL(D) = 0.05
	18.12	LAMINITE - Very low to low strength, fresh, grey and dark grey laminite, fine grained sand										
219		From 18.56m to 18.82m, fine grained sandstone layer						18.56m: P,sh,pl,ro				
	19								C	100	100	
218		From 19.18m to 19.75m, fine grained sandstone layer										
		From 19.47m, coal lense, 5mm thick										
	19.75							19.82m: P,sh,pl,ro				

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 3 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
217		SILTSTONE - Low strength, fresh, grey siltstone *(continued)*							C	100	100	
	21							20.77m: P,sh,pl,ro				PL(A) = 0.07 PL(D) = 0.11
216		From 21.62m, low to medium strength										
	22											
215								22.38m: P,sh,pl,ro				PL(A) = 0.27 PL(D) = 0.21
									C GT002	100	100	
	23											
214												
	24											
213												
	25							25.09m: P,sh,pl,ro				PL(A) = 0.43 PL(D) = 0.24
212									C	100	100	
	26											
211		From 26.24m to 26.43m, with some coarse grained sand										
	26.43	CARBONACEOUS SILTSTONE - Low to medium strength, fresh, dark grey-black carbonaceous siltstone										
	27											PL(A) = 0.6 PL(D) = 0.38
210								27.76m: P,sh,pl,ro				
	28								C	100	100	
209												PL(A) = 0.28 PL(D) = 0.25
	29							29.13m: P,sh,pl,ro				
208												
	30.0	From 29.87m to 30.56m, casing							C	0	0	

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 4 OF 17

RL	Depth (m)	Description of Strata	Graphic Log	Type	Core Rec. %	RQD %	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Test Results & Comments
207		advanced rotary drilling, no sample recovered		C	0	0		
		SILTSTONE - Fresh, grey siltstone						
	31						31.06m: J,70°,pl, cl, 20mm throw	
206							31.62m: J,70°,pl,ro	
				C	100	100	31.74m: P,sh,pl,ro	PL(A) = 0.74 PL(D) = 0.63
	31.97						31.98m: P,sh,pl,ro	
	32	CARBONACEOUS SILTSTONE / STONEY COAL - Medium strength, fresh, dark grey to black, carbonaceous siltstone / stoney coal		GT003				
205	32.1							
	32.29	TUFF - Very low to low strength, fresh, grey white tuff						PL(A) = 0.33 PL(D) = 0.25
	33	CARBONACEOUS SILTSTONE / STONEY COAL - Medium strength, fresh, dark grey to black, carbonaceous siltstone / stoney coal		GT004				PL(A) = 0.24 PL(D) = 0.19
204	33.08							
	33.3							
	33.49	TUFF - Very low strength, highly to moderately weathered, grey white tuff		C	100	89		
	33.82							
	34	From 33.19m to 33.22m, siltstone band, low to medium strength, fresh, grey					34.12m: P,sh,pl,ro	
203		SILTSTONE - Low to medium strength, fresh, grey siltstone					34.48m: P,sh,pl,ro	
		From 33.41m to 33.42m, tuff band, extremely low to very low strength, highly to moderately weathered						
	35							
	35.13	TUFF - Very low to low strength, highly to moderately weathered, grey white tuff with intermixed siltstone bands		C	100	100		
202							35.49m: P,sh,pl,ro	PL(A) = 0.35 PL(D) = 0.22
	36	SILTSTONE - Medium strength, fresh, grey siltstone					35.9m to 36.18m, J,st, pl, ro	
		From 34m, intermixed with tuff						
201		From 34.9m to 35.2m, high to very high strength					36.54m-36.85m, J,sv, pl, cl	
	36.86	SILTSTONE - Medium to high strength, fresh, grey siltstone						
	37	From 35.13m to 35.63m, interlaminated with tuff		GT005				
200		TUFF - Very low to low strength, fresh grey white tuff		C	100	100		PL(A) = 0.12 PL(D) = 0.05
	37.84	From 37.78m, very low strength						
	38	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark brown to black carbonaceous siltstone with some coal lenses up to 10mm thick					38.05m: P,sh,pl,ro	
199	38.22						38.15m: P,sh,pl,ro	
		SILTSTONE - Medium to high strength, fresh, grey siltstone		GT006				PL(A) = 1.4 PL(D) = 1.45
	39							
198				C	100	100		
		From 39.81m to 39.85m, coal band						

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 5 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
197	40.25	LAMINITE - Medium to high strength, fresh, grey laminite, fine to medium grained sand										PL(A) = 0.6 PL(D) = 0.28
	40.94	SILTSTONE - Medium to high strength, fresh, grey siltstone							C	100	100	
196	41	From 41.8m to 41.82m, tuff band, extremely low strength										
	42	From 42.02m to 42.18m, tuff band, very low to low strength with some fine to medium grained sand										
195	42.18											
	42.38	CARBONACEOUS SILTSTONE - Medium strength, fresh, dark brown to black carbonaceous siltstone										
	42.53											
	43	TUFF - Very low to low strength, fresh, grey white tuff										PL(A) = 1.66 PL(D) = 0.54
194		SILTSTONE - Medium to high strength, fresh, grey siltstone							GT007 C	100	94	
	43.65	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark brown to black carbonaceous siltstone										
	44 44.01	From 43.82m, tuff band, extremely low strength, extremely weathered, grey, 10mm thick							GT008			
193	44.57	TUFF - Very low to low strength, fresh, grey white tuff										
	44.88	From 44.52m, coal lense 15mm thick										
	45	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark brown to black										PL(A) = 1.98 PL(D) = 1.19
192	45.57	COAL - Medium to high strength, black coal						46.05m: P,sh,pl,ro	GT009			
	46	From 45.15m, tuff band 20mm thick From 45.31m, tuff band 15mm thick From 45.37m, tuff band 35mm thick From 45.46m, tuff band 10mm thick						46.44m: P,sh,pl,ro	C	100	100	
191	47	SILTSTONE - Medium to high strength, fresh, grey siltstone										PL(A) = 2.02 PL(D) = 0.95
	47.76	TUFF - Medium to high strength, fresh, grey white tuff										
190	47.88											
	48	SILTSTONE - Medium to high strength, fresh, grey siltstone						48.15m-48.22m, Fg 48.29m-48.34m, Fg 48.4m: P,sh,pl,ro 48.59m: P,sh,pl,ro 48.68m: P,sh,pl,ro				
189		From 48.15m to 48.22m, extremely low strength, extremely weathered, fragmented										
	49	From 48.78m to 48.85m, tuff band						48.99m: P,sh,pl,ro	C	100	89	PL(A) = 3.02 PL(D) = 1.41
188	49.88											

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 6 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
187		SANDSTONE - Medium to high strength, fresh, grey, fine grained sandstone *(continued)*						50.4m: P,sh,pl,ro	C	100	89	
	51											PL(A) = 1.62 PL(D) = 0.86
186	51.64								C	100	87	
	51.78	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark grey carbonaceous siltstone						51.83m-51.88m, Fg 51.95m-51.99m, Fg				
	52 52.01											
	52.14	COAL - Low to medium strength, fresh, black coal From 51.93m, stone band 20mm thick										
185		SANDSTONE - Medium to high strength, fresh, grey, fine grained sandstone										
	53							53.04m: P,sh,pl,ro	C	100	100	PL(A) = 1 PL(D) = 0.76
184		SILTSTONE - Medium to high strength, fresh, grey siltstone										
	53.76											
		SANDSTONE - Medium to high strength, fresh, grey, fine grained sandstone										
183	54							54.44m: Clay seam, 6mm thick				
									GT010			
	55											PL(A) = 2.58 PL(D) = 1.75
182								55.35m: P,sh,pl,ro	C	100	100	
		From 55.72m to 56.28m, fine to coarse grained sand with some fine to medium sized subrounded, subangular gravel										
	56	From 56.28m, fine to medium grained										
181												
	57											PL(A) = 1.24 PL(D) = 1.13
180								57.49m: P,sh,pl,ro				
								57.83m: P,sh,pl,ro				
	58							58.09m: P,sh,pl,ro				
179												
		From 58.48m, fine to coarse grained sand with some fine to medium sized subangular, subrounded gravel							C	100	100	
	59											
178												PL(A) = 1.36 PL(D) = 1.1

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 7 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
177		SANDSTONE - Medium to high strength, fresh, grey, fine grained sandstone *(continued)*										
		From 60.24m to 60.73m, with some wisps less than 1mm carbonaceous						60.78m: P,sh,pl,ro				
	61											
176												PL(A) = 0.85 PL(D) = 0.89
									C	100	100	
	62											
175												
	63											
174												PL(A) = 0.9 PL(D) = 0.61
	64											
173												
									C	100	100	
	65											
172												
	66											PL(A) = 1.25 PL(D) = 0.97
171								66.2m: J,50°,pl,ro 66.23m: J,130°,pl,ro				
		From 66.32m, fine to medium grained										
		From 66.4m, carbonaceous band, 5mm thick						66.67m: P,sh,pl,ro 66.78m: P,sh,pl,ro	GT011			
	67	From 66.41m to 66.44m, siltstone band										
170		From 67m to 67.2m, siltstone intrusion										
		From 67.13m, coal lense 5mm thick						67.5m: P,sh,pl,ro	C	100	100	
		From 67.48m to 67.51m, very low to low strength, moderately weathered										PL(A) = 0.73 PL(D) = 0.64
	68											
169		From 68.25m to 68.28m, very low to low strength, moderately weathered						68.54m: P,sh,pl,ro				
	69							68.97m: P,sh,pl,ro				
	69.16							69.13m: P,sh,pl,ro				
168		SILTSTONE - Medium to high strength, fresh, grey siltstone							C	100	97	
		From 69.85m to 70.12m, fine to						69.83m: P,sh,pl,ro				

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 8 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
167		medium grained sand										PL(A) = 0.88 PL(D) = 0.53
	70.3	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone						70.18m: P,sh,pl,ro 70.5m: P,sh,pl,ro				
	71							70.94m: P,sh,pl,ro 71.12m: P,sh,pl,ro 71.22m: P,sh,pl,ro	C	100	97	
166	71.52	SILTSTONE - Medium to high strength, fresh, grey siltstone						71.44m: P,sh,pl,ro 71.52m: P,sh,pl,ro				
	72											PL(A) = 1.02 PL(D) = 0.49
165									GT012			
	73								C	100	100	PL(A) = 2.56 PL(D) = 1.09
164												
	74											
163	74.28											
	74.4	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark brown black carbonaceous siltstone interlayered with some coal						74.4m-74.6m, J,sv,ir,ro 74.74m: P,sh,pl,ro				
	75	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark brown From 74.89m to 74.92m, coal band						75m: P,sh,pl,ro				PL(A) = 1.03 PL(D) = 0.52
162		From 75.8m, tuff band, extremely low to very low strength, 8mm thick										
	76	From 76.02m, tuff band, extremely low to very low strength, 6mm thick From 76.4m, tuff band, extremely low to very low strength, 20mm thick							C	100	98	
161		From 76.5m to 76.53m, tuff band, extremely low to very low strength										
	77	From 76.8m to 77.37m, intermixed with tuff bands										PL(A) = 1.19 PL(D) = 1.39
160												
	78	78.05 SILTSTONE - Medium to high strength, fresh, grey siltstone										
159												
	79							78.87m: P,sh,pl,ro 79m: Fr,80°,ir,ro	C	100	94	PL(A) = 0.99 PL(D) = 1.01
	79.15	TUFF - Very low strength, moderately weathered, grey white tuff							GT013			
158	79.33	From 79.73m to 79.75m, tuff band						79.52m-79.8m, Fr,sv,ir,ro				

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 9 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
157	80.05	From 79.8m to 79.84m, tuff band From 79.93m to 79.95m, tuff band CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark brown carbonaceous siltstone *(continued)*						79.93m: P,sh,pl,ro	C	100	94	
156	81	SANDSTONE - Medium to high strength, fresh, grey, fine grained sandstone From 80.2m to 80.24m, tuff band From 80.23m to 80.5m, with some carbonaceous wisps						81.73m: P,sh,pl,ro 81.91m: P,sh,pl,ro	GT014			PL(A) = 0.97 PL(D) = 0.47
155	82	From 81.2m to 81.9m, with some siltstone bands up to 80mm thick						82.72m: P,sh,pl,ro 82.93m: P,sh,pl,ro	C	100	100	
154	83							83.4m: J,70°,ir,ro				
	83.5	SILTSTONE - Medium to high strength, fresh, dark grey siltstone						83.83m: P,sh,pl,ro				PL(A) = 1.87 PL(D) = 0.04
153	84 84.0	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark brown carbonaceous siltstone From 84.06m to 84.16m, coal						84.35m: P,sh,pl,ro				
152	85 85.0	SILTSTONE - Medium to high strength, fresh, grey siltstone						84.86m: P,sh,pl,ro 85.41m: P,sh,pl,ro	C	100	100	
151	86							85.96m: P,sh,pl,ro 86.09m: P,sh,pl,ro				
	86.3	SANDSTONE - Medium to high strength, fresh, grey, fine grained sandstone From 86.62m to 86.7m, tuff band, very low strength, grey						86.46m: P,sh,pl,ro 86.79m: P,sh,pl,ro 86.92m: P,sh,pl,ro	C	100	100	PL(A) = 1.1 PL(D) = 0.68
150	87							87.2m: P,sh,pl,ro 87.67m: P,sh,pl,ro				PL(A) = 0.58 PL(D) = 0.51
149	88	From 88.15m to 88.28m, extremely low strength, highly weathered, clay like properties						88.15m-88.28m, weathered zone 88.65m: P,sh,pl,ro	C	100	96	
148	89							89.11m: P,sh,pl,ro 89.34m: P,sh,pl,ro				
	89.51	LAMINITE - Medium to high strength, fresh, grey, fine grained laminite						89.56m: P,sh,pl,ro				

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

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LOCATION: Bylong

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DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 10 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
147		LAMINITE - Medium to high strength, fresh, grey, fine grained laminite *(continued)*										PL(A) = 0.98 PL(D) = 0.54
								90.49m: P,sh,pl,ro				
								90.74m: P,sh,pl,ro				
								90.83m: P,sh,pl,ro				
	91	From 91m to 91.45m, fractured zone, healed						91m-91.45m, F, healed				
146								91.53m: P,sh,pl,ro	C	100	85	
								91.62m: P,sh,pl,ro				
								91.65m: P,sh,pl,ro				PL(A) = 1.86 PL(D) = 0.94
	92							91.99m: P,sh,pl,ro				
145									GT015			
	93											
144								93.3m: P,sh,pl,ro				
	93.5	SANDSTONE - Medium to high strength, fresh, grey siltstone										
								93.76m: P,sh,pl,ro				
	94											
143								94.47m: P,sh,pl,ro	C	100	100	PL(A) = 2.04 PL(D) = 0.66
								94.83m: P,sh,pl,ro				
	95											
142								95.5m: J,45°,pl, closed				
	96											
								96.05m: P,sh,pl,ro				PL(A) = 1.52 PL(D) = 0.88
141	96.25	SILTSTONE - Medium to high strength, fresh, grey siltstone										
								96.45m: P,sh,pl,ro				
	97											
140								97.21m: P,sh,pl,ro				
									C	100	100	PL(A) = 1.2 PL(D) = 0.77
								97.71m: P,sh,pl,ro				
	98	From 97.8m to 97.88m, tuff band						97.95m: P,sh,pl,ro				
	98.13	From 97.9m to 98.03m, carbonaceous band										
139		From 98.11m to 98.13m, tuff band										
	98.77	CARBONACEOUS SILTSTONE / STONEY COAL - Medium strength, fresh, dark brown to black carbonaceous siltstone / stoney coal										PL(A) = 0.85 PL(D) = 0.39
	99							99.04m: P,sh,pl,ro				
138		SILTSTONE - Medium to high strength, fresh, grey siltstone							C	100	95	

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TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 11 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
137		SILTSTONE - Medium to high strength, fresh, grey siltstone *(continued)*										
									GT016			
	101	From 100.9m to 101.0m, fractured zone, clay infill						100.93m: P,sh,pl,ro 101.05m: P,sh,pl,ro	C	100	95	
136		From 101.09m to 101.26m, fractured zone, clay infill						101.34m: P,sh,pl,ro 101.36m: P,sh,pl,ro 101.49m: P,sh,pl,ro 101.53m: P,sh,pl,ro 101.7m: P,sh,pl,ro 101.8m: P,sh,pl,ro				PL(A) = 1.3 PL(D) = 0.39
	101.68	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark brown to black										
	102 102.0	SILTSTONE - Medium to high strength, fresh, grey siltstone						101.83m-101.84m, Fz 101.98m-102m, Fz 102.17m-102.30m, J, sv, pl, un 102.19m: P, 5°, pl, ro 102.28m-102.32m, fragmented				PL(A) = 0.33 PL(D) = 0.28
135	103											
	103.2	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark brown-black carbonaceous siltstone with trace calcite and trace to some coal in parts						102.38m-102.51m, J, 55°, pl, ti	C	100	63	PL(A) = 1.35 PL(D) = 0.78
	103.64											
	104	SANDSTONE - High to very high strength, fresh, grey to dark grey, fine to medium grained sandstone						104.13m: P, sh, pl, ti				PL(A) = 3.61 PL(D) = 2.68
134	104.52	From 104.3m, laminite										
		SILTSTONE - High strength, fresh, dark grey siltstone							C	100	100	
133	105											PL(A) = 1.28 PL(D) = 0.41
	105.56	COAL - High strength, fresh, black coal						105.53m: P, sh, pl, ro 105.56m-105.65m, J, sv, pl, ro				
	105.83											
	106	SILTSTONE - Medium to high strength, fresh, grey to dark grey siltstone, with some extremely to very low strength bands						105.58m: P, sh, pl, ro 105.68m: P, sh, pl, ro 105.7m: P, sh, pl, ro 105.74m: P, sh, pl, un 105.82m: P, sh, pl, un 105.84m: P, sh, pl, un 105.85m: P, sh, pl, un 105.86m: P, sh, pl, un 105.88m-105.89m, P, 35°, pl, ti 105.90m-105.91m, P, 28°, pl, ti 105.93m: P, sh. pl, ro 106.04m-106.16m, fractured zone 106.28m: P, 6°, pl, ti 106.30m-106.31m, P, 10°, pl, ti 106.43m: P, sh, pi, ti 107.56m-107.75m, J, 50°, pl, ti 107.81m-108.10m, J, 80°, pl, ti 107.89m: P, sh, ir, ti 107.94m: P, sh, ir, ti 108.09m-108.45m, fractured 108.40m-108.45m, fragmented 108.71m: P, sh, pl, ro	GT017 C	100	76	PL(A) = 1.51 PL(D) = 0.76 PL(A) = 2.06 PL(D) = 1
132	107											
	107.08	COAL - High strength, fresh black coal From 107.36m to 107.54m, carbonaceous siltstone										
	107.77	MUDSTONE - Low to medium strength, fresh, dark brown mudstone with trace coal lenses up to 3mm thick										
131	108											
	108.75	SANDSTONE - Medium to high strength, fresh, light grey to grey, fine grained sandstone							C	100	98	PL(A) = 0.14 PL(D) = 0.13 PL(A) = 0.75 PL(D) = 1.48
130	109											
129												
128												

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 12 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
127		SANDSTONE - Medium to high strength, fresh, light grey to grey, fine grained sandstone *(continued)* From 110.2m, high to very high strength						109.22m: P, sh, pl, ro	C GT018	100	98	PL(A) = 4.04 PL(D) = 1.19
	110.88											
126	111	COAL - Medium to high strength, fresh black coal						111.05m-111.07m, fragmented 111.40m-111.50m, fractured zone, tight 111.69m: P, sh, pl, ro				PL(A) = 0.61 PL(D) = 0.63
	111.84	From 111.71m, carbonaceous siltstone						111.83m: P, sh, pl, ro	GT019			
125	112	SANDSTONE - High to very high strength, fresh, light grey to grey fine to medium grained sandstone						112.49m: P, 6°, un, ro	C	100	96	PL(A) = 3.4 PL(D) = 1.6
124	113											
123	114											PL(A) = 3.12 PL(D) = 1.59
122	115							115.51m: P, sh, pl, ro	C	100	96	PL(A) = 3.26 PL(D) = 1.52
121	116											
	116.23	COAL - High strength, fresh black coal with some carbonaceous siltstone						116.24m-116.31m, J, 45°-50°, pl, ti 116.37m: P, sh, pl, ro				
	116.52								GT020			
120	117	SILTSTONE/SANDSTONE - Medium to high strength, fresh, grey to dark grey siltstone with interbedded fine grained sandstone bands from 2mm to 60mm										PL(A) = 1.15 PL(D) = 0.07
	117.4											
119	118	COAL - Medium to high strength, fresh black coal						117.64m: P, sh, pl, ti	C GT021	100	92	PL(A) = 2.09 PL(D) = 0.49
118	119	From 118.91m to 119.00m, low to medium strength tuff band						118.38m: P, sh, pl, ro 118.51m-118.75m, J, 60°-75°, ir, ro 118.75m-118.82m, J, 60°, ir, ro 118.82m-118.83m, P, sh, ir, ro 118.91m-119.00m, fractured	C	100	90	PL(A) = 1.5 PL(D) = 0.5
		From 119.81m to 119.96m, medium						119.70m-119.72m, P, 22°, pl, ro				

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

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BORE No: AGE01
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SHEET 13 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
117		to high strength tuff band COAL - Medium to high strength, fresh black coal *(continued)*						119.70000001m: P, sh, un, ti 119.91m: P, sh, un, ti 120.09m-120.22m, J, sv, pl, ro 120.21m: P, sh, pl, ro 120.21m-120.29m, J, 45°-60°, ir, ti 120.29m-120.32m, fractured 120.61m: P, sh, cu, ro 120.64m: P, sh, pl, ro 120.65m: P, sh, pl, ro 120.67m: P, sh, pl, ro 120.80m-120.91m, J, 50°, pl, ti 121.15m-121.27m, J, 70°, pl, ti 121.44m-121.75m, J, 80°, pl, ti 121.85m: P, sh, P, ro 122.49m: P, sh, un, ro 122.71m-122.82m, J, 85°, pl, ti 123.12m-123.30m, J, 45°-90°, cu, ro 123.3m: P, sh, pl, ro 123.37m: P, sh, P, ro 123.37m-123.44m, J, sv, pl, ro				PL(A) = 0.53 PL(D) = 0.26
	121	From 120.67m to 120.91m, tuff band (medium to high strength)										
116									C	100	92	PL(A) = 1.1 PL(D) = 0.59
	121.85	From 121.7m, carbonaceous siltstone										
	122								GT022			
115		TUFFACEOUS CLAYSTONE - Medium strength, fresh, light grey tuffaceous claystone										PL(D) = 0.73
	122.41	COAL - High strength, fresh black coal										
	123											
114												
	123.56	SANDSTONE - High strength, fresh, grey to dark grey, fine to medium grained sandstone with some siltstone laminations ranging from 1mm to 10mm thick							GT023			PL(A) = 1.93 PL(D) = 1.11
	124											
113									C	100	94	
	125											
112												PL(A) = 2.06 PL(D) = 1.45
	126											
111									GT024			PL(A) = 2.29 PL(D) = 1.29
	126.57	COAL - Low to medium strength, fresh black coal with some siderite in parts						126.57m-126.65m, J, 75°, pl, ti, fragmented 126.65m: P, sh, pl, ro 126.80m-126.90m, J, 80°, pl, ti 126.87m-126.90m, fragmented 126.90m-126.94m, J, 50°, pl, ti 126.92m-127.01m, J, 50°, pl, ro 126.94m-127.01m, J, 45°-80°, pl, ro 127.08m: P, sh, un, ti 127.30m-127.45m, J, 45°, un, ro 127.45m-127.56m, P, 25°, pl, ro 127.47m: P, 8°, pl, ro 127.48m-127.58m, J, sv, pl, ti 127.60m-127.63m, P, 40°, pl, ti 127.62m-127.68m, P, 45°, un, ti				
	127											PL(A) = 0.53 PL(D) = 0.28
110									C	100	82	
	128											
109												
	129								GT025			
108									C	100	75	PL(D) = 0.16

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TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
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Geotechnics / Environment / Groundwater

BOREHOLE LOG

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BORE No: AGE01
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DATE: 25/10 - 7/11/12
SHEET 14 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
107								128.01m-128.07m, P, 40°, pl, ro	C	100	75	
	130.43	From 130.31m, carbonaceous siltstone						128.02m-128.73m, J, sv, un, ro				
		SANDSTONE - Medium to high strength, fresh, grey to dark grey, fine to coarse grained sandstone with some siltstone laminations in parts						129.07m-129.19m, J, sv, cu, ro	GT026			PL(A) = 1.53 PL(D) = 1.6
	131							129.11m-129.15m, fractured				
106								129.35m-129.67m, J, sv, pl, ti	C	99	99	
								129.8m: P, sh, pl, ro				
								129.93m-129.94m, P, 5°, pl, ti				
								130.08m-130.18m, J, sv, ch ro				
	132	From 132.0m, high to very high strength						130.09m-130.22m, J, sv, un, ro				
105								130.14m: P, sh, pl, ro				
								130.19m: P, sh, pl, ro				PL(A) = 2.96 PL(D) = 2.19
	133											PL(A) = 2.79 PL(D) = 2.75
104									C	100	99	
	134											
103		From 134.37m to 134.63m, mudstone bands						134.37m-134.38m, P, 25°, pl, ro				PL(A) = 1.33 PL(D) = 0.59
								134.40m-134.41m, P, 15°, pl, ro				
	135											
102								135.26m-135.32m, J, 45°, pl, ro				
								135.28m-135.34m, J, 45°, pl, ti				
	136											PL(A) = 4.99 PL(D) = 3.16
101									C	100	97	
	137											
100												PL(A) = 5.56 PL(D) = 3.7
	138							138.33m: P, sh, pl, ro				
99								138.36m: P. sh, un, ro	C		78	
	138.8	SILTSTONE - Medium to high strength, fresh, dark grey siltstone						138.75m: P. sh, un, ro				
	139							138.80m-138.91m, J, 50°, cu, ti				PL(A) = 1.14
98								138.82m-138.92m, J, 50°, cu, ti				
								139.05m-139.17m, J, 45°-60°, un, ro	C	100	97	

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

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WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
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BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 15 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
97		SILTSTONE - Medium to high strength, fresh, dark grey siltstone *(continued)*							GT027			
								140.53m-140.72m, J, 70°, pl, ro 140.56m-140.76m, J, 68°, pl, ro	C	100	97	PL(A) = 1.86 PL(D) = 0.96
	141							141.03m-141.20m, J, 60°, cu, ti 141.40m-141.55m, J, 45°, un, ti				
96	141.71	SANDSTONE - Very high strength, fresh, grey, fine to medium grained sandstone with some siltstone laminations and trace coal and siderite in parts										PL(A) = 2.15 PL(D) = 0.67
	142							141.96m: P, sh, un, ro				PL(A) = 7.88 PL(D) = 3.36
95									C	96	94	
	143							142.62m-142.87m, J, 78°, un, ti 142.88m-143.23m, J, 45°, un, ro 142.96m-143.14m, J, sv, cu, ti (x2)				
94												
	144											
93	144.48	SILTSTONE - High strength, fresh, grey siltstone with some fine grained sand						144.40m-145.05m, J, 45°, pl, ro 144.52m-144.84m, J, 85°, pl, ti 144.80m-145.05m, J, 65°, pl, ro 144.97m-145.12m, J, 50°, un, ti				PL(A) = 2.58 PL(D) = 1.93
	145								C	100	93	PL(A) = 2.4 PL(D) = 0.99
92												
	146							146.00m-146.80m, J, 60°, un, ti				
91												
	147											
90												PL(A) = 2.26 PL(D) = 1.35
	148											
89	148.48	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone From 148.84m to 146.97m, tuff band							C	100	100	PL(A) = 1.86 PL(D) = 0.9
	149								GT028			
88								>>				

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 16 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
87		SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone *(continued)* From 150.0m, trace to some siderite bands ranging from 10mm to 100mm thick										PL(A) = 1.43 PL(D) = 1.13
86	151								C	100	100	
85	152							152.23m-152.64m, J, sv, cu, ti				PL(A) = 2.76 PL(D) = 3.01
84	153							153.04m-153.37m, J, sv, un, in, calcite 153.24m-153.32m, J, 50°, pl, ti 153.41m-153.47m, P/J, ???, 10°, un, in, calcite (7) 153.46m-153.60m, J, sv, un, ???, ti				PL(A) = 0.44 PL(D) = 0.21
83	154 154.34	SILTSTONE/SIDERITE - Low strength, fresh, grey and light brown siltstone with medium strength siderite bands up to 150mm thick						154.13m-154.15m, extremely weathered band 154.53m-154.65m, J, 60°, pl, int, calcite (10mm thick) 154.56m-154.68m, J, 45°-??, cu, int, calcite (8mm thick) 154.68m-154.76m, J, 50°, pl, int, calcite (4mm thick) 154.71m-154.74m, J, 48°, pl, dis, int, calcite (4mm thick) 154.73m-154.79m, J, 75°, pl, dis, int, calcite (8mm thick) 154.82m-154.86m, J, 40°, pl, dis, int, calcite (3mm thick) 155.07m-155.08m, P, sh, 5°, un, int, calcite (2mm thick) 155.18m-155.23m, J, 45°, pl, int, calcite (1mm thick) 155.47m-155.49m, P, 23°, pl, int, calcite (1mm thick) 155.79m-155.83m, P, 40°, cu, int, calcite (2mm thick) 155.81m: P, sh, pl, int, calcite (1mm thick) 155.81m-155.82m, P, 10°, cu, int, calcite (1mm thick) 155.84m-155.97m, J, 55°, pl, ti 155.86m-155.88m, P, 15°, pl, ti	C	100	60	PL(A) = 0.71 PL(D) = 0.43
82	155											
81	156 156.1	Bore discontinued at 156.1m, limit of investigation										
80	157											
79	158											
78	159											

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.26 AHD
EASTING: 229454.86
NORTHING: 6414924.44
DIP/AZIMUTH: 90°/--

BORE No: AGE01
PROJECT No: 49761.02
DATE: 25/10 - 7/11/12
SHEET 17 OF 17

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
77								155.90m-155.92m, P, 40°, cu, int, calcite				
76	161											
75	162											
74	163											
73	164											
72	165											
71	166											
70	167											
69	168											
68	169											

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan/Fulham **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 11.25m, HQ3 to 156.10m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.38 AHD
EASTING: 229450.88
NORTHING: 6414924.81
DIP/AZIMUTH: 90°/--

BORE No: AGE01-W
PROJECT No: 49761.02
DATE: 25/10/12-
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
237	0.15	TOPSOIL - Brown silty sand topsoil, generally comprising fine grained sand, trace clay, abundant rootlets							Stickup=0.5m
		CLAY - Hard, brown clay, M<<Wp							
	1	From 1.0m, with some fine sized subrounded gravel							
236		From 1.5m, orange brown							
	2								
235	2.5	SANDY GRAVEL - Brown sandy gravel, fine to coarse grained sand, fine to medium sized, subrounded gravel, moist to wet							
	3	From 2.8m, saturated							
234									
	4								
233									
	5								
232									
	6								From 0m to 11.7m, backfill
231									
	7								
230									
	8								
229									
	9								
228		From about 9.5m, with some cobbles							

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 13.5m, HQ3 to 20.45m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS: Top of pipe RL 237.89 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.38 AHD
EASTING: 229450.88
NORTHING: 6414924.81
DIP/AZIMUTH: 90°/--

BORE No: AGE01-W
PROJECT No: 49761.02
DATE: 25/10/12-
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
227		SANDY GRAVEL - Brown sandy gravel, fine to coarse grained sand, fine to medium sized, subrounded gravel, moist to wet *(continued)*							
226	11.53	SANDSTONE - Medium strength, moderately to slightly weathered, yellow brown, fine to medium grained sandstone		C	11.53		PL(A) = 2.74 PL(D) = 2.38		
	12.1	From 12.01m to 12.1m, granite fragments		C	11.9 11.94				
	12.23	CORE LOSS - 0.13m		C	12.32				
225	12.32 12.39	SANDSTONE - Medium strength, moderately to slightly weathered, yellow brown, fine to medium grained sandstone		C	12.52				
	12.79 12.85	CORE LOSS - 0.07m		C	12.79 12.85				From 11.7m to 14.3m, bentonite
224		BASALT - High to very high strength, fresh, grey basalt							
	13.5	CORE LOSS - 0.06m		S	13.5		25/85mm		
	13.59 13.75	Casing advanced rotary drilling, no sample recovered		C	13.59				
	14	SILTSTONE - Very low to low strength, slightly weathered to fresh, grey siltstone, trace fine to medium grained sand and clay			13.96 14.0		PL(A) = 0 PL(D) = 0.02		
223		CORE LOSS - 0.16m		C					
		SANDSTONE - Very low to low strength, fresh, grey, fine grained sandstone with some clay and silt							
	15	From 13.92m to 13.98m, extremely low strength, extremely weathered, clay seam			15.04				
222		From 14.14m to 14.16m, extremely low strength, extremely weathered		GT001					
		From 14.47m to 14.49m, extremely low strength, extremely weathered, clay seam			15.5 15.55		PL(A) = 0.14 PL(D) = 0.08		
	16	From 16.3m to 16.45m, carbonaceous siltstone, medium to high strength, fresh, dark grey		C					
221	17	From 16.93m to 17.12m, high strength							From 14.3m to 20.45m, gravel From 14.45m to 20.45m, Class 18 PVC
220	18.12	LAMINITE - Very low to low strength, fresh, grey and dark grey laminite, fine grained sand			18.03 18.07		PL(A) = 0.1 PL(D) = 0.05		
		From 18.56m to 18.82m, fine grained sandstone layer							
219	19	From 19.18m to 19.75m, fine grained sandstone layer		C					
		From 19.47m, coal lense, 5mm thick							
218	19.75	SILTSTONE - Low strength, fresh, grey siltstone							

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 13.5m, HQ3 to 20.45m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS: Top of pipe RL 237.89 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 237.38 AHD
EASTING: 229450.88
NORTHING: 6414924.81
DIP/AZIMUTH: 90°/--

BORE No: AGE01-W
PROJECT No: 49761.02
DATE: 25/10/12-
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
217		SILTSTONE - Low strength, fresh, grey siltstone *(continued)*		C					End cap
	20.45	Bore discontinued at 20.45m, limit of investigation			20.45				
216	21								
215	22								
214	23								
213	24								
212	25								
211	26								
210	27								
209	28								
208	29								

RIG: Total (Envirodrill) **DRILLER:** Total (Sawyer) **LOGGED:** Cowan **CASING:** HW to 11.25m

TYPE OF BORING: Solid flight auger with TC Bit to 9.2m, rotary to 13.5m, HQ3 to 20.45m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS: Top of pipe RL 237.89 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 241.80 AHD
EASTING: 230106.57
NORTHING: 6143814.11
DIP/AZIMUTH: 90°/--

BORE No: AGE02-D
PROJECT No: 49761
DATE: 30/10/2013
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
241	0.15	TOPSOIL - Generally comprising dark brown, fine grained silt topsoil, humid							Stickup = 0.509
		SANDY SILT - (Loose), dark brown, fine grained sandy silt, M<<Wp							
	1	From 1.0m, medium dense with some fine sized subangular/subrounded gravel							
240	2.0	GRAVEL - Loose, brown, coarse sized subrounded gravel with trace silt							From 0.0m to 4.8m, grout From -0.51m to 5.5m, Class 18 blank
		From 2.6m to 2.8m, fine sized subangular/subrounded gravel, wet							
239	2.9	CLAY - Firm, brown clay with some medium sized gravel, M>Wp							
	3.4	CLAYEY GRAVEL - Medium dense, brown, fine to medium sized subangular / subrounded clayey gravel, with some fine grained sand and stiff gravelly clay in parts							
238	4								
237	5								From 4.8m to 5.2m, bentonite
	5.5	GRAVEL - Medium dense, brown, fine to medium sized subangular / subrounded gravel, slightly clayey with some medium grained sand, wet							
236	6								
235	7	From 7.5m, dense with some clay							
234	8								From 5.2m to 11.5m, gravel From 5.5m to 11.5m, screen
233	9	From 9.1m, medium dense							
232									

RIG: Hydropower Scout **DRILLER:** Total Drilling (Sawyer) **LOGGED:** Fulham **CASING:** HW to 11.4m

TYPE OF BORING: HW casing advanced, rotary to 12.5m

WATER OBSERVATIONS: Free groundwater observed at 2.3m

REMARKS: Top of Pipe RL 242.31 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 241.80 AHD
EASTING: 230106.57
NORTHING: 6143814.11
DIP/AZIMUTH: 90°/--

BORE No: AGE02-D
PROJECT No: 49761
DATE: 30/10/2013
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
231	11	GRAVEL - Medium dense, brown, fine to medium sized subangular / subrounded gravel, slightly clayey with some medium grained sand, wet *(continued)*							11
	11.4								End cap
230	12	SANDSTONE - Extremely low strength, extremely weathered, friable, grey, fine to medium grained sandstone							12
	12.5	Bore discontinued at 12.5m, limit of investigation							
229	13								13
228	14								14
227	15								15
226	16								16
225	17								17
224	18								18
223	19								19
222									

RIG: Hydropower Scout **DRILLER:** Total Drilling (Sawyer) **LOGGED:** Fulham **CASING:** HW to 11.4m

TYPE OF BORING: HW casing advanced, rotary to 12.5m

WATER OBSERVATIONS: Free groundwater observed at 2.3m

REMARKS: Top of Pipe RL 242.31 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 241.81 AHD
EASTING: 230105.5
NORTHING: 6413814.87
DIP/AZIMUTH: 90°/--

BORE No: AGE02-S
PROJECT No: 49761
DATE: 31/10/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
241	0.15	TOPSOIL - Generally comprising dark brown, fine grained silt topsoil, humid							Stickup = 0.567
		SANDY SILT - (Loose), dark brown, fine grained sandy silt, M<<Wp							From 0.0m to 1.2m, grout From -0.57m to 1.8m, Class 18 blank
	1	From 1.0m, medium dense with some fine sized subangular/subrounded gravel							From 1.2m to 1.6m, bentonite
240	2.0	GRAVEL - Loose, brown, coarse sized subrounded gravel with trace silt							
		From 2.6m to 2.8m, fine sized subangular/subrounded gravel, wet							
239	2.9	CLAY - Firm, brown clay with some medium sized gravel, M>Wp							From 1.6m to 4.8m, 5mm gravel From 1.8m to 4.8m, Class 18 screen
	3.4	CLAYEY GRAVEL - Medium dense, brown, fine to medium sized subangular / subrounded clayey gravel, with some fine grained sand and stiff gravelly clay in parts							
238	4								
237	4.8	Bore discontinued at 4.8m, limit of investigation							End cap
236	5								
235	6								
234	7								
233	8								
232	9								

RIG: Hydropower Scout **DRILLER:** Total Drilling (Sawyer) **LOGGED:** Fulham **CASING:** HW to 4.8m

TYPE OF BORING: HW casing advanced, rotary to 4.8m

WATER OBSERVATIONS: Free groundwater observed at 2.3m

REMARKS: Top of Pipe RL 242.38 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 1 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
241	0.15	TOPSOIL - Generally comprising dark brown, fine grained silt topsoil, humid							A			
		SANDY SILT - (Loose), dark brown, fine grained sandy silt, M<<Wp							A			
	1	From 1.0m, medium dense with some fine sized subangular/subrounded gravel							S			6,6,6 N = 12
240												
	2								A			
	2.0	GRAVEL - Loose, brown, coarse sized subrounded gravel with trace silt							A			
239		From 2.6m to 2.8m, fine sized subangular/subrounded gravel, wet							S			5,4,2 N = 6 pp = 60
	2.9	CLAY - Firm, brown clay with some medium sized gravel, M>Wp										
	3											
	3.4	CLAYEY GRAVEL - Medium dense brown fine to medium sized subangular / subrounded clayey gravel with some fine grained sand, stiff gravelly clay in parts							A			8,5,9 N = 14
238	4								S,pp			pp = 150-200 kPa
237	5											
	5.5	GRAVEL - Medium dense, brown, fine to medium sized subangular / subrounded gravel, slightly clayey with some medium grained sand, wet							A			pp = 50
									S			14,15,18 N = 33
236	6								S			12,8,18 N = 26
235	7											
		From 7.5m, dense with some clay							S			11,14,17 N = 31
234	8											
233	9											
		From 9.1m, medium dense							S			8,11,13 N = 24
232												

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 2 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
231	11	GRAVEL - Medium dense, brown, fine to medium sized subangular / subrounded gravel, slightly clayey with some medium grained sand, wet *(continued)*							S			16 (bouncing)
	11.4											
230		SANDSTONE - Extremely low strength, extremely weathered, friable, grey, fine to medium grained sandstone										
	12								S			11,21,23 N = 44
229	12.5	COAL - Medium to high strength, slightly weathered, black coal										
	13 13.0	COAL - High strength, fresh stained, highly fractured black coal						From 13.0m to 13.42m, highly fractured with pyrite				
	13.47	CORE LOSS - 1.48m (13.47m to 14.95m)						13.47m: CORE LOSS: 1480mm	C	34	0	
228	14											
227	15 14.95	SILTSTONE - Extremely low to very low strength, fresh stained, friable grey siltstone										PL(A) = 0.02
		From 15.25m to 15.90m, rock roller, no core recovered							A			
226	15.9 16	SILTSTONE - Very low strength, fresh stained, friable, grey siltstone							C	100	0	PL(A) = 0.07 PL(D) = 0.03
225	17											
	17.35	SANDSTONE - Very low strength, fresh stained, friable, grey fine grained sandstone							C	100	8	PL(A) = 0.06 PL(D) = 0.06
224	18							17.9m: P, 5°, ir, sm				
	18.1	SILTSTONE - Very low strength, fresh, dark grey siltstone						18.05m: BP, 2°, cu, ro				PL(A) = 0.08 PL(D) = 0.07
223		From 18.6m, low strength						18.65m: P, 5°, pl, sm				PL(A) = 0.11
	19	From 18.85m to 19.04m, extremely low strength, tuff band						19.23m: BP, 10°, pl, ro, clay	C	100	89	
222									GT001			PL(A) = 0.1

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 3 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
221	20.27	From 19.98m to 20.13m, very low strength, tuff band						19.98m: BP, sh, pl, ro 20.13m: BP, sh, pl, ro				
		SANDSTONE - Low strength, fresh, light grey and grey, fine to medium grained sandstone							C	100	89	PL(A) = 0.14
	21							20.94m: J, 40°, un, ro				
								21.26m: BP, 5°, cu, sm				PL(A) = 0.1
220	22 22.0	MUDSTONE - Low strength, fresh, dark grey mudstone										PL(A) = 0.14 PL(D) = 0.16
		From 22.29m to 22.39m, tuff band						From 22.26m to 22.28m, fragmented				
	22.55	SANDSTONE - Medium strength, fresh, grey, fine to medium grained sandstone						22.58m: BP, sh, pl, ro	C	96	96	
219	23							23.06m: BP, sh, pl, ti				
								23.36m: P, sh, pl, sm				
218	24 24.07	CORE LOSS - 0.15m (24.07m to 24.22m)						24.07m: CORE LOSS: 150mm				
	24.22	SILTSTONE - Low strength, fresh, grey and light grey siltstone										PL(A) = 0.24 PL(D) = 0.16
217	25 24.96	CARBONACEOUS MUDSTONE - Medium strength, fresh, dark brown carbonaceous mudstone						From 25.25m to 25.32m, fragmented				
		From 25.22m to 25.4m, coal						From 25.32m to 25.43m, 2 x J, sv, st, sm	C	99	96	PL(A) = 0.56 PL(D) = 0.36
216	25.79	SILTSTONE - Medium strength, fresh, grey siltstone						From 25.6m to 25.7m, J, 45°, cu, ro				
	26											PL(D) = 0.36
	26.3	SANDSTONE - Low to medium strength, fresh, grey, fine to medium grained sandstone						26.3m: BP, 5°, un, ro				
215	27											
								27.56m: BP, 2°, un, sm	C	100	100	
214	28											
		From 28.08m, very low strength										
	28.25	CORE LOSS - 0.16m (28.25m to 28.41m)						28.25m: CORE LOSS: 160mm				
	28.41	SANDSTONE - Very low strength, fresh, grey, fine to medium grained sandstone										
213	29	From 28.66m, medium strength with some fine sized gravel in parts						28.9m: P, sh, pl, sm, clay	C	92	72	
								29.12m: P, sh, un, sm				
212									GT002			PL(A) = 0.52

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 4 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE - Very low strength, fresh, grey, fine to medium grained sandstone *(continued)*						30m: 2 x P, sh, un, sm	C	92	72	PL(A) = 0.76 PL(D) = 0.62
211									C	92	92	
	30.96 31.08	CORE LOSS - 0.12m (30.96m to 31.08m)						30.96m: CORE LOSS: 120mm				
		SANDSTONE - Medium strength, fresh, grey, fine to coarse grained sandstone with some fine sized gravel in parts						31.21m: J, 45°, pl, ro 31.26m: P, sh, cu, sm 31.57m: P, 5°, un, ro				
210	32							32.18m: P, 10°, pl, ro, clay 32.66m: BP, 5°, pl, ro, ti	C	98	95	PL(A) = 0.96 PL(D) = 0.93
209	33											
208								33.43m: P, 5°, pl, ro	C	91	87	
	34 34.09 34.24	CORE LOSS - 0.15m (34.09m to 34.24m)						34.05m: P, 5°, ir, sm 34.09m: CORE LOSS: 150mm				PL(A) = 0.5
207		SANDSTONE - Medium strength, fresh, grey, fine to coarse grained sandstone with some fine sized gravel in parts						34.64m: P, 5°, ir, sm, coal	C	94	92	
	35							From 35.05m to 35.07m, P, 10°, un, ro				
206	35.58 35.65	From 35.52m, low strength CORE LOSS - 0.07m (35.58m to 35.65m)						35.53m: BP, 5°, ir, ti, clay 35.58m: CORE LOSS: 70mm	C	93	85	
	36	SANDSTONE - Very low to low strength, fresh, grey, fine to medium grained sandstone						35.9m: P, 30°, pl, ro				PL(D) = 5.75
205	36.33 36.44	From 35.77m, very high strength CORE LOSS - 0.11m (36.33m to 36.44m)						36.33m: CORE LOSS: 110mm 36.5m: BP, 2°, pl, ro From 36.52m to 36.91m, J, 45°-90°, ir, ro				
	37	SANDSTONE - Medium strength, fresh, grey, fine to medium grained sandstone						From 37.24m to 37.39m, J, 85°, ir, ro 37.39m: 2 x P, 5°-10°, un, ro, fe	C	96	96	
204	38											PL(A) = 0.62 PL(D) = 0.44
									GT003			
203		From 38.66m, siderite band, 70mm thick						38.65m: BP, sh, pl, ro				
	39	From 38.9m, mudstone band, 80mm thick										
202									C	100	100	

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 5 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
201		SANDSTONE - Medium strength, fresh, grey, fine to medium grained sandstone *(continued)*						40.29m: P, 3°, un, sm, fe				PL(A) = 0.68 PL(D) = 0.57
	41	From 41.0m, some fine to medium sized gravel						41.11m: BP, sh, un, sm	C	100	100	
200								41.66m: P, 2°, pl, ro				
	42							42.07m: BP, sh, un, ti				PL(A) = 1.36
199								From 42.88m to 43.01m, 3 x P, 5°, pl, ro				
	43								C	100	100	
198												PL(A) = 1.15 PL(D) = 1.01
	44											
197												
	45											PL(A) = 1.38
196								45.42m: P, 10°, un, ro From 45.42m to 45.82m, J, 75°, un, ro				
	46											
195								46.5m: P, 10°, pl, ro	C	100	100	
	47											PL(A) = 1.11
194	47.65	CARBONACEOUS MUDSTONE - High strength, fresh, dark brown carbonaceous mudstone with some coal						From 47.65m to 43.38m, J, 80°-90°, un, ro				
	48											
193								48.63m: P, sh, un, ro From 48.76m to 49.0m, 3 x J, 70°-90°, un, ro	C	100	99	
	49											
192	49.42	SILTSTONE - Low strength, fresh, grey siltstone						From 49.37m to 49.42m, fragmented	GT004			PL(A) = 0.16 PL(D) = 0.14
									C	100	42	

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
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Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 6 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
191	51	SILTSTONE - Low strength, fresh, grey siltstone *(continued)* From 50.15m, interbedded with fine grained sandstone laminations From 50.55m, medium strength From 50.85m to 54.87m, highly fractured, interbedded with extremely low to very low strength bands (crush zone)						From 50.12m to 50.2m, F, 45°, pl, ti, 2mm throw 50.79m: 2 x P, sh, pl, ro From 50.84m to 50.87m, 2 x P, 5°, un, sm From 50.97m to 51.03m, fragmented	C	100	42	PL(A) = 0.34 PL(D) = 0.36
190	52								C	92	0	
189	52.88	CORE LOSS - 0.15m (52.88m to 53.03m)						52.88m: CORE LOSS: 150mm				
188	53.03 54	SILTSTONE - Medium strength, fresh, highly fractured, grey to light grey siltstone interbedded with very low strength bands (crush zone)							C	100	0	PL(D) = 0.09
187	54.27 55	SILTSTONE - Medium strength, fresh, grey and light grey siltstone From 54.67m, interbedded with laminations of extremely low to very low strength siltstone generally at 50mm to 100mm spacings						From 55.02m to 55.14m, J, 45°, un, ti 55.28m: P, sh, pl, sm				PL(D) = 1.38
186	56							From 55.52m to 55.79m, J, 80°, un, ti 56.39m: P, sh, pl, sm	C	100	89	PL(A) = 1.02
185	57	From 57.14m, very low strength, tuff						56.8m: P, 8°, cu, sm 56.87m: P, 5°, pl, sm, clay infill	GT005			
184	57.34 58	CARBONACEOUS MUDSTONE - High strength, fresh, dark brown carbonaceous mudstone with some coal lenses						From 56.94m to 57.08m, 5 x P, sh, pl, sm 57.45m: P, sh, pl, ro From 57.61m to 57.72m, J, 60°, un, ro From 57.72m to 57.76m, fragmented 58.1m: P, sh, pl, sm, clay infill	C	100	57	PL(A) = 1.62
183	58.91 59	From 58.55m to 58.81m, low strength, tuff SANDSTONE - Medium strength, fresh, grey and dark grey, fine to medium grained sandstone with some very low strength bands						From 58.3m to 58.37m, 2 x J, sv, un, ro 58.81m: P, sh, pl, ro, clay infill	C	98	77	PL(A) = 0.14
182	59.5 59.54	CORE LOSS - 0.04m (59.5m to 59.54m)						From 59.43m to 59.5m, fragmented 59.5m: CORE LOSS: 40mm				

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

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SAMPLING & IN SITU TESTING LEGEND

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BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
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E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 7 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
181	61	SANDSTONE - Medium strength, fresh, grey fine to medium grained sandstone with some bands of siltstone *(continued)*						59.64m: P, 2°, un, ro, calcite From 59.66m to 59.73m, J, 50°, un, ro 59.77m: P, sh, un, ro, calcite 60.42m: P, sh, pl, ti From 60.42m to 60.58m, J, 65°, pl, ro, fe 60.47m: P, sh, un, sm 60.5m: P, sh, un, sm				PL(A) = 0.57
180	61.1	SILTSTONE - Medium strength, fresh, grey siltstone							C	100	95	
	62	From 61.75m to 62.68m, low strength						From 62.15m to 62.27m, J, 50°, pl, sm, clay				PL(A) = 0.29 PL(D) = 0.21
179	63											
	63.11	LAMINITE - Medium strength, fresh, grey, fine to medium grained laminite						From 63.38m to 63.51m, F, 45°, pl, ti, 7mm throw				
178	64											PL(A) = 0.46
177	65							64.88m: P, sh, un, sm, clay	C	100	98	
176	66							From 65.79m to 65.91m, J, 80°, pl, ti 65.96m: P, sh, pl, ro, clay				PL(A) = 0.9 PL(D) = 0.6
	66.33	MUDSTONE - Medium strength, fresh, grey mudstone										
175	67							67.04m: P, sh, pl, ro, clay				
174								67.56m: P, sh, un, sm	C	100	97	
	68	From 67.8m to 69.23m, carbonaceous						From 68.0m to 68.22m, 2 x J, 70°-90°, ir, sm 68.22m: P, sh, pl, sm, extremely low strength 68.31m: P, 3°, un, sm, extremely low strength 68.86m: P, sh, un, sm 68.99m: P, 5°, ir, sm				PL(A) = 0.69
173		From 68.37m to 68.52m, low strength, tuff band From 68.52m to 68.79m, high strength, coal band										
	69	From 69.04m to 69.23m, some coal From 69.23m, high strength										
172									C GT006	100	100	PL(A) = 1.33

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 8 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
171	71	MUDSTONE - Medium strength, fresh, grey mudstone *(continued)*						>>	C	100	100	
170	72	From 71.8m, medium strength										PL(A) = 1 PL(D) = 0.84
169	72.84	From 72.61m to 72.7m, very low strength, tuff band						72.61m: BP, sh, pl, sm				PL(A) = 0.48
	72.91	From 72.81m, coal						72.84m: CORE LOSS: 70mm				
	73	CORE LOSS - 0.07m (72.84m to 72.91m)						73.01m: P, sh, pl, ro				
168	73.41	CARBONACEOUS MUDSTONE - Medium strength, fresh, dark brown carbonaceous mudstone with some coal						73.4m: BP, 5°, un, sm	C	98	98	PL(A) = 0.7 PL(D) = 0.71
	74	LAMINITE - Medium strength, fresh, grey to light grey, fine to medium grained laminite						73.98m: P, sh, un, sm				PL(A) = 1.66
167	74.52	MUDSTONE - High strength, fresh, grey mudstone						74.69m: P, sh, un, sm				
	75							75.18m: P, 7°, ir, clay				PL(A) = 1.76
166		From 75.76m, some coal						75.52m: BP, 3°, un, ro 75.59m: P, sh, un, sm				
	76							75.89m: 2 x P, sh, un, ro				
	76.0	SANDSTONE - High strength, fresh, grey, fine grained sandstone							C	100	98	
165	76.91							76.78m: BP, 5°, un, ro				
	77	SILTSTONE - High strength, fresh, grey siltstone										PL(A) = 1.35
164	77.94	From 77.86m, tuff						77.86m: BP, sh, pl, ro				
	78	CARBONACEOUS MUDSTONE - High strength, fresh, dark brown carbonaceous mudstone with some coal										
	78.45							78.45m: CORE LOSS: 60mm				PL(A) = 1.12
163	78.51	CORE LOSS - 0.06m (78.45m to 78.51m)						From 78.56m to 79.01m, J, sv, pl, ro, calcite				
	79	CARBONACEOUS MUDSTONE - High strength, fresh, dark brown carbonaceous mudstone with some coal						78.78m: P, sh, un, sm, calcite 79.24m: P, sh, pl, ro, ca 79.32m: P, sh, un, ro	C	98	94	
162	79.52	SILTSTONE - High strength, fresh, grey siltstone						79.79m: J, 45°, un, ro				

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 9 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
161	81	SILTSTONE - High strength, fresh, grey siltstone *(continued)*						From 80.5m to 80.74m, J, 55°, un, ro	C	98	94	PL(A) = 1.33
160	82	From 81.88m, laminite						82.12m: BP, sh, un, sm	GT007			PL(A) = 1.41
159	82.58	SANDSTONE - High to very high strength, friable, fine to medium grained sandstone							C	100	97	PL(A) = 2.84 PL(D) = 3.05
158	83.86	From 83.63m, high strength siltstone						From 83.86m to 84.18m, 4 x P, 3°, un, ro				
157	84.7	COAL - High strength, fresh, black coal						85.18m: P, sh, pl, ro				PL(A) = 1.19
156	86	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone with some siltstone laminations						85.69m: P, 2°, pl, ro 86.12m: P, 5, ir, ro, coal	C	100	79	
155	87											PL(A) = 1.56
154	88							From 88.14m to 88.26m, J, 45°, un, ti	GT008 C	100	100	PL(A) = 2.31
153	89							89.07m: BP, sh, pl, sm				
152	89.35	MUDSTONE - High strength, fresh, dark grey mudstone						From 89.55m to 89.76m, J, 85°, pl, sm				PL(A) = 1.66

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 10 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		MUDSTONE - High strength, fresh, dark grey mudstone *(continued)*						90m: P, sh, un, sm	C	100	100	
151		From 90.59m to 91.1m, sandstone and siltstone bands up to 100mm thick						90.66m: BP, 5°, pl, sm 90.74m: BP, sh, un, sm				
	91											PL(A) = 2.31
150									GT009 C	100	92	
	91.88	COAL - Medium to high strength, fresh, black coal						From 92.03m to 92.17m, J, 70°, pl, ro, ti From 92.2m to 92.3m, J, sv, pl, sm, ti From 92.34m to 92.63m, J, sv, un, sm, ca From 92.75m to 93m, 3 x J, 45°-60°, un, ro, ca From 93.07m to 93.2m, J, 80°, un, sm, ca				
149	92											
	93											
		From 93.4m, some carbonaceous mudstone						93.25m: P, sh, pl, ro From 93.3m to 93.39m, fragmented 93.63m: 3 x P, sh, pl, sm 93.66m to 94.23m, J, sv, un, ro				
148	94											
		From 94.3m to 94.54m, tuff band						94.33m: P, sh, pl, ro 94.37m: J, 10°-45°, ir, ti, clay	C	100	91	
147	95							94.87m: P, sh, pl ti				PL(A) = 0.46
		From 95.2m, carbonaceous mudstone										
	95.41	TUFF CLAYSTONE - High strength, fresh, grey tuff claystone							GT010			
146	96							95.73m: P, sh, pl, sm				PL(D) = 1.17
	96.04	COAL - High strength, fresh, black coal										
								From 96.35m to 96.85m, J, sv, un, ro				
145	97											
	97.11	SILTSTONE - High strength, fresh, grey siltstone						96.93m: P, sh, un, sm				
												PL(A) = 2.85 PL(D) = 1.84
144	98								C GT011	100	97	
								>>				
143	98.88	LAMINITE - High strength, fresh, grey, fine to medium grained laminite										PL(A) = 1.59 PL(D) = 1.23
	99											
	99.54	SANDSTONE - Medium strength, fresh, grey, medium to coarse grained sandstone							C	100	96	
142												

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 11 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
141		SANDSTONE - Medium strength, fresh, grey, medium to coarse grained sandstone *(continued)*						100.55m: P, 5°, un, ro	GT012			PL(A) = 0.72 PL(D) = 0.71
	101 101.07	COAL - High strength, fresh, black coal						From 101.1m to 101.4m, J, 45°, un, ro	C	100	96	
140	102							From 101.56m to 101.66m, 3 x J, 45°, un, ro From 101.79m to 101.92m, J, 45°, ir, ro				PL(A) = 1.28
139								From 102.26m to 102.61m, J, 75°, un, ro				
	103							From 102.65m to 102.77m, 2 x J, 45°, st, ro From 102.78m to 104.11m, J, sv, un, ro				
138								103.44m: P, 3°, pl, ro	C	100	97	
	104							From 104.0m to 104.29m, J, sv, un, ti				
137								From 104.4m to 104.6m, J, 45°, un, ro				
	104.91 105	SANDSTONE - Medium strength, fresh, grey, fine to medium grained sandstone						From 104.6m to 104.83m, J, sv, un, ro From 104.83 to 104.88, fragmented From 104.88m to 105.5m, J, 85°, un, ro	C	100	100	
136								105.71m: J, 35°, un, ro From 105.71 to 105.96, J, 70°-90°, ir, ro				
	106								GT013			PL(A) = 0.85 PL(D) = 0.58
135		From 106.6m, high strength						106.61m: P, 5°, un, ro	C	100	98	
	107											
134		From 107.4m, fine grained sandstone						107.85m: BP, 5°, un, sm				
	108											PL(A) = 2.59 PL(D) = 2.71
133												
	109	From 109.04m to 109.28m, very high strength mudstone band						109.13m: J, 45°, st, ro	C	100	100	
132								From 109.86m to				PL(A) = 2.12 PL(D) = 1.02

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 12 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
131		SANDSTONE - Medium strength, fresh, grey, fine to medium grained sandstone *(continued)*						110.22m, J, sv, un, ro	C	100	100	
	110.85											
	111	SILTSTONE - High strength, fresh, grey siltstone										PL(A) = 1.85
130												
	112											
	112.1	SANDSTONE - Very high strength, fresh, grey, fine to medium grained sandstone						112.3m: 2 x P, 5°, cu, sm				
129									C	100	100	
	113							112.86m: P, 2°, cu, sm				
								113.16m: P, sh, un, sm				
128												PL(A) = 3.27
								113.73m: P, sh, pl, ro				
	114							113.97m: P, 2°, un, sm				
127		From 114.48m to 115.03m, mudstone						114.48m: P, 2°, un, sm 114.62m: P, 2°, un, sm From 114.65m to 114.85m, J, sv, pl, sm				
	115											PL(A) = 3.08 PL(D) = 3.61
126								From 115.53m to 115.88m, J, 60°, un, ro	C	100	99	
	116							115.87m: BP, 7°, un, sm 116.06m: BP, 5°, un, ro				
125								116.47m: P, 5°, un, ro	GT014			
	117											PL(A) = 3.25
124												PL(A) = 3.27
	118							>>				
123									C	100	100	
	119											
	119.34	SILTSTONE - High strength, fresh, grey siltstone										PL(A) = 1.01
122								119.88m: P, sh, un, ro				

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 13 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
121	121	SILTSTONE - High strength, fresh, grey siltstone *(continued)* From 120.65m to 120.66m, very low strength tuff						From 120.41m to 120.53m, J, 40°, cu, sm, ti 120.65m: BP, sh, pl, sm	C	100	100	
120	122							From 121.85m to 122.09m, 2 x J, 80°, cu, sm	C	100	98	PL(A) = 1.37 PL(D) = 1.39
119	122.2	SANDSTONE - High strength, fresh, grey, fine grained sandstone						From 122.58m to 122.63m, J, 75°, pl, ti, ca				
118	123	From 122.92m, some siderite bands up to 30mm thick										PL(A) = 1.85 PL(D) = 1.88
117	124								C	100	100	
116	125								GT015			PL(A) = 1.56
115	126							125.54m: 2 x P, sh, pl, ti, ca 126.06m: J, 12°, pl, sm, ti, ca From 126.2m to 126.42m, 3 x J, 45°, pl, ti				PL(A) = 1.04
114	127	From 127.0m, medium strength						126.73m: J, 25°, pl, sm, ti, ca	C	100	99	
113	127.9 128	SILTSTONE - Low strength, fresh, grey siltstone with some fine grained sandstone bands up to 50mm thick and some siderite bands up to 30mm thick						From 127.65m to 127.78m, 4 x J, 5°-20°, ir, ro, ti, ca From 128.13m to 128.24m, 3 x J, 50°, un, ti, ca From 128.5m to 128.65m, 2 x J, 40°, cu, ti, ca 128.69m: P, sh, cu, sm, clay				PL(A) = 0.27 PL(D) = 0.16
112	129							From 129.21 to 129.63, 6 x J, 30°-45°, pl, ro, ti, ca From 129.79m to	C	100	82	

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 241.71 AHD
EASTING: 230107.68
NORTHING: 6413813.52
DIP/AZIMUTH: 90°/--

BORE No: AGE02
PROJECT No: 49761
DATE: 16-26/9/13
SHEET 14 OF 14

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
111	131	SILTSTONE - Low strength, fresh, grey siltstone with some fine grained sandstone bands up to 50mm thick and some siderite bands up to 30mm thick *(continued)* From 130.27m, medium strength						130.1m, highly fractured to fragmented From 130.27m, medium strength From 130.37m to 130.49m, J, 45°, pl, sm, ti, ca, 40mm thick From 130.78m to 130.85m, J, sv, un, ti, ca 130.95m: J, 45°, cu, ti, ca From 131.56m to 132.08m, J, 80°, un, sm, ti, ca	C	100	82	PL(A) = 0.45 PL(A) = 0.52
110	132											
	132.18	Bore discontinued at 132.18m, limit of investigation										
109	133											
108	134											
107	135											
106	136											
105	137											
104	138											
103	139											
102												

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 13.5m, HW to 39.5m

TYPE OF BORING: Solid flight auger to 6.0m, HW casing advanced rotary to 13m, HQ to 132.18m

WATER OBSERVATIONS: Free groundwater observed at 2.3m, 20L/1.5 mins at 78.4m to 79m, 60L/mins at 101.1m to 101.4m, 160L/mins at EOH

REMARKS: 100% water loss at 31m, 100% water loss at 36.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 246.93 AHD
EASTING: 230107.64
NORTHING: 6412878.03
DIP/AZIMUTH: 90°/--

BORE No: AGE03-W
PROJECT No: 49761
DATE: 7 - 11/12/2012
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
246	0	TOPSOIL - (Stiff), brown, fine to medium grained sandy silt topsoil, some fine subangular gravel, M<Wp							Stickup=0.55m From 0m to 0.3m, cement
	1			S	1.0		7,9,12 N = 21		
	1.35	CLAYEY SILT - Very stiff, brown clayey silt, some fine to medium grained sand, M<Wp			1.45				
245	2								
	2.3	CLAY - Hard, dark brown clay, M>Wp			2.5				
	2.65	SANDY SILT - Hard, brown, fine to medium grained sandy silt, some clay, M<Wp		S,pp			7,10,12 N = 22 >500kPa		
244	3				2.95				
	3.2	SILTY CLAY - (Very stiff), dark brown silty clay, M>Wp							
	3.7	SANDY SILT - (Soft), yellowish brown, fine grained sandy silt, M<Wp							
243	3.9				4.0				
	4			pp	4.1		200-250kPa		
	4.1	CLAY - Very stiff, dark brown clay, M>Wp		S	4.2		3,5,4		
	4.25	SILTY CLAY - Stiff, yellowish and orangish brown mottled grey silty clay, M>Wp		pp	4.25 4.35		N = 9 100-200kPa		
		SILTY SAND - Loose, yellowish brown silty fine to medium grained sand, trace fine to medium subrounded gravel, saturated			4.45				
242	5								
	5.3	SAND - Medium dense, fine to medium grained sand, some silt, some fine subrounded gravel, saturated			5.5				
				S			3,7,7 N = 14		
	5.8	GRAVELLY SAND - Medium dense, brown, fine subrounded gravelly fine to medium grained sand, trace silt, saturated			5.95				
241	6								
	6.3	GRAVELLY SAND - Medium dense, brown mottled red, fine subrounded gravelly fine to coarse sand, trace silt and clay, saturated			6.8				
		From 6.9m, trace to some basalt and fine to coarse grained sandstone boulders (inferred from drilling resistance, cuttings and SPT samples)		S			23,14,10 N = 24		
240	7				7.25				
239	8								
		From 8.3m, dense			8.3				
				S			15,16,17 N = 33		From 0.3m to 16.7m, grout
					8.75				
238	9								
237				S,pp	9.8		100kPa		

RIG: Hydropower Scout **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 17.00m

TYPE OF BORING: Solid flight auger to 5.5m, wash boring to 13.20m, HQ3 to 31.50m

WATER OBSERVATIONS: Free groundwater observed at 4.7m

REMARKS: Top of pipe RL 247.584 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 246.93 AHD
EASTING: 230107.64
NORTHING: 6412878.03
DIP/AZIMUTH: 90°/--

BORE No: AGE03-W
PROJECT No: 49761
DATE: 7 - 11/12/2012
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
				S,pp	10.25		28 for 100mm, 0,0		
	10.4	SANDY CLAY/CLAYEY SAND - Firm/(medium dense), brown, fine to medium grained sandy clay/clayey sand, slightly gravelly (gravel subangular and subrounded fine grained)		S	10.4		34, 30 for 90mm, 0		
236	11	From 10.4m, interbedded with basalt and sandstone boulders (inferred from high drilling resistance and cuttings)			10.85				11
	11.45	CORE LOSS - 0.3m		C	11.0				
	11.75	SANDY CLAY/CLAYEY SAND - Firm/(medium dense), brown, fine to medium grained sandy clay/clayey sand, slightly gravelly (gravel subangular and subrounded fine grained)			11.75				
235	12								12
234	13								13
	13.2	GRAVELLY SAND - (Dense), brown, fine to medium subangular and subrounded gravelly fine to medium grained sand interbedded with basalt and sandstone cobbles/boulders			13.2				
	13.7	CORE LOSS - 0.75m		C					
233	14				14.0				14
	14.45	GRAVELLY SAND - (Dense), brown, fine to medium subangular and subrounded gravelly fine to medium grained sand interbedded with basalt and sandstone cobbles/boulders			14.45				
	14.85	CORE LOSS - 0.63m		C					
232	15				15.0				15
	15.5	GRAVELLY SAND - (Dense), brown, fine to medium subangular and subrounded gravelly fine to medium grained sand interbedded with basalt and sandstone cobbles/boulders			15.5				
231	16			C					16
	15.95	CORE LOSS - 0.63m			16.45				
	16.58								
	16.7	GRAVELLY SAND - (Dense), brown, fine to medium subangular and subrounded gravelly fine to medium grained sand interbedded with basalt and sandstone cobbles/boulders		C					
230	17			C	17.0				17
	16.95								
	17.0								
	17.3	TUFF - Fresh, very low strength, light grey tuff		pp	17.3		250kPa		From 16.7m to 18.0m, bentonite
	17.32	CLAY - Fresh, extremely low strength, dark grey clay			17.32		PL(A) = 0.97		
	17.68	CORE LOSS - 0.3m (wash bored to clean hole after installing casing)		C	17.48				
229	18				17.75		PL(A) = 4.63		18
	17.96								
	18.0	CLAY - Fresh, very low strength, dark grey clay			18.0				
		SILTSTONE - Fresh, low strength, grey siltstone laminated with some tuff and fine to medium grained sandstone							
		From 17.62m, grading into sandstone			18.57		PL(A) = 1.97		
228	19	SANDSTONE - Fresh, high strength, light grey, fine to medium grained sandstone with some tuff laminations							19
	19.2	From 17.88m, grading into tuff			19.26				
		TUFF - Fresh, low strength, light grey tuff laminated with some fine to medium strength sandstone							
					19.73		PL(A) = 1.23		
227	19.98	SANDSTONE - Fresh, medium strength, light grey, fine to			19.77		PL(D) = 1.02		

RIG: Hydropower Scout **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 17.00m

TYPE OF BORING: Solid flight auger to 5.5m, wash boring to 13.20m, HQ3 to 31.50m

WATER OBSERVATIONS: Free groundwater observed at 4.7m

REMARKS: Top of pipe RL 247.584 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 246.93 AHD
EASTING: 230107.64
NORTHING: 6412878.03
DIP/AZIMUTH: 90°/--

BORE No: AGE03-W
PROJECT No: 49761
DATE: 7 - 11/12/2012
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
226	20.17	medium grained sandstone with trace siltstone laminations			20.2				
	20.27								
	20.33	LAMINITE - Fresh, medium strength, grey laminite							
	20.46	From 19.8m, grading into siltstone			20.6		PL(A) = 2.72		
	20.65	SILTSTONE - Fresh, medium strength, dark grey siltstone *(continued)*							
	21	From 20.04m, significant water loss			21.0		PL(A) = 2.05		21 From 18.0m to 24.15m, gravel From 18.15m to 24.15m, Class 18 PVC Screen
	21.32	CORE LOSS - 0.07m			21.05				
		SILTSTONE - Fresh, medium strength grey siltstone							
		COAL - Fresh, medium strength, dark brown/black coal							
225	22	COAL/CARBONACEOUS SILTSTONE - Fresh, high strength, dark brown carbonaceous siltstone laminated with coal			21.96		PL(A) = 1.55		22
		SILTSTONE - Fresh, medium strength, grey siltstone							
		From 20.91m to 21.94m, fine to medium grained sandstone band			22.73		PL(A) = 1.53		
224	23	SANDSTONE - Fresh, medium strength, light grey, fine to medium grained sandstone							23
	23.26	From 21.32m to 21.97m, some siltstone laminations		C					
	23.46	From 22.9m, low strength, fine to coarse grained		C					
		From 23.22m, very low strength		GT001	23.5				
		CORE LOSS - 0.20m		C	23.63		PL(A) = 0.17		
223	24	SANDSTONE - Fresh, very low strength, light grey, fine to coarse grained sandstone		C	23.86		PL(A) = 0.97		24 End cap
		From 23.70m, medium strength		C	24.0				
		From 23.43m to 24.64m, laminite band			24.74				
222	25			GT002	25.0		PL(A) = 2.14 PL(D) = 2.06		25
					25.04				
		From 25.45m to 25.76m, very high strength, fine to medium grained sandstone band			25.54		PL(A) = 23.21 PL(D) = 30.44		
221	26								26
		From 26.07m, very low to low strength, thinly laminated with very low strength clay seams			26.12		PL(A) = 0.44 PL(D) = 0.3		
	26.46								
	26.55	SANDY CLAY - Fresh, extremely low strength, light grey, medium strength sandy clay			26.55				From 24.15m to 29.0m, bentonite
	26.7								
	26.73	CORE LOSS - 0.15m							
220	27	SANDY CLAY - Fresh, extremely low strength, light grey, fine to medium grained sandy clay							27
		SANDSTONE - Fresh, medium strength, light grey, fine to medium grained sandstone							
					27.84				
219	28			GT003					28
				C	28.28		PL(A) = 2.56 PL(D) = 1.7		
					28.33				
218	29								29
					29.6				
217	29.89			C					

RIG: Hydropower Scout **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 17.00m

TYPE OF BORING: Solid flight auger to 5.5m, wash boring to 13.20m, HQ3 to 31.50m

WATER OBSERVATIONS: Free groundwater observed at 4.7m

REMARKS: Top of pipe RL 247.584 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 246.93 AHD
EASTING: 230107.64
NORTHING: 6412878.03
DIP/AZIMUTH: 90°/--

BORE No: AGE03-W
PROJECT No: 49761
DATE: 7 - 11/12/2012
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
216	30.05	SILTSTONE - Fresh, medium strength, grey and brown siltstone (bedded on 10° offset) *(continued)*		C					From 29.0m to 31.5m, 5mm gravel
	30.44	SANDSTONE - Fresh, medium strength, light grey, fine to medium grained sandstone			30.55				At 30.5m, vibrating wire piezometer
	30.55	From 30.29m to 30.39m, low to medium strength siltstone band		C	30.83		PL(A) = 1.16		
	31	CORE LOSS - 0.11m							31
		SANDSTONE - Fresh, medium strength, light grey, fine to medium grained sandstone							End cap
	31.5	From 30.76m, fine to coarse grained			31.5				
215	32	Bore discontinued at 31.5m, limit of investigation							32
214	33								33
213	34								34
212	35								35
211	36								36
210	37								37
209	38								38
208	39								39
207									

RIG: Hydropower Scout **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 17.00m

TYPE OF BORING: Solid flight auger to 5.5m, wash boring to 13.20m, HQ3 to 31.50m

WATER OBSERVATIONS: Free groundwater observed at 4.7m

REMARKS: Top of pipe RL 247.584 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.08 AHD
EASTING: 228634.9
NORTHING: 6411382
DIP/AZIMUTH: 90°/--

BORE No: AGE04
PROJECT No: 49761
DATE: 23/11/2012
SHEET 1 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
257	0.0	TOPSOIL - Brown, gravelly silt topsoil, generally comprising fine to medium sized subangular gravel with some fine grained sand, humid		D	0.1				Stickup=0.81m
				D	0.25				
	0.5	GRAVELLY SILT - Brown, fine to medium sized, subangular gravelly silt with trace to some fine to medium grained sand, humid		D	0.5				
				D	0.75				
256	1	From 0.75m, some clay			1.0				
				S			7,10,11 N = 21		
					1.45				
255	2	2.0 CLAYEY SAND - Brown, fine to medium grained clayey sand with trace to some silt		D	2.0				
		From 2.5m, with some coarse grained sand			2.5				
				S			3,5,10 N = 15		
254	3				2.95				
253	4	4.0 SILTY SAND - Brown, fine to coarse grained silty sand with trace clay (humid?)		S	4.0		6,9,9 N = 18		
					4.45				
252	5	From 5.5m, with some clay			5.5				
				S			3,4,5 N = 9		
251	6				5.95				
250	7	7.0 SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized, subangular, subrounded gravel, saturated		S	7.0		8,10,17 N = 27		
					7.45				
249	8	From 8.5m, with some clay			8.5				
				S			15,15,16 N = 31		
248	9				8.95				

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 18.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 18.35m, HQ3 to 66.17m

WATER OBSERVATIONS: Free groundwater observed at 6.30m

REMARKS: Top of pipe RL 257.76 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.08 AHD
EASTING: 228634.9
NORTHING: 6411382
DIP/AZIMUTH: 90°/--

BORE No: AGE04
PROJECT No: 49761
DATE: 23/11/2012
SHEET 2 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
247		SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized, subangular, subrounded gravel, saturated *(continued)*		S	10.0 10.44		7, 15, 25/135mm		
246	11								11
	11.5	SANDY CLAY - Firm to stiff, brown, fine grained sandy clay		S, pp	11.5 11.95		2,1,3 N = 4 50-200kPa		
245	12								12
244	13 13.0	SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized subangular gravel with some clay		S	13.0 13.45		9,14,26 N = 40		13
243	14								14
				S	14.5 14.95		8,8,4 N = 12		
242	15								15
241	16								16
		From 16.5m, with some fine to coarse sized subangular gravel		S	16.5 16.79		24, 25/140mm		
240	17								17
	17.9	SILTSTONE - Extremely low to very low strength, highly weathered, grey, siltstone		S	18.0 18.1		25/100mm		
239	18								18
	18.4	SANDSTONE - Very low to low strength, slightly weathered, grey white fine to medium grained sandstone			18.35 18.49		PL(A) = 0.15 PL(D) = 0.07		
238	19	From 19.02m to 19.18m, siltstone band		C					19
	19.3	SILTSTONE - Very low to low strength, slightly weathered to fresh, grey, grey to white siltstone			19.77		PL(A) = 0.47 PL(D) = 0.2		

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 18.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 18.35m, HQ3 to 66.17m

WATER OBSERVATIONS: Free groundwater observed at 6.30m

REMARKS: Top of pipe RL 257.76 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.08 AHD
EASTING: 228634.9
NORTHING: 6411382
DIP/AZIMUTH: 90°/--

BORE No: AGE04
PROJECT No: 49761
DATE: 23/11/2012
SHEET 3 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
237		From 19.95m, dark grey SILTSTONE - Very low to low strength, slightly weathered to fresh, grey, grey to white siltstone *(continued)*							
	20.63	From 20.52m, coal, extremely low strength, extremely weathered, black		C					
	20.8								
	20.87	CORE LOSS - 0.17m							
236	21 21.04								21
	21.2	COAL - Low to medium strength, slightly weathered to fresh, black, fragmented coal			21.2				
	21.39								
	21.55	TUFF - Very low strength, moderately weathered, white, tuff							
235	22	COAL - Low to medium strength, slightly weathered to fresh, black coal							22
		CORE LOSS - 0.19m			22.24		PL(A) = 0.93		
		COAL - Low strength, slightly weathered to fresh, black, fragmented coal		C					
234	23	SILTSTONE - Low strength, slightly weathered to fresh, grey siltstone							23
		From 21.62m to 21.65m, extremely low strength, extremely weathered							
		From 21.94m, clay band, 10mm thick			23.54		PL(A) = 0.72 PL(D) = 0.35		
		From 22.17m, low to medium strength							
233	24				24.2				24
232	25								25
	25.27	COAL / CARBONACEOUS SILTSTONE - Very low to low strength, slightly weathered, black, dark brown coal / carbonaceous siltstone			25.18		PL(A) = 1.18 PL(D) = 0.42		
		From 25.72m to 25.89m, tuff band		C					
231	26	From 25.89m, low to medium strength							26
	26.27	SILTSTONE - Low strength, fresh, grey siltstone							
230	27				27.2				27 From 0m to 54.0m, grout
	27.41	CARBONACEOUS SILTSTONE - Low strength, fresh, dark brown to black, carbonaceous silt			27.43		PL(A) = 1.51 PL(D) = 0.1		
229	28								28
		From 28.7m to 28.86m, with some coal bands up to 20mm thick		C					
228	29				29.28		PL(A) = 1 PL(D) = 0.34		29

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 18.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 18.35m, HQ3 to 66.17m

WATER OBSERVATIONS: Free groundwater observed at 6.30m

REMARKS: Top of pipe RL 257.76 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.08 AHD
EASTING: 228634.9
NORTHING: 6411382
DIP/AZIMUTH: 90°/--

BORE No: AGE04
PROJECT No: 49761
DATE: 23/11/2012
SHEET 4 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
227				C	30.18				
	30.25	COAL / STONEY COAL - Low to medium strength, fresh, black, dark brown coal / stoney coal							
226	31 30.99	SILTSTONE - Low to medium strength, fresh, grey siltstone			31.32		PL(A) = 0.54 PL(D) = 0.51		31
	31.61	COAL / STONEY COAL - Low to medium strength, fresh, black, dark brown coal / stoney coal		C					
225	32 31.94	SILTSTONE - Medium strength, fresh, grey siltstone							32
224	33				33.04 33.07		PL(A) = 1.08 PL(D) = 0.49		33
	33.27	TUFFACEOUS SANDSTONE - Low strength, moderately weathered, grey to white, fine to coarse grained tuffaceous sandstone							
	33.46	SILTSTONE - Low to medium strength, fresh, grey siltstone							
223	34			C					34
222	35				35.32		PL(A) = 2.61 PL(D) = 0.65		35
221	36				36.05				36
	36.2	LAMINITE - Medium strength, fresh, grey, fine grained laminite							
220	37				37.41		PL(A) = 5.79 PL(D) = 3.35		37
	37.9	SILTSTONE - Medium strength, fresh, grey siltstone							
219	38								38
	38.57	TUFF - Very low to low strength, fresh, grey to white							
	38.64	COAL - Low to medium strength, fresh, black coal From 38.88m, low to medium strength From 39.18m, low strength							
218	39				39.06				39
	39.4	SILTSTONE - Medium strength, fresh, grey siltstone		C					
	39.68	LAMINITE - Medium strength, fresh, grey, fine to medium grained laminite			39.94		PL(A) = 0.75		

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 18.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 18.35m, HQ3 to 66.17m

WATER OBSERVATIONS: Free groundwater observed at 6.30m

REMARKS: Top of pipe RL 257.76 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.08 AHD
EASTING: 228634.9
NORTHING: 6411382
DIP/AZIMUTH: 90°/--

BORE No: AGE04
PROJECT No: 49761
DATE: 23/11/2012
SHEET 5 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
217		LAMINITE - Medium strength, fresh, grey, fine to medium grained laminite *(continued)*					PL(D) = 0.78		
					40.82		PL(A) = 2.59 PL(D) = 1.58		
216	41								41
215	42				42.08				42
	42.2	CARBONACEOUS SILTSTONE - Medium strength, fresh, dark grey carbonaceous siltstone			42.63		PL(A) = 1 PL(D) = 0.46		
214	43								43
	43.17	LAMINITE - Medium strength, fresh, grey, fine to medium grained laminite		C					
213	44			C					44
					44.8		PL(A) = 2.22 PL(D) = 0.93		
212	45								45
	45.15	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark grey to black carbonaceous siltstone (possible coal / stoney coal?)			45.15				
211	46								46
				C					
	46.87				46.84		PL(A) = 0.91 PL(D) = 0.33		
210	47	SANDSTONE - Medium to high strength, fresh, grey, fine grained sandstone							47
	47.14	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark grey to black carbonaceous siltstone (possible coal / stoney coal?)							
209	48				48.08 48.22 48.25		PL(A) = 1.88 PL(D) = 0.63		48
208	49			C					49
	49.21	TUFF - Very low to low strength, moderately weathered, grey to white tuff with some fine to medium grained sand							
	49.6	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark grey to black carbonaceous siltstone							
	49.88								

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 18.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 18.35m, HQ3 to 66.17m

WATER OBSERVATIONS: Free groundwater observed at 6.30m

REMARKS: Top of pipe RL 257.76 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.08 AHD
EASTING: 228634.9
NORTHING: 6411382
DIP/AZIMUTH: 90°/--

BORE No: AGE04
PROJECT No: 49761
DATE: 23/11/2012
SHEET 6 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
207		(possible coal / stoney coal?)							
		From 49.74m to 49.80m, stone band							
		COAL - Medium strength, fresh, black coal *(continued)*							
	50.51	TUFF - Medium to high strength, fresh, grey to white tuff with some fine grained sand		C					
206	51 51.06	COAL - Medium strength, fresh, black coal			51.18				51
					51.66		PL(A) = 1.95 PL(D) = 0.81		
205	52	From 51.9m to 51.97m, tuff band							52
	52.19	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone		C					
204	53				53.27		PL(A) = 2.59 PL(D) = 1.4		53
203	54				54.14				54
202	55				55.17		PL(A) = 2.1 PL(D) = 0.87		55
				C					From 54.0m to 56.5m, bentonite
201	56	From 55.77m, fine to coarse grained with trace to some fine sized, subrounded gravel							56
200	57				57.15 57.18		PL(A) = 0.82 PL(D) = 0.92		57
	57.61	COAL - Low to medium strength, fresh, black coal							
199	58								58
	58.59	CORE LOSS - 0.25m		C					
	58.84	COAL - Low to medium strength, fragmented, black coal							
198	59				59.71		PL(A) = 0.87 PL(D) = 0.15		59
	60.0								

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 18.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 18.35m, HQ3 to 66.17m

WATER OBSERVATIONS: Free groundwater observed at 6.30m

REMARKS: Top of pipe RL 257.76 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.08 AHD
EASTING: 228634.9
NORTHING: 6411382
DIP/AZIMUTH: 90°/--

BORE No: AGE04
PROJECT No: 49761
DATE: 23/11/2012
SHEET 7 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
197		SILTSTONE - Medium to high strength, fresh, grey siltstone		C	60.15				From 57.17m to 63.17m, Class 18 PVC Screen
	60.49								
		SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone			60.84		PL(A) = 2.89 PL(D) = 2.19		
196	61								61
				C					From 56.5m to 66.17m, gravel
195	62								62
		From 62.64m, high to very high strength							
194	63				63.13				63
					63.86		PL(A) = 2.84 PL(D) = 2.23		
193	64			C					64
192	65								65
					65.68		PL(A) = 4.12 PL(D) = 3.46		
191	66								66
	66.17	Bore discontinued at 66.17m, limit of investigation			66.17				End cap
190	67								67
189	68								68
188	69								69

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 18.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 18.35m, HQ3 to 66.17m

WATER OBSERVATIONS: Free groundwater observed at 6.30m

REMARKS: Top of pipe RL 257.76 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.07 AHD
EASTING: 228636.91
NORTHING: 6411382.67
DIP/AZIMUTH: 90°/--

BORE No: AGE04-D
PROJECT No: 49761
DATE: 23/11/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
257	0.5	TOPSOIL - Brown, gravelly silt topsoil, generally comprising fine to medium sized subangular gravel with some fine grained sand, humid							Stickup=0.7m
256	1	GRAVELLY SILT - Brown, fine to medium sized, subangular gravelly silt with trace to some fine to medium grained sand, humid From 0.75m, some clay							
255	2.0	CLAYEY SAND - Brown, fine to medium grained clayey sand with trace to some silt From 2.5m, with some coarse grained sand							
254	3								
253	4.0	SILTY SAND - Brown, fine to coarse grained silty sand with trace clay (humid?)							From 0m to 9.0m, backfilled with drill cuttings
252	5	From 5.5m, with some clay							
251	6								
250	7.0	SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized, subangular, subrounded gravel, saturated							
249	8	From 8.5m, with some clay							
248	9								

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 2.5m

TYPE OF BORING: Wash boring from 0.0m to 17.3m

WATER OBSERVATIONS: No free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 257.63 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.07 AHD
EASTING: 228636.91
NORTHING: 6411382.67
DIP/AZIMUTH: 90°/--

BORE No: AGE04-D
PROJECT No: 49761
DATE: 23/11/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
247		SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized, subangular, subrounded gravel, saturated *(continued)*							
246	11								11
	11.5	SANDY CLAY - Firm to stiff, brown, fine grained sandy clay							From 9.0m to 14.0m, bentonite
245	12								12
244	13 13.0	SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized subangular gravel with some clay							13
243	14								14
242	15								15
241	16								16 From 14.0m to 17.3m, 5mm gravel From 14.3m to 17.3m, Class 18 PVC Screen
		From 16.5m, with some fine to coarse sized subangular gravel							
240	17								17
	17.3	Bore discontinued at 17.3m, limit of investigation							End cap
239	18								18
238	19								19

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 2.5m

TYPE OF BORING: Wash boring from 0.0m to 17.3m

WATER OBSERVATIONS: No free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 257.63 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.05 AHD
EASTING: 228637.65
NORTHING: 6411382.9
DIP/AZIMUTH: 90°/--

BORE No: AGE04-S
PROJECT No: 49761
DATE: 23/11/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
257	0.5	TOPSOIL - Brown, gravelly silt topsoil, generally comprising fine to medium sized subangular gravel with some fine grained sand, humid							Stickup=0.76m
256	1	GRAVELLY SILT - Brown, fine to medium sized, subangular gravelly silt with trace to some fine to medium grained sand, humid From 0.75m, some clay							From 0m to 2.5m, backfill with drill cuttings
255	2.0	CLAYEY SAND - Brown, fine to medium grained clayey sand with trace to some silt From 2.5m, with some coarse grained sand							From 2.5m to 5.05m, bentonite
254	3								
253	4.0	SILTY SAND - Brown, fine to coarse grained silty sand with trace clay (humid?)							
252	5	From 5.5m, with some clay							
251	6								
250	7.0	SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized, subangular, subrounded gravel, saturated							From 5.05m to 11.3m, 5mm gravel From 5.3m to 11.3m, Class 18 PVC Screen
249	8	From 8.5m, with some clay							
248	9								

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 2.5m

TYPE OF BORING: Wash boring from 0.0m to 11.3m

WATER OBSERVATIONS: No free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 257.57 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.05 AHD
EASTING: 228637.65
NORTHING: 6411382.9
DIP/AZIMUTH: 90°/--

BORE No: AGE04-S
PROJECT No: 49761
DATE: 23/11/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
247		SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized, subangular, subrounded gravel, saturated *(continued)*							
246	11								11 End cap
	11.3	Bore discontinued at 11.3m, limit of investigation							
245	12								12
244	13								13
243	14								14
242	15								15
241	16								16
240	17								17
239	18								18
238	19								19

RIG: TD Rig 103 **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 2.5m

TYPE OF BORING: Wash boring from 0.0m to 11.3m

WATER OBSERVATIONS: No free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 257.57 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.06 AHD
EASTING: 228635.88
NORTHING: 6411382.32
DIP/AZIMUTH: 90°/--

BORE No: AGE04-W
PROJECT No: 49761
DATE: 23/11/2012
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
257	0.0	TOPSOIL - Brown, gravelly silt topsoil, generally comprising fine to medium sized subangular gravel with some fine grained sand, humid		D	0.1				Stickup=0.76m
				D	0.25				
	0.5	GRAVELLY SILT - Brown, fine to medium sized, subangular gravelly silt with trace to some fine to medium grained sand, humid		D	0.5				
				D	0.75				
256	1	From 0.75m, some clay			1.0				1
				S			7,10,11 N = 21		
					1.45				
255	2.0	CLAYEY SAND - Brown, fine to medium grained clayey sand with trace to some silt		D	2.0				2
		From 2.5m, with some coarse grained sand			2.5				
				S			3,5,10 N = 15		
254	3				2.95				3
253	4.0	SILTY SAND - Brown, fine to coarse grained silty sand with trace clay (humid?)		S	4.0		6,9,9 N = 18		4
					4.45				
252	5	From 5.5m, with some clay			5.5				5
				S			3,4,5 N = 9		
251	6				5.95				6
250	7.0	SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized, subangular, subrounded gravel, saturated		S	7.0		8,10,17 N = 27		7
					7.45				
249	8	From 8.5m, with some clay			8.5				8
				S			15,15,16 N = 31		From 0m to 17.4m, grout
248	9				8.95				9

RIG: HydroPower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 18.2m

TYPE OF BORING:

WATER OBSERVATIONS: No free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 257.63 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.06 AHD
EASTING: 228635.88
NORTHING: 6411382.32
DIP/AZIMUTH: 90°/--

BORE No: AGE04-W
PROJECT No: 49761
DATE: 23/11/2012
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
247		SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized, subangular, subrounded gravel, saturated *(continued)*		S	10.0 10.44		7, 15, 25/135mm		
246	11								11
	11.5	SANDY CLAY - Firm to stiff, brown, fine grained sandy clay		S, pp	11.5 11.95		2,1,3 N = 4 50-200kPa		
245	12								12
244	13 13.0	SAND - Medium dense to dense, brown, fine to coarse grained sand with some fine to medium sized subangular gravel with some clay		S	13.0 13.45		9,14,26 N = 40		13
243	14								14
				S	14.5 14.95		8,8,4 N = 12		
242	15								15
241	16								16
		From 16.5m, with some fine to coarse sized subangular gravel		S	16.5 16.79		24, 25/140mm		
240	17								17
	17.9	SILTSTONE - Extremely low to very low strength, highly weathered, grey, siltstone		S	18.0 18.1		25/100mm		
239	18								18
	18.4	SANDSTONE - Very low to low strength, slightly weathered, grey white fine to medium grained sandstone			18.35 18.49		PL(A) = 0.15 PL(D) = 0.07		From 17.4m to 19.7m, bentonite
238	19	From 19.02m to 19.18m, siltstone band		C					19
	19.3	SILTSTONE - Very low to low strength, slightly weathered to fresh, grey, grey to white siltstone			19.77		PL(A) = 0.47 PL(D) = 0.2		

RIG: HydroPower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 18.2m

TYPE OF BORING:

WATER OBSERVATIONS: No free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 257.63 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 257.06 AHD
EASTING: 228635.88
NORTHING: 6411382.32
DIP/AZIMUTH: 90°/--

BORE No: AGE04-W
PROJECT No: 49761
DATE: 23/11/2012
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		From 19.95m, dark grey SILTSTONE - Very low to low strength, slightly weathered to fresh, grey, grey to white siltstone *(continued)*							
	20.63	From 20.52m, coal, extremely low strength, extremely weathered, black		C					
	20.8								
	20.87	CORE LOSS - 0.17m							
236	21 21.04								21
	21.2	COAL - Low to medium strength, slightly weathered to fresh, black, fragmented coal			21.2				
	21.39								
	21.55	TUFF - Very low strength, moderately weathered, white, tuff							
235	22	COAL - Low to medium strength, slightly weathered to fresh, black coal							22
		CORE LOSS - 0.19m			22.24		PL(A) = 0.93		
		COAL - Low strength, slightly weathered to fresh, black, fragmented coal		C					
234	23	SILTSTONE - Low strength, slightly weathered to fresh, grey siltstone							23
		From 21.62m to 21.65m, extremely low strength, extremely weathered							From 19.7m to 25.95m, gravel
		From 21.94m, clay band, 10mm thick			23.54		PL(A) = 0.72 PL(D) = 0.35		From 19.95m to 25.95m, Class 18 PVC Screen
		From 22.17m, low to medium strength							
233	24				24.2				24
232	25								25
	25.27	COAL / CARBONACEOUS SILTSTONE - Very low to low strength, slightly weathered, black, dark brown coal / carbonaceous siltstone			25.18		PL(A) = 1.18 PL(D) = 0.42		
		From 25.72m to 25.89m, tuff band							
231	26 25.95	From 25.89m, low to medium strength							26 End cap
		Bore discontinued at 25.95m, limit of investigation							
230	27								27
229	28								28
228	29								29

RIG: HydroPower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Cowan **CASING:** HW to 18.2m

TYPE OF BORING:

WATER OBSERVATIONS: No free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 257.63 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 259.92 AHD
EASTING: 227890.76
NORTHING: 6410501.47
DIP/AZIMUTH: 90°/--

BORE No: AGE05
PROJECT No: 49761
DATE: 29/11/2012
SHEET 1 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
259	0	SILTY CLAY - (Stiff) brown silty clay, some fine to coarse grained sand, trace fine subangular gravel, M>Wp							Stickup=0.55m From 0m to 0.3m, cement
	1	From 1.0m, very stiff		S	1.0		9,13,16 N = 29		
	1.35	SILTY SAND/SILTY CLAY - Medium dense, brown silty, fine to medium grained sand interbedded with very stiff to hard clay and silty clay, M>Wp			1.45				
258	2	From 2.5m to 2.95m, hard clay band			2.5				
				pp	2.6		>500kPa		
				S	2.7		7,14,15 N = 29		
257	3				2.95				
256	4	From 4.0m to 4.25m, sandy clay band, M>Wp, transitioning into sand			4.0				
				pp	4.0		>230-250kPa		
	4.25	SAND - Medium dense, brown, fine to medium grained sand, some fine subangular/subrounded gravel, some silt, humid		S	4.25		10,12,14 N = 26		
255	5	From 5.0m, damp			4.45				
					5.5				
	5.7	GRAVELLY SAND - Medium dense, brown, fine to coarse grained, subangular/subrounded gravelly, fine to coarse grained sand, trace silt, damp to wet		S			5,5,7 N = 12		
254	6	From 6.25m, interbedded with sandy clay in parts			5.95				
253	7				7.0				
				S			18,12,14 N = 26		
					7.45				
252	8								
	8.7	SANDSTONE - Highly weathered, low strength, brown, fine to medium grained sandstone			8.8				
251	9	From 8.7m to 9.2m, high drilling resistance using wash boring (changed to HQ at 9.2m)		S			41/130mm (bouncing) N>50		
					9.2				
					9.25				
	9.69			C	9.62		PL(A) = 0.45		
250									

RIG: Hydropower Scout **DRILLER:** Sawyer **LOGGED:** Holden **CASING:** HW to 8.6m

TYPE OF BORING: Solid flight auger to 7.0m, wash boring to 9.2m, HQ3 to 56.90m

WATER OBSERVATIONS: Free groundwater observed at 6.25m

REMARKS: Top of pipe RL 260.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 259.92 AHD
EASTING: 227890.76
NORTHING: 6410501.47
DIP/AZIMUTH: 90°/--

BORE No: AGE05
PROJECT No: 49761
DATE: 29/11/2012
SHEET 2 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.2	SILTSTONE/SANDSTONE - Moderately weathered, low strength, brown, fine to medium grained sandstone laminated with grey siltstone *(continued)*		C	10.07		PL(A) = 0.27		
					10.2				
		SILTSTONE - Slightly weathered, very low strength, grey siltstone			10.5		PL(A) = 0.17		
249	11			C					11
		From 11.2m, medium strength			11.22		PL(A) = 1.08		
		From 11.5m, fresh							
248	12				12.1				12
	12.36	TUFF - Fresh, very low strength, light grey tuff							
	12.39								
	12.48	MUDSTONE - Fresh, medium strength, dark grey mudstone							
	12.72								
247	13	COAL - Fresh, medium strength, black/dark brown coal							13
		SILTSTONE - Fresh, medium strength, grey siltstone			13.18		PL(A) = 1.19		
				C					
246	14				14.13		GT-001		14
	14.26				14.23				
		MUDSTONE - Fresh, medium strength, dark grey mudstone			14.57		PL(A) = 1.38		
245	15				15.11				15
	15.23	COAL - Fresh, medium strength, dark grey coal							
	15.5	SILTSTONE - Fresh, medium strength, grey siltstone							
244	16			C					16
					16.68		PL(A) = 1.56 PL(D) = 1.31		
243	17				17.2				17
	17.33	COAL - Fresh, medium strength, black coal			17.36		PL(A) = 1.8		
	17.7	From 17.66m, coal seam		C					
242	18	SILTSTONE - Fresh, high strength, dark grey siltstone							18
		From 17.73m to 17.74m, coal			18.14		PL(A) = 3.97		From 0.3m to 36.0m, grout
		From 17.86m to 17.89m, coal			18.17				
		From 17.95m, coal			18.5		PL(A) = 1.87		
		From 18.17m to 18.56m, medium strength, thinly laminated with coal			18.54		GT-002		
241	19				18.93				19
	19.22	CARBONACEOUS SILTSTONE/COAL - Fresh, medium strength, dark brown carbonaceous siltstone laminated with black coal		C					
					19.75		PL(A) = 2.45		
240									

RIG: Hydropower Scout **DRILLER:** Sawyer **LOGGED:** Holden **CASING:** HW to 8.6m

TYPE OF BORING: Solid flight auger to 7.0m, wash boring to 9.2m, HQ3 to 56.90m

WATER OBSERVATIONS: Free groundwater observed at 6.25m

REMARKS: Top of pipe RL 260.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 259.92 AHD
EASTING: 227890.76
NORTHING: 6410501.47
DIP/AZIMUTH: 90°/--

BORE No: AGE05
PROJECT No: 49761
DATE: 29/11/2012
SHEET 3 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	20.08	SILTSTONE - Fresh, medium strength, grey siltstone		C	20.32		PL(A) = 1.86 PL(D) = 1.39		
239	21	From 21.46m to 21.64m, medium strength sandstone band			21.14				21
238	21.91	LAMINITE - Fresh, medium strength, grey laminite		C	22.53		PL(A) = 2.11 PL(D) = 2.33		22
237	23	From 23.0m, grading into sandstone							23
	23.19	SANDSTONE - Fresh, high strength, light grey, fine to medium grained sandstone			23.44		PL(A) = 5.33 PL(D) = 3.58		
236	24								24
	24.15	CONGLOMERATE - Fresh, high strength, grey, medium grained conglomerate in a fine to medium grained sandstone matrix			24.28				
	24.33	SANDSTONE - Fresh, high strength, grey, fine to medium grained sandstone			24.66		PL(A) = 5.08 PL(D) = 3.69		
235	24.93 25	CONGLOMERATE - Fresh, high strength, grey, medium grained conglomerate in a fine to medium grained sandstone matrix							25
	25.27	SANDSTONE - Fresh, high strength, grey, fine to medium grained sandstone		C					
234	26	SILTSTONE - Fresh, medium strength, dark grey siltstone			25.97		PL(A) = 1.83 PL(D) = 2.69		26
		From 26.27m, grading into tuff							
	26.47	TUFF - Fresh, high strength, light grey tuff			26.5 26.58		PL(A) = 4.2		
233		From 26.47m to 26.97m, heat affected					GT-003		
	27								27
	27.07	From 26.97m, very low strength			27.03				
	27.15 27.27	COAL/CARBONACEOUS MUDSTONE - Fresh, high strength, dark brown/black coal/carbonaceous mudstone							
	27.63	COAL - Fresh, medium strength, black coal			27.66		PL(A) = 8.44 PL(D) = 3.64		
232	28	CARBONACEOUS MUDSTONE - Fresh, high strength, dark brown/black mudstone							28
	28.22 28.26/ 28.43	CARBONACEOUS MUDSTONE/COAL - Fresh, high strength coal/dark brown mudstone							
		TUFF - Fresh, medium strength, light grey tuff (possibly heat affected)		C					
231	29	COAL - Fresh, medium strength, black coal			29.0		PL(A) = 6.43 PL(D) = 4.84		29
		LAMINITE - Fresh, high strength, grey laminite (fine to medium grained sandstone)							
230		From 29.84m, grading into mudstone							

RIG: Hydropower Scout **DRILLER:** Sawyer **LOGGED:** Holden **CASING:** HW to 8.6m

TYPE OF BORING: Solid flight auger to 7.0m, wash boring to 9.2m, HQ3 to 56.90m

WATER OBSERVATIONS: Free groundwater observed at 6.25m

REMARKS: Top of pipe RL 260.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 259.92 AHD
EASTING: 227890.76
NORTHING: 6410501.47
DIP/AZIMUTH: 90°/--

BORE No: AGE05
PROJECT No: 49761
DATE: 29/11/2012
SHEET 4 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
229	30.05	MUDSTONE - Fresh, high strength, dark grey/black mudstone		C	30.08				
	31 31.03	SANDSTONE/SILTSTONE - Fresh, high strength, light grey, fine grained sandstone interbedded with grey siltstone (bedding up to 200mm thick)			30.96		PL(A) = 4.94		31
					31.0		GT-004		
					31.24				
228	32				32.18		PL(A) = 6.94		32
227	33				33.04		PL(A) = 4.69		33
	33.36	MUDSTONE - Fresh, high strength, dark grey/black mudstone			33.08				
226	34				34.05		PL(A) = 4.59		34
	34.52	From 34.38m to 34.40m, medium strength coal seam		C					
		COAL - Fresh, medium strength, black coal							
225	34.87	SILTSTONE - Fresh, high strength, dark grey siltstone			35.04		PL(A) = 4		35
	35								
	35.42								
	35.46	COAL - Fresh, medium strength, black coal							
	35.66	SILTSTONE - Fresh, high strength, dark grey siltstone							
224	36	CARBONACEOUS MUDSTONE/COAL - Fresh, high strength, grey/black carbonaceous mudstone/coal			36.14				36
					36.24		GT-010		
		From 36.62m to 36.68m, high strength tuff band			36.73				
223	36.8								
	36.86	TUFF - Fresh, medium strength, light grey/brown tuff							
	37	COAL - Fresh, medium strength, dark grey/black coal							37
	37.59	TUFF - Fresh, low strength, light grey/brown tuff		C	37.65		PL(A) = 0.59		
		From 37.76m to 37.90m, high strength mudstone band					PL(D) = 0.41		
222	38 37.99	From 37.9m, high strength							38
		COAL - Fresh, medium dense, dark grey/black coal							
	38.65	TUFF - Fresh, medium strength, light grey/brown tuff			38.63				
221		From 38.69m to 38.70m, very low strength					GT-005		From 36.0m to 41.7m, bentonite
	39	From 38.83m to 38.90m, very low strength			39.2				39
	39.7			C					
220		COAL - Fresh, medium strength, black coal							

RIG: Hydropower Scout **DRILLER:** Sawyer **LOGGED:** Holden **CASING:** HW to 8.6m

TYPE OF BORING: Solid flight auger to 7.0m, wash boring to 9.2m, HQ3 to 56.90m

WATER OBSERVATIONS: Free groundwater observed at 6.25m

REMARKS: Top of pipe RL 260.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 259.92 AHD
EASTING: 227890.76
NORTHING: 6410501.47
DIP/AZIMUTH: 90°/--

BORE No: AGE05
PROJECT No: 49761
DATE: 29/11/2012
SHEET 5 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
219	40.08	SILTSTONE - Fresh, high strength, grey siltstone			40.27		PL(A) = 5.98 PL(D) = 5.1		
	41								41
	41.08	From 40.93m, grading into sandstone		C	41.15				
		SANDSTONE - Fresh, high strength, light grey, fine to medium grained sandstone					GT-006		
218					41.62 41.66		PL(A) = 4.98 PL(D) = 3.7		
	42				42.13				42
217		From 42.64m, fine to coarse grained							
	43								43
		From 43.52m, medium strength, slightly fine grained		C	43.66		PL(A) = 1.55 PL(D) = 1.64		
	43.73	COAL - Fresh, medium strength, black coal							
216	44								44
215	45	45.0 CORE LOSS			45.1				45 From 41.7m to 48.1m, gravel From 41.9m to 47.9m, Class 18 PVC Screen
	45.45	COAL - Fresh, medium strength, black coal							
214	46	46.1 SANDSTONE - Fresh, high strength, grey, fine to medium grained sandstone		C	46.38		PL(A) = 6.94 PL(D) = 6.95		46
213	47				47.34 47.4		PL(A) = 7.57 PL(D) = 6.83 GT-007		47
		From 47.69m to 47.79m, medium strength, fine to coarse grained			47.69				
212	48				48.1				48
211					48.8		PL(A) = 6.81 PL(D) = 8.81		
	49			C					49
	49.08	SANDSTONE - Fresh, high strength, grey, fine to medium grained sandstone			49.55				
210				C			GT-008		
	49.98				49.88		PL(A) = 3.84		

RIG: Hydropower Scout **DRILLER:** Sawyer **LOGGED:** Holden **CASING:** HW to 8.6m

TYPE OF BORING: Solid flight auger to 7.0m, wash boring to 9.2m, HQ3 to 56.90m

WATER OBSERVATIONS: Free groundwater observed at 6.25m

REMARKS: Top of pipe RL 260.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 259.92 AHD
EASTING: 227890.76
NORTHING: 6410501.47
DIP/AZIMUTH: 90°/--

BORE No: AGE05
PROJECT No: 49761
DATE: 29/11/2012
SHEET 6 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
209	50.36	CONGLOMERATE - Fresh, high strength, grey conglomerate (fine to medium sized gravel in fine to coarse grained sand matrix) *(continued)*		C	49.92		PL(D) = 3.64		
		SILTSTONE - Fresh, high strength, dark grey siltstone			50.73				
	51				51.04		PL(A) = 5.38		End cap
	51.53	SANDSTONE - Fresh, high strength, light grey, fine to medium grained sandstone							
208	52			C					
207	53				53.16		PL(A) = 9		
					53.2		PL(D) = 6.78		
							GT-009		
					53.62				
206	54				53.85				From 50.9m to 56.9m, no well
		From 54.5m, very high strength							
205	55			C					
					55.54		PL(A) = 11.98 PL(D) = 9.05		
204	56								
203	56.9				56.9				
	57	Bore discontinued at 56.9m, limit of investigation							
202	58								
201	59								
200									

RIG: Hydropower Scout **DRILLER:** Sawyer **LOGGED:** Holden **CASING:** HW to 8.6m

TYPE OF BORING: Solid flight auger to 7.0m, wash boring to 9.2m, HQ3 to 56.90m

WATER OBSERVATIONS: Free groundwater observed at 6.25m

REMARKS: Top of pipe RL 260.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 259.91 AHD
EASTING: 227889.84
NORTHING: 6410500.11
DIP/AZIMUTH: 90°/--

BORE No: AGE05-A
PROJECT No: 49761
DATE: 29/11/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
259	0	SILTY CLAY - (Stiff) brown silty clay, some fine to coarse grained sand, trace fine subangular gravel, M>Wp							Stickup=0.55m From 0m to 0.3m, cement
	1	From 1.0m, very stiff		S	1.0		9,13,16 N = 29		
	1.35	SILTY SAND/SILTY CLAY - Medium dense, brown silty, fine to medium grained sand interbedded with very stiff to hard clay and silty clay, M>Wp			1.45				
258	2	From 2.5m to 2.95m, hard clay band		pp S	2.5 2.6 2.7		>500kPa 7,14,15 N = 29		From 0.3m to 4.5m, backfill and cuttings
257	3				2.95				
256	4	From 4.0m to 4.25m, sandy clay band, M>Wp, transitioning into sand		pp S	4.0 4.0 4.25		>230-250kPa 10,12,14 N = 26		
	4.25	SAND - Medium dense, brown, fine to medium grained sand, some fine subangular/subrounded gravel, some silt, humid			4.45				
255	5	From 5.0m, damp							From 4.5m to 5.2m, bentonite
	5.7	GRAVELLY SAND - Medium dense, brown, fine to coarse grained, subangular/subrounded gravelly, fine to coarse grained sand, trace silt, damp to wet		S	5.5		5,5,7 N = 12		
254	6	From 6.25m, interbedded with sandy clay in parts			5.95				
253	7			S	7.0		18,12,14 N = 26		From 5.2m to 8.4m, gravel From 5.4m to 8.4m, Class 18 PVC Screen
					7.45				
252	8								End cap
	8.4	Bore discontinued at 8.4m, limit of investigation							
251	9								
250									

RIG: Hydropower Scout **DRILLER:** Sawyer **LOGGED:** Holden **CASING:** HW to 8.6m

TYPE OF BORING: Solid flight auger to 7.0m, wash boring to 9.2m, HQ3 to 56.90m

WATER OBSERVATIONS: Free groundwater observed at 6.25m

REMARKS: Top of pipe RL 260.47 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 259.88 AHD
EASTING: 227891.49
NORTHING: 6410502.59
DIP/AZIMUTH: 90°/--

BORE No: AGE05-W
PROJECT No: 49761
DATE: 29/11/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
259	0	SILTY CLAY - (Stiff) brown silty clay, some fine to coarse grained sand, trace fine subangular gravel, M>Wp							Stickup=0.52m From 0m to 0.3m, cement
	1	From 1.0m, very stiff		S	1.0		9,13,16 N = 29		
	1.35	SILTY SAND/SILTY CLAY - Medium dense, brown silty, fine to medium grained sand interbedded with very stiff to hard clay and silty clay, M>Wp			1.45				
258	2	From 2.5m to 2.95m, hard clay band		pp S	2.5 2.6 2.7		>500kPa 7,14,15 N = 29		
257	3				2.95				
256	4	From 4.0m to 4.25m, sandy clay band, M>Wp, transitioning into sand		pp S	4.0 4.0 4.25		>230-250kPa 10,12,14 N = 26		From 0.3m to 8.4m, grout
	4.25	SAND - Medium dense, brown, fine to medium grained sand, some fine subangular/subrounded gravel, some silt, humid			4.45				
255	5	From 5.0m, damp							
	5.7	GRAVELLY SAND - Medium dense, brown, fine to coarse grained, subangular/subrounded gravelly, fine to coarse grained sand, trace silt, damp to wet		S	5.5		5,5,7 N = 12		
254	6	From 6.25m, interbedded with sandy clay in parts			5.95				
253	7			S	7.0		18,12,14 N = 26		
					7.45				
252	8								
	8.7	SANDSTONE - Highly weathered, low strength, brown, fine to medium grained sandstone		S	8.8		41/130mm (bouncing) N>50		From 8.4m to 9.5m, bentonite
251	9	From 8.7m to 9.2m, high drilling resistance using wash boring (changed to HQ at 9.2m)			9.2 9.25				
	9.69			C	9.62		PL(A) = 0.45		
250									

RIG: Hydropower Scout **DRILLER:** Sawyer **LOGGED:** Holden **CASING:** HW to 8.6m

TYPE OF BORING: Solid flight auger to 7.0m, wash boring to 9.2m, HQ3 to 56.90m

WATER OBSERVATIONS: Free groundwater observed at 6.25m

REMARKS: Top of pipe RL 260.50 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 259.88 AHD
EASTING: 227891.49
NORTHING: 6410502.59
DIP/AZIMUTH: 90°/--

BORE No: AGE05-W
PROJECT No: 49761
DATE: 29/11/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	10.2	SILTSTONE/SANDSTONE - Moderately weathered, low strength, brown, fine to medium grained sandstone laminated with grey siltstone *(continued)*		C	10.07 10.2		PL(A) = 0.27		
		SILTSTONE - Slightly weathered, very low strength, grey siltstone			10.5		PL(A) = 0.17		
249	11	From 11.2m, medium strength			11.22		PL(A) = 1.08		11
		From 11.5m, fresh		C					
248	12				12.1				12
	12.36	TUFF - Fresh, very low strength, light grey tuff							
	12.39 12.48 12.72	MUDSTONE - Fresh, medium strength, dark grey mudstone			12.6				From 9.5m to 15.7m, gravel From 9.7m to 15.7m, Class 18 PVC Screen
247	13	COAL - Fresh, medium strength, black/dark brown coal							13
		SILTSTONE - Fresh, medium strength, grey siltstone			13.18		PL(A) = 1.19		
				C					
246	14				14.13		GT-001		14
	14.26	MUDSTONE - Fresh, medium strength, dark grey mudstone			14.23				
					14.57		PL(A) = 1.38		
245	15				15.11				15
	15.23	COAL - Fresh, medium strength, dark grey coal							
	15.5	SILTSTONE - Fresh, medium strength, grey siltstone							End cap
	15.7	Bore discontinued at 15.7m, limit of investigation							
244	16								16
243	17								17
242	18								18
241	19								19
240									

RIG: Hydropower Scout **DRILLER:** Sawyer **LOGGED:** Holden **CASING:** HW to 8.6m

TYPE OF BORING: Solid flight auger to 7.0m, wash boring to 9.2m, HQ3 to 56.90m

WATER OBSERVATIONS: Free groundwater observed at 6.25m

REMARKS: Top of pipe RL 260.50 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 270.68 AHD
EASTING: 228648.82
NORTHING: 6409111.16
DIP/AZIMUTH: 90°/--

BORE No: AGE07
PROJECT No: 49761
DATE: 7-9/5/13
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
									Stickup = 0.68m
270.48	0.2	TOPSOIL - Grey brown sandy silt topsoil, generally comprising fine to medium grained sand, abundant rootlets, humid							
	0.6	SANDY SILT / SILTY SAND - Red brown, fine to medium grained sandy silt / silty sand, humid with trace to some clay		D	0.5				
270	1	SILTY CLAY - Hard, red brown silty clay with trace to some fine to medium grained sand, M<<Wp		S	1.0		14,20,21 N = 41		
					1.45				
269	2			U_{75}	2.0 2.2		pp = >400 kPa		
	2.5	CLAYSTONE - Extremely low strength, extremely weathered grey claystone		S	2.5 2.77		22,25/120,- refusal		
268	2.9	CORE LOSS - 0.25m (2.90m-3.15m)			2.9				
	3.15	CLAYSTONE - Extremely low strength, extremely weathered, red brown, orange brown fragmented claystone From 3.35m, extremely low to very low strength, highly to moderately weathered, grey From 3.5m, extremely low strength, extremely weathered, orange brown From 3.73m, very low to low strength, moderately weathered, grey		C					
267	4				3.9				
266	4.63	From 3.88m, extremely low to very low strength, fragmented From 4.0m, very low to low strength From 4.07m, extremely low to very low strength, fragmented		C					
	5								
	5.35	From 4.11m, very low to low strength, grey brown, highly fractured			5.35 5.43		PL(D) = 0.16 PL(A) = 0.3		
265	5.64	From 4.35m, brown, orange brown with some grey From 4.56m, extremely low strength, extremely weathered, orange brown		C	5.57		PL(D) = 0.16		
	6								
	6.02	CORE LOSS - 0.72m (4.63m-5.35m)			6.1				
	6.3	BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt			6.56		PL(A) = 0.19 PL(D) = 0.13		
264	6.5	CLAYSTONE - Extremely low to very low strength, extremely to highly weathered, brown claystone							
	7				7.14		PL(A) = 0.2 PL(D) = 0.1		
		CORE LOSS - 0.28m (6.02m-6.3m)							
263		CLAYSTONE - Low strength, moderately to slightly weathered, grey, brown, claystone		C					
	8	SANDSTONE - Low strength, moderately to slightly weathered, grey brown, fine to medium grained sandstone From 7.0m, with some dark grey			8.12		PL(A) = 0.87 PL(D) = 0.23		
262					8.78		PL(D) = 0.37		
	9			GT001	8.81		PL(D)=>0.71		
	9.1				9.1				
261	9.14	CORE LOSS - 0.04m (9.10m-9.14m), rock roller cleaning out hole							
		SANDSTONE - Low strength, moderately to slightly weathered, grey brown, fine to medium grained sandstone From 9.54m, with some red brown		C					

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger TC to 2.77m, rock roll to 2.9m, HQ3 to 42.03m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids. No free groundwater observed whilst auger drilling

REMARKS: From 6.0m, 100% water loss. Top of pipe RL 271.34 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 270.68 AHD
EASTING: 228648.82
NORTHING: 6409111.16
DIP/AZIMUTH: 90°/--

BORE No: AGE07
PROJECT No: 49761
DATE: 7-9/5/13
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		From 9.9m, medium to high strength, slightly weathered SANDSTONE - Low strength, moderately to slightly weathered, grey brown, fine to medium grained sandstone *(continued)*			10.41		PL(A) = 3.97 PL(D) = 4.32		From 0m to 20.5m, grout
260		From 10.46m, high to very high strength							
	11	From 10.6m, fine to coarse grained with trace fine sized subrounded gravel (microgranite?)		C	11.1		PL(A) = 2.95 PL(D) = 3.06		11
259		From 11.58m, medium to coarse grained with some fine sized subrounded gravel (microgranite?)			11.87		PL(D) = 0.33		
	12				12.1				12
	12.41	CLAYSTONE - Very low strength, moderately weathered, brown claystone			12.55				
258		From 12.51m, brown		GT002					
	12.86	From 12.59m to 12.64m, very low to low strength, extremely to highly weathered, black coal			12.86				
	13	From 12.69m, extremely low to very low strength, extremely to highly weathered, light brown and white			13.23				13
257	13.59	From 12.79m, low strength, moderately weathered		C					
		STONEY COAL - Low to medium strength, slightly weathered to fresh, dark brown to black							
	14								14
	14.11	From 12.99m to 13.01m, coal			14.23		PL(A) = 2.13 PL(D) = 0.68		
256		From 13.03m to 13.06m, coal							
		From 13.21m to 13.29m, bands of coal up to 20mm thick							
		From 13.33m to 13.48m, coal							
	15	SILTSTONE - Medium to high strength, fresh, grey siltstone			15.07		PL(A) = 2.62 PL(D) = 1.81		15
		SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone with some siltstone laminations			15.1				
255	15.6	SILTSTONE - Medium to high strength, fresh, grey siltstone							
	16	From 15.7m to 16.25m, fine grained sandstone, intrusion, 80°, 25-35mm thick			16.19				16
		From 15.81m to 16.69m, carbonaceous siltstone		GT003					
					16.49		PL(A) = 0.93 PL(D) = 0.26		
254				C	16.52				
	16.84	LAMINITE - Medium to high strength, fresh, grey, fine grained laminite							
	17								17
					17.55		PL(A) = 2.71 PL(D) = 0.47		
253									
	18								18
	18.14	SILTSTONE - Medium to high strength, fresh, grey siltstone			18.14 18.24		PL(A) = 2.09 PL(D) = 0.48		
252									
	19			C					19
	19.15	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone			19.32 19.35		PL(A) = 2.71 PL(D) = 1.5 PL(A) = 4.05		
251									

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger TC to 2.77m, rock roll to 2.9m, HQ3 to 42.03m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids. No free groundwater observed whilst auger drilling

REMARKS: From 6.0m, 100% water loss. Top of pipe RL 271.34 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 270.68 AHD
EASTING: 228648.82
NORTHING: 6409111.16
DIP/AZIMUTH: 90°/--

BORE No: AGE07
PROJECT No: 49761
DATE: 7-9/5/13
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
250		SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone *(continued)*		C	20.5		PL(D) = 3.62 PL(A)=>4.69		
	21				21.12 21.2		PL(A) = 1.76 PL(D) = 1.51		21
249				GT004	21.52				
	21.76				21.76		PL(A) = 0.88		
	21.9	CARBONACEOUS SILTSTONE - Medium strength, fresh, dark grey black carbonaceous siltstone		C	21.79 21.8		PL(D) = 0.65 PL(A) = 0.98		From 20.5m to 23.0m, bentonite
	22	STONEY COAL - Medium to high strength, fresh, black stoney coal From 22.11m, sandstone band, 10mm thick							22
248					22.48		PL(A) = 1.25 PL(D) = 0.47		
				GT005	22.51 22.76				
	23								23
		From 23.19m to 23.24m, with some stoney wisps		C	23.28		PL(A) = 1.49 PL(D) = 0.38		
	23.52	SILTSTONE - Medium to high strength, fresh, grey to dark grey siltstone From 23.72m to 23.84m, carbonaceous band			23.81				
247	24			GT006	24.04 24.07		PL(A) = 1.11 PL(D) = 0.3		24
	24.32								
	24.49	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark grey to black carbonaceous siltstone							
		STONEY COAL / COAL - Medium to high strength, fresh, black, stoney coal / coal							
246	25								25
				C	25.67		PL(A) = 1.04 PL(D) = 0.19 PL(A)=>0.60		
		From 25.81m to 25.91m, clay band, extremely low to very low strength, highly weathered		GT007	25.7 25.73 25.96				
	26								26
245					26.46 26.47		PL(A) = 1.28 PL(D) = 0.28 PL(A) = 1.86		
	27 27.03	From 26.9m, with some stone fragments			27.03		PL(A) = 0.12 PL(D) = 0.03		27
		TUFF - Low to medium strength, fresh, grey tuff		GT008	27.09 27.12				
	27.31	COAL / STONEY COAL - Medium strength, fresh, black coal / stoney coal From 27.43m to 27.48m, tuff band, medium strength, fresh, grey			27.34				
244	28 28.01								28
		TUFF - Low to medium strength, fresh, grey tuff From 28.17m to 28.24m, extremely low to very low strength		GT009	28.04 28.3		PL(A) = 0.37 PL(D) = 0.14		
	28.43			C	28.33				
		COAL / STONEY COAL - Medium strength, fresh, coal / stoney coal From 28.73m to 28.75m, tuff band, medium to high strength, fresh, grey							
243	29								29
	29.34								
	29.58	SILTSTONE - Medium to high strength, fresh, grey siltstone			29.53				
		LAMINITE - Medium to high strength, fresh, grey, fine to medium grained laminite		GT010	29.87		PL(A) = 2.49		From 23.0m to 36.5m, 5mm gravel
242									
241									

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger TC to 2.77m, rock roll to 2.9m, HQ3 to 42.03m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids. No free groundwater observed whilst auger drilling

REMARKS: From 6.0m, 100% water loss. Top of pipe RL 271.34 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 270.68 AHD
EASTING: 228648.82
NORTHING: 6409111.16
DIP/AZIMUTH: 90°/--

BORE No: AGE07
PROJECT No: 49761
DATE: 7-9/5/13
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		LAMINITE - Medium to high strength, fresh, grey, fine to medium grained laminite *(continued)*		C	29.9 30.13		PL(D) = 1.21		From 24.1m to 36.1m, Class 18 PVC Screen
240	30.7	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone							
	31	From 31.2m, fine to coarse grained			31.14		PL(A) = 0.78 PL(D) = 1.33		
239				C					
	32				32.1		PL(A) = 1.09 PL(D) = 1.23		
238									
	33				33.11		PL(A) = 0.9 PL(D) = 0.96		
	33.28	STONEY COAL / COAL - Medium strength, fresh, black stoney coal / coal			33.14 33.44		PL(D) = 0.11		
237				GT010	33.47 33.79		PL(A)=>0.59 PL(D) = 0.38		
	33.87	COAL - Medium strength, fresh, black coal			33.82		PL(A)=>0.38		
	34			C					
236	34.78	From 34.65m, tuff band 5-7mm thick From 34.71m, tuff band, 10mm thick							
	35	STONEY COAL / COAL - Medium to high strength, fresh, black stoney coal / coal From 35.18m, laminite leaching			35.13				
				GT012	35.41 35.44		PL(A) = 2.44 PL(D) = 1.83		
235	35.76	TUFFACEOUS SANDSTONE - Extremely low strength, moderately weathered, grey to white, fine to medium grained tuffaceous sandstone From 35.78m, medium strength, fresh			35.94				
	35.94 36				36.07		PL(D)=>4.86		
				GT013	36.1 36.39		PL(D)=>4.70		
234		META SILTSTONE(?) - High to very high strength, fresh grey with some green crystals metal siltstone From 36.6m, tuffaceous sandstone intrusion, medium to high strength, grey white			36.42				
	37 37.01	TUFFACEOUS SANDSTONE - Medium to high strength, fresh, grey white tuffaceous sandstone			37.24		PL(A) = 1.22 PL(D) = 0.8		
				GT014	37.27				
233	37.67			C	37.6				
	37.75	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark grey black carbonaceou siltstone							
	38								
	38.14	STONEY COAL / COAL - Medium strength, fresh, black, stoney coal / coal							
232		SANDSTONE - High to very high strength, fresh, grey, fine to medium grained sandstone From 38.33m, fine grained From 38.74m, fine to coarse grained			38.69				
				GT015					
	39				38.99 39.02		PL(A) = 1.55 PL(D) = 0.77		From 36.5m to 42.03m, bentonite
231				C					
					39.89		PL(D) = 0.96		

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger TC to 2.77m, rock roll to 2.9m, HQ3 to 42.03m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids. No free groundwater observed whilst auger drilling

REMARKS: From 6.0m, 100% water loss. Top of pipe RL 271.34 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 270.68 AHD
EASTING: 228648.82
NORTHING: 6409111.16
DIP/AZIMUTH: 90°/--

BORE No: AGE07
PROJECT No: 49761
DATE: 7-9/5/13
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
230	41	SANDSTONE - High to very high strength, fresh, grey, fine to medium grained sandstone *(continued)*		C					41
229	42	42.03 Bore discontinued at 42.03m, limit of investigation			42.0 42.03		PL(A) = 3.01 PL(D) = 3.14		42 End cap
228	43								43
227	44								44
226	45								45
225	46								46
224	47								47
223	48								48
222	49								49
221									

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger TC to 2.77m, rock roll to 2.9m, HQ3 to 42.03m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids. No free groundwater observed whilst auger drilling

REMARKS: From 6.0m, 100% water loss. Top of pipe RL 271.34 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 270.68 AHD
EASTING: 228647.04
NORTHING: 6409111.72
DIP/AZIMUTH: 90°/--

BORE No: AGE07W
PROJECT No: 49761
DATE: 7-9/5/13
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
270	0.2	TOPSOIL - Grey brown sandy silt topsoil, generally comprising fine to medium grained sand, abundant rootlets, humid							Stickup = 0.65m
	0.6	SANDY SILT / SILTY SAND - Red brown, fine to medium grained sandy silt / silty sand, humid with trace to some clay							
269	1	SILTY CLAY - Hard, red brown silty clay with trace to some fine to medium grained sand, M<<Wp							
	2								
268	2.5	CLAYSTONE - Extremely low strength, extremely weathered grey claystone							
	2.9	CORE LOSS - 0.25m (2.90m-3.15m)							
	3								
	3.15	CLAYSTONE - Extremely low strength, extremely weathered, red brown, orange brown fragmented claystone From 3.35m, extremely low to very low strength, highly to moderately weathered, grey From 3.5m, extremely low strength, extremely weathered, orange brown From 3.73m, very low to low strength, moderately weathered, grey							From 0m to 6.9m, grout
267	4								
266	4.63	From 3.88m, extremely low to very low strength, fragmented From 4.0m, very low to low strength From 4.07m, extremely low to very low strength, fragmented							
	5								
	5.35	From 4.11m, very low to low strength, grey brown, highly fractured							
265	5.64	From 4.35m, brown, orange brown with some grey From 4.56m, extremely low strength, extremely weathered, orange brown							
	6								
	6.02	CORE LOSS - 0.72m (4.63m-5.35m)							
	6.3								
264	6.5	BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt							
	7	CLAYSTONE - Extremely low to very low strength, extremely to highly weathered, brown claystone							
		CORE LOSS - 0.28m (6.02m-6.3m)							
263		CLAYSTONE - Low strength, moderately to slightly weathered, grey, brown, claystone							
	8	SANDSTONE - Low strength, moderately to slightly weathered, grey brown, fine to medium grained sandstone From 7.0m, with some dark grey							From 6.9m to 8.9m, bentonite
262	9								
	9.1								
	9.14	CORE LOSS - 0.04m (9.10m-9.14m), rock roller cleaning out hole							
261		SANDSTONE - Low strength, moderately to slightly weathered, grey brown, fine to medium grained sandstone From 9.54m, with some red brown							

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 7.2m

TYPE OF BORING: 100mm DTH to 20m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Description from AGE07 Log. Top of pipe RL 271.32 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 270.68 AHD
EASTING: 228647.04
NORTHING: 6409111.72
DIP/AZIMUTH: 90°/--

BORE No: AGE07W
PROJECT No: 49761
DATE: 7-9/5/13
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
260	11	From 9.9m, medium to high strength, slightly weathered SANDSTONE - Low strength, moderately to slightly weathered, grey brown, fine to medium grained sandstone *(continued)*							
		From 10.46m, high to very high strength							
		From 10.6m, fine to coarse grained with trace fine sized subrounded gravel (microgranite?)							
259	12	From 11.58m, medium to coarse grained with some fine sized subrounded gravel (microgranite?)							
	12.41	CLAYSTONE - Very low strength, moderately weathered, brown claystone							
258	12.86	From 12.51m, brown							
	13	From 12.59m to 12.64m, very low to low strength, extremely to highly weathered, black coal							From 8.9m to 17.55m, 5mm gravel
		From 12.69m, extremely low to very low strength, extremely to highly weathered, light brown and white							
257	13.59	From 12.79m, low strength, moderately weathered							From 9.5m to 17m, Class 18 PVC Screen
	14	STONEY COAL - Low to medium strength, slightly weathered to fresh, dark brown to black							
	14.11	From 12.99m to 13.01m, coal							
256		From 13.03m to 13.06m, coal							
		From 13.21m to 13.29m, bands of coal up to 20mm thick							
		From 13.33m to 13.48m, coal							
	15	SILTSTONE - Medium to high strength, fresh, grey siltstone							
		SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone with some siltstone laminations							
255	15.6	SILTSTONE - Medium to high strength, fresh, grey siltstone							
	16	From 15.7m to 16.25m, fine grained sandstone, intrusion, 80°, 25-35mm thick							
		From 15.81m to 16.69m, carbonaceous siltstone							
254	16.84	LAMINITE - Medium to high strength, fresh, grey, fine grained laminite							
	17								
253	18								
	18.14	SILTSTONE - Medium to high strength, fresh, grey siltstone							
252	19								From 17.55m to 20m, bentonite
	19.15	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone							
251	20.0	Bore discontinued at 20.0m, limit of investigation							End cap

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 7.2m

TYPE OF BORING: 100mm DTH to 20m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Description from AGE07 Log. Top of pipe RL 271.32 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 282.09 AHD
EASTING: 231144.41
NORTHING: 6407146.65
DIP/AZIMUTH: 90°/--

BORE No: AGE08
PROJECT No: 49761
DATE: 7-13/12/12
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
282		SANDY SILT - Stiff, brown, fine to coarse grained sandy silt with abundant organics, M<Wp							Stickup=0.??m
281	1.0	SANDSTONE AND SILTSTONE - Extremely low strength, extremely weathered, yellow brown / grey brown, fine to medium grained sandstone and carbonaceous siltstone		S	1.0		15,21/130mm, refusal, bouncing		
	1.28	CORE LOSS - 0.32m			1.28				
	1.6	SILTSTONE - Low strength, moderately weathered, grey / grey brown siltstone with interbedded fine to medium grained sandstone			1.9		PL(A) = 0.48		
280	2.22	SANDSTONE - Low to medium strength, moderately weathered, grey / grey brown fine to medium grained sandstone		C					
279					3.3		PL(A) = 0.31		
					3.4				
278		From 3.87m, interbedded siltstone							
	4.7	SANDSTONE - High strength, fresh, grey, medium grained sandstone with interbedded siltstone to 5.25m			4.6		PL(A) = 0.97		
277				C	5.15		PL(A) = 1.77		
		From 5.25m, medium to coarse grained							
276					6.0		PL(A) = 1.49		
					6.36				
275									
				C					
274									
273					8.9		PL(A) = 1.35		
	9.46	At 9.42m to 9.46m, tuffaceous claystone			9.4				
		COAL - High strength, fresh, black / dark brown coal with interbedded carbonaceous siltstone		C	9.75		PL(A) = 1.06		

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 1.65m

TYPE OF BORING: Solid flight auger to 1.0m, HQ3 coring to 36.4m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 282.71 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 282.09 AHD
EASTING: 231144.41
NORTHING: 6407146.65
DIP/AZIMUTH: 90°/--

BORE No: AGE08
PROJECT No: 49761
DATE: 7-13/12/12
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
272		At 9.95m to 9.98m, tuffaceous claystone							
	10.33	SANDSTONE AND SILTSTONE - High strength, fresh, grey / dark grey, fine to medium grained sandstone and siltstone (laminite?)			10.7		PL(A) = 1.01		
271	11			C					11
270	12				12.05		PL(A) = 1.13		12
					12.34				
		At 12.49m to 12.8m, carbonaceous siltstone / coal							
269	13								13 From 0m to 25.7m, grout
	13.14	CARBONACEOUS SILTSTONE / COAL - Medium strength, fresh, dark brown carbonaceous siltstone / coal			13.35		PL(A) = 0.62		
268	14 13.95	SILTSTONE AND SANDSTONE - High strength, fresh, grey / dark grey siltstone and fine to medium grained sandstone		C					14
267	15				14.95		PL(A) = 1.54		15
					15.29				
266	16				16.25		PL(A) = 1.55		16
				C					
265	17				16.95		PL(A) = 2.84		17
					17.53		PL(A) = 2.98		
		At 17.65m to 17.85m, carbonaceous siltstone							
264	17.95 18 18.0	CORE LOSS - 0.05m							18
		COAL - Medium to high strength, fresh, dark brown / black coal with interbedded carbonaceous siltstone			18.34				
	18.76	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone							
263	19			C					19
					19.35		PL(A) = 1.99		
					19.75		PL(A) = 1.67		
	19.9								

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 1.65m

TYPE OF BORING: Solid flight auger to 1.0m, HQ3 coring to 36.4m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 282.71 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 282.09 AHD
EASTING: 231144.41
NORTHING: 6407146.65
DIP/AZIMUTH: 90°/--

BORE No: AGE08
PROJECT No: 49761
DATE: 7-13/12/12
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
262		CARBONACEOUS SILTSTONE / COAL - Medium strength, fresh, dark brown carbonaceous siltstone / coal *(continued)*		C					
261	21	From 21m, coal with interbedded carbonaceous siltstone			21.3		PL(A) = 0.64 PL(D) = 1.32		
		At 21.38m to 21.39m, tuffaceous claystone band			21.34				
260	22			C	22.65		PL(A) = 0.87		
259	23	At 23.11m to 23.24m, tuffaceous claystone band			23.2		PL(A) = 0.4		
		At 23.32m to 23.37m, tuffaceous claystone band							
	23.52	TUFFACEOUS CLAYSTONE - Medium strength, fresh, pale grey tuffaceous claystone							
	23.76	At 23.52m to 23.55m, extremely low strength, extremely weathered							
258	24	COAL - Medium to high strength, fresh, dark brown / black coal with interbedded carbonaceous siltstone			24.36				
	24.6	At 24.22m to 24.25m, tuffaceous band			24.65		PL(A) = 1.56		
257	25	SANDSTONE AND SILTSTONE - High strength, fresh, grey / dark grey fine to medium grained sandstone and siltstone		C					
256	26								
255	27				27.35		PL(A) = 1.9		From 25.7m to 29.25m, bentonite
					27.38				
	27.88								
254	28	SANDSTONE - High strength, fresh, grey, coarse grained sandstone with interbedded pebbly sandstone			28.0		PL(A) = 1.19		
253	29			C					

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 1.65m

TYPE OF BORING: Solid flight auger to 1.0m, HQ3 coring to 36.4m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 282.71 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 282.09 AHD
EASTING: 231144.41
NORTHING: 6407146.65
DIP/AZIMUTH: 90°/--

BORE No: AGE08
PROJECT No: 49761
DATE: 7-13/12/12
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
252		SANDSTONE - High strength, fresh, grey, coarse grained sandstone with interbedded pebbly sandstone *(continued)*		C	30.45		PL(A) = 0.97		
	30.74				30.47				
		COAL - Medium to high strength, dark brown / black coal			30.9		PL(A) = 0.69		
251	31	At 30.99m, tuffaceous claystone band 10mm							31
				C					From 29.25m to 34m, 5mm gravel
250	32								From 29.4m to 33.9m, Class 18 PVC Screen 32
					32.8		PL(A) = 1.16		
249	33 33.02								33
		CORE LOSS - 0.36m							
	33.38				33.38				
		COAL - Medium to high strength, dark brown / black coal							
	33.82								
248	34	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone with interbedded coarse grained sandstone and sparse thin siltstone laminations			34.05		PL(A) = 2.67		34
				C					
247	35								35 From 33.9m to 36.4m, sump
246	36								36
	36.4				36.35		PL(A) = 2.84		End cap
		Bore discontinued at 36.4m, limit of investigation			36.4				
245	37								37
244	38								38
243	39								39

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 1.65m

TYPE OF BORING: Solid flight auger to 1.0m, HQ3 coring to 36.4m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 282.71 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 282.03 AHD
EASTING: 231144.14
NORTHING: 6407147.66
DIP/AZIMUTH: 90°/--

BORE No: AGE08-W
PROJECT No: 49761
DATE: 7-13/12/12
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
282		SANDY SILT - Stiff, brown, fine to coarse grained sandy silt with abundant organics, M<Wp							
281	1.0	SANDSTONE AND SILTSTONE - Extremely low strength, extremely weathered, yellow brown / grey brown, fine to medium grained sandstone and carbonaceous siltstone							
	1.28	CORE LOSS - 0.32m							
	1.6	SILTSTONE - Low strength, moderately weathered, grey / grey brown siltstone with interbedded fine to medium grained sandstone							
280	2.22	SANDSTONE - Low to medium strength, moderately weathered, grey / grey brown fine to medium grained sandstone							
279		From 3.87m, interbedded siltstone							From 0m to 5.5m, grout
278	4.7	SANDSTONE - High strength, fresh, grey, medium grained sandstone with interbedded siltstone to 5.25m							
277		From 5.25m, medium to coarse grained							
276									From 5.5m to 7.5m, bentonite
275									
274									
273	9.46	At 9.42m to 9.46m, tuffaceous claystone							
		COAL - High strength, fresh, black / dark brown coal with interbedded carbonaceous siltstone							

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** Uncased

TYPE OF BORING: Rock roller from 0.0m to 13.8m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 282.76 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 282.03 AHD
EASTING: 231144.14
NORTHING: 6407147.66
DIP/AZIMUTH: 90°/--

BORE No: AGE08-W
PROJECT No: 49761
DATE: 7-13/12/12
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
272		At 9.95m to 9.98m, tuffaceous claystone							
	10.33								
271	11	SANDSTONE AND SILTSTONE - High strength, fresh, grey / dark grey, fine to medium grained sandstone and siltstone (laminite?)							From 7.5m to 13.8m, 5mm gravel From 7.8m to 13.8m, Class 18 PVC Screen
270	12								
		At 12.49m to 12.8m, carbonaceous siltstone / coal							
269	13								
	13.14	CARBONACEOUS SILTSTONE / COAL - Medium strength, fresh, dark brown carbonaceous siltstone / coal							
	13.8	Bore discontinued at 13.8m, limit of investigation							End cap
268	14								
267	15								
266	16								
265	17								
264	18								
263	19								

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** Uncased

TYPE OF BORING: Rock roller from 0.0m to 13.8m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 282.76 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 285.69 AHD
EASTING: 229945.09
NORTHING: 6406679.91
DIP/AZIMUTH: 90°/--

BORE No: AGE09
PROJECT No: 49761
DATE: 3/4/2013
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
285	0	CLAY -							Stick up = 0.56m From 0m to 0.4m, asphalt
284	2								
283	3								
282	4								
281	5								
280	6								
279	7								
278	7.27	COAL -							
	7.9								
278	8	CLAY -							
	8.0	CORE LOSS -							
277	9								
	9.0	SANDSTONE -							
276	10.0								

RIG: DRS078 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 15m

TYPE OF BORING: HQ3 to 36.45m

WATER OBSERVATIONS: Free groundwater observed at 11.9m (determined by dipping hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 286.32 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 285.69 AHD
EASTING: 229945.09
NORTHING: 6406679.91
DIP/AZIMUTH: 90°/--

BORE No: AGE09
PROJECT No: 49761
DATE: 3/4/2013
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
275	11	SILTSTONE -							From 0.4m to 21.7m, grout
	11.39	CARBONACEOUS SHALE -							
274	11.7	SILTSTONE -							
	12								
273	13								
	13.45	COAL -							
272	13.82	MUDSTONE -							
	14								
271	14.9								
	15	15.0 CORE LOSS -							
		SILTSTONE -							
270	15.76	SANDSTONE -							
	16	16.03 SILTSTONE -							
	16.26	CARBONACEOUS SHALE -							
269	16.7								
	16.74	COAL -							
	16.75	TUFF -							
	17	COAL -							
268	17.61								
	17.63	CARBONACEOUS SHALE -							
		COAL -							
	18								
	18.24								
	18.28	SILTSTONE -							
	18.45	TUFF -							
267	18.51								
	18.55	COAL -							
	19	TUFF -							
		COAL -							
	19.3								
	19.31	SILTSTONE -							
266		COAL -							
	19.74								
	19.92	TUFF -							

RIG: DRS078 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 15m

TYPE OF BORING: HQ3 to 36.45m

WATER OBSERVATIONS: Free groundwater observed at 11.9m (determined by dipping hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 286.32 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

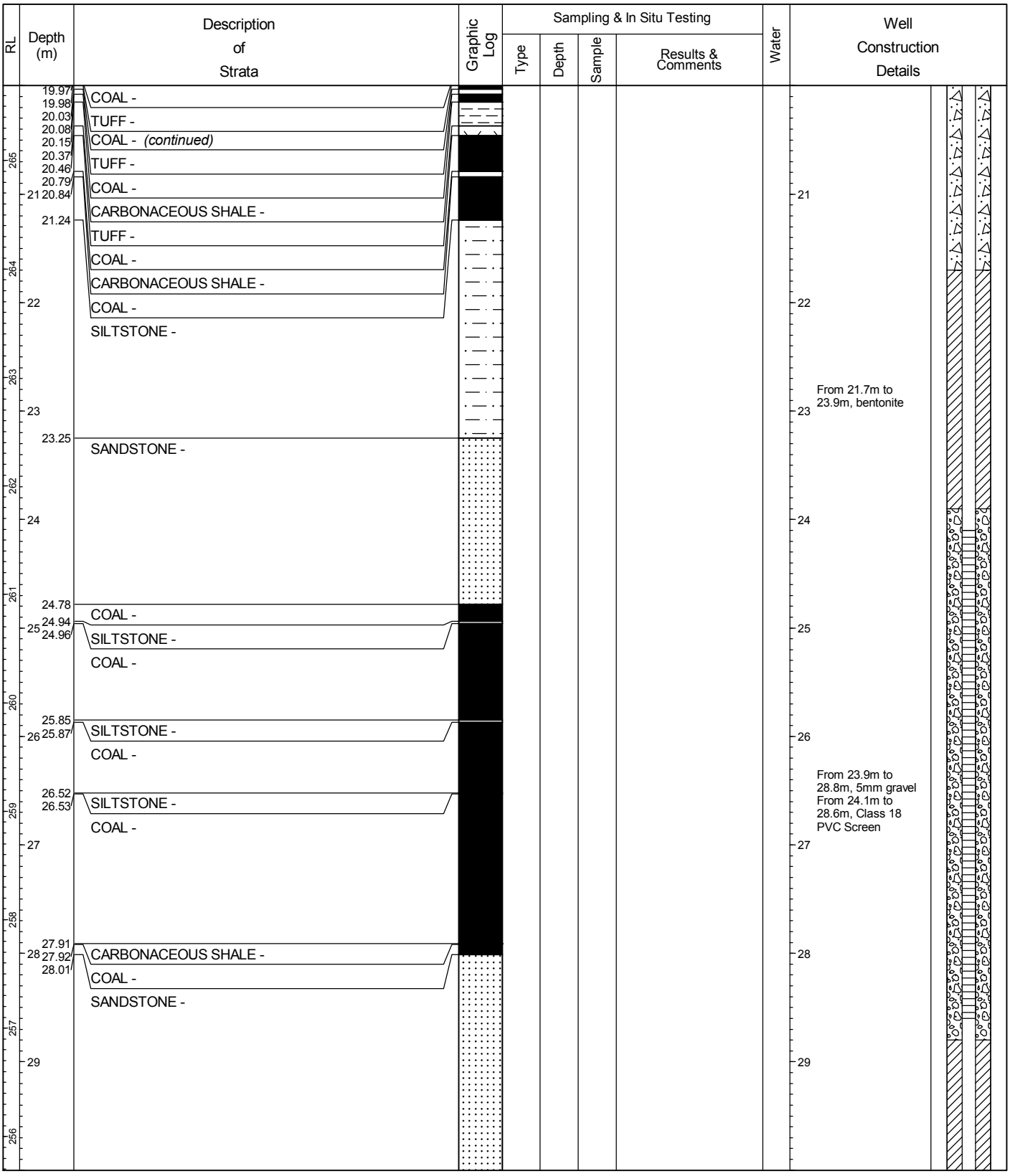
Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 285.69 AHD
EASTING: 229945.09
NORTHING: 6406679.91
DIP/AZIMUTH: 90°/--

BORE No: AGE09
PROJECT No: 49761
DATE: 3/4/2013
SHEET 3 OF 4



RIG: DRS078 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 15m

TYPE OF BORING: HQ3 to 36.45m

WATER OBSERVATIONS: Free groundwater observed at 11.9m (determined by dipping hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 286.32 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 285.69 AHD
EASTING: 229945.09
NORTHING: 6406679.91
DIP/AZIMUTH: 90°/--

BORE No: AGE09
PROJECT No: 49761
DATE: 3/4/2013
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
255	31	SANDSTONE - *(continued)*							31 From 28.6m to 31.6m, Class 18 Blank (sump) End cap
254	31.99 32 32.02	CONGLOMERATE -							32
		SANDSTONE -							From 28.8m to 36.3m, bentonite
253	33								33
252	33.8	CARBONACEOUS SHALE -							
	34 34.07	SANDSTONE -							34
251	35								35
250	36								36
	36.45	Bore discontinued at 36.45m							
249	37								37
248	38								38
247	39								39
246									

RIG: DRS078 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 15m

TYPE OF BORING: HQ3 to 36.45m

WATER OBSERVATIONS: Free groundwater observed at 11.9m (determined by dipping hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 286.32 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 285.81 AHD
EASTING: 229944.95
NORTHING: 6406677.52
DIP/AZIMUTH: 90°/--

BORE No: AGE09-W
PROJECT No: 49761
DATE: 2/5/2013
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
285	0.2	TOPSOIL - Grey brown sandy silt topsoil, generally comprising fine to medium grained sand, trace fine sized gravel, abundant rootlets, humid		D	0.5				Stickup = 0.7m
	1.0	SILTY SAND - Red brown, fine to medium grained silty sand, slightly clayey, humid (possible weathered sandstone)							
		CLAYSTONE - Extremely low strength, extremely weathered, red, brown claystone with some fine sized gravel and fine to medium grained sand		S	1.0		16,24,25/125mm refusal		
	1.65				1.43				
284		CLAYSTONE - Extremely low strength, extremely weathered, red brown claystone with some fine to medium grained sand		GT001	1.65 1.8				
	2.08	From 2.08m, very low to low strength, highly weathered,		C	2.05 2.08		PL(D) = 0.06		
283									From 0m to 5.5m, grout
	3.06				3.06				
	3.48	From 3.35m, extremely low strength, extremely weathered, fragmented		C					
282	3.99	CLAYSTONE - Medium to high strength, moderately to slightly weathered, grey with some ironstaining claystone			3.84		PL(D) = 0.16		
	4.06	CLAYSTONE - Extremely low strength, extremely weathered, brown claystone, fragmented (possible clay layer)			4.3				
	4.35			C					
	4.6	CORE LOSS - 0.29m (4.06m-4.35m)							
281		CLAYSTONE - Extremely low strength, extremely weathered, brown claystone, fragmented (possible clay layer)			5.27		PL(A) = 0.72 PL(D) = 0.15		
		SANDSTONE - Low to medium strength, moderately to slightly weathered, grey brown fine grained sandstone		C	5.3				
280									From 5.5m to 6.9m, bentonite
					6.3				
279				C	6.86		PL(A) = 0.54 PL(D) = 0.19		
	7.03								
	7.13	CLAYSTONE - Very low strength, moderately weathered, yellow, grey claystone							
	7.18	COAL - Extremely low to very low strength, extremely weathered, black coal							
278	7.75	CORE LOSS - 0.57m (7.18m to 7.75m)		C	7.75				
	7.93				7.93				
	7.99	COAL - Extremely low to very low strength, extremely weathered, black coal		C					
	8.11								
	8.44	CORE LOSS - 0.06m (7.93m to 7.99m)			8.5				
277	8.6	COAL AND TUFF - Extremely low to very low strength, extremely weathered, black, grey white fragmented coal and tuff		GT002 C	8.54 8.81		PL(A) = 2.22 PL(D) = 0.9		
					8.84				
		CARBONACEOUS SILTSTONE - Low strength, moderately to slightly weathered, dark grey with some ironstaining carbonaceous siltstone with some wisps of coal			9.1				
	9.56			C	9.54		PL(A) = 1.54 PL(D) = 0.56		
276		SILTSTONE - Low strength, slightly weathered, grey							
	9.97								

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 5.7m

TYPE OF BORING: Solid flight auger TC Bit to 1.43m, rock roller to 1.65m, HQ3 to 18.06m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 286.50 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 285.81 AHD
EASTING: 229944.95
NORTHING: 6406677.52
DIP/AZIMUTH: 90°/--

BORE No: AGE09-W
PROJECT No: 49761
DATE: 2/5/2013
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
275	10.51	siltstone SANDSTONE - Low to medium strength, fresh, grey, fine grained sandstone							
	11	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark grey carbonaceous siltstone LAMINITE - Medium to high strength, fresh, grey, fine grained laminite *(continued)*		C	10.93		PL(A) = 0.99 PL(D) = 0.08		11
		CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark grey carbonaceous siltstone			11.34		PL(A) = 0.58 PL(D) = 0.17		From 6.9m to 15.5m, gravel From 7.56m to 15.06m, Class 18 PVC Screen
274	11.88								
	12	LAMINITE - Medium to high strength, fresh, grey fine grained laminite			12.1		PL(A) = 5.67 PL(D) = 0.93		12
				GT003	12.13				
					12.45				
273	13	From 13.09m to 13.25m, carbonaceous siltstone							13
	13.38	COAL - Low to medium strength, fresh, black, coal with some stoney coal		C					
272	13.81	SILTSTONE - Medium to high strength, fresh, grey siltstone			13.83		PL(A) = 1.08 PL(D) = 0.56		14
	14								
	14.35	LAMINITE - Medium to high strength, fresh, grey, fine grained laminite							
271	15				15.11				15
					15.48				
				GT004	15.72		PL(A) = 1.14 PL(D) = 1.15		
270	15.96				15.77				
	16	SILTSTONE - Medium to high strength, fresh, grey siltstone							16
	16.46	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark grey black, carbonaceous siltstone		C					
269	16.91								From 15.5m to 18.06m, bentonite
	17	STONEY COAL - Medium to high strength, fresh, dark brown black stoney coal with some coal lenses			17.04		PL(D) = 0.32		17
268					17.6		PL(D) = 0.56		
	18	18.06			18.06				18 End cap
		Bore discontinued at 18.06m, limit of investigation							
267	19								19
266									

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 5.7m

TYPE OF BORING: Solid flight auger TC Bit to 1.43m, rock roller to 1.65m, HQ3 to 18.06m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 286.50 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 298.30 AHD
EASTING: 231810.02
NORTHING: 6405355.85
DIP/AZIMUTH: 90°/--

BORE No: AGE10/BY0206CH
PROJECT No: 49761
DATE: 6/4/2013
SHEET 1 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
298	0	CLAY -							Stick up = 0.45m From 0m to 5.5m, asphalt
297	1								
296	2	2.0 MUDSTONE -							
295	3								
294	4								
293	5								
292	6								
291	7	6.73 6.79 TUFF - MUDSTONE - 7.12 7.23 CARBONACEOUS SHALE - 7.32 COAL - SANDSTONE -							
290	8								
289	9								

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** McMeeken (Cockatoo) **CASING:** HW to 5.8m

TYPE OF BORING: HQ3 to 54.24m

WATER OBSERVATIONS: Free groundwater observed at 10.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 298.75 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 298.30 AHD
EASTING: 231810.02
NORTHING: 6405355.85
DIP/AZIMUTH: 90°/--

BORE No: AGE10/BY0206CH
PROJECT No: 49761
DATE: 6/4/2013
SHEET 2 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
288		SANDSTONE - *(continued)*							
	11								11
287									
	11.93								
12	11.95	CARBONACEOUS SHALE -							12
		CORE LOSS -							
286	12.3	MUDSTONE -							
	13								13
285									
	14								14
284									
	15								15
283									
	16								16
282									
	16.4								
	16.46	SANDSTONE -							
	16.6								
	16.67	MUDSTONE -							
	16.89								
17	16.92	SILTSTONE -							17
	17.05								
281	17.13	SANDSTONE -							
		COAL -							
		CARBONACEOUS SHALE							
	17.72								
	17.74	COAL -							
18	17.91								18
	17.99	TUFF -							
280	18.29	CARBONACEOUS SHALE -							
	18.32								
	18.43	COAL -							
		CARBONACEOUS SHALE -							
	18.85								
19	19.02	COAL -							19 From 0.4m to 37.6m, grout
		TUFF -							
279		COAL -							
		CARBONACEOUS SHALE -							
		MUDSTONE -							

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** McMeeken (Cockatoo) **CASING:** HW to 5.8m

TYPE OF BORING: HQ3 to 54.24m

WATER OBSERVATIONS: Free groundwater observed at 10.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 298.79 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 298.30 AHD
EASTING: 231810.02
NORTHING: 6405355.85
DIP/AZIMUTH: 90°/--

BORE No: AGE10/BY0206CH
PROJECT No: 49761
DATE: 6/4/2013
SHEET 3 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
278	20.14	SILTSTONE - *(continued)*							
		SANDSTONE -							
	20.95								
277	21.05	SILTSTONE -							
		MUDSTONE -							
276	22.72	SILTSTONE -							
275	24.08	SANDSTONE -							
274									
273									
272	26.43	MUDSTONE -							
	26.55								
	26.63	SANDSTONE -							
271	26.95	COAL -							
	27.04	CARBONACEOUS SHALE -							
		SILTSTONE -							
270	27.94	MUDSTONE -							
269	29.36	CARBONACEOUS SHALE -							
	29.64	COAL -							
	29.81								
	29.82								

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** McMeeken (Cockatoo) **CASING:** HW to 5.8m

TYPE OF BORING: HQ3 to 54.24m

WATER OBSERVATIONS: Free groundwater observed at 10.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 298.79 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 298.30 AHD
EASTING: 231810.02
NORTHING: 6405355.85
DIP/AZIMUTH: 90°/--

BORE No: AGE10/BY0206CH
PROJECT No: 49761
DATE: 6/4/2013
SHEET 4 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
268	30.04	TUFF -							
		COAL - *(continued)*							
		CARBONACEOUS SHALE -							
	30.87								
	30.93	SANDSTONE -							
267		CARBONACEOUS SHALE -							
	31.78								
	31.79	TUFF -							
	32	CARBONACEOUS SHALE -							
	32.19								
266		TUFF -							
	32.42								
	32.51	COAL -							
	32.54	TUFF -							
	33	COAL -							
	33.21								
265	33.22	TUFF -							
	33.35								
	33.55	CARBONACEOUS SHALE -							
	33.72	COAL -							
	33.94	TUFF -							
	34								
	34.04								
264	34.09	CARBONACEOUS SHALE -							
	34.41	TUFF -							
	34.69	CARBONACEOUS SHALE -							
	34.88	COAL -							
	35 34.9								
	34.98	TUFF -							
263		COAL -							
		TUFF -							
		COAL -							
		SILTSTONE -							
	36								
	36.08	SANDSTONE -							
262									
	37								
261									
	38								
260									
	39								
259									From 37.6m to 40.6m, bentonite

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** McMeeken (Cockatoo) **CASING:** HW to 5.8m

TYPE OF BORING: HQ3 to 54.24m

WATER OBSERVATIONS: Free groundwater observed at 10.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 298.79 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 298.30 AHD
EASTING: 231810.02
NORTHING: 6405355.85
DIP/AZIMUTH: 90°/--

BORE No: AGE10/BY0206CH
PROJECT No: 49761
DATE: 6/4/2013
SHEET 5 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
258		SANDSTONE - *(continued)*							
	40.83								
	41	CONGLOMERATE -							41
	41.17								
257		COAL -							
	42								42
	42.19								
256	42.22	TUFF -							
		COAL -							
	43								43 From 40.6m to 45.55m, 5mm gravel From 41.0m to 45.5m, Class 18 PVC Screen
255									
	44								44
254									
	44.96								
	45	SANDSTONE -							45
253									
	46								46
252									
	47								47 From 45.5m to 48.5m, Class 18 PVC
251									
	48								48
250									
	49								49
249									
	49.37	MUDSTONE -							
	49.56	SANDSTONE -							From 45.55m to

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** McMeeken (Cockatoo) **CASING:** HW to 5.8m

TYPE OF BORING: HQ3 to 54.24m

WATER OBSERVATIONS: Free groundwater observed at 10.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 298.79 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 298.30 AHD
EASTING: 231810.02
NORTHING: 6405355.85
DIP/AZIMUTH: 90°/--

BORE No: AGE10/BY0206CH
PROJECT No: 49761
DATE: 6/4/2013
SHEET 6 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
248		SANDSTONE - *(continued)*							54.24m, bentonite
	50.64	MUDSTONE -							
	51								51
247	51.54	SANDSTONE -							
	52								52
246									
	53								53
245	53.77	MUDSTONE -							
	54								54
244	54.24	Bore discontinued at 54.24m							
	55								55
243									
	56								56
242									
	57								57
241									
	58								58
240									
	59								59
239									

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** McMeeken (Cockatoo) **CASING:** HW to 5.8m

TYPE OF BORING: HQ3 to 54.24m

WATER OBSERVATIONS: Free groundwater observed at 10.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 298.79 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 298.47 AHD
EASTING: 231809.03
NORTHING: 6405352.84
DIP/AZIMUTH: 90°/--

BORE No: AGE10-W
PROJECT No: 49761
DATE: 30/4/2013
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
298	0.0	TOPSOIL - Sandy silt topsoil, generally comprising, fine to medium grained sand, trace fine sized, subrounded gravel, humid, abundant rootlets		D	0.5				Stickup = 0.54m
	0.8	SILTSTONE - Extremely low strength, extremely weathered, brown siltstone			1.0		11,26,- refusal		
297	1.55	SILTSTONE - Low to medium strength, highly to moderately weathered, brown siltstone		C	1.55 1.58 1.78		PL(A) = 0.07 PL(D) = 0.03		
		From 1.63m to 1.66m, extremely low strength, extremely weathered							
296		From 2.01m, extremely low to very low strength, extremely to highly weathered		C					
		From 2.47m, extremely low strength, extremely weathered			2.64				
		From 2.85m to 2.92m, extremely weathered coal seam		C					
295		From 2.92m, low to medium strength, moderately to slightly weathered, grey			3.14 3.24		PL(A) = 0.11 PL(D) = 0.09		
				C					
294		From 4.24m, very low strength							
	4.5	From 4.35m, low to medium strength							
	4.59	CORE LOSS - 0.09m (4.5m-4.59m)			4.59 4.75		PL(A) = 0.02 PL(D) = 0.01		From 0m to 9.6m, grout
	4.99	SANDSTONE - Low strength, slightly weathered, grey, brown, fine to medium grained sandstone							
293		SILTSTONE - Medium strength, fresh, grey, siltstone		C	5.34				
		At 5.18m, tuffaceous clay seam 15mm thick		GT001	5.64 5.67		PL(A) = 0.8 PL(D) = 0.34		
				C	6.1				
292	6.22	CARBONACEOUS SILTSTONE - Medium strength, fresh, dark grey							
					6.9		PL(A) = 0.43 PL(D) = 0.24		
		From 6.96m to 7.0m, tuff band							
291	7.36	COAL - Low to medium strength, fresh, black coal		C					
	7.54	From 7.5m, fragmented							
		SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone			7.92		PL(D) = 0.51		
290					8.66				
		From 8.67m, fine to coarse grained		GT002	8.92		PL(A) = 2.48 PL(D) = 2.4		
					8.95 9.04				
289				C					

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HQ3 to 20.98m

TYPE OF BORING: Solid flight auger TC Bit to 1.3m, rock roller to 1.55m, HQ3 to 20.98m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 299.02 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 298.47 AHD
EASTING: 231809.03
NORTHING: 6405352.84
DIP/AZIMUTH: 90°/--

BORE No: AGE10-W
PROJECT No: 49761
DATE: 30/4/2013
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone *(continued)*			10.18		PL(A) = 1.95 PL(D) = 1.47		From 9.6m to 11.35m, bentonite
288		From 10.6m, grey brown							
	11			C	11.22		PL(A) = 2.5 PL(D) = 2.91		11
287									
	12				12.07		PL(A) = 2.22 PL(D) = 2.93		12
	12.14	SILTSTONE - Medium strength, fresh, grey siltstone			12.1				
286		From 12.14m to 12.65m, with some carbonaceous lenses / laminations			12.65				
				GT003					
	13				13.02		PL(A) = 0.58 PL(D) = 0.39		13
285				C	13.05				
	14	From 14m, with some fine grained sandstone lenses / laminations			14.28		PL(A) = 2.6 PL(D) = 0.56		14
284									
	14.9								
	15	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone			15.01		PL(A) = 2.2 PL(D) = 2.07		15 From 11.35m to 18.5m, gravel From 12.0m to 18.0m, Class 18 PVC Screen
	15.06	SILTSTONE - Medium to high strength, fresh, grey siltstone			15.04				
283		From 15.15m to 15.22m, fine grained sandstone							
	16				16.2		PL(A) = 1.81 PL(D) = 0.44		16
282		From 16.42m to 16.47m, fine grained sandstone		C					
	16.72	From 16.61m, fine grained sandstone							
	17	COAL - Low to medium strength, fresh, black coal			17.05		PL(A) = 0.8 PL(D) = 0.11		17
	17.24	TUFF - Low strength, fresh, white, tuff			17.24				
281		From 17.43m, low to medium strength		GT004					
					17.54		PL(A) = 0.06 PL(D) = 0.03		
	17.74	CARBONACEOUS SILTSTONE - Low to medium strength, fresh, dark grey to black carbonaceous siltstone with some coal lenses			17.57				
	18				18.03		PL(A) = 0.64 PL(D) = 0.73		18
280		From 18.34m to 18.37m, sandstone, fine grained band			18.2				
	18.94			C					
	19	SILTSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone with some siltstone lenses / laminations			19.55		PL(A) = 1.33 PL(D) = 0.76		19
279					19.91				From 18.5m to 21.0m, bentonite

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HQ3 to 20.98m

TYPE OF BORING: Solid flight auger TC Bit to 1.3m, rock roller to 1.55m, HQ3 to 20.98m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 299.02 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 298.47 AHD
EASTING: 231809.03
NORTHING: 6405352.84
DIP/AZIMUTH: 90°/--

BORE No: AGE10-W
PROJECT No: 49761
DATE: 30/4/2013
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
278	20.26	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone with some siltstone lenses / laminations		GT005 GT005 C	20.0 20.0 20.17 20.2		PL(A) = 1.05 PL(D) = 0.45		
277	21 20.98	Bore discontinued at 20.98m, limit of investigation			20.95 20.98		PL(D) = 1.25		21 End cap
276	22								22
275	23								23
274	24								24
273	25								25
272	26								26
271	27								27
270	28								28
269	29								29

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HQ3 to 20.98m

TYPE OF BORING: Solid flight auger TC Bit to 1.3m, rock roller to 1.55m, HQ3 to 20.98m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 299.02 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: AGE11
PROJECT No: 49761
DATE: 4/12/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDY SILT - Stiff, brown, fine to coarse grained sandy silt with trace fine sized subrounded gravel, M<Wp							Stickup=0.57m From 0m to 0.3m, concrete
	1			S	1.0 1.45		5,3,3 N = 6		
	2	From 2m, some fine sized subrounded gravel, some coarse grained sandy silt with some fine to medium grained sand		S	2.5 2.95		14,24,24 N = 48		From 0.3m to 3.6m, backfill and cuttings From 0m to 5.25m, Class 18 Blank
	3								
	4			S	4.0		15,20/60mm		
	4.2	SANDSTONE - Extremely low strength, extremely weathered, yellow brown medium to coarse grained sandstone From 4.44m, fine to coarse grained sandstone			4.2 4.21				From 3.6m to 5.25m, bentonite
	5			pp pp C pp pp	4.58 4.65 4.68 4.95 5.15		550 kPa 300 kPa 250 kPa 300 kPa		
	5.72	At 5.54m to 5.72m, conglomerate band (medium to coarse sized subrounded gravel)		C					
	6	SANDSTONE - High strength, slightly weathered, pale grey mottled yellow brown, medium grained sandstone			6.2				
	7			C					
	8	From 8.19m, fine to medium grained sandstone, interbedded carbonaceous siltstone / sandstone			8.8				
	9			C					
		At 9.51m to 9.73m, pebbly sandstone From 9.74m to 9.86m, thin coal laminations							From 5.2m to 14.2m, 5mm gravel From 5.2m to

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger to 4.2m, rockroller blade bit wash boring to 4.44m, HQ3 coring to 14.79m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: AGE11
PROJECT No: 49761
DATE: 4/12/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		At 9.84m to 9.96m, conglomerate From 9.96m, interbedded siltstone SANDSTONE - High strength, slightly weathered, pale grey mottled yellow brown, medium grained sandstone *(continued)*							14.2m, Class 18 PVC Screen
	10.87	From 10.26m, fine grained sandstone		C					
	11	SILSTONE - High strength, fresh, grey siltstone From 10.92m, fresh							
					11.82				
	12	From 12.33m, sandstone/siltstone							
	12.58	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone							
	13			C					
		From 13.76m, interbedded siltstone							
	14								Bentonite
	14.79	Bore discontinued at 14.79m, limit of investigation			14.79				
	15								
	16								
	17								
	18								
	19								

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger to 4.2m, rockroller blade bit wash boring to 4.44m, HQ3 coring to 14.79m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 326.05 AHD
EASTING: 230633.5
NORTHING: 6402142.12
DIP/AZIMUTH: 90°/--

BORE No: AGE11-W
PROJECT No: 49761
DATE: 4/12/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
326	0	SANDY SILT - Stiff, brown, fine to coarse grained sandy silt with trace fine sized subrounded gravel, M<Wp							Stickup=0.57m From 0m to 0.3m, concrete
325	1								
324	2	From 2m, some fine sized subrounded gravel, some coarse grained sandy silt with some fine to medium grained sand							From 0.3m to 3.6m, backfill and cuttings
323	3								
322	4								
	4.2	SANDSTONE - Extremely low strength, extremely weathered, yellow brown medium to coarse grained sandstone							From 3.6m to 5.1m, bentonite
		From 4.44m, fine to coarse grained sandstone							
321	5								
	5.72	At 5.54m to 5.72m, conglomerate band (medium to coarse sized subrounded gravel)							
320	6	SANDSTONE - High strength, slightly weathered, pale grey mottled yellow brown, medium grained sandstone							
319	7								
318	8	From 8.19m, fine to medium grained sandstone, interbedded carbonaceous siltstone / sandstone							
317	9								
		At 9.51m to 9.73m, pebbly sandstone							From 5.1m to 14.2m, 5mm gravel
		From 9.74m to 9.86m, thin coal laminations							From 5.2m to

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger to 4.2m, rockroller blade bit wash boring to 4.44m, HQ3 coring to 14.79m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 326.68 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 326.05 AHD
EASTING: 230633.5
NORTHING: 6402142.12
DIP/AZIMUTH: 90°/--

BORE No: AGE11-W
PROJECT No: 49761
DATE: 4/12/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
316		At 9.84m to 9.96m, conglomerate From 9.96m, interbedded siltstone SANDSTONE - High strength, slightly weathered, pale grey mottled yellow brown, medium grained sandstone *(continued)*							14.2m, Class 18 PVC Screen
	10.87	From 10.26m, fine grained sandstone							
315	11	SILSTONE - High strength, fresh, grey siltstone From 10.92m, fresh							11
314	12	From 12.33m, sandstone/siltstone							12
	12.58	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone							
313	13								13
312	14	From 13.76m, interbedded siltstone							14 End Cap From 14.2m to 14.79m, bentonite
	14.79	Bore discontinued at 14.79m, limit of investigation							
311	15								15
310	16								16
309	17								17
308	18								18
307	19								19

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger to 4.2m, rockroller blade bit wash boring to 4.44m, HQ3 coring to 14.79m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 326.68 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 327.69 AHD
EASTING: 230011.41
NORTHING: 6400310.11
DIP/AZIMUTH: 90°/--

BORE No: AGE12W
PROJECT No: 49761.02
DATE: 25 - 29/10/2012
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
327	0	SAND - Very loose, brown, fine grained sand with some clay and trace silt, humid		A	0.1				Stickup = 0.35m
				A	0.5				
	1	From 1.0m, slightly clayey, damp		S	1.0		1,1,1 N = 2		
					1.45				
326	2	CLAYEY SAND/SANDY CLAY - (Loose), brown, fine to medium grained clayey sand/sandy clay, saturated							
	2.4	SANDY GRAVEL - Loose, brown, fine to medium grained sandy fine to medium sized subangular, subrounded gravel with some clay, saturated		S	2.5		5,3,3 N = 6		
325	2.6								
	2.9	SAND - Loose, brown, fine to medium grained sand, slightly clayey, saturated		pp	2.9 2.95		180kPa		
	3	SANDY CLAY - Stiff, brown, fine to medium grained sandy clay, M>Wp							
324	4								
	4.0	SAND - Loose, brown, fine to medium grained sand, some to slightly clayey, saturated		S	4.2		3,5,4 N = 9		
323	5				4.65				
		From 5.65m, medium dense, slightly clayey in parts		S	5.65		4,7,5 N = 12		From 0m to 11.40m, grout
322	6				6.1				
	6.8	SILTY CLAY - Very soft, dark brown silty clay with trace fine grained sand, M>>Wp		S, pp	7.0		0,0,0 N = 0 0-50kPa		From 0.0m to 13.3m, Class 18 PVC
321	7				7.45				
320	8								
	8.5	CLAYEY SAND - Loose, grey, fine to medium grained clayey sand, wet to saturated		S, pp	8.65		3,3,3 N = 6 20-60kPa		
319	9				9.1				
	9.5	SANDY GRAVEL - Medium dense, brown, fine to medium grained sand, fine to medium sized subangular, subrounded gravel, slightly clayey, wet							
318									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 10.6m

TYPE OF BORING: Solid flight auger to 2.5m, rotary to 12.3m, HQ to 22.72m

WATER OBSERVATIONS: Groundwater measured at 7.0m during drilling

REMARKS: At 17.18m, water loss (500L). Top of pipe RL 328.12 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 327.69 AHD
EASTING: 230011.41
NORTHING: 6400310.11
DIP/AZIMUTH: 90°/--

BORE No: AGE12W
PROJECT No: 49761.02
DATE: 25 - 29/10/2012
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
317	11	SANDY GRAVEL - Medium dense, brown, fine to medium grained sand, fine to medium sized subangular, subrounded gravel, slightly clayey, wet *(continued)*		S	10.1 10.4		12,10,8 N = 18		
316	12	From 11.65m, slightly clayey sand in parts		S C	11.65 11.9 12.1		8,7,12 N = 19		From 11.4m to 13.3m, bentonite
315	13	12.3 12.41 SILTSTONE - Low strength, extremely to highly weathered, grey siltstone 12.47 BASALT - High to very high strength, moderately weathered, grey basalt (possible floater) 13.02 CORE LOSS - 0.55m SILTSTONE - Low strength, extremely to highly weathered, grey siltstone From 13.35m, moderately weathered		C	12.47				
314	14	13.92 13.97 CORE LOSS - (0.05m) SILTSTONE - Medium to high strength, moderately weathered, grey siltstone		C	13.92				
313	15	From 14.5m, high strength pyrite band, 7mm thick		C	15.32				
312	16	From 15.32m, medium strength From 15.74m to 15.85m, very low strength From 16.1m, medium to high strength		C	16.68				
311	17	16.26 CORE LOSS - 2.21m		C C	16.96				
310	18			C	18.32				From 13.3m to 22.6m, 5mm gravel 13.4m to 22.6m, Class 18 Screen
309	19	18.47 18.54 SILTSTONE - Low strength, highly to moderately weathered, grey siltstone 18.69 18.9 CORE LOSS - 0.15m 19.05 SILTSTONE - Medium strength, moderately weathered, grey siltstone 19.2 19.34 CORE LOSS - 0.15m SILTSTONE - Medium strength, moderately weathered, grey siltstone		C	19.79				
308				C					

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 10.6m

TYPE OF BORING: Solid flight auger to 2.5m, rotary to 12.3m, HQ to 22.72m

WATER OBSERVATIONS: Groundwater measured at 7.0m during drilling

REMARKS: At 17.18m, water loss (500L). Top of pipe RL 328.12 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Pty Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 327.69 AHD
EASTING: 230011.41
NORTHING: 6400310.11
DIP/AZIMUTH: 90°/--

BORE No: AGE12W
PROJECT No: 49761.02
DATE: 25 - 29/10/2012
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
307	21	CORE LOSS - 0.14m SILTSTONE - Medium strength, slightly weathered to fresh, grey siltstone *(continued)* From 20.05m, medium to high strength, with some very low to low bands From 20.52m to 20.60m, tuff band		C	20.25				21
				C	20.57				
				C	21.23				
306	22			C					22 End cap
305	22.72	Bore discontinued at 22.72m, limit of investigation			22.72				
	23								23
304	24								24
303	25								25
302	26								26
301	27								27
300	28								28
299	29								29
298									

RIG: Total (Envirodrill) **DRILLER:** Foody **LOGGED:** Fulham **CASING:** HW to 10.6m

TYPE OF BORING: Solid flight auger to 2.5m, rotary to 12.3m, HQ to 22.72m

WATER OBSERVATIONS: Groundwater measured at 7.0m during drilling

REMARKS: At 17.18m, water loss (500L). Top of pipe RL 328.12 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 354.97 AHD
EASTING: 231057.2
NORTHING: 6401937.49
DIP/AZIMUTH: 90°/--

BORE No: AGE13
PROJECT No: 49761
DATE: 4-6/12/12
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
354	0	SANDY SILT - Stiff, brown, fine to coarse grained sandy silt, M<Wp		A	0.5				Stickup=0.7m
	1				1.0				
	1.1	SAND AND SILT - Very stiff, yellow brown slightly fine to meidum sized subrounded gravelly fine to coarse grained,		S			11,10,5 N = 15		
	1.4	trace subrounded cobbles, M<Wp (moist)		pp	1.4 1.45		220 kPa		
353	2	SANDY CLAY - Very stiff, dark brown, fine to coarse grained sandy clay with some silt, M≥Wp From 2.0m, M>Wp		A	2.0				
	2.2	SANDY CLAY - Hard, fine to coarse grained, fine to medium grained sandy clay with interbedded silty clay, M<Wp (residual)			2.5				
	2.9			pp S	2.7		>450 kPa 5,12,21 N = 33		
352	3	SILTSTONE - Extremely low strength, extremely weathered, grey siltstone (soil like properties)			2.95				
				A	3.5				
351	4			S	4.0 4.14		15.140mm, ref, bouncing		
		From 4.14m, carbonaceous siltstone, interbedded fine grained sandstone		C					
350	5								
	5.1	CORE LOSS - 0.53m		C	5.1				
	5.63	SILTSTONE - Medium strength, slightly weathered, grey siltstone with interbedded fine to medium grained sandstone			5.77				
349	6	At 5.89m, extremely weathered carbonaceous siltstone / coal lense		C	6.1				
348	7			C					
347	8								
	8.7	SANDSTONE - High strength, fresh, yellow brown, medium grained sandstone							
346	9				9.1				
				C					

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.5m

TYPE OF BORING: Solid flight auger to 4.0m, rock roller blade bit wash boring to 4.0m, HQ3 coring to 45.21m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 355.57 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 354.97 AHD
EASTING: 231057.2
NORTHING: 6401937.49
DIP/AZIMUTH: 90°/--

BORE No: AGE13
PROJECT No: 49761
DATE: 4-6/12/12
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
344	11	SANDSTONE - High strength, fresh, yellow brown, medium grained sandstone *(continued)*		C	11.05				
		From 11.0m, medium to coarse grained		C	12.12				
343	12								
342	13	From 13.17m, coarse grained							
		At 13.59m to 13.61m, conglomerate band		C	15.15				
341	14								
340	15								
339	16								
338	17			C					From 0m to 34.5m, backfill/cuttings
337	18				18.13				
	18.14	SILTSTONE - High strength, fresh, dark grey siltstone with interbedded carbonaceous siltstone and thin coal laminations							
336	19			C					
	19.15	COAL / CARBONACEOUS SILTSTONE - Fresh, dark brown coal / carbonaceous siltstone At 19.49m to 19.62m, siltstone band							

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.5m

TYPE OF BORING: Solid flight auger to 4.0m, rock roller blade bit wash boring to 4.0m, HQ3 coring to 45.21m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 355.57 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 354.97 AHD
EASTING: 231057.2
NORTHING: 6401937.49
DIP/AZIMUTH: 90°/--

BORE No: AGE13
PROJECT No: 49761
DATE: 4-6/12/12
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	20.12	TUFFACEOUS CLAYSTONE - Medium strength, fresh, pale grey tuffaceous claystone							
	20.34	CARBONACEOUS SILTSTONE / COAL - High strength, fresh, dark brown coal / carbonaceous siltstone		C					
334	21	At 20.86m to 20.89m, tuffaceous claystone / siltstone							
		At 21.16m to 21.19m, tuffaceous siltstone / claystone			21.16				
333	22								
		At 22.38m to 22.54m, carbonaceous siltstone / coal		C					
	22.8	SANDSTONE / SILTSTONE - High strength, fresh, grey to dark grey, fine to medium grained sandstone / siltstone							
332	23	Gtom 23.6m to 23.98m, siltstone band							
331	24	At 23.98m to 24.62m, carbonaceous siltstone / coal			24.17				
330	25			C					
329	26								
328	27				27.13				
327	28	At 28.10m to 28.55m, carbonaceous siltstone / coal		C					
326	29								
	29.89								

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.5m

TYPE OF BORING: Solid flight auger to 4.0m, rock roller blade bit wash boring to 4.0m, HQ3 coring to 45.21m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 355.57 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 354.97 AHD
EASTING: 231057.2
NORTHING: 6401937.49
DIP/AZIMUTH: 90°/--

BORE No: AGE13
PROJECT No: 49761
DATE: 4-6/12/12
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		COAL - High strength, fresh, dark brown to black coal with interbedded carbonaceous siltstone *(continued)*		C	30.16				
324	31								31
	31.27	TUFFACEOUS CLAYSTONE - Medium strength, fresh, pale grey tuffaceous claystone							
	31.45	COAL - High strength, fresh, dark brown to black coal with interbedded carbonaceous siltstone		C					
323	32	At 31.52m to 31.53m, tuffaceous claystone							32
	32.24	At 31.57m to 31.62m, tuffaceous claystone At 32.14m to 32.15m, tuffaceous claystone At 32.17m to 32.19m, siderite?							
		TUFFACEOUS CLAYSTONE - Medium strength, fresh, pale grey, tuffaceous claystone							
322	32.92 33	COAL - Medium to high strength, fresh, dark brown coal with interbedded carbonaceous siltstone			33.2				33
321	34	At 33.73m to 33.78m, tuffaceous claystone							34
	34.47	TUFFACEOUS SANDSTONE / SILTSTONE - High strength, fresh, pale grey to grey, tuffaceous fine to medium grained sandstone / siltstone		C					
320	35 35.0	From 34.8m, tuffaceous siltstone / claystone							35
		SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone							
319	36								36
	36.22	SANDSTONE - High strength, fresh, grey, medium grained sandstone with interbedded siltstone			36.22				
318	37								37
		From 37.62m, coarse grained sandstone with interbedded pebbly sandstone		C					
317	38								38
	38.58	COAL - High strength, fresh, dark brown to black, coal							
316	39								39
					39.22				
		At 39.53m, tuffaceous siltstone (tuffaceous siltstone -5mm)		C					

From 34.5m to 37.1m, bentonite

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.5m

TYPE OF BORING: Solid flight auger to 4.0m, rock roller blade bit wash boring to 4.0m, HQ3 coring to 45.21m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 355.57 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 354.97 AHD
EASTING: 231057.2
NORTHING: 6401937.49
DIP/AZIMUTH: 90°/--

BORE No: AGE13
PROJECT No: 49761
DATE: 4-6/12/12
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
314	41	At 39.89m, tuffaceous siltstone - 10mm COAL - High strength, fresh, dark brown to black, coal *(continued)* At 40.9m, tuffaceous siltstone - 5 mm At 41.3m, tuffaceous siltstone - 5mm		C					From 37.6m to 43.6m, Class 18 PVC Screen From 37.1m to 45.1m, 5mm gravel
313	42								
	42.1	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone			42.21				
312	43			C					
311	44	From 43.95m, interbedded coarse grained sandstone							End cap
310	45								
	45.21	Bore discontinued at 45.21m, limit of investigation			45.21				
309	46								
308	47								
307	48								
306	49								

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.5m

TYPE OF BORING: Solid flight auger to 4.0m, rock roller blade bit wash boring to 4.0m, HQ3 coring to 45.21m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 355.57 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 355.05 AHD
EASTING: 231057.16
NORTHING: 6401936.48
DIP/AZIMUTH: 90°/--

BORE No: AGE13-W
PROJECT No: 49761
DATE: 4-6/12/12
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
355		SANDY SILT - Stiff, brown, fine to coarse grained sandy silt, M<Wp		A	0.5				Stickup=0.55m
					1.0				
354	1			S			11,10,5 N = 15 220 kPa		From 0m to 2.5m, grout
	1.1	SAND AND SILT - Very stiff, yellow brown slightly fine to meidum sized subrounded gravelly fine to coarse grained, trace subrounded cobbles, M<Wp (moist)		pp	1.4				
	1.4				1.45				
		SANDY CLAY - Very stiff, dark brown, fine to coarse grained sandy clay with some silt, M≥Wp		A	2.0				
353	2	From 2.0m, M>Wp							
	2.2	SANDY CLAY - Hard, fine to coarse grained, fine to medium grained sandy clay with interbedded silty clay, M<Wp (residual)			2.5				
				pp	2.7		>450 kPa 5,12,21 N = 33		
	2.9			S					
352	3	SILTSTONE - Extremely low strength, extremely weathered, grey siltstone (soil like properties)			2.95				From 2.5m to 4.05m, bentonite
				A	3.5				
351	4				4.0				
		From 4.14m, carbonaceous siltstone, interbedded fine grained sandstone		S	4.14		15.140mm, ref, bouncing		
350	5								
	5.1	CORE LOSS - 0.53m							
	5.63	SILTSTONE - Medium strength, slightly weathered, grey siltstone with interbedded fine to medium grained sandstone							
349	6	At 5.89m, extremely weathered carbonaceous siltstone / coal lense							
348	7								
347	8								
	8.7	SANDSTONE - High strength, fresh, yellow brown, medium grained sandstone							
346	9								From 4.05m to 14.1m, 2/5mm gravel From 4.1m to 14.1m, Class 18 PVC Screen

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.5m

TYPE OF BORING: Solid flight auger to 4.0m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of pipe RL 355.61 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 355.05 AHD
EASTING: 231057.16
NORTHING: 6401936.48
DIP/AZIMUTH: 90°/--

BORE No: AGE13-W
PROJECT No: 49761
DATE: 4-6/12/12
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
345		SANDSTONE - High strength, fresh, yellow brown, medium grained sandstone *(continued)*							
344	11	From 11.0m, medium to coarse grained							11
343	12								12
342	13	From 13.17m, coarse grained At 13.59m to 13.61m, conglomerate band							13
341	14								14 End cap
	14.1	Bore discontinued at 14.1m, limit of investigation							
340	15								15
339	16								16
338	17								17
337	18								18
336	19								19

RIG: Hydropower Scout **DRILLER:** (Total) Wakeman **LOGGED:** Semmler **CASING:** HW to 4.5m
TYPE OF BORING: Solid flight auger to 4.0m
WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids
REMARKS: Top of pipe RL 355.61 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 309.36 AHD
EASTING: 229440.46
NORTHING: 6406002.33
DIP/AZIMUTH: 90°/--

BORE No: AGE14
PROJECT No: 49761
DATE: 4/12/2013
SHEET 1 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details (Stickup = 0.541m)
309	0	SILTY SAND - (Loose), brown, fine grained silty sand, dry		A	0.1				
				A	0.25				
		From 0.5m to 1.5m, some coarse grained sand and trace fine to medium sized subangular/subrounded gravel		A	0.5				
	1	From 1.0m, dense			1.0				1
308				S			10,15,20 N = 35		
		At 1.4m to 1.45m, sandstone cobble			1.45				
				U_{75}	1.5				
				pp	1.67		>400 kPa		
	1.8	CLAY - (Hard), red/brown clay with some fine grained sand and trace fine sized gravel, M<<Wp							
	2								2
307					2.5				
				S			17,27/150mm refusal		
					2.8				
	3				3.0				3
306				D					
	4								4
305									
	4.8	GRAVEL - (Medium dense), brown, fine to medium sized subangular/subrounded gravel with trace clay, humid		D	4.8				

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 3.25m, HW to 7.5m

TYPE OF BORING: Solid flight auger to 2.5m, HQ to 6.0m, rotary to 8.0m, HQ to 27.01m

WATER OBSERVATIONS: Free groundwater measured at 22.5m during drilling

REMARKS: Top of Pipe RL 309.90 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 309.36 AHD
EASTING: 229440.46
NORTHING: 6406002.33
DIP/AZIMUTH: 90°/--

BORE No: AGE14
PROJECT No: 49761
DATE: 4/12/2013
SHEET 2 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
304		GRAVEL - (Medium dense), brown, fine to medium sized subangular/subrounded gravel with trace clay, humid *(continued)*		D					
	6 6.0	CLAY - Hard, red/brown clay with trace fine to medium sized gravel, M<<Wp		S	6.0		12,20,25/100mm refusal		6
303					6.4				
		From 6.5m, some weathered siltstone cobbles up to 30mm in diameter		S	6.5		12,28/115mm refusal		
					6.77				
	7								7
302									
	7.6	SILTSTONE - Very low to low strength, highly weathered, brown and grey siltstone		S	7.6		20/90mm refusal bouncing		
					7.66				
				S	7.85		8/10mm refusal bouncing		
					7.86				
	8 8.0	SILTSTONE - Extremely low to very low strength, extremely to highly weathered, brown siltstone			8.0				8
	8.12	CORE LOSS - 0.18m (8.12m to 8.30m)							
	8.3	SILTSTONE - Very low strength, highly weathered, brown siltstone		C					
301					8.58		PL(A) = 0.04		
					8.8				
	9				8.97		PL(A) = 0.69		9
		From 9.09m, slightly weathered		C					
300		From 9.3m, medium strength			9.34		PL(A) = 0.77		
	9.45	SANDSTONE - Medium strength, slightly weathered, light brown, fine grained sandstone			9.63		PL(A) = 4.41 PL(D) = 0.63		
					9.8				
				C					

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 3.25m, HW to 7.5m

TYPE OF BORING: Solid flight auger to 2.5m, HQ to 6.0m, rotary to 8.0m, HQ to 27.01m

WATER OBSERVATIONS: Free groundwater measured at 22.5m during drilling

REMARKS: Top of Pipe RL 309.90 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 309.36 AHD
EASTING: 229440.46
NORTHING: 6406002.33
DIP/AZIMUTH: 90°/--

BORE No: AGE14
PROJECT No: 49761
DATE: 4/12/2013
SHEET 3 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE - Medium strength, slightly weathered, light brown, fine grained sandstone *(continued)*							
		From 10.0m, high strength, fresh			10.2		PL(D) = 2.91		
299					10.4		PL(A) = 2.99		
	10.46	LAMINITE - High strength, fresh stained, grey and light grey, fine grained laminite							
		From 10.77m, fresh							
	11			C					11 From 0.0m to 22.0m, grout From -0.54m to 22.7m, Class 18 blank
298					11.31		PL(A) = 2.8		
	12				11.97				12
		From 12.1m, carbonaceous mudstone							
	12.3	COAL - High strength, fresh, black coal							
297					12.63		PL(A) = 1		
	12.68	SILTSTONE - High strength, fresh, dark grey siltstone							
					12.88		PL(A) = 0.85		
	13	From 13.02m to 13.66m, interbedded with fine grained sandstone bands up to 50mm thick							13
					13.3		PL(A) = 2.08 PL(D) = 1.37		
296				GT001 C	13.3				
					13.49				
					13.69		PL(A) = 1.63		
	14	From 14.0m, medium strength, carbonaceous							14
					14.11		PL(A) = 0.96		
295	14.36	COAL - Medium to high strength, fresh black coal							
					14.53		PL(A) = 0.89		
					14.99				

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 3.25m, HW to 7.5m

TYPE OF BORING: Solid flight auger to 2.5m, HQ to 6.0m, rotary to 8.0m, HQ to 27.01m

WATER OBSERVATIONS: Free groundwater measured at 22.5m during drilling

REMARKS: Top of Pipe RL 309.90 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 309.36 AHD
EASTING: 229440.46
NORTHING: 6406002.33
DIP/AZIMUTH: 90°/--

BORE No: AGE14
PROJECT No: 49761
DATE: 4/12/2013
SHEET 4 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		COAL - Medium to high strength, fresh black coal *(continued)*			14.99				
294					15.4		PL(A) = 1.15		
		From 15.61m to 15.84m, tuff band							
	16								16
293				C	16.5		PL(A) = 2.53		
		From 16.84m to 17.04m, medium strength, tuff band							
	17				16.95		PL(A) = 0.54		17
292									
	17.6	From 17.55m, very low strength, tuff							
		TUFF - High strength, fresh, light grey tuff			17.8		PL(A) = 1.47		
	18 18.0				17.99				
		COAL - Very high strength, fresh, black coal			18.05		PL(A) = 3.36		18
291									
	19			C					19
	19.05	SILTSTONE - High strength, fresh, grey siltstone with some fine grained sandstone bands up to 50mm thick							
290					19.3		PL(A) = 2.49		

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 3.25m, HW to 7.5m

TYPE OF BORING: Solid flight auger to 2.5m, HQ to 6.0m, rotary to 8.0m, HQ to 27.01m

WATER OBSERVATIONS: Free groundwater measured at 22.5m during drilling

REMARKS: Top of Pipe RL 309.90 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 309.36 AHD
EASTING: 229440.46
NORTHING: 6406002.33
DIP/AZIMUTH: 90°/--

BORE No: AGE14
PROJECT No: 49761
DATE: 4/12/2013
SHEET 5 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
289		SILTSTONE - High strength, fresh, grey siltstone with some fine grained sandstone bands up to 50mm thick *(continued)*		C	20.5 20.55		PL(A) = 2.87 PL(D) = 1.25		
	20.66	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone with some siltstone laminations		GT002	20.8				
	21				21.0				21
288					21.51		PL(A) = 1.65 PL(D) = 1.69		
		From 21.6m, medium strength, coarse grained							
	22				22.2				22
287				GT003					From 22.0m to 22.4m, bentonite
				C	22.48 22.55		PL(A) = 0.78 PL(D) = 0.77		
	22.72	COAL - Medium strength, fresh, black coal			22.85		PL(A) = 0.66 PL(D) = 0.32		
	23								23
286									
	24				24.01				24
		From 24.2m, high strength							From 22.4m to 25.7m, gravel From 22.7m to 25.7m, Class 18 screen
285				C	24.44		PL(A) = 1.39		

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 3.25m, HW to 7.5m

TYPE OF BORING: Solid flight auger to 2.5m, HQ to 6.0m, rotary to 8.0m, HQ to 27.01m

WATER OBSERVATIONS: Free groundwater measured at 22.5m during drilling

REMARKS: Top of Pipe RL 309.90 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 309.36 AHD
EASTING: 229440.46
NORTHING: 6406002.33
DIP/AZIMUTH: 90°/--

BORE No: AGE14
PROJECT No: 49761
DATE: 4/12/2013
SHEET 6 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
284		COAL - Medium strength, fresh, black coal *(continued)*			25.45		PL(A) = 1.68		
	25.67	SANDSTONE - High strength, fresh, grey, coarse grained sandstone							
	26			C					26
283					26.25				
				GT004	26.4		PL(A) = 1.71 PL(D) = 1.78		From 25.7m to 27.0m, Class 18 blank From 25.7m to 27.0m, bentonite
					26.49				
					26.79		PL(A) = 0.08		
	27 27.01	Bore discontinued at 27.01m, limit of investigation			27.01				End cap 27
282									
	28								28
281									
	29								29
280									

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 3.25m, HW to 7.5m

TYPE OF BORING: Solid flight auger to 2.5m, HQ to 6.0m, rotary to 8.0m, HQ to 27.01m

WATER OBSERVATIONS: Free groundwater measured at 22.5m during drilling

REMARKS: Top of Pipe RL 309.90 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 303.23 AHD
EASTING: 229850.02
NORTHING: 6405267.65
DIP/AZIMUTH: 90°/--

BORE No: AGE15
PROJECT No: 49761
DATE: 3 - 10/12/2013
SHEET 1 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details (Stickup = 0.503m)
303		SANDY SILT - (Loose), brown, fine grained sandy silt, dry to humid		A	0.1				
				A	0.25				
				A	0.5				
	1 1.0	CLAY - Hard (dry), red/brown clay with some fine grained sand and some silt, M<<Wp		S	1.0		13,23/150 refusal		1
302					1.3				
				U_{75}	1.5				
				pp	1.65		>400 kPa		
	2								2
301		From 2.5m, trace fine sized gravel		S	2.5		21,28/150 refusal		
					2.8				
	3			U_{75}	3.0				3
				pp	3.11		>400 kPa		
300									
	4			S	4.0		12,18,19 N = 37		4
299					4.45				

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 7.8m, HQ to 30.34m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of Pipe RL 303.73 AHD. Coordinates in MGA.
20% water loss at 11.24m, 100% water loss at 11.94m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 303.23 AHD
EASTING: 229850.02
NORTHING: 6405267.65
DIP/AZIMUTH: 90°/--

BORE No: AGE15
PROJECT No: 49761
DATE: 3 - 10/12/2013
SHEET 2 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
298		CLAY - Hard (dry), red/brown clay with some fine grained sand and some silt, M<<Wp *(continued)*							
		From 5.5m, grading to rock		S	5.5		15,25/120mm refusal		
					5.77				
	6								6
297									From 0.0m to 12.6m, grout
	6.8	SANDSTONE - Low strength, highly weathered, brown fine grained sandstone with some fine sized gravel bands							From -0.50m to 13.9m, Class 18 blank
	7				7.0				7
296				S			15,24,25/130 refusal		
					7.43				
	7.8	CORE LOSS - 0.45m (7.80m to 8.25m)			7.8				
	8								8
295	8.25	SANDSTONE - Extremely low to very low strength, extremely to highly weathered, brown, fine to medium grained sandstone		C	8.43		PL(A) = 0.02		
					8.85		PL(A) = 0.24		
					8.93		PL(D) = 0.15		
	9								9
	9.1	From 9.04m, extremely weathered		C					
294		CORE LOSS - 0.29m (9.1m to 9.39m)							
	9.39				9.42		PL(A) = 0.01		
	9.43	WEATHERED COAL - Extremely low strength, extremely weathered, friable, dark brown coal			9.45				
	9.48								
	9.65	SILTSTONE - Medium strength, moderately weathered, brown siltstone		C	9.72		PL(A) = 1.05		
		From 9.47m, weathered coal							
		CORE LOSS - 0.17m (9.48m to 9.65m)							

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 7.8m, HQ to 30.34m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of Pipe RL 303.73 AHD. Coordinates in MGA.
20% water loss at 11.24m, 100% water loss at 11.94m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 303.23 AHD
EASTING: 229850.02
NORTHING: 6405267.65
DIP/AZIMUTH: 90°/--

BORE No: AGE15
PROJECT No: 49761
DATE: 3 - 10/12/2013
SHEET 3 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
293		SILTSTONE - High strength, moderately weathered, brown siltstone *(continued)*			10.15		PL(A) = 0.8		
	10.4	SANDSTONE - Medium strength, moderately weathered, brown, fine to medium grained sandstone							
					10.9		PL(A) = 0.95		
	11			C					11
292		From 11.25m, slightly weathered			11.5		PL(A) = 0.53		
	12				12.0				12
291		From 12.2m, moderately weathered							
		From 12.72m, slightly weathered			12.82		PL(A) = 1.02		
	13	From 12.97m, coarse grained		C					13 From 12.6m to 13.3m, bentonite
290					13.67		PL(A) = 0.76 PL(D) = 0.59		
	14								14
	14.05	From 13.99m, highly weathered			14.03				
289		WEATHERED COAL - Extremely low strength, extremely weathered, friable, dark brown and red weathered coal From 14.2m, very low strength			14.28		PL(A) = 0.04		
				C					
		From 14.85m, extremely low strength							
	15.0				15.0				

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 7.8m, HQ to 30.34m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of Pipe RL 303.73 AHD. Coordinates in MGA.
20% water loss at 11.24m, 100% water loss at 11.94m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 303.23 AHD
EASTING: 229850.02
NORTHING: 6405267.65
DIP/AZIMUTH: 90°/--

BORE No: AGE15
PROJECT No: 49761
DATE: 3 - 10/12/2013
SHEET 4 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CORE LOSS - 0.13m (15.0m to 15.13m)			15.0				
288	15.13	SANDSTONE - Medium strength, moderately to slightly weathered, brown and grey, fine to medium grained sandstone			15.28		PL(A) = 1.24		
		From 15.27m, high strength							
	16								16
287		From 16.0m, some very low strength bands up to 20mm thick		C	16.55		PL(A) = 1.83		
					16.86		PL(A) = 1.9		
	17								17
286		From 17.21m, very high strength, fresh, light grey, (possibly heat affected)							
	18				17.95		PL(A) = 3.18		18
285					18.0				
					18.6		PL(A) = 5.36 PL(D) = 3.81		
				C					
	19				19.08		PL(A) = 1.93 PL(D) = 1.96		19
284	19.2	MUDSTONE - Medium strength, fresh stained, brown mudstone							
		From 19.72m, fresh			19.48		PL(A) = 0.96		
					19.7				
				C					

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 7.8m, HQ to 30.34m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of Pipe RL 303.73 AHD. Coordinates in MGA.
20% water loss at 11.24m, 100% water loss at 11.94m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 303.23 AHD
EASTING: 229850.02
NORTHING: 6405267.65
DIP/AZIMUTH: 90°/--

BORE No: AGE15
PROJECT No: 49761
DATE: 3 - 10/12/2013
SHEET 5 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
283		MUDSTONE - Medium strength, fresh stained, brown mudstone *(continued)* From 20.0m, high strength			20.08		PL(A) = 1.72		
		From 20.38m to 20.6m, fine to medium grained sandstone band		C	20.38		PL(A) = 1.95 PL(D) = 1.12		
					20.81		PL(A) = 1.32		
	21				20.99				21
282	21.14	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone with some mudstone from 21.57m to 22.72m			21.44		PL(A) = 1.9 PL(D) = 1.09		From 13.3m to 30.34m, gravel
	22								22
281				C	22.12		PL(A) = 1.99		From 13.9m to 30.34m, Class 18 machine slotted
		From 22.8m, very high strength							
	23								23
280					23.23		PL(A) = 4.23 PL(D) = 3.23		
	24				24.02				24
279					24.18		PL(D) = 14.16		
				C					
	24.74	MUDSTONE - High strength, fresh, dark grey mudstone							

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 7.8m, HQ to 30.34m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of Pipe RL 303.73 AHD. Coordinates in MGA.
20% water loss at 11.24m, 100% water loss at 11.94m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 303.23 AHD
EASTING: 229850.02
NORTHING: 6405267.65
DIP/AZIMUTH: 90°/--

BORE No: AGE15
PROJECT No: 49761
DATE: 3 - 10/12/2013
SHEET 6 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
278		MUDSTONE - High strength, fresh, dark grey mudstone *(continued)*			25.13		PL(A) = 1.93		
	25.44	SILTSTONE - Very high strength, fresh, light grey siltstone							
	26			C	26.0		PL(A) = 3.12		26
277		From 26.45m to 26.55m, high strength tuff			26.51		PL(A) = 1.25		
		From 26.55m, grey			26.83		PL(A) = 1.57 PL(D) = 1.06		
	27				26.97				27
276		From 27.32m, very high strength with some interbedded sandstone laminations up to 30mm thick							
	28				27.95		PL(A) = 3.2		28
275				C					
	28.65	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone			28.9		PL(A) = 1.47		
	29								29
274	29.66	MUDSTONE - High strength, fresh, grey mudstone			29.95		PL(A) = 1.18		

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 7.8m, HQ to 30.34m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of Pipe RL 303.73 AHD. Coordinates in MGA.
20% water loss at 11.24m, 100% water loss at 11.94m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 303.23 AHD
EASTING: 229850.02
NORTHING: 6405267.65
DIP/AZIMUTH: 90°/--

BORE No: AGE15
PROJECT No: 49761
DATE: 3 - 10/12/2013
SHEET 7 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
273		MUDSTONE - High strength, fresh, grey mudstone *(continued)*		C	29.99 29.99		PL(D) = 1.14		End cap
	30.34	Bore discontinued at 30.34m, limit of investigation			30.34				
	31								31
272									
	32								32
271									
	33								33
270									
	34								34
269									

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 7.2m

TYPE OF BORING: Solid flight auger to 7.0m, rotary to 7.8m, HQ to 30.34m

WATER OBSERVATIONS: Free groundwater observations obscured due to drilling fluids

REMARKS: Top of Pipe RL 303.73 AHD. Coordinates in MGA.
20% water loss at 11.24m, 100% water loss at 11.94m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: WorleyParsons Services Pty Ltd
PROJECT: Bylong Coal Project
LOCATION: Bylong, NSW

SURFACE LEVEL: --
EASTING: 231078
NORTHING: 6412159
DIP/AZIMUTH: 90°/--

BORE No: AGE16
PROJECT No: 49761.04
DATE: 8/3/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	SANDY SILT - Brown, fine to medium grained sandy silt, some fine to medium sized subangular gravel, occassional cobbles at surface, abundant organics to 0.05m, humid		A	0.1				Stick up = 0.73m From 0 to 0.2m, concrete
	0.3	CLAYEY GRAVEL - Brown, clayey, fine to medium sized gravel, trace to some fine to medium grained sand, humid to damp		A	0.5				From 0.2m to 0.5m, bentonite From 0m to 1.1m, 50mm diameter Class 18 PVC
	0.7	SANDY CLAYEY GRAVEL - Brown mottled orange, fine to medium grained sandy clayey, fine to medium sized, subrounded and subangular gravel, some clayey fine to medium grained sand zones, damp			1.0				
1				S			18,30,32/120mm refusal (bouncing)		1
					1.45				
2									2
	2.2	SANDY CLAY - Brown, fine to medium grained sandy clay, trace fine to medium sized subangular gravel (basalt), M<Wp/damp to moist		S	2.5		13,24,25 N = 49		From 0.5m to 4.1m, 2/5mm gravel From 1.1m to 4.1m, 50mm diameter Class 18 PVC screen
3									3
	3.1	CLAYEY SAND - Brown, fine to coarse grained clayey sand, trace fine to medium sized subrounded and subangular gravel, damp to moist							
4				S	4.0 4.07		7/80mm refusal (bouncing)		4 End cap
	4.1	Bore discontinued at 4.1m, limit of investigation/refusal on inferred rock							

RIG: Hagstrom Drilling Hydrapower **DRILLER:** C. Nelson **LOGGED:** Wilson **CASING:** Nil

TYPE OF BORING: Solid flight auger with TC-bit to 4.1m

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: * Approximate coordinates by handheld GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: WorleyParsons Services Pty Ltd
PROJECT: Bylong Coal Project
LOCATION: Bylong, NSW

SURFACE LEVEL: --
EASTING: 231567
NORTHING: 6411761
DIP/AZIMUTH: 90°/--

BORE No: AGE18
PROJECT No: 49761.04
DATE: 4 - 6/3/2016
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTY SAND - Brown, fine grained silty sand, trace fine sized subangular gravel, abundant rootlets to 0.1m, humid		A	0.1				Stick up = 0.7m
		From 0.3m, slightly claeye with some fine to medium sized subangular gravel, humid		A	0.5				From 0 to 0.5m, concrete
	0.8								
		GRAVELLY SAND - Brown, fine to medium sized subangular gravelly, fine to medium grained sand, some clay, damp to moist			1.0				
	1			S			17,25/70mm refusal		1
					1.22				
	1.5								
		CLAYEY SAND - Brown, fine to medium grained clayey sand, trace to some fine subangular gravel, damp to moist							
	2								2 From 0.5m to 3.4m, 2/5mm gravel
				A	2.3				
					2.5				
				S			12,25/130mm refusal		
					2.78				
	3								3 From 2.3m to 3.4m, 50mm diameter Class 18 PVC
	3.5								
		GRAVELLY SAND - Grey brown, fine to medium sized subrounded and subangular gravelly, fine to medium grained sand, damp to moist							
	4								4 From 3.4m to 4.4m, bentonite
				S	4.0		15/90mm refusal		
					4.09				
	5.0								

RIG: Hagstrom Drilling Hydrapower **DRILLER:** J. Gay **LOGGED:** Wilson **CASING:** PW to 3.8m, HW to 7.8m

TYPE OF BORING: 125mm diameter solid flight auger to 7.8m, washbore with casing advancer to 7.8m

WATER OBSERVATIONS: No free groundwater observed during drilling, groundwater observations obscured from 7.8m due to washbore drilling

REMARKS: * Approximate coordinates by handheld GPS. PVC casing raised by drill rods to 7.4m depth. PW casing remains in bore from 0.65m to 3.75m (could not be retrieved)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: WorleyParsons Services Pty Ltd
PROJECT: Bylong Coal Project
LOCATION: Bylong, NSW

SURFACE LEVEL: --
EASTING: 231567
NORTHING: 6411761
DIP/AZIMUTH: 90°/--

BORE No: AGE18
PROJECT No: 49761.04
DATE: 4 - 6/3/2016
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SLIGHTLY GRAVELLY SAND - Brown, fine to medium sized, subrounded and subangular, slightly gravelly, fine to medium grained sand, some clay, moist		S	5.5 5.56		15/60mm refusal		From 3.5m to 7.8m, 2/5mm gravel From 4.4m to 7.4m, 50mm diameter Class 18 PVC screen
6									6
		From 6.5m, trace clay							
7				S	7.0 7.14		21/140mm refusal		7 End cap
	7.8	At 7.8m, refusal on assumed rock							
		Bore discontinued at 7.8m, limit of investigation/refusal							
8									8
9									9

RIG: Hagstrom Drilling Hydrapower **DRILLER:** J. Gay **LOGGED:** Wilson **CASING:** PW to 3.8m, HW to 7.8m

TYPE OF BORING: 125mm diameter solid flight auger to 7.8m, washbore with casing advancer to 7.8m

WATER OBSERVATIONS: No free groundwater observed during drilling, groundwater observations obscured from 7.8m due to washbore drilling

REMARKS: * Approximate coordinates by handheld GPS. PVC casing raised by drill rods to 7.4m depth. PW casing remains in bore from 0.65m to 3.75m (could not be retrieved)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: WorleyParsons Services Pty Ltd
PROJECT: Bylong Coal Project
LOCATION: Bylong, NSW

SURFACE LEVEL: --
EASTING: 231834
NORTHING: 6411591
DIP/AZIMUTH: 90°/--

BORE No: AGE19
PROJECT No: 49761.04
DATE: 7/3/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDY SILT - Brown, fine to medium grained subangular sandy silt, trace fine to medium sized gravel, occassional cobbles at surface, abundant organics to 0.05m, humid		A	0.5				Stickup = 0.7m From 0m to 0.3m, concrete From 0.3m to 0.5m, bentonite From 0m to 0.85m, 50mm diameter Class 18 PVC
	0.6	CLAYEY GRAVELLY SAND - Orange brown, fine to medium grained gravelly, subrounded and subangular, fine to medium grained sand, humid			1.0				
	1			S			11,14,21 N = 35		From 0.5m to 1.95m, 2/5mm gravel From 0.85m to 1.95m, 50mm diameter Class 18 PVC screen
		From 1.35m, fine to medium sized, subangular gravel (grey basalt)			1.45				
	1.85	BASALT -(Extremely high strength), slightly weathered, grey basalt							End cap
	2 2.0	(High drilling resistance with TC-bit)							
		Bore discontinued at 2.0m, limit of investigation/inferred top of basalt							
	3								
	4								

RIG: Hagstrom Drilling Hydrapower **DRILLER:** J. Gay **LOGGED:** Wilson **CASING:** Nil

TYPE OF BORING: Solid flight auger with TC-bit to 2.0m

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: * Approximate coordinates by handheld GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: WorleyParsons Services Pty Ltd
PROJECT: Bylong Coal Project
LOCATION: Bylong, NSW

SURFACE LEVEL: --
EASTING: 232073
NORTHING: 6411477
DIP/AZIMUTH: 90°/--

BORE No: AGE20
PROJECT No: 49761.04
DATE: 7/3/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0	SANDY SILT - Brown, fine to medium grained sandy silt, trace to some fine to medium sized, subangular gravel, abundant organics to 0.05m, humid		A	0.1				Stickup = 0.63m From 0m to 0.1m, concrete
		From 0.3m, trace fine to medium sized subangular gravel		A	0.5				From 0.1m to 0.3m, bentonite From 0m to 0.6m, 50mm diameter Class 18 PVC
	0.7	From 0.6m, increase in drilling resistance							
	1	SANDY CLAY - Orange-brown, fine to medium grained sandy clay, some fine to medium sized, subrounded and subangular gravel, M<Wp/damp			1.0				From 0.3m to 1.5m, 2/5mm gravel From 0.6m to 1.5m, 50mm diameter Class 18 PVC screen
				S			17,14/145mm refusal (bouncing)		
	1.45				1.29				
	1.5	BASALT -(Extremely high strength), slightly weathered, grey basalt (High drilling resistance with TC-bit)							End cap
		Bore discontinued at 1.5m, limit of investigation/refusal of TC-bit							
	2								
	3								
	4								

RIG: Hagstrom Drilling Hydrapower **DRILLER:** J. Gay **LOGGED:** Wilson **CASING:** Nil

TYPE OF BORING: Solid flight auger with TC-bit to 1.5m

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: * Approximate coordinates by handheld GPS. Secondary bore drilled 1.1m west to 1.15m to confirm presence of rock

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Australasian Groundwater & Environmental Consultants Pty Ltd
4 Hudson St, Hamilton, NSW 2303
Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

BOREHOLE LOG

AGE22M

PROJECT No: **G1606F**
PROJECT NAME: **Bylong borefield installation**
DATE DRILLED: **21.03.2016**
LOGGED BY: **B.McKay (AGE)**

DRILLING COMPANY: **Hagstrom Drilling**
DRILLER: **S. Mortimer**
DRILLING METHOD: **Mud Rotary**
DRILL RIG: **Hydrapower scout**

EASTING: **230405.74 mE**
NORTHING: **6407002.82 mN**
DATUM: **MGA94 (z56)**
RL: **275.67 mAHD**
EOH: **18 mBGL**

COMMENTS: **Alluvial monitoring bore.**

Stratigraphic Cloumn	Soil or Rock Field Material Description	Graphic Log	Depth (mBGL) / R.L. (mAHD)	Bore Construction	Bore Description
			276 / 0	+0.72 m -0 mAHD	Protective lockable steel collar PVC stick up: +0.72 m
Soil	Clay, very dark brown, medium plasticity, subangular lithic clasts up to 5mm throughout. Clay highly cohesive.				
Alluvial sand and gravel	Clay, mottled dark brown and orange, medium plasticity, moderately cohesive, subrounded to subangular siliceous clasts to 3mm. Poorly sorted clayey throughout.		274 / 2		Bentonite grout dry weight (10 %): 0 m to 1 m
	Granular gravel, siliceous subrounded clasts averaging 2mm across. Medium sorting. Clayey throughout (light brown), various colours.		272 / 4		149.2 mm rock roller: 0 m to 18 m (mud) 152.4 mm blade: 0 m to 18 m (mud) Bentonite seal: 1 m to 3 m
	Fluvial sediments, granular gravel, siliceous, white to dark brown, rounded to subangular, whole sequence fining up.		270 / 6		50 mm PN 18 uPVC blank casing: 0 m to 8 m
	Gravel, ~3mm across average, white to clear to orange subrounded to subangular clasts, rounding increasing with depth. Clayey throughout.		268 / 8	6-May-16	2 mm washed, rounded, quartz gravel pack: 3 m to 18 m
	Gravel, granular to pebble sized, subrounded to subangular, poorly sorted. Clear, white, pink and iron staining on siltstone clasts, sideritic nodules. Carbonaceous siltsone fragments throughout. Clast size increasing with depth. Carbonaceous towards base.		266 / 10		
	Dull stony coal 5% / carbonaceous siltstone 30% / fine grained sandstone iron stained (65%).		264 / 12		50 mm PN 18 uPVC machine slotted casing, slot aperture: 0.5 mm, slot length: 50 mm, 672 slots / m, 8 m to 11 m
Highly weathered competent rock	Sandstone 80%, light grey, fine grained, carbonaceous siltstone 20%.		262 / 14		
	Sandstone, light grey, fine grained, coaly with carbonaceous fragments throughout, iron stained sandstone bands throughout.		260 / 16		End of bore: 17 mBGL
			258 / 18		End of hole: 18 m BGL
			256 / 20		
			254 / 22		
			252 / 24		

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Level 2, 15 Mallon Street, Bowen Hills, Queensland 4006

BOREHOLE LOG page:1 of 1

AGE26M

PROJECT No: **G1606F**
PROJECT NAME: **Bylong borefield installation**
DATE DRILLED: **01.04.2016**
LOGGED BY: **B.McKay (AGE)**

DRILLING COMPANY: **Hagstrom Drilling**
DRILLER: **S. Mortimer**
DRILLING METHOD: **Mud Rotary**
DRILL RIG: **Hydrapower scout**

EASTING: **230338.9 mE**
NORTHING: **6408244.7 mN**
DATUM: **MGA94 (z56)**
RL: **267.19 mAHD**
EOH: **12 mBGL**

COMMENTS: **Alluvial monitoring bore.**

Stratigraphic Cloumn	Soil or Rock Field Material Description	Graphic Log	Depth (mBGL) / RL. (mAHD)	Bore Construction	Bore Description
			268 / 0	+0.55 m -0 mAHD	Protective lockable steel collar PVC stick up: +0.55 m
Soil	Clay dark brown, medium plasticity.				
Alluvial sand and gravel	Granular pebbly gravel, clayey throughout, very poorly sorted., subangular, weathered siltstone/sandstone siliceous clasts to 1cm. Occasional clast to 4cm.		266 / 2 264 / 4 262 / 6 260 / 8	6-May-16	Bentonite grout dry weight (10 %): 0 m to 1 m 149.2 mm rock roller: 0 m to 12 m (mud) Bentonite seal: 1 m to 3 m 152.4 mm blade: 0 m to 12 m (mud) 50 mm PN 18 uPVC blank casing: 0 m to 9 m 2 mm washed, rounded, quartz gravel pack: 3 m to 12 m
	Granular to pebbly gravel 95%, basalt 5%, very poorly sorted subangular to sub rounded, very hard drilling on blade.		258 / 10		
	Granular gravel, pebbly in part 60%, basalt 40%, poorly sorted, subangular to subrounded, clast size and basalt abundance increasing with depth.		256 / 12 254 / 14 252 / 16 250 / 18 248 / 20 246 / 22 244 / 24		50 mm PN 18 uPVC machine slotted casing, slot aperture: 0.5 mm, slot length: 50 mm, 672 slots / m, 9 m to 12 m End of bore: 12 mBGL End of hole: 12 m BGL

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BOREHOLE LOG page:1 of 1

AGE28P

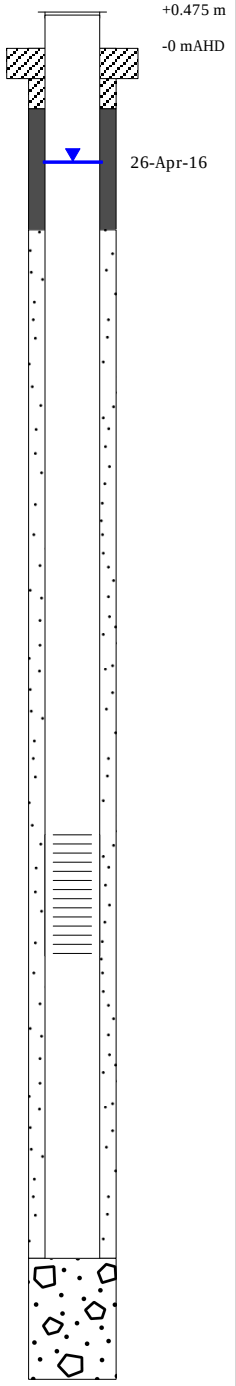
PROJECT No: **G1606F**
PROJECT NAME: **Bylong borefield installation**
DATE DRILLED: **04.04.2016**
LOGGED BY: **B.McKay (AGE)**

DRILLING COMPANY: **Gricks Drilling**
DRILLER: **S. Gricks**
DRILLING METHOD: **Mud Rotary**
DRILL RIG: **Gardner Denver 1500W**

EASTING: **232022.9 mE**
NORTHING: **6406186.7 mN**
DATUM: **MGA94 (z56)**
RL: **283.91 mAHD**
EOH: **22 mBGL**

COMMENTS: **Alluvial pumping bore southern Tarwyn Park.**

Stratigraphic Cloumn	Soil or Rock Field Material Description	Graphic Log	RL. (mAHD) / Depth (mBGL)
Soil	Sandy clay, dark brown, fine to coarse grained, low plasticity.		284 / 0
Alluvial sand and gravel	Sandy clay, gravelly at base. Dark brown subangular to subrounded clasts from 2 to 10mm, low plasticity.		282 / 2
	Gravel, granular to pebbly, extremely clayey throughout, brown, subangular to subrounded, very poorly sorted.		280 / 4
	Gravelly clay, granular to clay fraction, with coal fragments throughout, subangular to subrounded clasts, rare pebbly clasts, poorly sorted. Larger weathered sandstone clasts, sub rounded, starting from 10m, medium plasticity.		278 / 6, 276 / 8, 274 / 10
	Clayey gravel, pebbly. Rare coaly fragments. Subrounded to subangular, poorly sorted.		272 / 12
	Clayey gravel, granular to pebbly in part. Basalt and coal 1%. Clasts subangular to subrounded.		270 / 14
	Clayey gravel, granular to pebbly in part, subangular to subrounded. Basalt throughout sample modal 40%. Base of alluvium.		
Weathered competent rock	Coal, dull, and granular gravel throughout sample.		
	Coal, dull stony/sooty/minor bright. Silcrete/quartzite. Weathered rock.		268 / 16
	Coal dull, pyritic, highly weathered; with tuffaceous claystone band.		
	Coal dull to stony / carbonaceous mudstone / siltstone with minor silcrete/quartzite.		266 / 18
	Sandstone grey, weathered, with dull minor bright coal lenses throughout.		
	Sandstone grey, fine grained, weathered.		264 / 20
	Sandstone dark grey, very fine grained, weathered, with siltstone laminae and coaly/carbonaceous wisps throughout.		262 / 22, 260 / 24



Bore Construction

Protective lockable steel collar

PVC stick up: +0.475 m

Bentonite grout dry weight (10 %): 0 m to 1 m

609.6 mm hole opener: 0 m to 2 m (air)

Bentonite seal: 1 m to 3 m

203.2 mm blade: 0 m to 13 m (mud)

203.2 mm rock roller: 13 m to 20 m (mud)

381 mm rock roller: 0 m to 20 m (mud)

219 mm steel blank casing: 0 m to 13 m

1.5-3 mm washed, rounded, quartz gravel pack: 3 m to 20 m

Bore Description

Bore development: 1.1 hr; EC: 407 µS/cm; pH: 7.72

Open hole flow rate at 15 m: 5.633 L/s

219 mm steel wire wound screen, slot aperture: 0.6mm mm, slot length: mm, slots / m, 13 m to 15 m

End of bore: 20 mBGL

End of hole: 22 m BGL

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BOREHOLE LOG page:1 of 1

AGE33M

PROJECT No: **G1606F**
PROJECT NAME: **Bylong borefield installation**
DATE DRILLED: **16.04.2016**
LOGGED BY: **T.Walters (AGE)**

DRILLING COMPANY: **Hagstrom Drilling**
DRILLER: **S. Mortimer**
DRILLING METHOD: **Mud Rotary**
DRILL RIG: **Hydrapower scout**

EASTING: **231774.97 mE**
NORTHING: **6406915.71 mN**
DATUM: **MGA94 (z56)**
RL: **279.14 mAHD**
EOH: **19 mBGL**

COMMENTS: **Alluvial monitoring bore on Tarwyn Park.**

Stratigraphic Cloumn	Soil or Rock Field Material Description	Graphic Log	Depth (mBGL) / RL. (mAHD)	Bore Construction	Bore Description
			280 / 0	+0.67 m -0 mAHD	Protective lockable steel collar PVC stick up: +0.67 m
Soil	Soil (O), dark brown to black with silt.		278 / 2		Bentonite grout dry weight (10 %): 0 m to 1 m
Alluvial sand and gravel	Gravel, light brown with grey speckling, fine sand 0.125mm (SA2) to gravel pebbles 5mm (G2), subangular grains, poorly sorted.		276 / 4	4-May-16	149.2 mm rock roller: 0 m to 19 m (mud) 152.4 mm blade: 0 m to 19 m (mud) Bentonite seal: 1 m to 3 m
			274 / 6		50 mm PN 18 uPVC blank casing: 0 m to 13 m
	Gravel, light grey, fine sand 0.125mm (SA2) to gravel pebbles 5mm (G2), subangular grains, poorly sorted.		272 / 8		2 mm washed, rounded, quartz gravel pack: 3 m to 18.6 m
	Gravel, light brown to orange, fine sand 0.125mm (SA2) to gravel pebbles 5mm (G2), subangular grains, poorly sorted.		270 / 10		
	Gravel, light brown, orange and black, fine sand 0.125mm (SA2) to gravel pebbles 5mm (G2), subangular grains, poorly sorted. Noted increased abundance of blacker chips, interpreted bedload clasts.		268 / 12		
	Gravel, light brown, orange and black, fine sand 0.125mm (SA2) to gravel pebbles 5mm (G2), subangular grains, poorly sorted. Less coarse chips 13m, coarser 14m interval. Driller deduced clay at 15.5m prior to competent rock.		266 / 14		Sampled 04.05.2016 paramaters - SWL 1.412mBGL, pH 6.23, 439uS/cm, 16.4C and 296ppm TDS. 50 mm PN 18 uPVC machine slotted casing, slot aperture: 0.5 mm, slot length: 50 mm, 672 slots / m, 13 m to 16 m
			264 / 16		
BOW					
competent rock	Sandstone, light grey, very fine grained (SA1), low strength, with black to brown, very hard carbonaceous siltstone. competent rock.		262 / 18		End of bore: 18 mBGL Hole collapse: 18.6 m to 19 m End of hole: 19 m BGL
	Sandstone, light grey, very fine grained (SA1), moderate strength, with low strength black siltstone.		260 / 20		
	Siltstone, black, carbonaceous, low strength, with light grey, very fine grained (SA1), moderate strength sandstone.		258 / 22		
			256 / 24		

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 310.61 AHD
EASTING: 235106.29
NORTHING: 6406727.79
DIP/AZIMUTH: 90°/--

BORE No: B3-D
PROJECT No: 49761
DATE: 28/11/2013
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
310	0	SILTY SAND - (Loose), brown, medium grained silty sand with some fine sized subangular gravel, dry to humid							TOC = 0.509m
		From 0.6m, trace medium sized gravel							
	1	From 1m, medium dense							1
309									
	2								2
	2.3	CLAYEY GRAVEL - Loose to medium dense, brown, fine sized subangular gravel with some coarse grained sand, humid to damp							
308		From 3m, damp							
	3								3
	3.5	CLAYEY SAND - Loose, brown, fine to medium grained clayey sand with trace to some fine sized subangular gravel, damp							
307	4								4
306	5								5
305	6	From 5.9m to 6.2m, clayey gravel, humid							6
304	7	From 7m, slightly gravelly							7 From 0m to 14.0m, grout
303									From -0.51m to 15.7m, Class 18 blank
	8								8
302		From 8.5m, medium dense							
	9								9
301	9.5	SAND - Medium dense, brown, fine to coarse grained sand, slightly fine sized gravel with some clay, humid to damp							

RIG: Hydropower Scout **DRILLER:** Total Drilling (Sinclair) **LOGGED:** Fulham **CASING:** HW to 17.9m

TYPE OF BORING: Solid flight to 14m, HW casing advanced to 17.9m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: Top of Pipe RL 311.12 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 310.61 AHD
EASTING: 235106.29
NORTHING: 6406727.79
DIP/AZIMUTH: 90°/--

BORE No: B3-D
PROJECT No: 49761
DATE: 28/11/2013
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
300	11	SAND - Medium dense, brown, fine to coarse grained sand, slightly fine sized gravel with some clay, humid to damp *(continued)*							11
	11.1	GRAVELLY CLAY - (Stiff), grey, fine sized gravelly clay, M>Wp From 11.5m, some cobbles of brown, fine to medium grained sandstone							
299	12								12
	12.1	SANDY CLAY - Very stiff to hard, brown, fine to medium grained sandy clay, M>Wp							
298	13	From 13.3m, grey							13
297	14								14
	14.5	GRAVEL - (Medium dense), brown, medium to coarse sized subangular gravel, slightly clayey in parts, interbedded with weathered sandstone cobbles up to 60mm in diameter							
296	15								15
295	16								16
294	17								17
293	17.6	SANDSTONE - Extremely low strength, extremely weathered, brown sandstone							
	18 18.0	Bore discontinued at 18.0m, limit of investigation							18
292	19								19
291									

Well Construction Details: From 14.0m to 14.4m, bentonite; From 14.4m to 18.0m, gravel; From 15.7m to 18.0m, Class 18 machine slotted; End cap

RIG: Hydropower Scout **DRILLER:** Total Drilling (Sinclair) **LOGGED:** Fulham **CASING:** HW to 17.9m

TYPE OF BORING: Solid flight to 14m, HW casing advanced to 17.9m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: Top of Pipe RL 311.12 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 310.61 AHD
EASTING: 235106.03
NORTHING: 6406726.78
DIP/AZIMUTH: 90°/--

BORE No: B3-S
PROJECT No: 49761
DATE: 27/11/2013
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
310	0	SILTY SAND - (Loose), brown, medium grained silty sand with some fine sized subangular gravel, dry to humid							TOC = 0.538m
		From 0.6m, trace medium sized gravel							
	1	From 1m, medium dense							
309									
	2								
	2.3	CLAYEY GRAVEL - Loose to medium dense, brown, fine sized subangular gravel with some coarse grained sand, humid to damp							
308		From 3m, damp							
	3								
	3.5	CLAYEY SAND - Loose, brown, fine to medium grained clayey sand with trace to some fine sized subangular gravel, damp							
307	4								
306									From 0m to 9.5m, grout
	5								From -0.54m to 10.15m, Class 18 blank
305									
	6	From 5.9m to 6.2m, clayey gravel, humid							
304									
	7	From 7m, slightly gravelly							
303									
	8								
302		From 8.5m, medium dense							
	9								
301	9.5	SAND - Medium dense, brown, fine to coarse grained sand, slightly fine sized gravel with some clay, humid to damp							From 9.5m to 9.9m, bentonite

RIG: Hydropower Scout **DRILLER:** Total Drilling (Sawyer) **LOGGED:** Fulham **CASING:** Uncased

TYPE OF BORING: Solid flight to 13.6m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: Top of Pipe RL 311.15 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 310.61 AHD
EASTING: 235106.03
NORTHING: 6406726.78
DIP/AZIMUTH: 90°/--

BORE No: B3-S
PROJECT No: 49761
DATE: 27/11/2013
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
300	11	SAND - Medium dense, brown, fine to coarse grained sand, slightly fine sized gravel with some clay, humid to damp *(continued)*							
	11.1								
299		GRAVELLY CLAY - (Stiff), grey, fine sized gravelly clay, M>Wp From 11.5m, some cobbles of brown, fine to medium grained sandstone							
	12								
298	12.1	SANDY CLAY - Very stiff to hard, brown, fine to medium grained sandy clay, M>Wp							
	13								
297	13.65	Bore discontinued at 13.65m, limit of investigation							
	14								
296									
	15								
295									
	16								
294									
	17								
293									
	18								
292									
	19								
291									

11 — 12 — From 9.9m to 13.65m, gravel
From 10.15m to 13.65m, Class 18 machine slotted
13 — End cap

RIG: Hydropower Scout **DRILLER:** Total Drilling (Sawyer) **LOGGED:** Fulham **CASING:** Uncased

TYPE OF BORING: Solid flight to 13.6m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: Top of Pipe RL 311.15 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 1 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
310	0	SILTY SAND - (Loose), brown, medium grained silty sand with some fine sized subangular gravel, dry to humid							A			
		From 0.6m, trace medium sized gravel							A			
	1	From 1m, medium dense							A			
									S			4,7,13 N = 20
309	2											
	2.3	CLAYEY GRAVEL - Loose to medium dense, brown, fine sized subangular clayey gravel with some coarse grained sand, humid to damp							S			5,4,6 N = 10
308	3	From 3m, damp										
	3.5	CLAYEY SAND - Loose, brown, fine to medium grained clayey sand with trace to some fine sized subangular gravel, damp							S			2,3,3 N = 6
307	4											
306	5											
305									S			2,2,3 N = 5
	6	From 5.9m to 6.2m, clayey gravel, humid										
304	7	From 7m, slightly gravelly							S			4,4,5 N = 9
303	8											
302		From 8.5m, medium dense							S			6,7,8 N = 15
	9											
301	9.5											

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 2 OF 15

RL	Depth (m)	Description of Strata	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
300	11	SAND - Medium dense, brown, fine to coarse grained sand, slightly fine sized gravel with some clay, humid to damp *(continued)*		S			6,16,30/130mm refusal
	11.1	GRAVELLY CLAY - (Stiff), grey, fine sized gravelly clay, M>Wp					
299		From 11.5m, some cobbles of brown, fine to medium grained sandstone		S			25/115mm refusal
	12						
	12.1	SANDY CLAY - Very stiff to hard, brown, fine to medium grained sandy clay, M>Wp					
298	13	From 13.3m, grey		S,pp			10,12,14 N = 26 >300 kPa
297	14						
	14.5	GRAVEL - (Medium dense), brown, medium to coarse sized subangular gravel, slightly clayey in parts, interbedded with weathered sandstone cobbles		S			30/150mm refusal
296	15			C	100	0	
	15.1	CORE LOSS - 15.1m to 15.75m (0.65m), (very little drilling resistance, gravel)	15.1m: CORE LOSS: 650mm	C	31.5	0	
295	15.75	GRAVEL - (Medium dense), brown, medium to coarse sized subrounded gravel with some clay, some fine to medium grained sand and some sandstone cobbles up to 60mm					
	16						
	16.05	CORE LOSS - 16.05m to 16.65m (0.6m), (very little drilling resistance, gravel)	16.05m: CORE LOSS: 600mm	C	33	0	
294	16.65	GRAVEL - (Medium dense), brown, medium to coarse sized subrounded gravel with some clay, some fine to medium grained sand and some sandstone cobbles up to 60mm					
	16.95	CORE LOSS - 16.95m to 17.6m (0.65m), (very little drilling resistance, gravel)	16.95m: CORE LOSS: 650mm	C	71	0	
293	17						
	17.6	SANDSTONE - Extremely low strength, extremely weathered, brown sandstone		A			
	18						
	18.2	SANDSTONE - Very low strength, highly weathered, light brown, fine to medium grained sandstone		S			20,26/100mm refusal
292	18.55	SANDSTONE - Very low to low strength, moderately weathered, light brown, fine to medium grained sandstone	19.24m: J,15°,pl,ro 19.68m-19.75m, 2xJ,50°, un,ro	C	98	8	PL(A) = 0.04 PL(D) = 0.06 PL(A) = 0.15 PL(D) = 0.12 PL(A) = 0.05 PL(D) = 0.04 PL(D) = 0.06 PL(A) = 0.01 PL(D) = 0.01 PL(A) = 0.12
291	19						

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 3 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
									C	98	8	
	20.26	CORE LOSS: 20.26m to 20.30m						20.26m: CORE LOSS: 40mm				PL(A) = 0.05
290	20.3	(0.04m)										PL(D) = 0.04
		SANDSTONE - Very low to low strength, moderately weathered, light brown, fine to medium grained sandstone						20.78m: J, 45°,un,ro	C	100	0	
	21	From 20.6m, slightly weathered										PL(D) = 0.08
		From 21.2m, fresh, grey										
289									C	84	0	
	22											PL(D) = 0.05
	22.14	CORE LOSS - 22.14m to 22.34m						22.02m: P,40°,pl,sm 22.14m: CORE LOSS: 200mm				
	22.34	(0.2m)										PL(A) = 0.1
288		SANDSTONE - Very low strength, fresh, grey, medium to coarse grained sandstone						22.62m: P,35°,pl,sm				PL(D) = 0.06
												PL(A) = 0.05
	23								C	92	0	PL(D) = 0.07
								23.0m-23.12m, J,45°,pl,un				PL(A) = 0.06
												PL(D) = 0.06
	23.37											PL(A) = 0.03
	23.45	CORE LOSS - 23.37m to 23.45m						23.37m: CORE LOSS: 80mm				PL(D) = 0.06
287		(0.08m)						23.5m-23.65m, J, 80°,pl,un	C	100	69	PL(A) = 0.04
		MUDSTONE - Medium strength, fresh, dark grey mudstone										PL(D) = 0.05
	24	From 24.03m to 24.07m, tuff band							C	100	100	PL(A) = 0.4
								24.08m-24.2m, J,sv, pl, sm, pyrite				PL(A) = 0.5
	24.38											PL(A) = 0.07
	24.48	CORE LOSS - 24.38m to 24.48m						24.38m: CORE LOSS: 100mm				
286		(0.1m)							C	86	60	
		MUDSTONE - Medium strength, fresh, dark grey mudstone										PL(A) = 0.34
	25											
	25.05	COAL - Medium strength, fresh, black coal with some tuff										
	25.38							25.2m-25.31m, 3xJ, 80-90°, cu, sm				PL(A) = 0.04
		TUFF - Extremely low strength, fresh, light grey tuff										PL(A) = 0.67
285	25.67	From 25.61m, medium strength, coal							C	100	76	PL(A) = 0.59
	26							25.83m: P,5°,pl,sm				PL(D) = 0.36
		SILTSTONE - Medium strength, fresh, light grey siltstone										
		From 26.34m, coal						26.3m-26.34m, fragmented				PL(A) = 1.11
	26.55											
284	26.61	CORE LOSS - 26.55m to 26.61m						26.55m: CORE LOSS: 60mm				PL(A) = 1.33
	26.8	(0.06m)						26.82m: P,5°,un,sm	C	91	17	PL(A) = 0.09
		CARBONACEOUS SILTSTONE - High strength, fresh, dark brown carbonaceous siltstone						26.91m: P,sh,pl,un 27.01m: Psh,pl,ro 27.09m: P,sh,pl,sm				PL(A) = 2.23
	27	From 26.72m, very low strength, light grey tuff						27.09m-27.18m, J,sv, un,ro				
283		COAL - High strength, fresh, black coal						27.25m: P,sh,pl, sm, clay infill				PL(A) = 0.05
	28							27.3m: P,5°,pl,un				
	28.07	At 26.93m, tuff band, 10mm thick						27.48m: P,sh,pl, sm, clay infill				PL(A) = 0.59
		At 27.47m, very low strength tuff band, 30mm thick						27.65m: P,sh,un,sm				
282		At 27.77m, very low strength tuff band, 60mm thick						27.69m: P,sh,un, sm, clay infill	GT001 C	100	83	PL(A) = 0.71
		At 27.89m, very low strength tuff band, 10mm thick						27.9m-28m, fragmented				
	29	At 28m, very low strength tuff band, 10mm thick						28.82m: BP, sh, pl, sm				
		SILTSTONE - Medium strength, fresh, light grey siltstone										PL(A) = 1.63
281		From 28.64m, grey										PL(D) = 1.05

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 4 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
280		From 29.52m, high strength							C	100	83	
		SILTSTONE - Medium strength, fresh, light grey siltstone *(continued)*										PL(A) = 1.99
		From 30.2m, dark grey										
	31							>>				PL(A) = 1.75
279									C	99	99	PL(A) = 1.97 PL(D) = 1.01
	32											
	32.05	CARBONACEOUS SILTSTONE - High strength, fresh, dark brown carbonaceous siltstone										PL(A) = 0.98
278		From 32.29m to 32.39m, coal						32.6m: P,sh,pl, sm				PL(A) = 1.37
	32.76	SILTSTONE - High strength, fresh, dark grey siltstone										PL(A) = 1.67
	33							32.93m: P,3°,un,ro				
	33.1 33.13	CORE LOSS - 33.1m to 33.13m (0.03m)						33.1m: CORE LOSS: 30mm				PL(A) = 1.52
277		SANDSTONE - High strength, fresh, grey, medium grained sandstone						33.43m: P,5°,pl,sm				
	34											PL(A) = 1.98 PL(D) = 1.17
276								34.51m: BP,2°,pl,sm 34.68m: J, 35°,pl,sm	C	100	65	
	35	From 35m, medium strength with some fine sized subrounded gravel						35m-35.25m, J,sv,un,ro				PL(A) = 0.84 PL(D) = 0.76
275								35.25m: P,5°,pl,un				
	36											PL(D) = 0.87
274		From 36.7m, high strength						36.63m: P,sh,pl,un				PL(A) = 1.9 PL(D) = 1.11
	37	From 37.2m, medium strength						36.97m: P,7°,pl,sm 36.99m: J,45°,pl,sm 37.07m: P,15°,pl,ro 37.09m: P,10°,pl,un 37.18m: P,3°,pl,sm 37.24m-37.28m, 3xJ, 15-20°,pl,sm 37.34m: J, 40°,pl,sm	C	100	25	PL(A) = 0.56 PL(D) = 0.49
273												
	38	From 38.11m, mudstone band, 70mm thick						37.38m: P,30°,ir,sm 37.41m: P,sh,un, ti 37.43m: J,7°,un,sm 37.52m: J,45°,cu,sm 37.53m-37.66m, J,75°, pl,sm 37.58m: J,30°,pl,sm 37.7m: J,45°,cu, sm	GT002 C	100	76	PL(A) = 1.34
272												
	39	From 39.15m, medium strength, medium to coarse grained						37.76m-37.87m, J,45°, st,ro 37.86m-38.1m, fractured 38.1m-38.22m, J, 45°, st, sm 38.18m: BP,45°,pl,ro	C	100	98	PL(A) = 1.51 PL(D) = 1.27
271												

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 5 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
270	41	SANDSTONE - High strength, fresh, grey, medium grained sandstone *(continued)* From 40.5m to 41.81m, fine to medium grained with no gravel						38.26m: P,2°,pl,ro 38.36m: P,5°,un,sm 39.1m-39.15m, highly fractured 39.4m: P,3°,pl,ro 40.06m: BP, 5°, pl,un, coal				PL(A) = 2.1 PL(D) = 1.04
269									C GT003	100	98	PL(A) = 1.73 PL(D) = 1.24
268	42							41.86m: BP, 2°,pl, sm, coal 42.28m: P,2°,pl,sm, Fe				PL(A) = 2.13 PL(D) = 1.76
267	43 43.01	COAL - Medium strength, highly fresh black coal						42.64m-42.66m, fragmented 42.84m: P,30°,pl,ro,Fe 42.87m-42.9m, fragmented 42.94m: P,2°,pl,un 43.01m: BP,sh,pl,sm 43.01m-43.31m, J, 80°,un,sm 43.16m-43.26m, 5xP, sh,pl,sm	C	100	74	PL(A) = 1.62 PL(A) = 0.74
266	44 44.25 44.3	CORE LOSS - 44.25m to 44.3m (0.05m)						43.34m-43.63m, 3xJ, 80-90°, ir, sm 43.69m-44.04m, J, sv,un,sm	C	92	47	PL(A) = 0.1
265	44.74 45 45.1	TUFF - Very low strength, fresh, light grey tuff From 44.5m to 44.55m, medium strength coal From 44.58m, medium strength coal SILTSTONE - Medium strength, fresh, grey and dark grey siltstone LAMINITE - Medium strength, fresh, grey and light grey, fine to medium grained laminite From 45.45m, high strength						43.69m-44.25m, highly fractured 44m-44.14m, J, 50°, pl, sm, ca 44.25m: CORE LOSS: 50mm 44.7m-44.74m, highly fractured 45.23m: P,sh,pl,sm, clay infill 45.29m: P,sh, pl, ti, clay infill 46m: P,sh,pl, sm, clay	C C C GT004	100 100 100	100 79	PL(A) = 0.91 PL(A) = 0.74 PL(A) = 0.82 PL(A) = 1.2
264	46 47							46.87m: P,sh, pl, sm, clay 46.9m: P,sh, pl, un, clay 47.01m: P,sh, un, sm, clay 47.12m: P,sh,pl,sm	C	100	99	PL(A) = 1.66
263	48	From 47.5m, medium strength										PL(A) = 0.63 PL(D) = 0.34
262	48.34 48.85 49	SILTSTONE - Medium strength, fresh, dark grey siltstone CARBONACEOUS MUDSTONE - High strength, fresh, dark brown carbonaceous mudstone with some very low strength bands up to 20mm thick							C	100	90	PL(A) = 0.88 PL(D) = 0.57 PL(A) = 0.71
261								49.16m: P,sh,pl,sm 49.17m-49.26m, fragmented 49.27m: P,2°,un,sm 49.39m-49.57m, J,75°,cu,sm	C	100	46	PL(A) = 0.57 PL(A) = 0.47

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 6 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
260	50.41	From 50.05m to 50.23m, extremely low strength, tuff bands up to 110mm thick						49.54m-49.73m, J, 80°,pl,sm 49.57m: P,sh,pl,sm 49.73m-49.86m, fragmented				PL(A) = 0.05 PL(D) = 0.06
	50.76	TUFF - Very low strength, fresh, grey and light grey tuff						50.25m: P,3°, un, sm 50.59m: BP, 2°,pl, sm, ti 50.62m: BP, 10°, pl, sm, ti	C	100	46	PL(A) = 0.04 PL(D) = 0.06
259	51	LAMINITE - Medium strength, fresh, grey and light grey, fine to medium grained laminite From 51.39m to 52.04m, siltstone						50.76m: BP, sh, pl,sm, ti 51.48m: P,sh,pl, sm, coal 51.64m: P,sh,un,sm, ca 51.75m: P,2°, un, sl, ca				PL(A) = 1.17 PL(A) = 1.01
258	52								C	100	100	PL(A) = 0.95
257	53											PL(A) = 1.01
	53.7	SILTSTONE - High strength, fresh, dark grey siltstone										PL(A) = 1.13
256	54	From 54.54m to 54.7m, medium strength, tuff From 54.7m to 54.9m, medium strength coal										PL(A) = 0.37 PL(A) = 0.4
	55							54.75m-54.91m, fractured 55.3m: P,2°, pl, un, clay	GT005			PL(A) = 0.84 PL(D) = 0.36
255									C	100	91	
	56											PL(D) = 0.46
254	57											PL(A) = 0.88
253	57.44	LAMINITE - High strength, fresh, grey and dark grey, fine to medium grained laminite						57.29m: P,5°, un,sm, clay				
	58							57.97m: P,sh, pl, sm				PL(A) = 1.41
252									C	100	100	
	59	From 59m, medium strength siltstone						59.14m: P, sh, un, sm				PL(A) = 0.77
251	59.6	From 59.36m, medium strength carbonaceous mudstone						59.42m: P, 2°,pl, un, clay				PL(A) = 0.99 PL(D) = 0.73
		From 59.75m, very high strength										PL(A) = 1.8 PL(D) = 1.33

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 7 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
250		SANDSTONE - High strength, fresh, grey, fine grained sandstone with some siltstone laminations up to 20mm thick *(continued)*							C	100	100	
	60.65	SILTSTONE - High strength, fresh, grey siltstone										PL(A) = 4.3
	61											PL(A) = 1.31 refusal
249									C	100	100	
								61.76m: P,sh,pl,ro				
	62											PL(A) = 1.2
248								62.77m: P,2°,un,sm				
	63											PL(A) = 1.07
247		From 63.76m, carbonaceous						63.84m: P, 0-30°, st, sm				
	64	From 63.99m to 64.15m, very low strength fuff						63.93m: P,sh,pl,sm, clay				PL(A) = 0.04
		From 64.15m to 64.26m, trace coal						64.48m: BP,10°, pl, sm, coal	C	100	79	PL(A) = 1.9
246	64.85	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone										PL(A) = 1.37
	65.74	SILTSTONE - High strength, fresh, grey siltstone										PL(A) = 2.31
245									GT006			
	66											
244	66.84	CARBONACEOUS MUDSTONE - High strength, fresh, dark grey carbonaceous mudstone with some tuff laminations										PL(A) = 2.34
	67							67.38m: P,sh, pl,sm, clay				
243	67.58	SANDSTONE - Medium strength, fresh, light grey, medium grained sandstone						67.41m: P,2°, un, sm 67.57m: P,sh, pl, sm, clay	C	100	99	PL(D) = 0.47
	68											
242												
	69											PL(A) = 1.96 PL(D) = 1.96
		From 69.15m, high strength										
241									C	100	100	
								69.78m: BP,2°, pl, sm				

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 8 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
240	71	SANDSTONE - Medium strength, fresh, light grey, medium grained sandstone *(continued)*						70.63m: P,5°, pl, sm	C	100	100	PL(A) = 2.48 PL(D) = 2.21
		From 71.22m, medium strength						71.22m: P,2°, cu, sm, coal 71.48m: P,sh, cu, sm, coal				PL(A) = 0.64
239	71.49	SILTSTONE - Medium strength, fresh, dark grey siltstone										PL(A) = 0.98 PL(D) = 0.75
	72											
238	72.82	CARBONACEOUS MUDSTONE - High strength, fresh dark brown carbonaceous mudstone										PL(A) = 0.81 PL(D) = 0.56
	73	At 73.18m, tuff band, 75mm thick						73.06m: P,sh,pl, sm, clay 73.17m: P,sh, pl, sm				PL(A) = 1.34
237		At 73.64m, tuff band, 70mm thick						73.71m: BP, sh, pl, sm	C	100	99	
	74	From 73.87m, coal										PL(A) = 1.03
	74.03	SILTSTONE - Very high strength, fresh, grey siltstone with some bands of sandstone up to 100mm thick										PL(A) = 3.12 PL(D) = 3.04
236	75	From 75m, high strength										PL(A) = 1.6
									GT007			
235	76	From 75.98m, very high strength sandstone with siltstone bands						75.82m: P, 2°, un, sm	C	100	100	PL(A) = 3.4
234	76.95	SILTSTONE - High strength, fresh, grey siltstone										PL(A) = 1.92
233	77							>>				
	78	From 78.42m to 79.2m, medium strength										PL(A) = 1.02
232	79								C	100	100	
231												PL(A) = 1.29
												PL(A) = 2.21

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
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DIP/AZIMUTH: 90°/--

BORE No: B3
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DATE: 1 - 14/11/2013
SHEET 9 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
230	80.72	From 79.9m to 80.11m, high strength carbonaceous with some coal SILTSTONE - High strength, fresh, grey siltstone *(continued)*						80.09m: BP,sh, pl, sm, coal	C	100	100	
229	81 81.51	SANDSTONE - Very high strength, fresh, light grey, fine to medium grained sandstone with some siltstone bands up to 40mm thick TUFF - Medium strength, fresh, light grey tuff										PL(A) = 5.49 PL(D) = 4.08 PL(A) = 0.67
	81.72	COAL - High strength, fresh, black coal and carbonaceous siltstone										PL(A) = 2.41
228	82 82.07	SILTSTONE - High strength, fresh, grey siltstone						81.89m-82.01m, J, sv, un, sm, ti 81.92m: P,sh, un,sm, coal 82.1m: P,5°,pl,sm, op				
	82.67	SANDSTONE - High strength, fresh, grey and light grey, fine to medium grained sandstone							C	100	99	PL(A) = 2
227	83	From 83.4m, coarse grained										
226	84 84.0	CONGLOMERATE - High strength, fresh, grey, fine to medium sized subrounded with fine to coarse grained sand and clay matrix, conglomerate with interbedded medium to coarse grained sandstone										PL(A) = 2.58 PL(D) = 1.79
	85											PL(A) = 1.79 PL(D) = 1.39
225								>>	GT008 C	100	100	
	86											
224	87											PL(A) = 1.94 PL(D) = 1.76
223	88	From 88.22m, thin coal laminations										PL(A) = 0.87
222									C	100	100	
	89 88.93	SANDSTONE - High strength, fresh, grey, medium grained sandstone						88.77m: P,sh,pl,ro, coal lamination				PL(A) = 2.1 PL(D) = 2.06
221												

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 10 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
220		SANDSTONE - High strength, fresh, grey, medium grained sandstone *(continued)*							C	100	100	PL(A) = 1.94 PL(D) = 1.09
	91											PL(A) = 2.48 PL(D) = 2.8
219		From 91.33m to 91.8m, interbedded conglomerate bands (40mm thickness, 20mm to 150mm spacings)						91.66m: P,sh,ir,ro	C	100	99	
	92	From 91.85m, interbedded siltstone, fine grained sandstone										PL(A) = 2.29
218												
	93											PL(A) = 3.14 PL(D) = 2.66
217								93.73m: P,sh, cu, ro, coal lense				PL(A) = 2.51 PL(D) = 2.2
	94											
	94.08	COAL - High strength, fresh, dark brown coal with interbedded carbonaceous siltstone						94.12m: P, 5-15°, pl-un, ro 94.15m: P, 5-15°, pl-un, ro				PL(A) = 1.03
216	94.65	From 94.6m, grading to dark grey						94.22m: P, 5-15°, pl-un, ro 94.26m: P, 5-15°, pl-un, ro	C	100	91	PL(A) = 1.01
	95	SILTSTONE - Medium to high strength, fresh, dark grey siltstone						94.3m: P, 5-15°, pl-un, ro				
	95.05	From 94.95m, grading to very fine to fine grained sandstone						94.36m: P,sh,pl, sm 94.46m: P,sh,pl,ro 94.48m: P,sh,pl,ro	GT009			PL(A) = 1.86
215	95.42	SANDSTONE - Hight strength, Fresh, dark grey to grey, very fine to fine grained sandstone with interbedded siltstone										
	96	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone with interbedded very fine grained sandstone and siltstone										PL(D) = 0.92
214		At 95.88m to 95.91m, conglomerate band										
	97	From 96.66m to 97.45m, medium to coarse grained, pebbly in parts										PL(A) = 1.26 PL(D) = 1.13
213									C	100	100	
	98											PL(A) = 1.66 PL(D) = 1.59
212												
	99							99.02m: P,sh,un,ro, coal lense				
		From 99.18m, coarse grained										
211									C	100	97	

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 11 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	100.17											PL(A) = 0.78
	100.3	COAL - High strength, fresh, dark brown coal with interbedded carbonaceous siltstone						100.2m: P,sh,pl,sm 100.29m: P,sh,pl,sm				PL(A) = 1.18
210		SILTSTONE - High strength, fresh grey siltstone with interbedded, fine to medium grained sandstone										
	101	From 100.65m to 101.15m, fine to medium grained sandstone with interbedded siltstone							C	100	97	PL(A) = 2.84 PL(D) = 1.46
209		From 100.3m to 102.3m, sparse tuffaceous bands (less than 30mm thick)							GT010			
	102											PL(A) = 1.39
	102.24	SILTSTONE and SANDSTONE - High strength, fresh, grey to dark grey siltstone and fine to medium grained sandstone						>>				
208												PL(A) = 1.31
	103											PL(A) = 2.55 PL(D) = 1.45
207									C	100	86	PL(A) = 2.58
	104								GT011			
		At 104.07m to 104.17m, coal band										PL(A) = 2.08 PL(D) = 1.55
206	104.6	COAL - High strength, fresh, dark brown coal with interbedded carbonaceous siltstone						104.6m-104.93m, J, sv, un-st, ro 104.64m: P,sh,un,ro 104.73m: P, sh, un,ro 104.8m: P, sh,pl,ro, Fg, coal 104.86m-104.93m, Fg, coal				
	105											PL(A) = 1.48
	105.43	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone with interbedded siltstone										
205								105.08m: P,sh,pl,ro 105.16m: P,sh,pl,ro 105.17m: P,sh,pl,ro 105.18m: P,sh,pl,ro				PL(A) = 2.77 PL(D) = 2.41
	106								GT012			
												PL(A) = 2.29 PL(D) = 1.23
204	106.63	COAL - High strength, fresh, dark brown coal with interbedded carbonaceous siltstone							C	100	99	PL(A) = 1.01
	107							106.82m-106.83m, fg tuffaceous siltstone 106.83-107.86, J, sv, pl, ro, ti 106.98m-108.55m, J, sv, un-pl, ti	GT013			
203		From 107.63m, interbedded tuffaceous claystone / siltstone						107.15m: P,sh, un,ro 107.16m: P,sh,pl,ro 107.5m: P,sh,un,ro 107.61m: P,sh, pl,ro 107.78m: P,sh, pl,ro				PL(A) = 1.98
	108											
202		At 108.58m to 108.8m, tuffaceous siltstone						108.56m: P,sh, pl,ro 108.59m: P,sh, pl,ro 108.83m: P,sh, pl,ro				PL(A) = 0.92 PL(D) = 0.62
	109								C	100	84	
	109.27	TUFFACEOUS CLAYSTONE / SILTSTONE - Medium strength, fresh, pale grey tuffaceous claystone / siltstone						109.13m-109.22m, J,sv,pl,ro 109.18m: P,sh,pl,ro 109.27m: P,sh,pl,ro 109.55m: P,sh,pl,ro 109.71m: P,sh,pl,ro				PL(A) = 1.24
201	109.52	From 109.42m, tuffaceous siltstone.										

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	$\dot{W}$	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 12 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		high strength										PL(A) = 2.34
	110.33	At 109.57m to 109.58m, tuffaceous siltstone						110.07m: P,sh,pl,ro				PL(D) = 1.32
		At 109.65m to 109.7m, tuffaceous siltstone / claystone						110.31m: P,sh,pl,ro				PL(A) = 1.91
200								110.53m: P,sh,pl,sm	C	100	84	
	110.89	COAL - High strength, fresh, dark brown coal with interbedded carbonaceous siltstone *(continued)*						110.55m: P,sh,pl,sm	GT014			
	111							110.87m: P,sh,cu, ro				
								110.94m: P,sh,pl,ro				
		TUFFACEOUS CLAYSTONE / SILTSTONE - Medium strength, fresh, pale grey tuffaceous claystone / siltstone						111.02m-111.55m, J,sv, pl,ro				
199								111.09m: P,sh,pl,2 x ro				
		From 110.75m, high strength						111.68m: P,sh,pl,sm				PL(A) = 1.01
	112							111.79m: P,sh,pl,ro				
	112.13	COAL - High strength, fresh, dark brown coal with interbedded siltstone bands						111.91m: P,sh,pl,sm				
								111.91m-112.09m, 2xJ, sh, 45-90°, ir, sm				
198		SILTSTONE - High strength, fresh, grey siltstone with some sandstone bands up to 40mm thick										PL(A) = 1.96
									C	100	100	
									GT015			
	113											PL(A) = 3.86
197												
												PL(A) = 2.85
	114							>>				
196	114.57	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone										
	115											PL(A) = 2.16
195									C	100	100	
	116	From 115.92m, medium strength, coarse grained										PL(A) = 0.8
								116.3m: P,sh,st, sm				
194								116.52m: P,5°,pl,sm				PL(A) = 1.58
									GT016			
	117											
193												PL(A) = 0.79
	117.93	COAL - Medium to high strength, fresh, fractured black coal						117.96m-118.39m, J,sv, 50°, cu,sm				
	118							118.11m-118.46m, 2xJ, sv, pl,un				
192									C	100	95	
								118.82m: P,sh,pl,sm				PL(A) = 1.36
	119							119m-119.11m, J, 45°, pl,sm				
								119.19m-119.65m, J, 80°, pl,un				
191								119.43m-119.78m, J, sv, pl,sm				
								119.78m-120.51m, J,				PL(A) = 0.89

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 13 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
190		COAL - Medium to high strength, fresh, fractured black coal *(continued)*						80°-90°,un,sm	C	100	95	
								120.45m-120.7m, J, 70°, un,sm 120.58m-120.73m, 2xJ, sv,un,sm				PL(A) = 1.18
189	121							120.68m-120.84m, J, 45°, pl, sm 121.05m: BP, sh, un,sm 121.17m-121.39m, 2xJ, 70-90°, ir, sm 121.45m: J, 45°, pl,sm 121.65m-122.35m, J,sv,un,sm	C	100	88	
188	122							121.9m-122.3m, J,sv,un,sm				PL(A) = 1.68
								122.47m-122.68m, J,80°, pl,sm				
	123							122.8m-122.91m, J,sv,pl,ro 122.99m-123.43m, J,sv,un,sm				PL(A) = 0.92 PL(D) = 0.7
187	123.6	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone with some siltstone bands up to 50mm thick						123.56m: P,sh,pl,un				
	124											
186									GT017			PL(A) = 1.59 PL(D) = 1.73
									C	100	100	
	125							124.84m: BP,sh,pl,un				
185												PL(A) = 1.84 PL(D) = 1.53
	126											
184								>>				PL(A) = 1.8 PL(D) = 1.73
	127											
183									C	100	100	
	128											PL(A) = 2.65 PL(D) = 1.43
182												PL(A) = 2.83 PL(D) = 1.41
								128.78m: BP,2°,un,sm				
	129											
181		From 129.7m, very high strength							C	100	100	PL(A) = 5.49

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 14 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
180		SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone with some siltstone bands up to 50mm thick *(continued)*										PL(A) = 3.74 PL(D) = 3.16
	131								C	100	100	
179		From 131.3m, high strength										PL(A) = 2.72 PL(D) = 1.64
	132											
178	132.62	SILTSTONE - Very high strength, fresh, grey siltstone										PL(A) = 3.7
	133											
177	133.49	SANDSTONE - High strength, fresh, grey, fine grained sandstone with siltstone laminations							C	100	100	
	134											PL(A) = 3.76
									GT018			
176		From 134.57m to 134.92m, high strength mudstone band										PL(A) = 2.32 PL(D) = 1.4
	135											
175												PL(A) = 1.22 PL(D) = 1.43
	136											
174									C	100	100	PL(A) = 2.61 PL(D) = 1.76
	137							>>				
	137.32	MUDSTONE - High strength, fresh, brown / grey mudstone with some fine grained sandstone laminations										PL(A) = 2.52 PL(D) = 1.82
173	138											
		From 138.36m, light grey										PL(A) = 1.84 PL(D) = 1.84
172	139								C	100	100	
171		At 139.87m, medium strength tuff										PL(A) = 4.66 PL(D) = 3.45 PL(A) = 0.68

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 310.58 AHD
EASTING: 235105.82
NORTHING: 6406725.88
DIP/AZIMUTH: 90°/--

BORE No: B3
PROJECT No: 49761
DATE: 1 - 14/11/2013
SHEET 15 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		band, 130mm thick										PL(D) = 0.52
170		MUDSTONE - High strength, fresh, brown / grey mudstone with some fine grained sandstone laminations *(continued)*										PL(A) = 1.2
	140.66	From 140m to 140.13m, dark grey							C	100	100	PL(A) = 2.63 PL(D) = 1.92
	141	SANDSTONE - High strength, fresh, grey, fine grained sandstone										
169	141.3	MUDSTONE - High strength, fresh, grey / brown mudstone										PL(A) = 2.51
	142											
168	142.58	SANDSTONE - High strength, fresh, grey, fine grained sandstone										PL(A) = 1.88
	143								C	100	100	PL(A) = 2.11 PL(D) = 1.37
167		From 143.44m, medium strength with some mudstone laminations up to 10mm thick										PL(A) = 0.89 PL(D) = 0.7
	144								GT019			
166									C	100	100	PL(A) = 0.82 PL(D) = 0.46
	145											
	145.26	Bore discontinued at 145.26m, limit of investigation										
165												
	146											
164												
	147											
163												
	148											
162												
	149											
161												

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham/Semmler **CASING:** HW to 14.75m, 18.3m and 45.3m

TYPE OF BORING: Solid flight auger to 14.5m, rotary to 15m, HQ to 17.65m, rotary to 18.55m, HQ to 145.26m

WATER OBSERVATIONS: Free groundwater observed at 11.45m

REMARKS: 100% water loss at 42.65m, 10% water loss at 123.56m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
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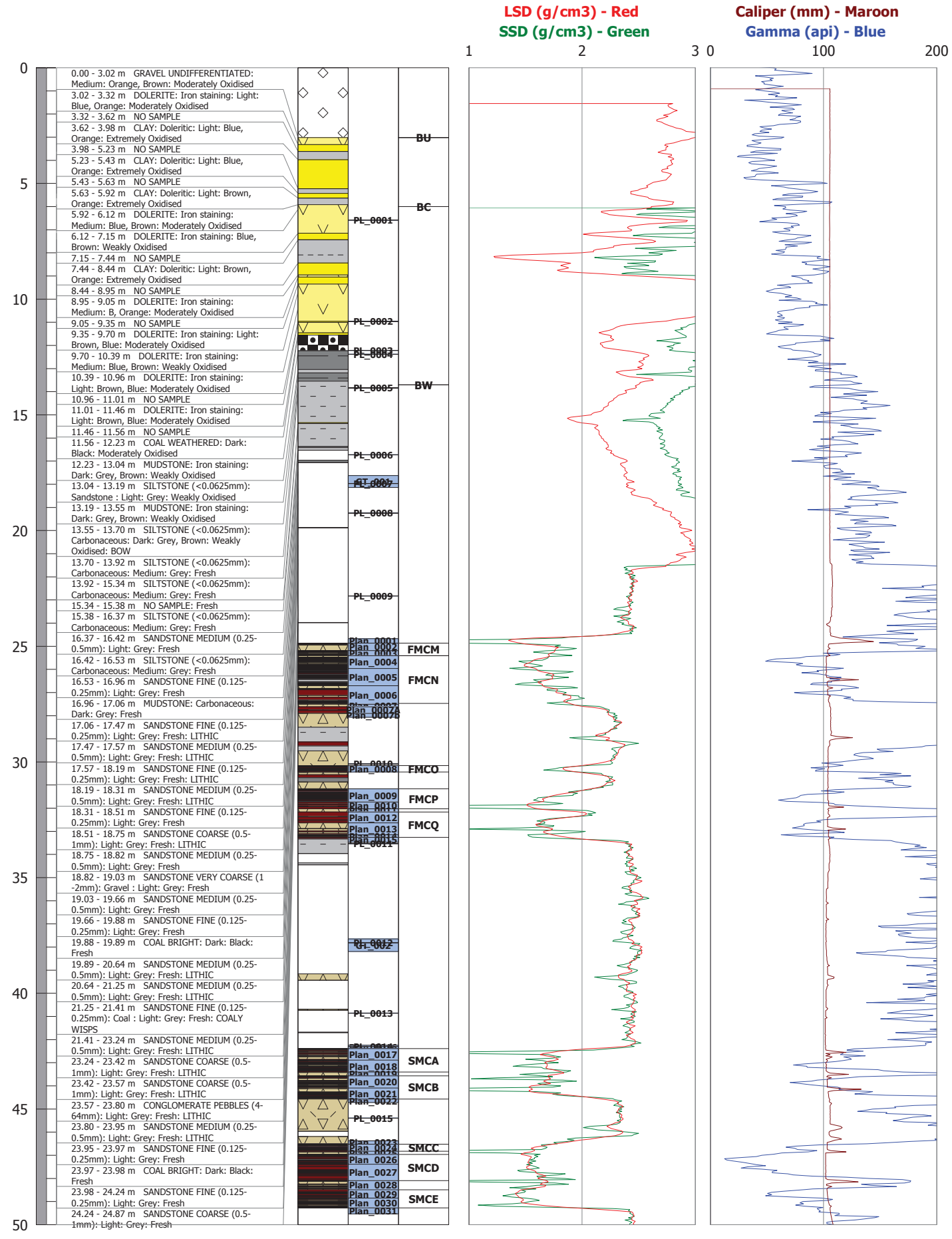
Bylong: Drillhole Summary

Hole Number: BY0001CH **Hole Type**: Part Open/Core Drilling
Date: 10/05/2011 **Tenement**: AUTH287
Total Depth: 200.44 m **Area**: Bylong Station

MGA94_56S
Easting: 233576.58
Northing: 6409320.64
Height: 375.40



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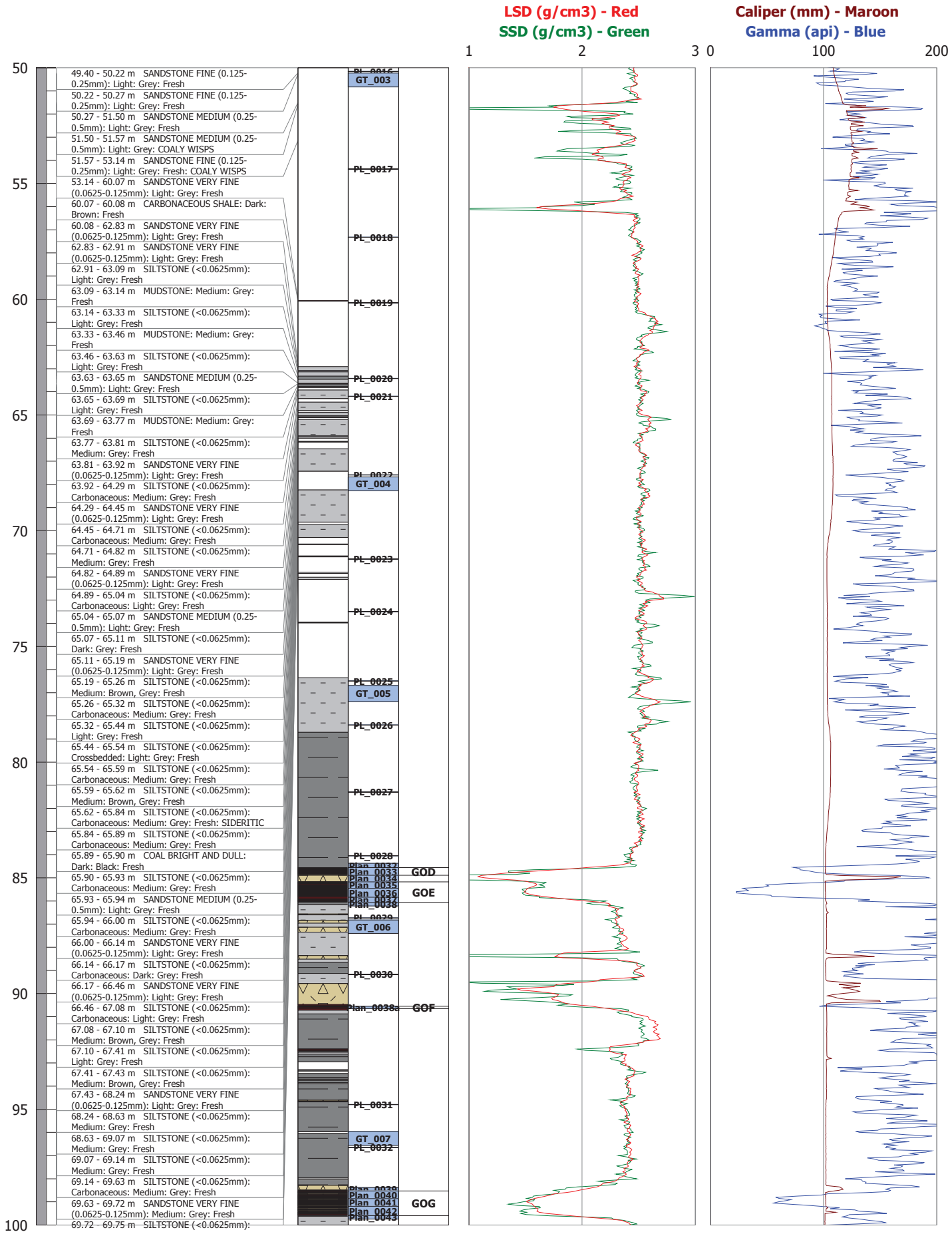

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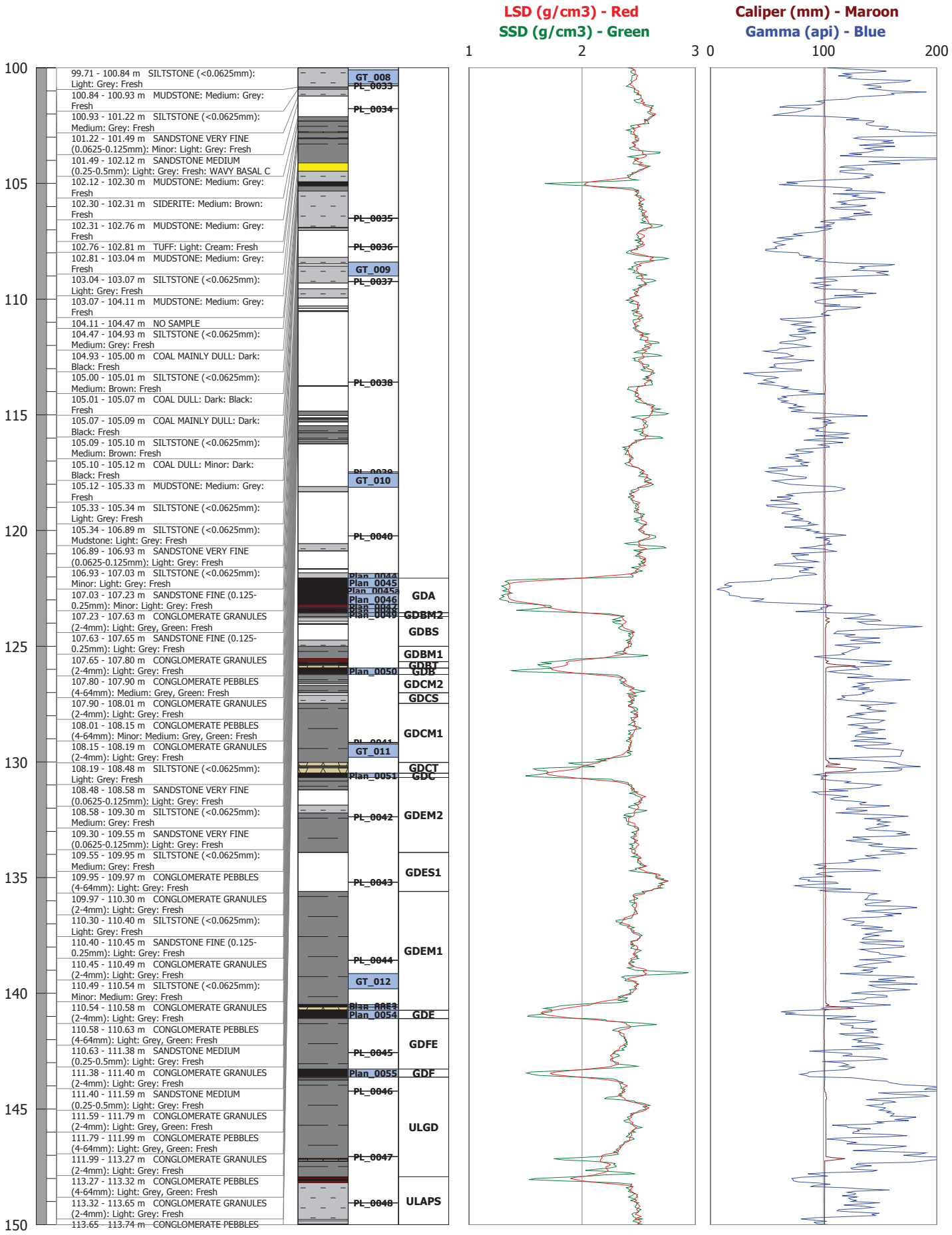

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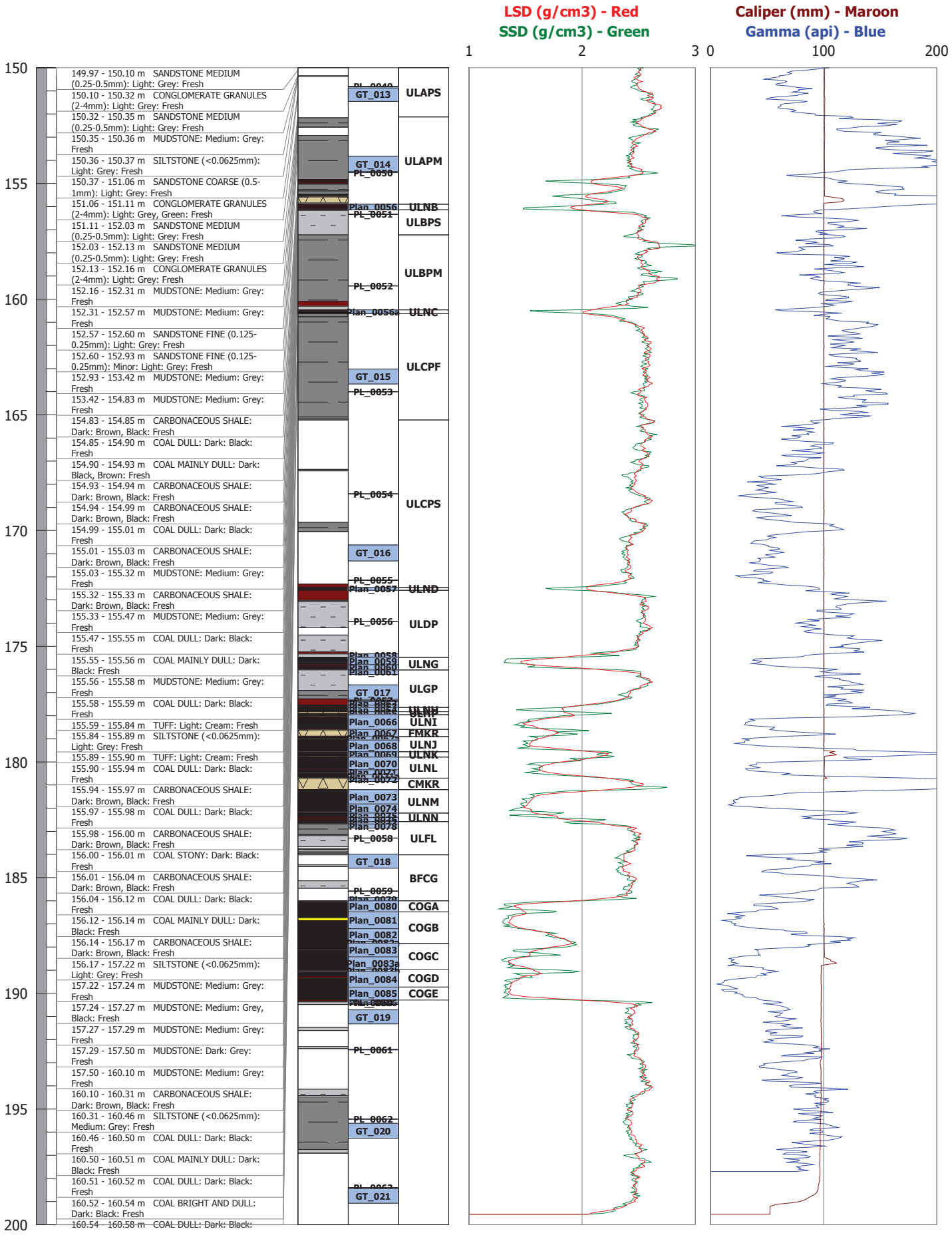

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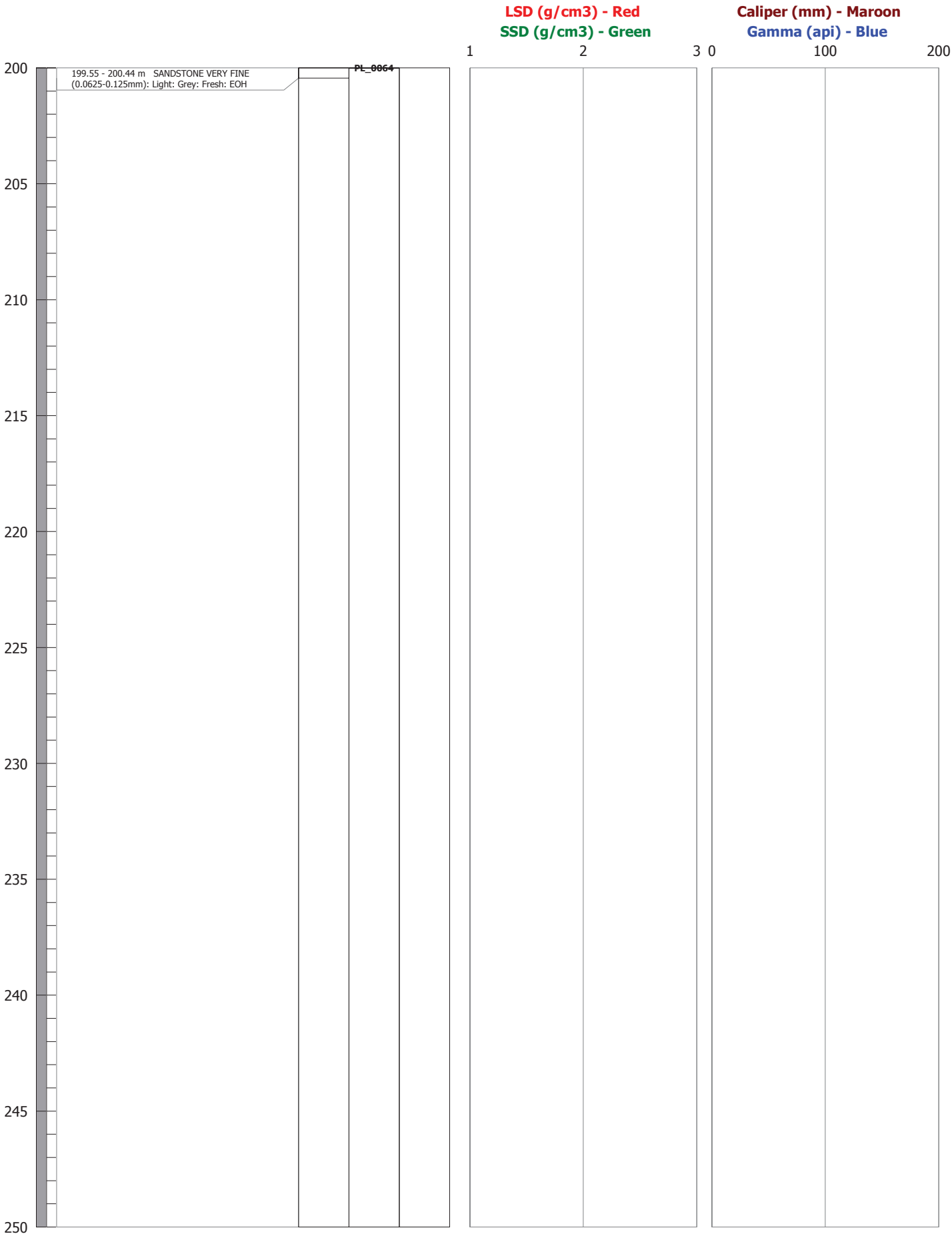
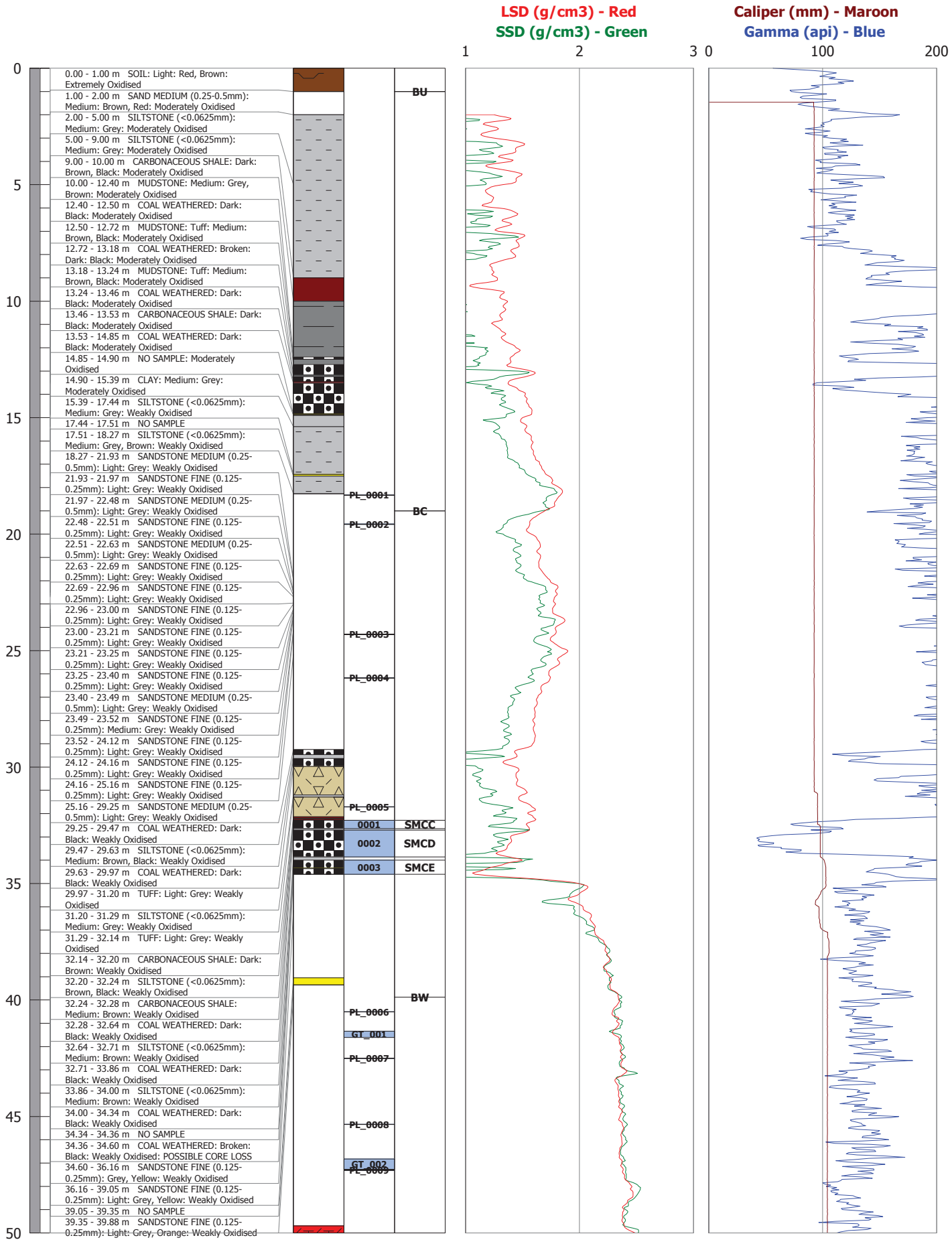


Bylong: Drillhole Summary

Hole Number: BY0007CH **Hole Type**: Part Open/Core Drilling
Date: 6/06/2011 **Tenement**: AUTH287
Total Depth: 186.64 m **Area**: Bylong Station

MGA94_56S
Easting: 230443.17
Northing: 6410217.64
Height: 368.69



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Date: 6/06/2011 **Tenement**: AUTH287
Total Depth: 186.64 m **Area**: Bylong Station

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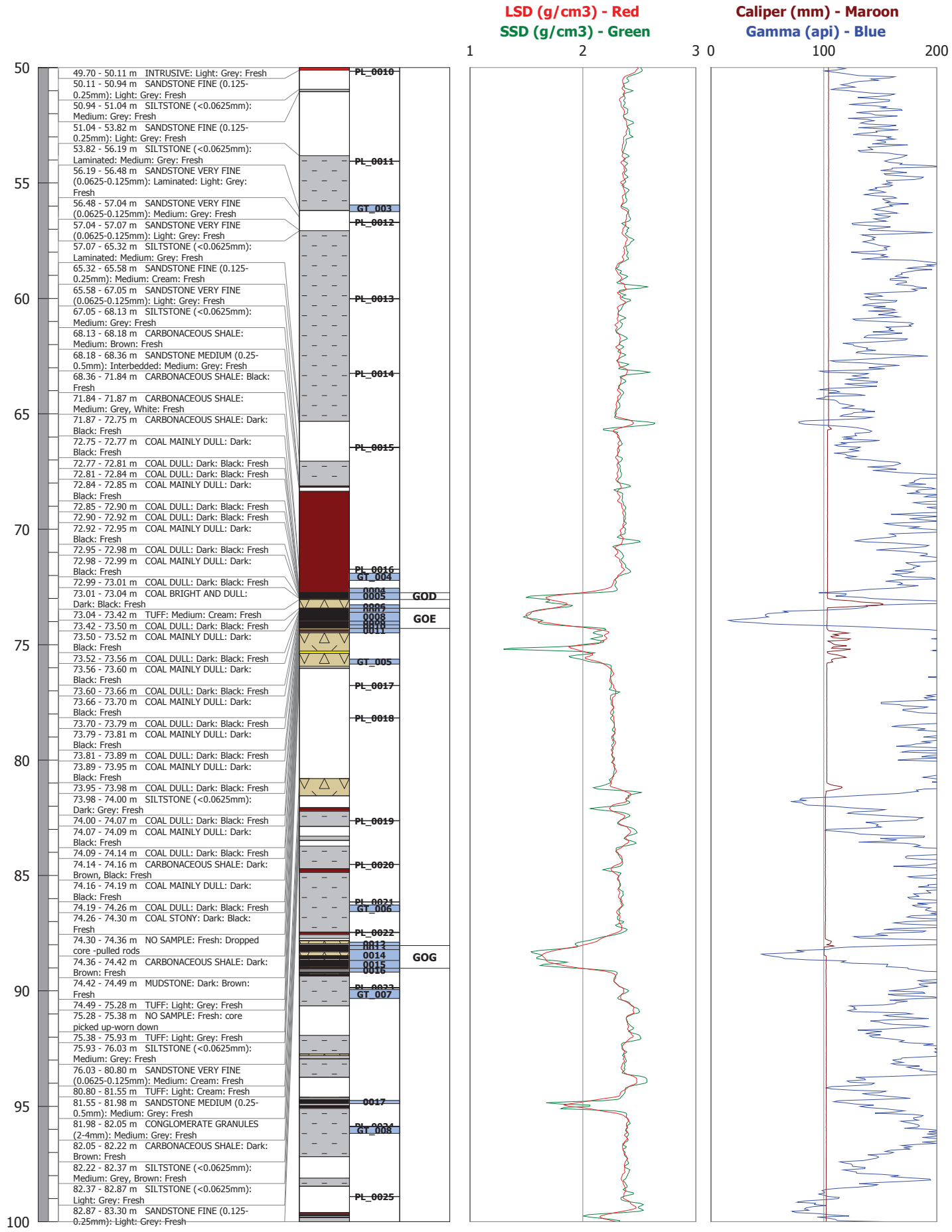

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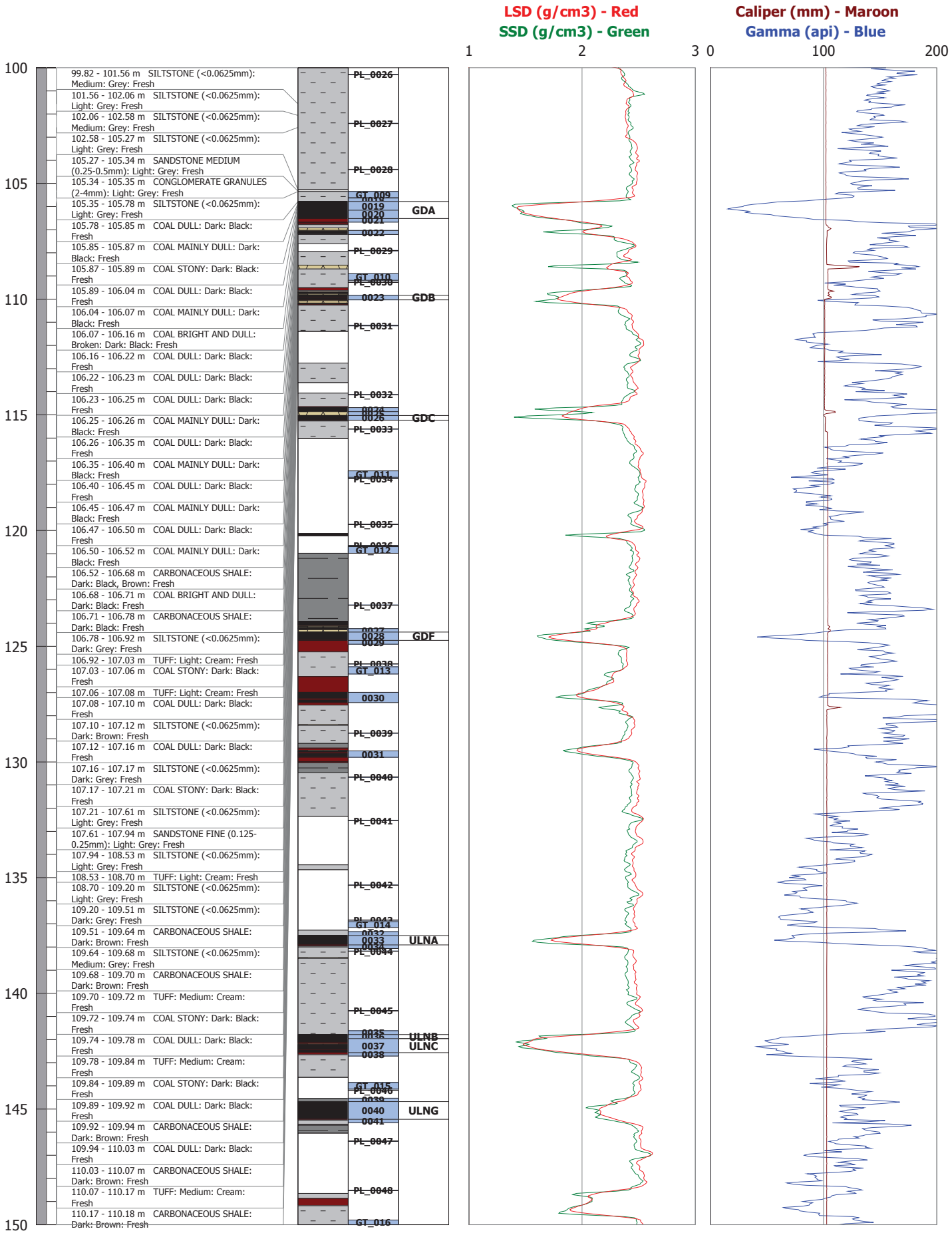

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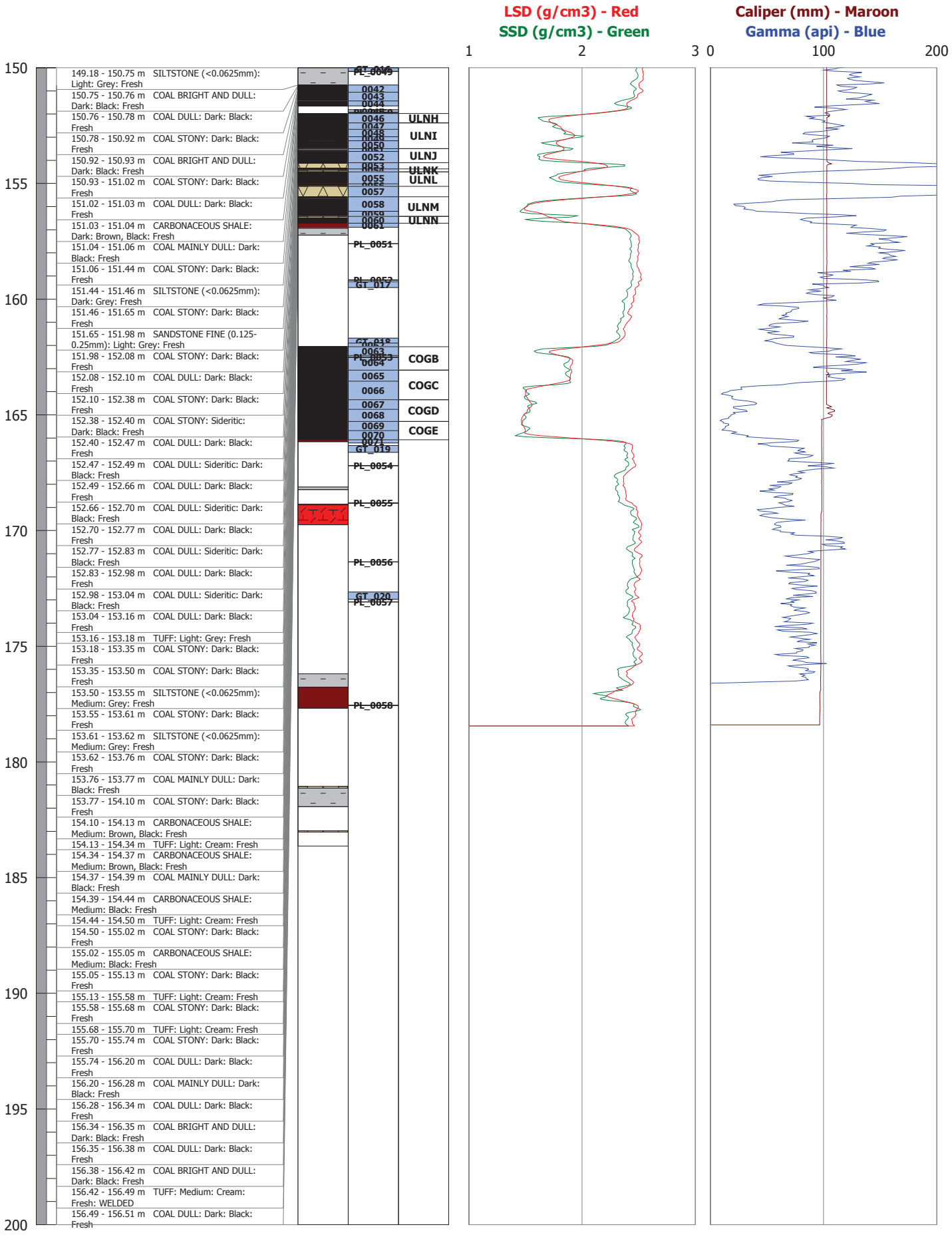

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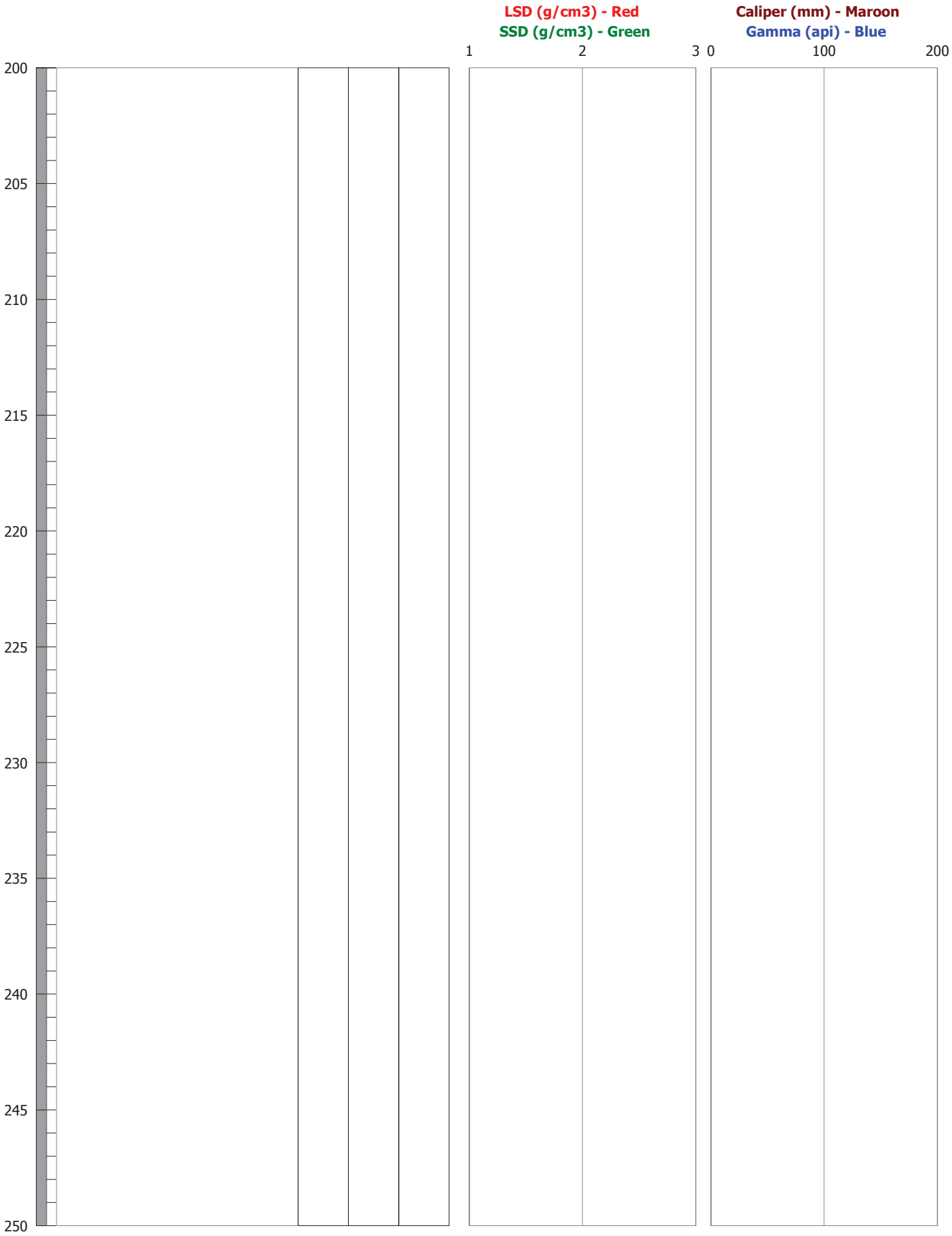
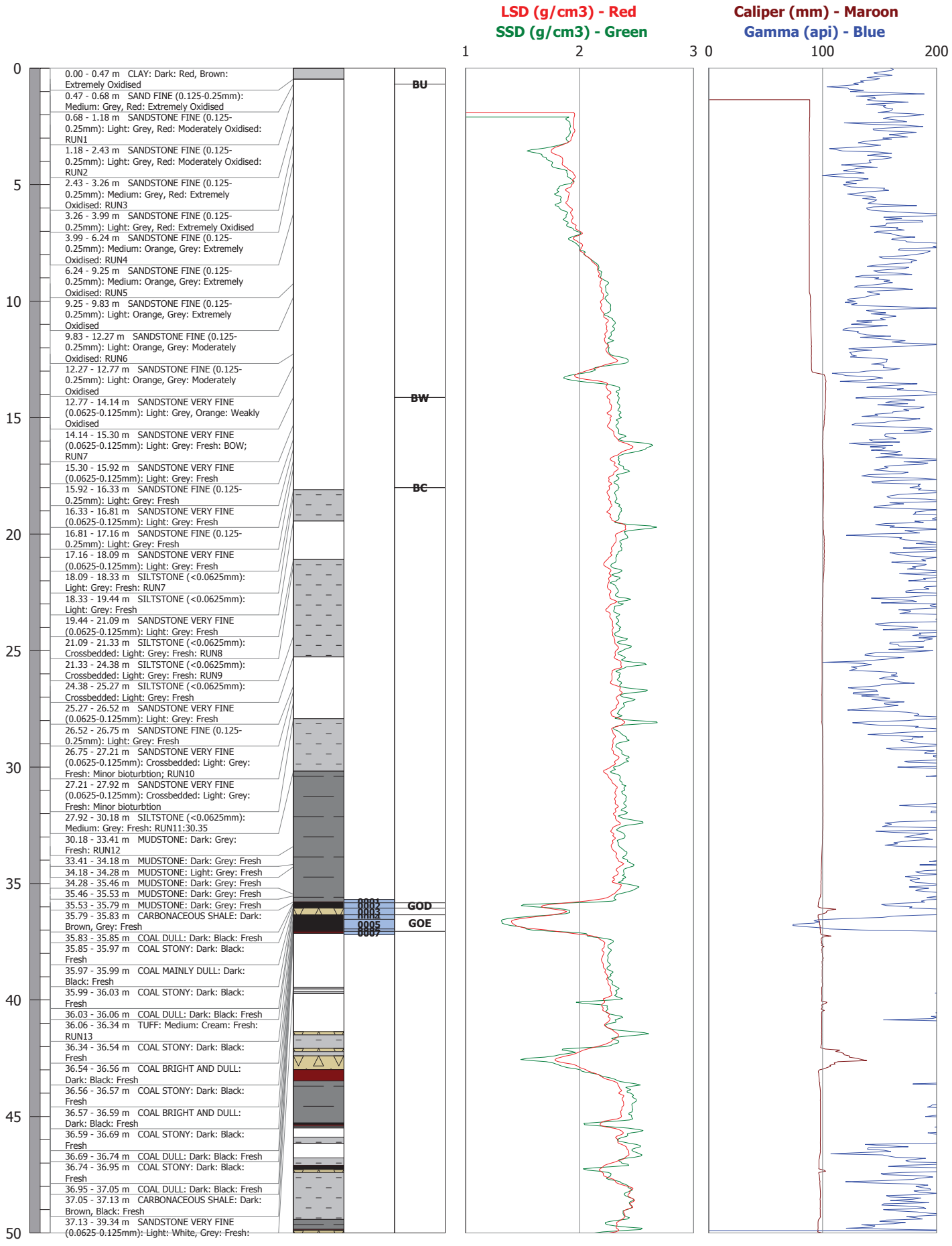


Bylong: Drillhole Summary

Hole Number: BY0010CH **Hole Type**: Core Drilling
Date: 22/06/2011 **Tenement**: AUTH287
Total Depth: 147.52 m **Area**: Bylong Station

MGA94_56S
Easting: 231893.30
Northing: 6412109.84
Height: 301.35



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Date: 22/06/2011 **Tenement**: AUTH287
Total Depth: 147.52 m **Area**: Bylong Station

MGA94_56S
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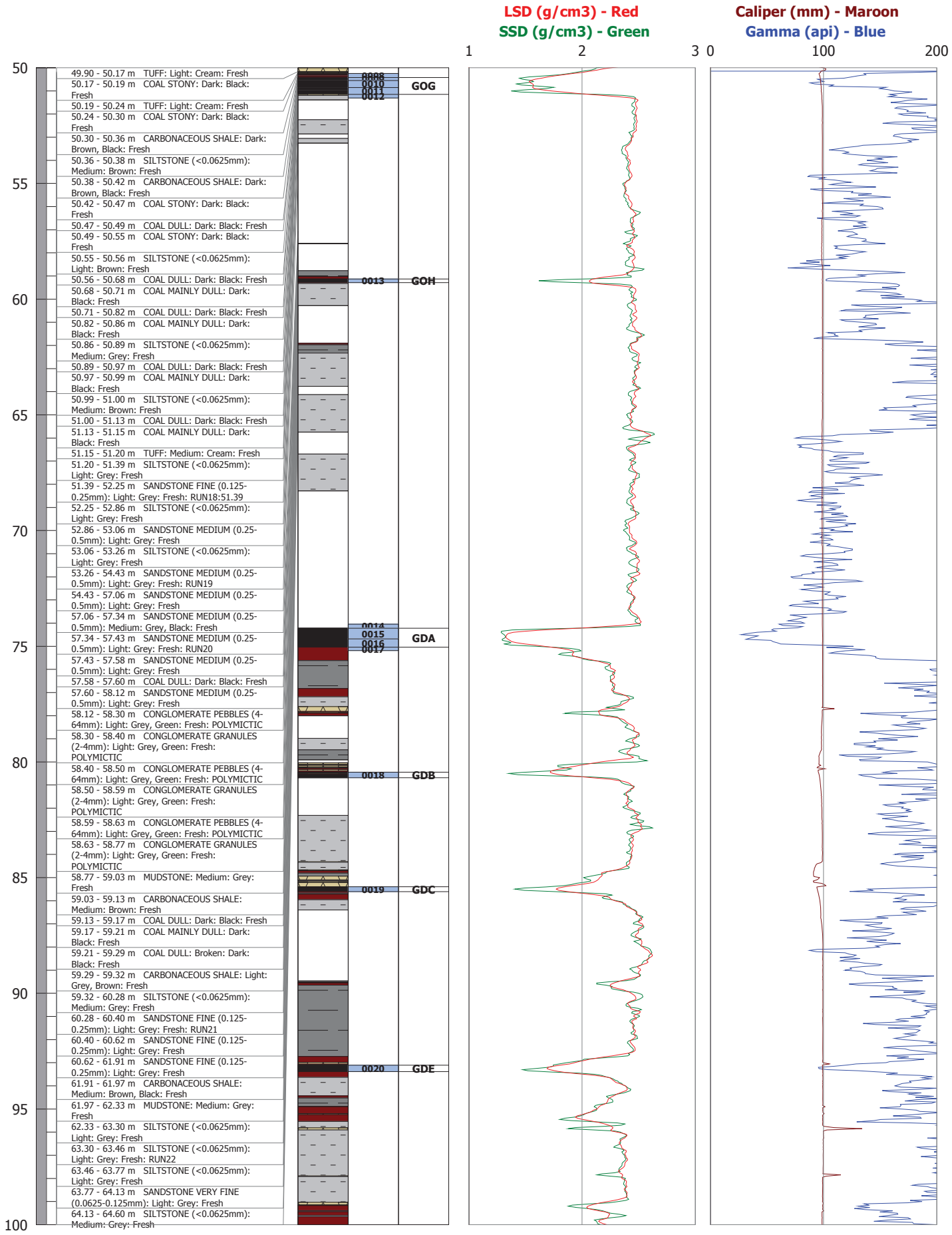

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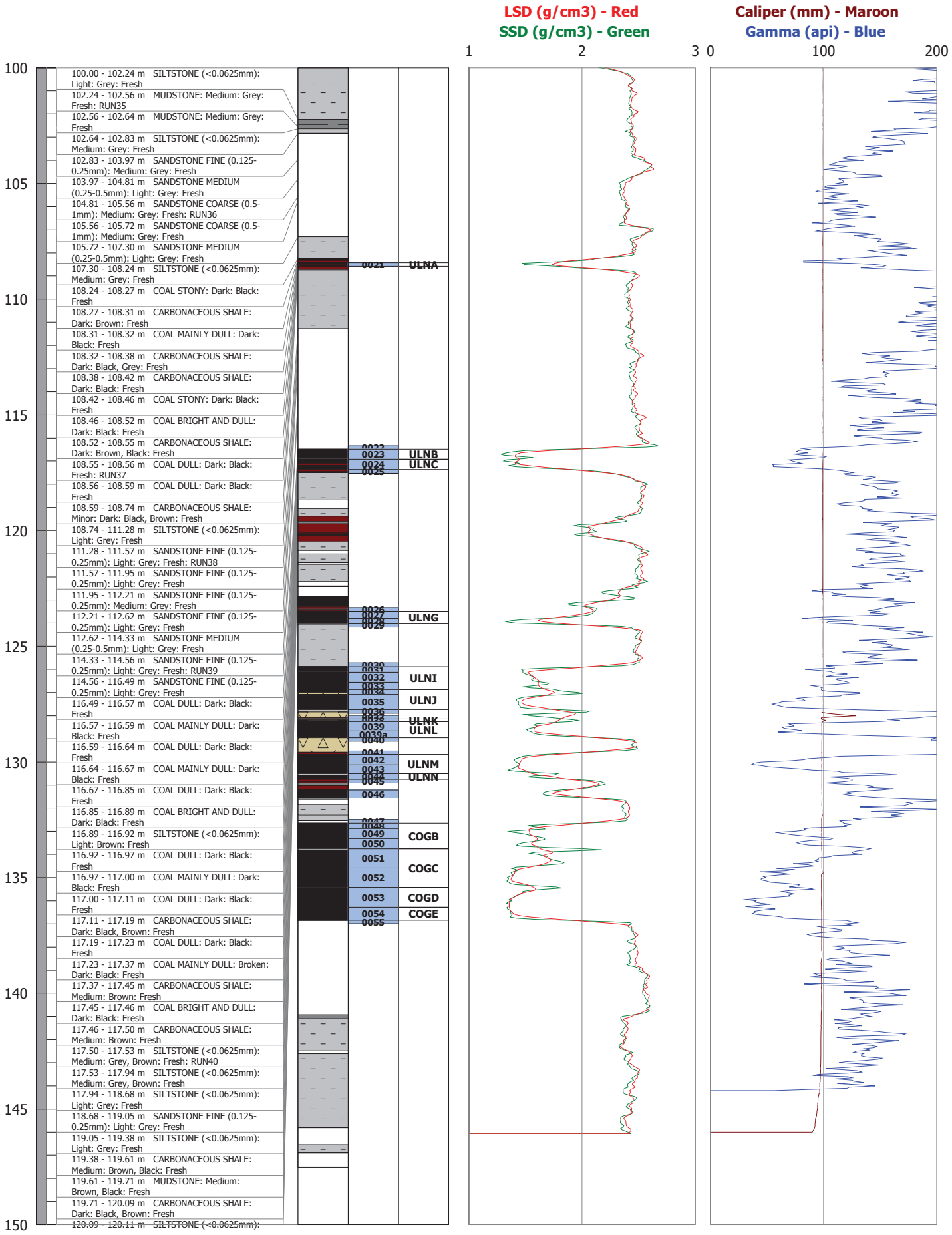


Bylong : Drillhole Summary

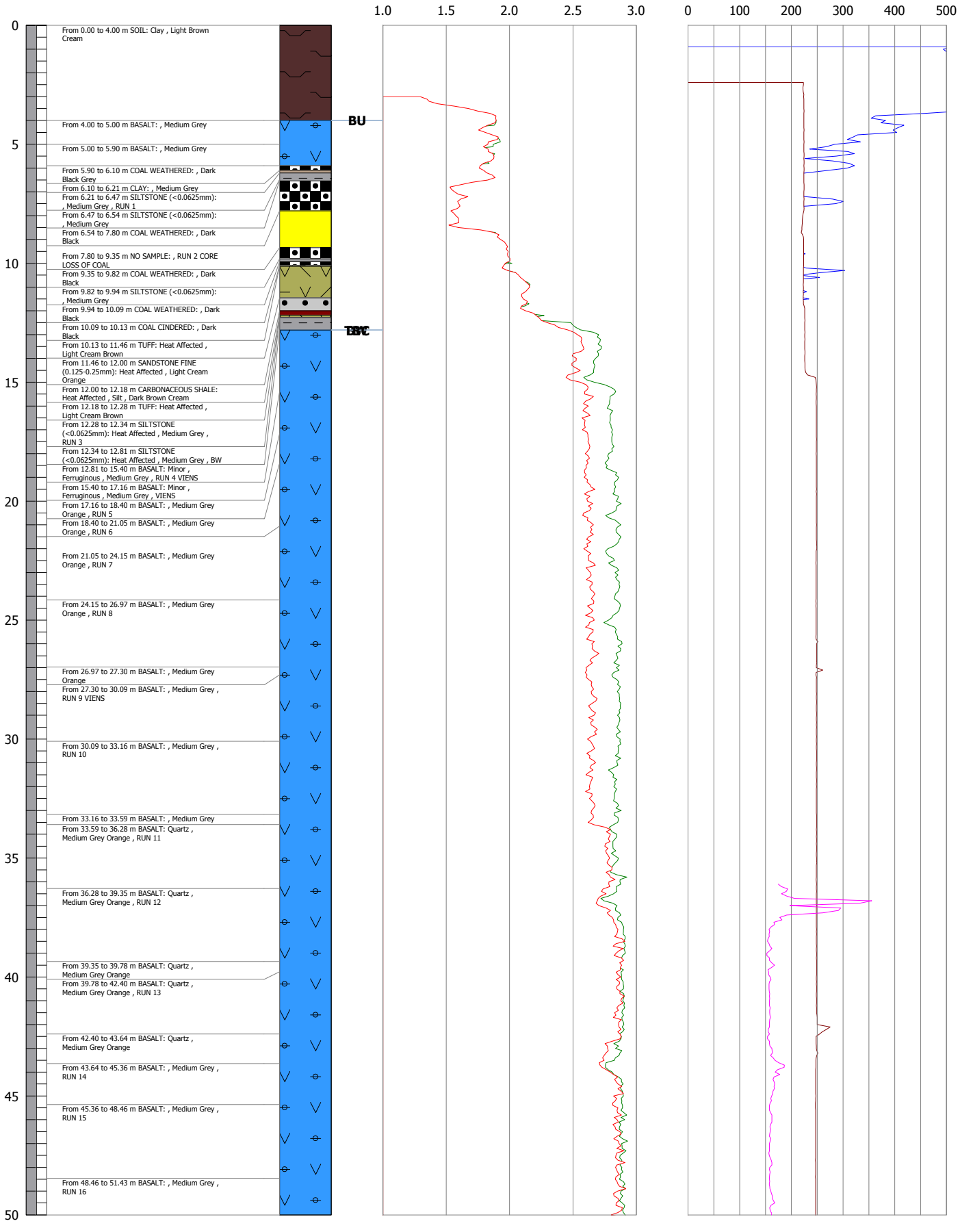
Hole Number : BY0011CH | **Hole Type** : Fully Cored | **Easting** : 232912.43

Date : 24/06/2011 | **Tenement** : AUTH287 | **Northing** : 6411415.62

Total Depth : 219.68 m | **Area** : Bylong Station | **Height** : 358.10 *MGA94_56S*

(ULN & COG coalesce)

Long Density - Red
Short Density - Green
Caliper (mm) - Maroon
Gamma - Blue **Sonic - Pink**



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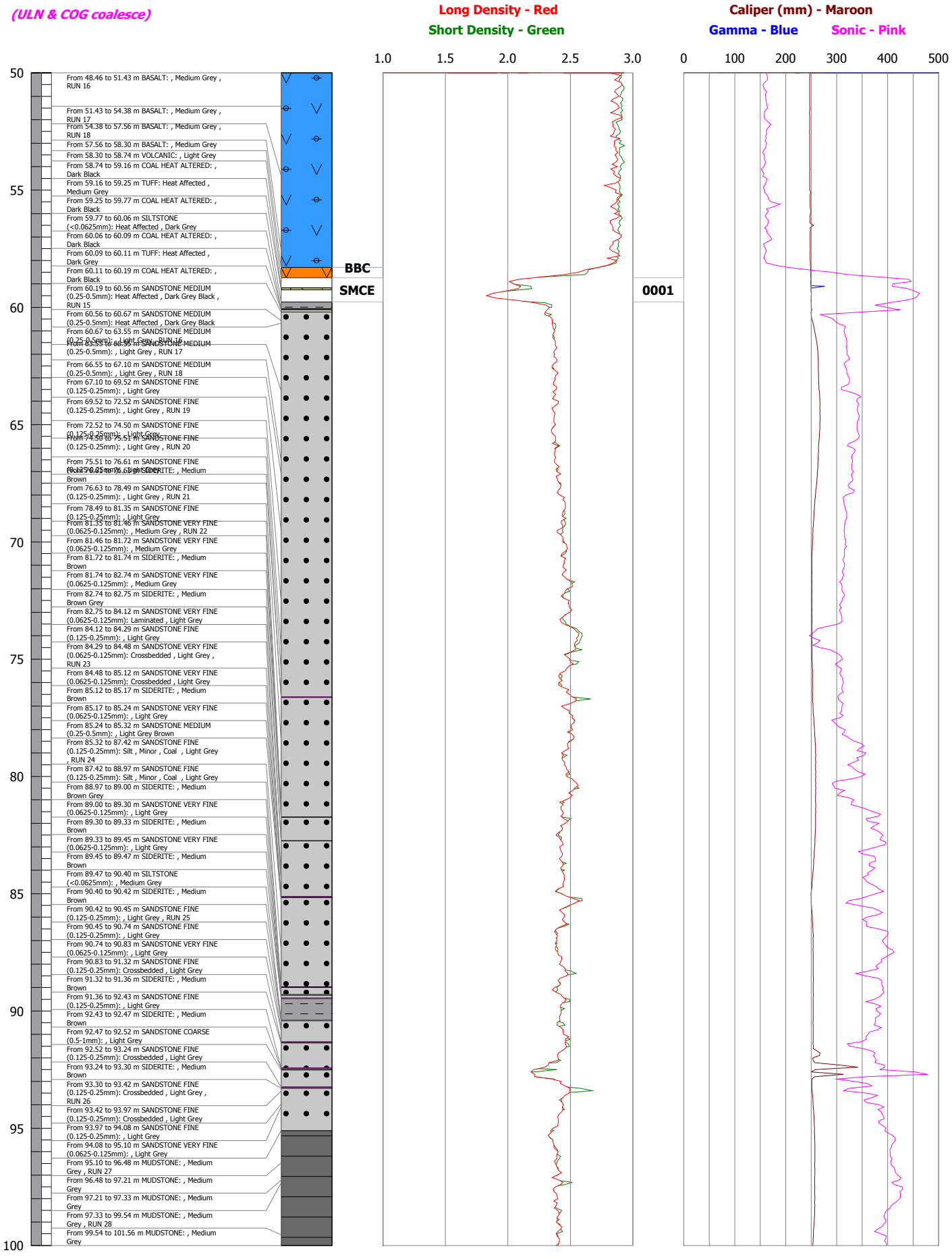

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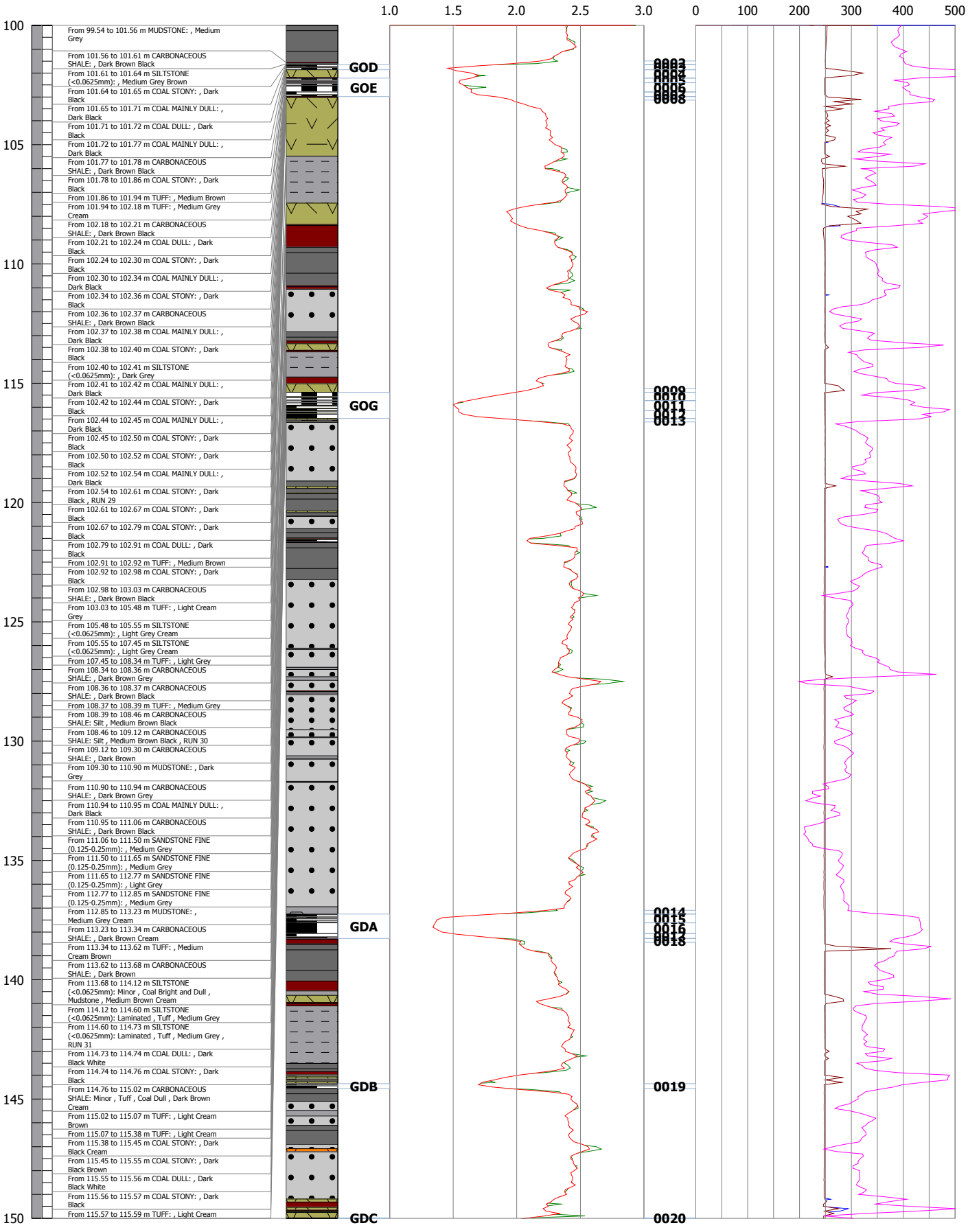

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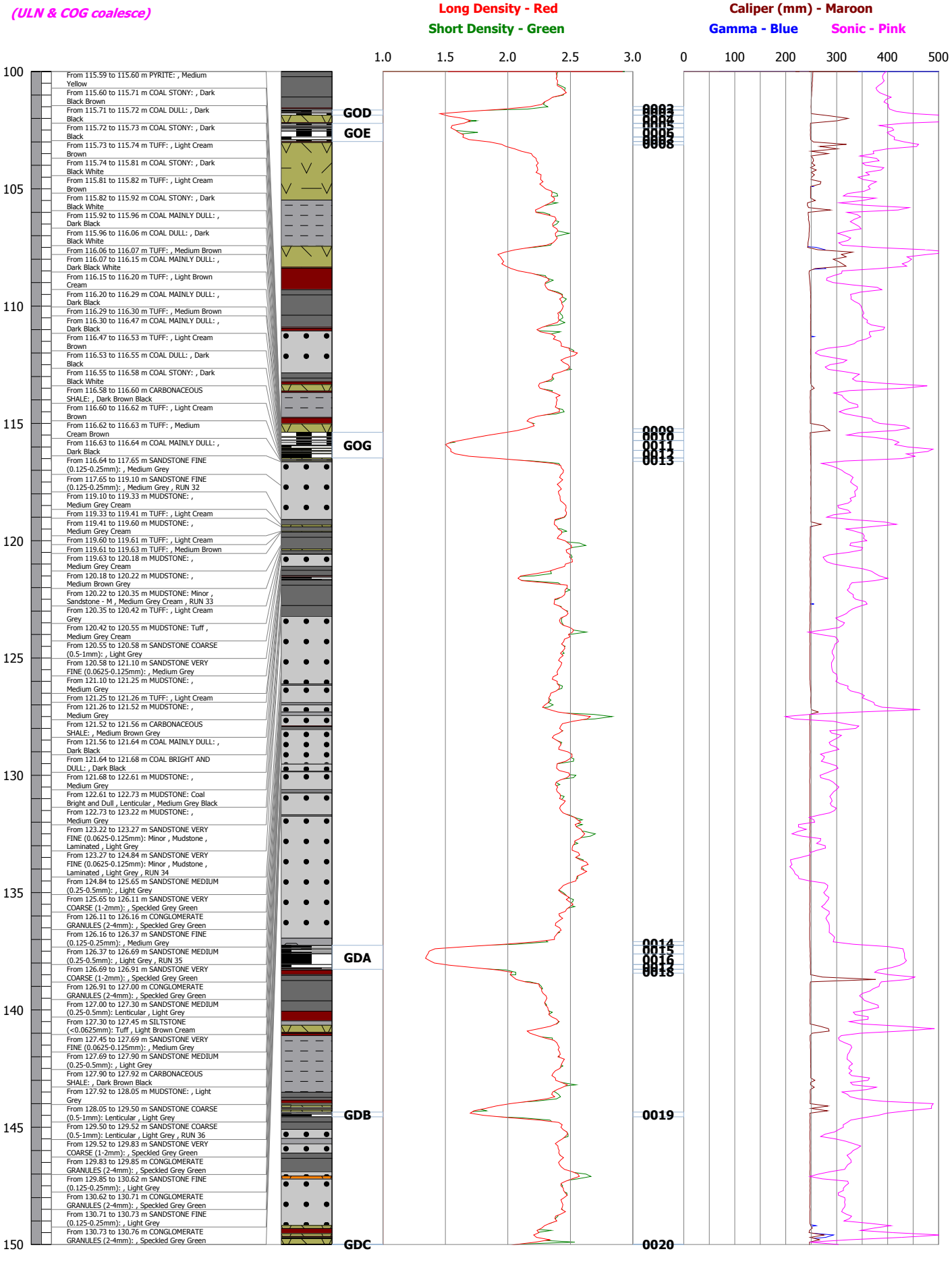

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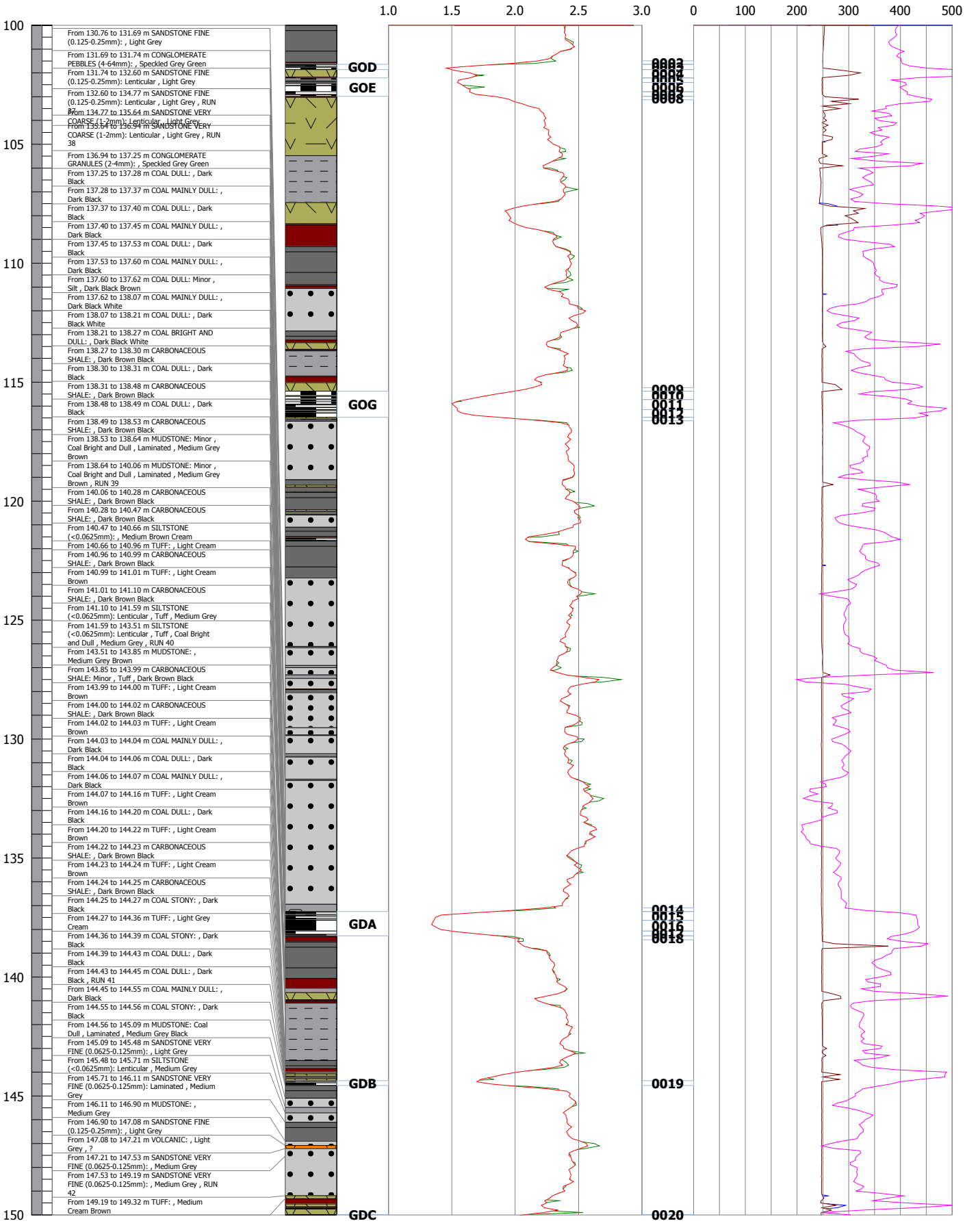

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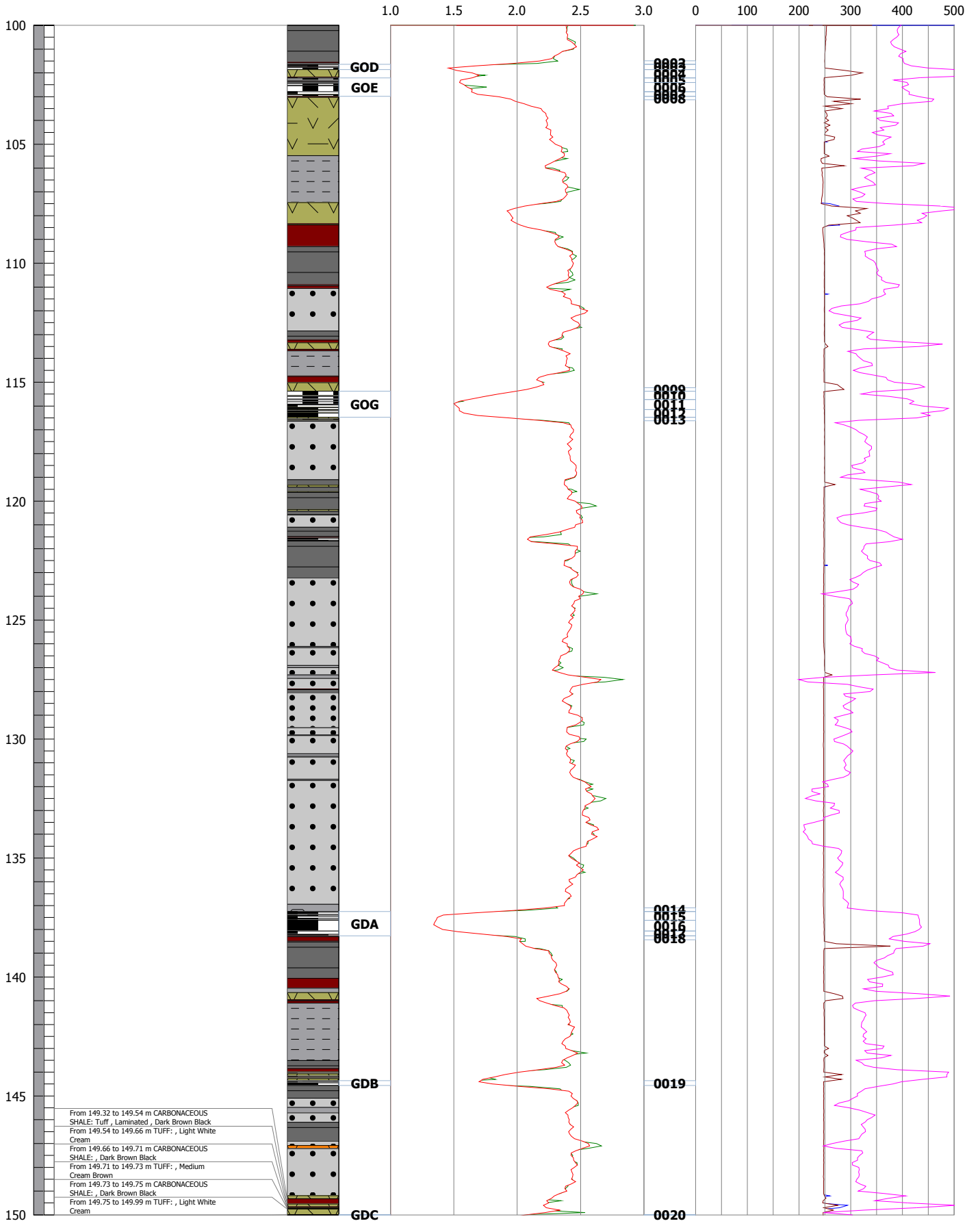

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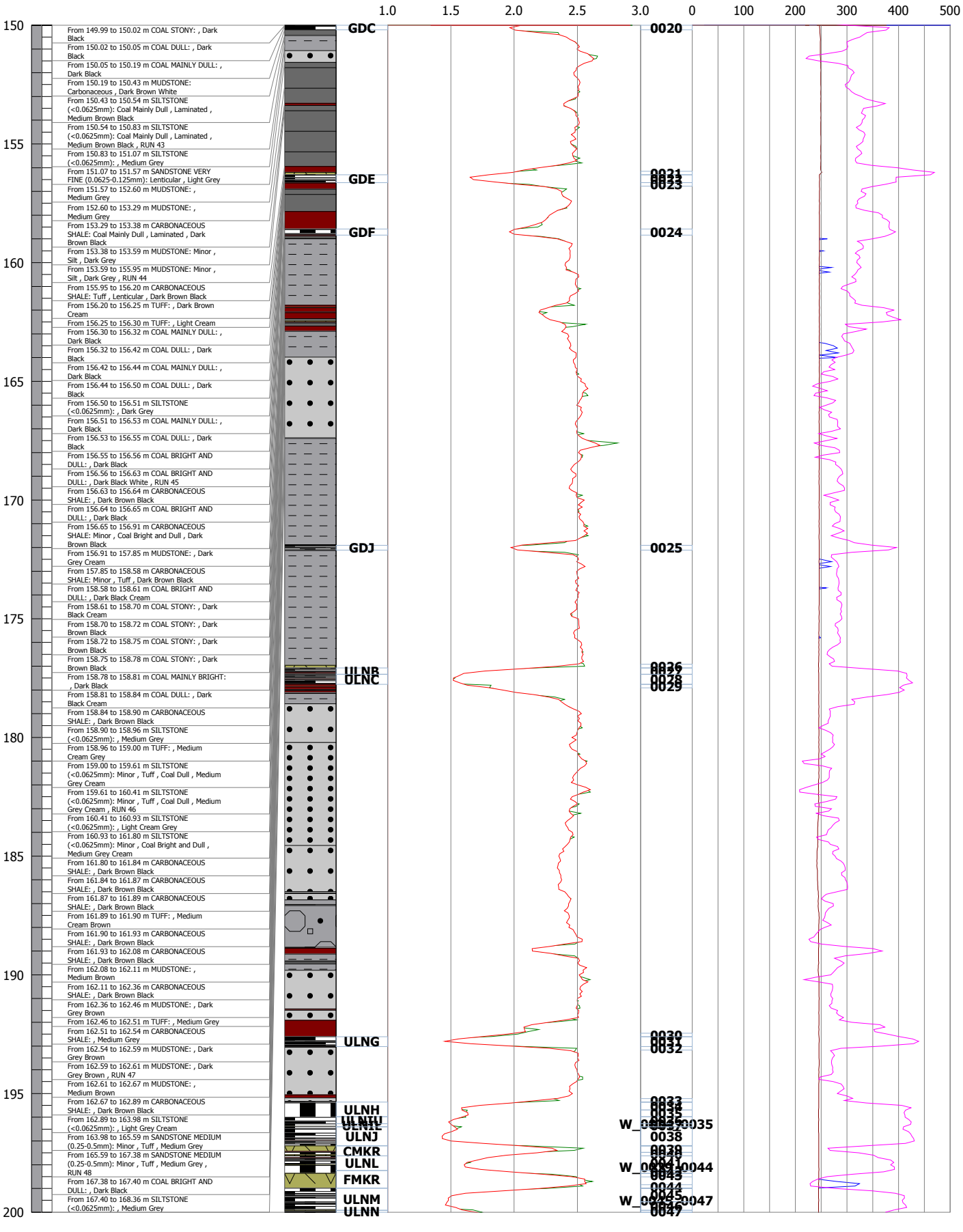

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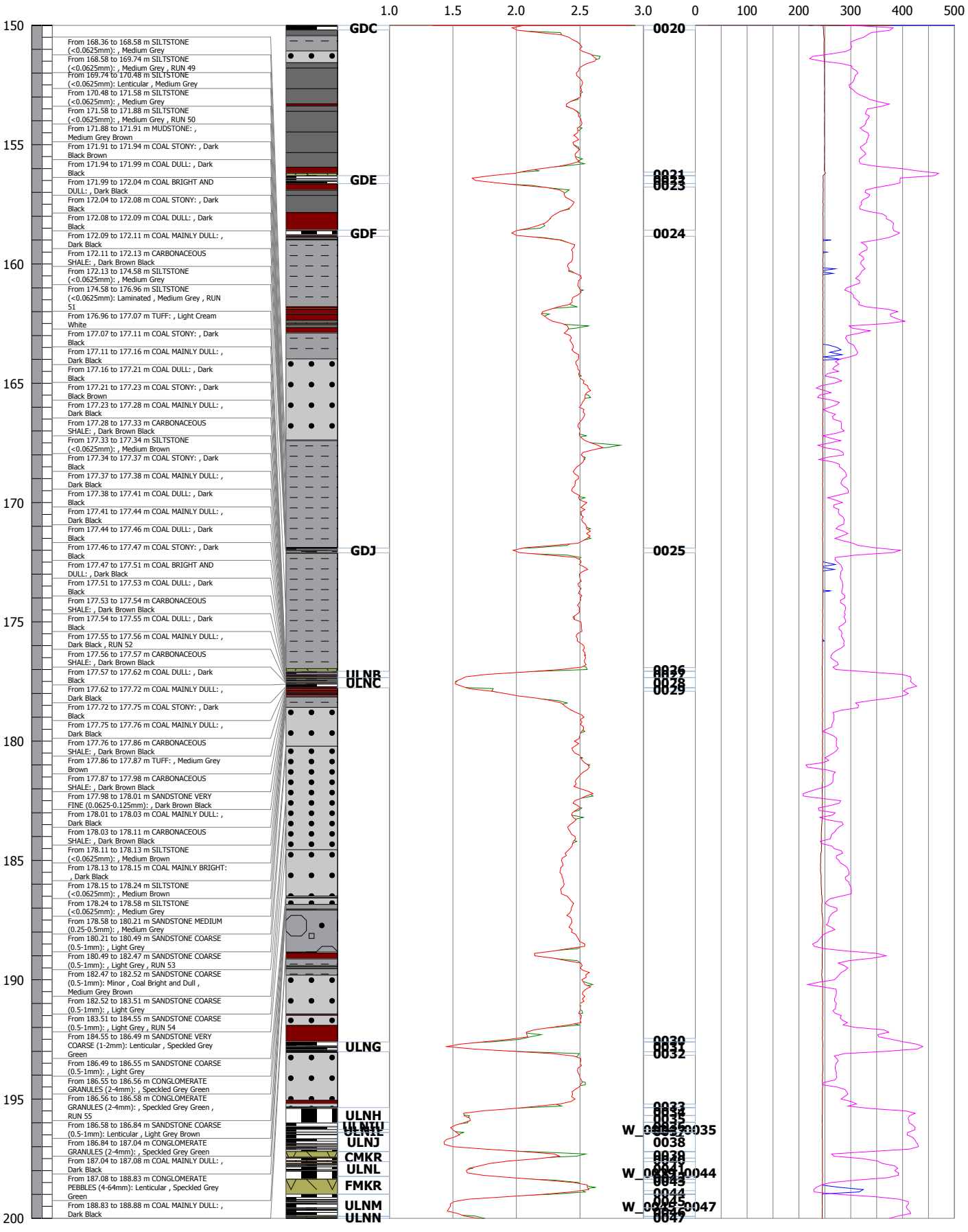

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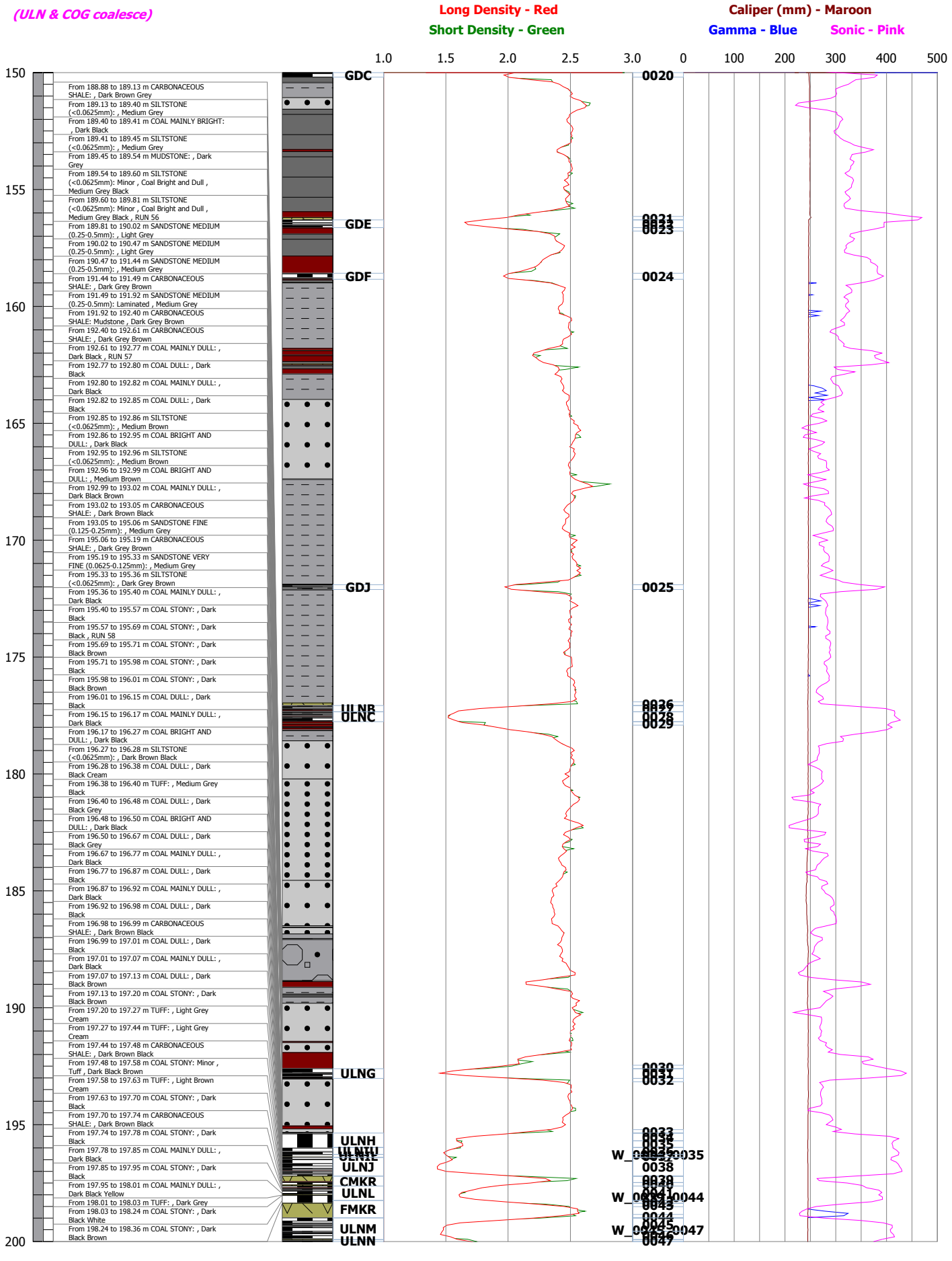

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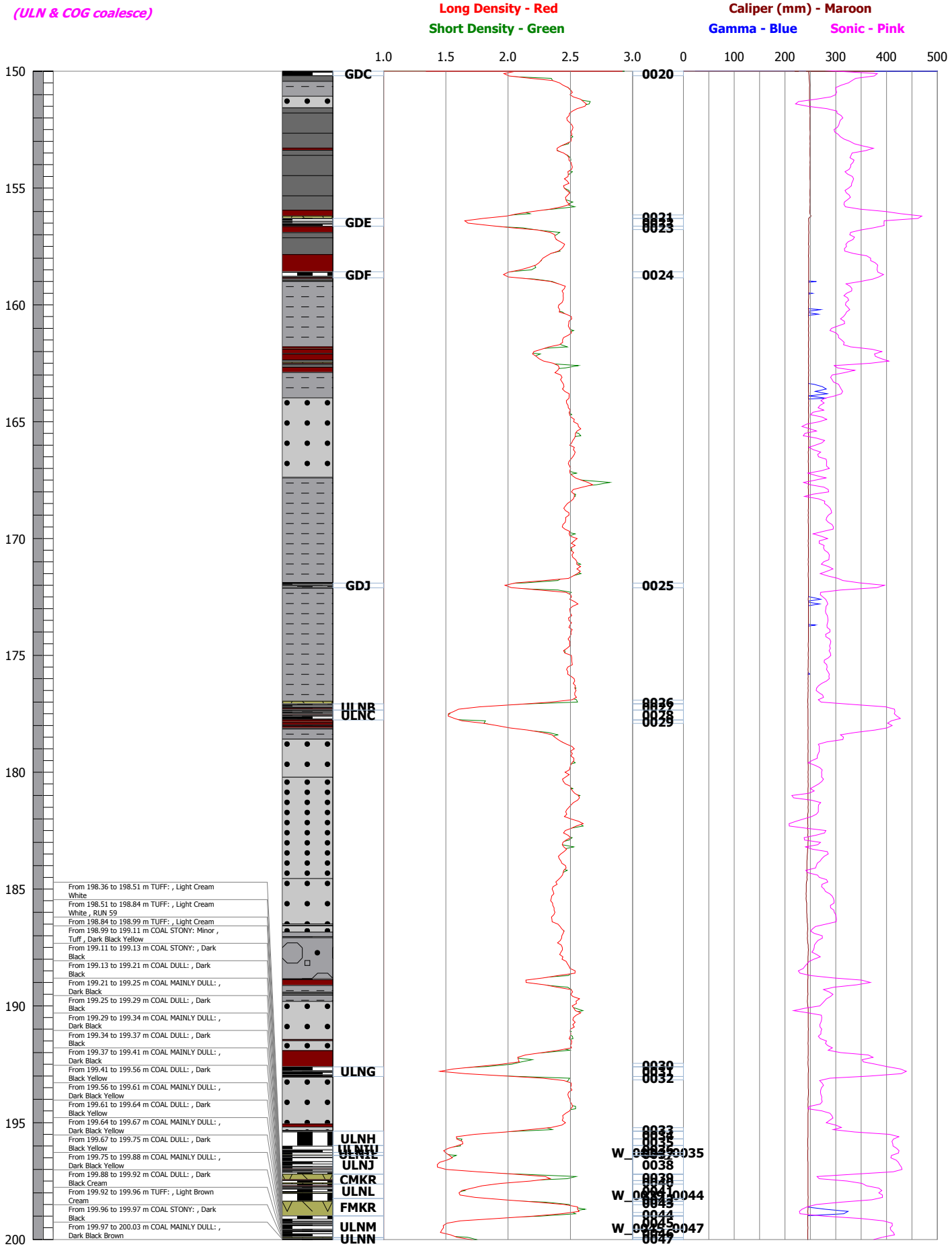

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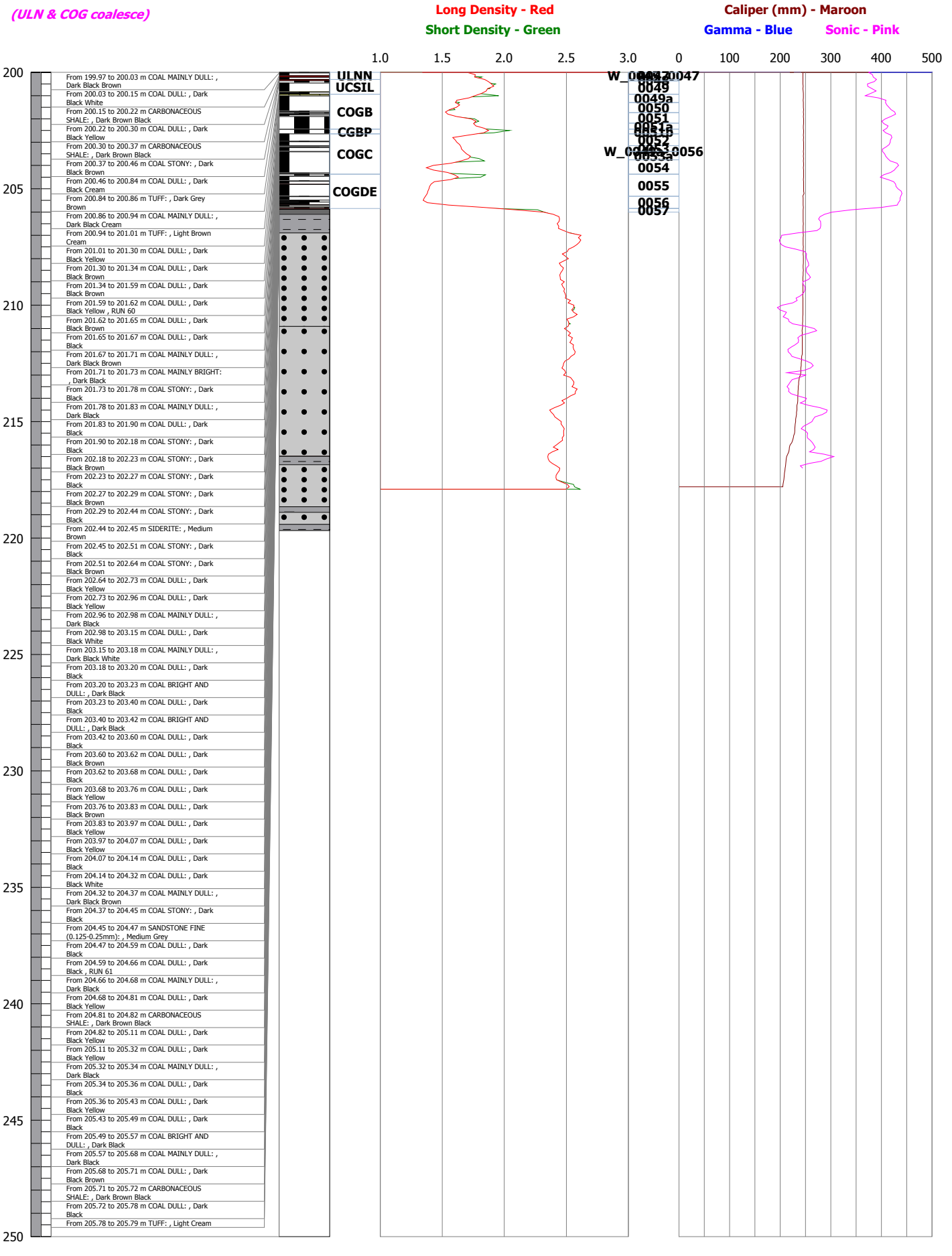

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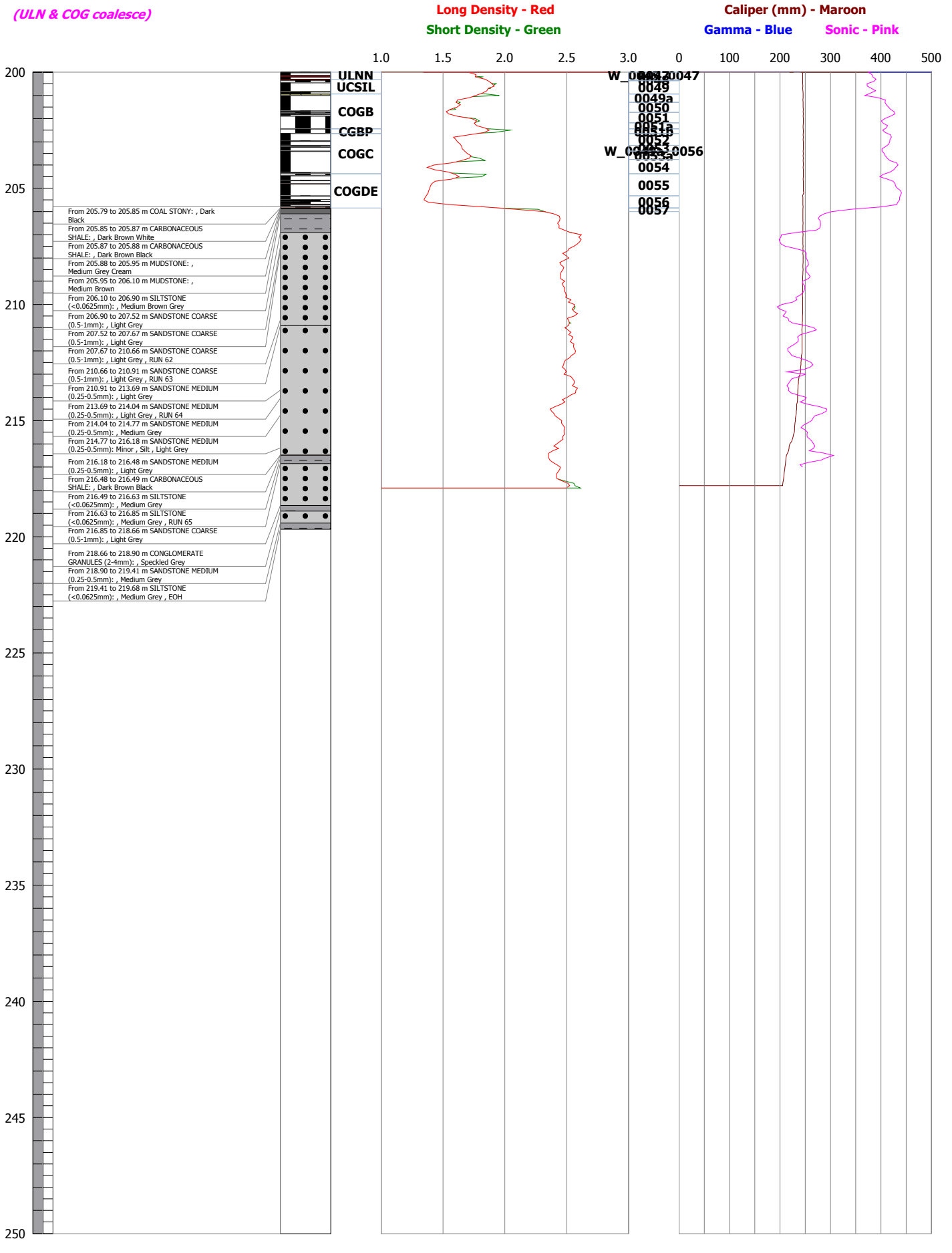
Total Depth : 219.68 m **Area** : Bylong Station **Height** : 358.10 ***MGA94_56S***



BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BY0011CH
PROJECT No: 49761
DATE: 25/10/2012
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	211											
	212											
	213											
	214	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone From 214.50m to 215.91m, thinly laminated with siltstone From 214.68m, trace coal bedding							C	100	100	PL(A) = 2.71 PL(D) = 2.23
	215											
	216											
	217								GT101			PL(A) = 2.76 PL(D) = 1.33
	217.55	CONGLOMERATE - High to very high strength, fresh, grey conglomerate (medium sized gravel in a fine to medium sized sand matrix)										PL(A) = 5.36 PL(D) = 2.68
	217.77											
	218	MUDSTONE - Medium strength, fresh, grey mudstone, slightly laminated with siltstone							C	100	99	
	219											PL(A) = 1 PL(D) = 0.49

RIG: DRS650 **DRILLER:** (Lucas) Hayes **LOGGED:** Holden **CASING:** Uncased

TYPE OF BORING: HQ3

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BY0011CH
PROJECT No: 49761
DATE: 25/10/2012
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		MUDSTONE - Medium strength, fresh, grey mudstone, slightly laminated with siltstone *(continued)*										PL(A) = 0.99 PL(D) = 0.93
	221	From 220.85m, grading into siltstone										
	221.14	TUFF - Medium strength, fresh, grey tuff						221.25m to 221.29m, clay seam	C	100	99	PL(A) = 0.42 PL(D) = 0.35
	221.29	From 221.25m, very low strength										
		SILTSTONE - High strength, fresh, grey siltstone										PL(A) = 1.6 PL(D) = 1.07
	222								GT102			
	223	From 223.5m, grading into sandstone						>>				
	224											
	224.16	SILTSTONE / SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone, interbedded with thinly laminated siltstone bands										
	225	From 225.5m to 225.6m, calcite veining										PL(A) = 1 PL(D) = 0.32
		From 225.83m to 225.85m, very low strength clay seam						225.73m: P,sh,pl, clay seam 225.83m to 225.85m, clay seam	C	100	83	
	226	From 226.52m to 226.68m, siderite band										PL(A) = 1.03
	227											
		From 227.57m to 228.46m, medium strength, thinly laminated with very low strength clay seams						227.39m to 227.58m, J,sv, ir, Ca 227.57m to 228.46m, multiple clay seams up to 50mm thick, spaced 5-20mm apart 227.72m to 227.87m, J,sv, pl, Ca 228.0m to 228.19m, J,sv, pl, Ca				
	228											PL(A) = 0.56
	229	From 229.09m to 229.96m, medium strength, thinly laminated with very low strength clay seams						229.09m to 229.96m, multiple clay seams up to 50mm thick, spaced 5-10mm apart 229.22m to 229.24m, P,10°,pl, Ca	C	99	73	
	229.96											PL(A) = 0.59

RIG: DRS650 **DRILLER:** (Lucas) Hayes **LOGGED:** Holden **CASING:** Uncased

TYPE OF BORING: HQ3

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BY0011CH
PROJECT No: 49761
DATE: 25/10/2012
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
		SILTSTONE - Medium strength, fresh, grey siltstone *(continued)*						229.26m to 229.28m, P,10°,pl, Ca				
		From 230.31m to 230.61m, medium strength, laminated with very low strength clay seams						229.27m to 229.4m, J,sv,pl, Ca				
								229.54m to 229.55m, P, 10°, pl, Ca				
	231							229.61m to 229.62m, P, 10°, pl, Ca				
								229.78m to 229.86m, J,50°,pl, Ca, 6mm infill				
								229.86m: P,sh,pl, Ca				
								229.87m: P,sh,pl, Ca	GT103			
								229.89m to 229.90m P,5°, pl, Ca				PL(A) = 3.04
	232	From 231.89m to 232.14m, medium strength, laminated with very low strength clay seams						229.97m to 230.23m, J, 70° to 80°, pl, Ca, 3mm infill				
								230.31m to 230.61m, multiple clay seams up to 20mm thick, spaced 5-10mm apart	C	99	73	
	233	From 232.9m to 232.99m, very low strength clay seam						230.44m to 230.48m, P, 30°, pl, Ca				
								230.59m to 230.60m, P,sh to 15°, pl, Ca				
								231.06m to 231.14m, J,60°,pl, Ca				
								231.36m to 231.42m, P, sh to 40°, pl, Ca, 10mm thick				PL(A) = 0.22
	234	From 234.07m to 234.15m, calcite vein						231.73m 231.82m, J, sv, ir, Ca / qz				
								231.86m to 231.94m, P, 30°, pl, Ca/qz, 15mm infill				
								231.89m to 232.14m, multiple clay seams up to 70mm thick, spaced 30mm apart				
	235							232.9m to 232.99m, very low clay seam				
								233.46m to 233.47m, P,sh,pl, Ca				PL(A) = 0.33
								233.47m to 233.49m, P,10°,pl, Ca				
	236							233.7m: P,sh,pl, Ca	GT104			
								234.57m to 234.6m, P,sh to 20°, pl, Ca				PL(A) = 0.71 PL(D) = 0.62
								234.99m to 235.05m, J, sv to 60°,pl, Ca				PL(A) = 0.89
								235.06m to 235.08m, P,sh to 10°, pl, Ca	C	100	95	
	237							235.14m to 235.16m, P,sh to 10°, pl, Ca				
								236.26m to 236.3m, P,sh to 35°, pl, Ca				PL(A) = 0.58 PL(D) = 0.46
												PL(A) = 0.93
	238	From 237.95m to 238.10m, medium strength, laminated with very low strength clay seams						238.01m to 238.05m, P,sh to 30°, pl, Ca				PL(D) = 0.27
								238.06m to 238.09m, clay seam				
								238.1m: P,sh,pl, Ca				
	238.7	Bore discontinued at 238.7m, limit of investigation										
	239											

RIG: DRS650 **DRILLER:** (Lucas) Hayes **LOGGED:** Holden **CASING:** Uncased

TYPE OF BORING: HQ3

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

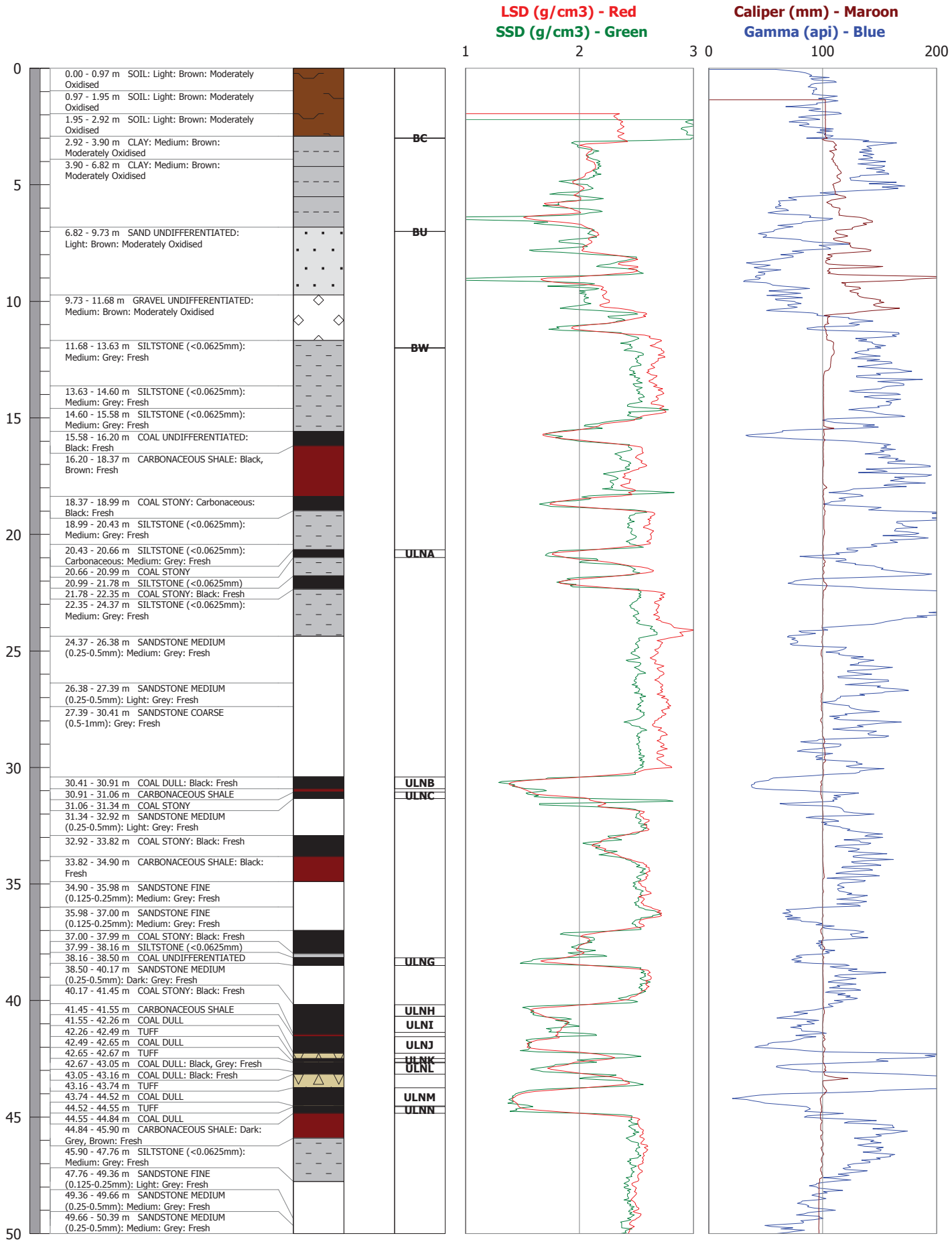
Bylong: Drillhole Summary

Hole Number: BY0014CH | **ole Type** : Part Open/Core Drilling | **MGA94_56S**

Date : 28/07/2011 | **Tenement**: AUTH287 | **Easting** : 229612.00

Total Depth: 66.29 m | **Area** : Bylong Station | **Northing**: 6410336.00

Height : 307.00



Bylong: Drillhole Summary

Hole Number: BY0014CH | **ole Type**: Part Open/Core Drilling | **MGA94_56S**

Date: 28/07/2011 | **Tenement**: AUTH287 | **Easting**: 229612.00

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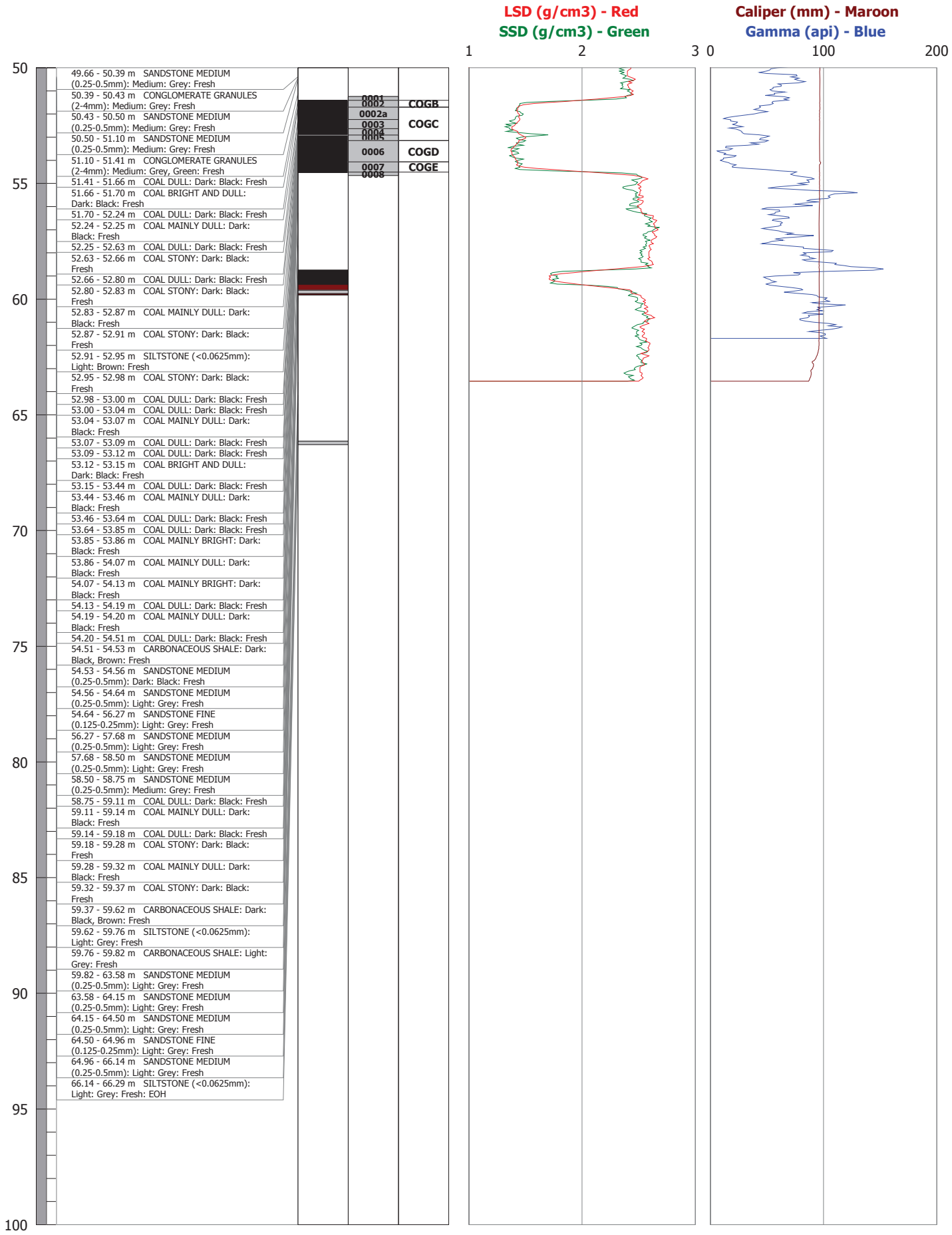
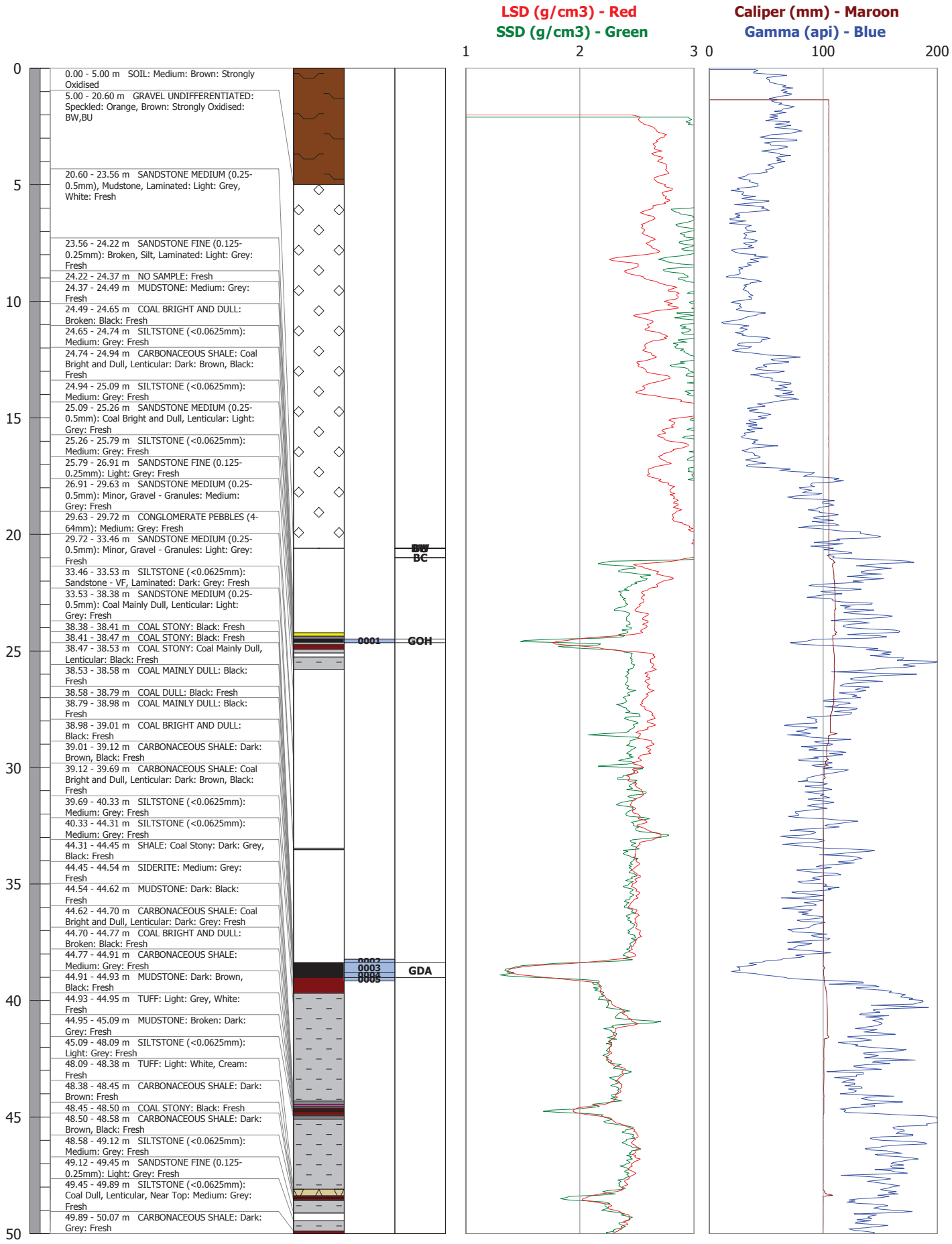


Bylong: Drillhole Summary

Hole Number: BY0015CH **Hole Type**: Core Drilling
Date: 7/07/2011 **Tenement**: AUTH287
Total Depth: 102.70 m **Area**: Bylong Station

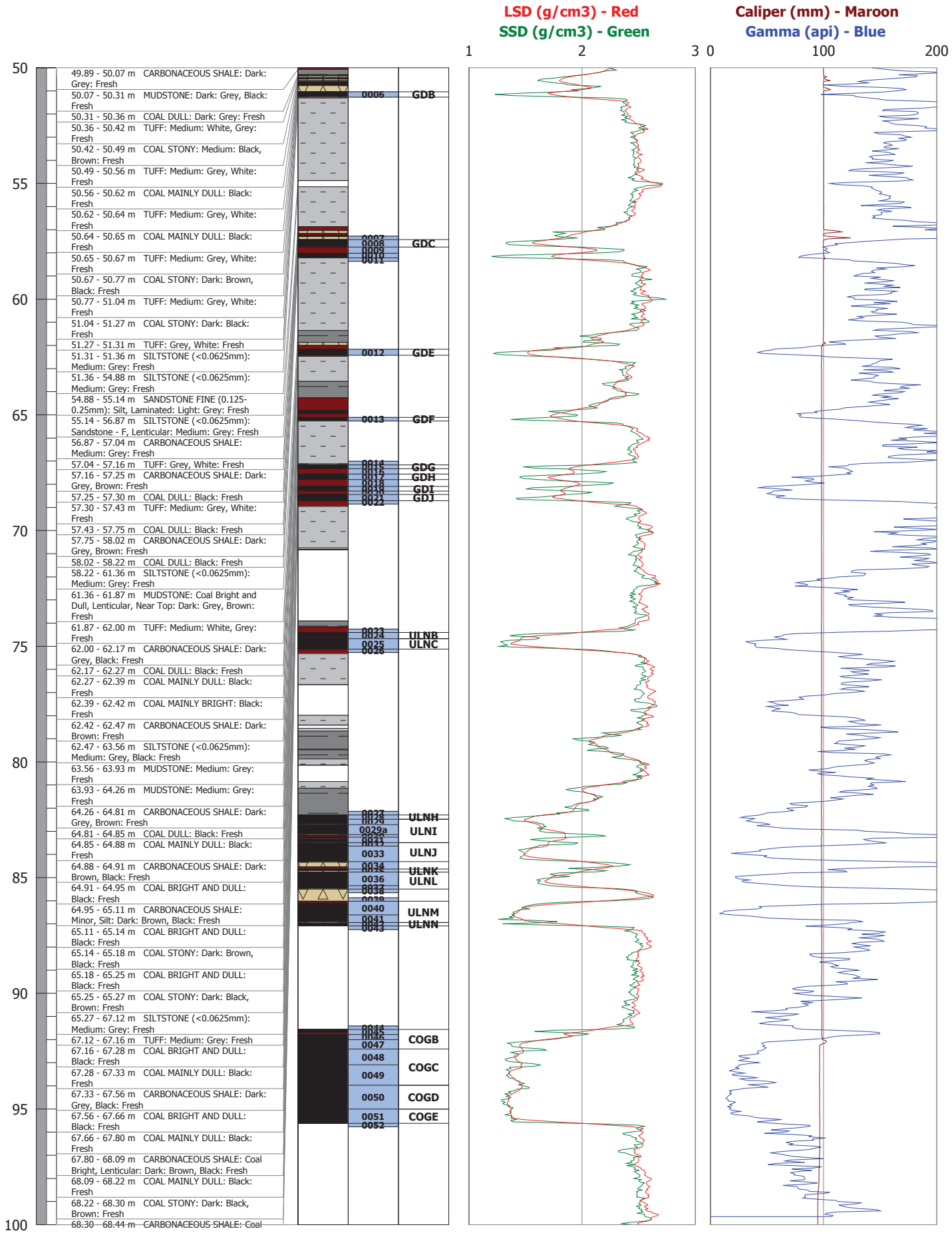
MGA94_56S
Easting: 230110.63
Northing: 6412947.60
Height: 247.24



Bylong: Drillhole Summary

Hole Number: BY0015CH **Hole Type**: Core Drilling
Date: 7/07/2011 **Tenement**: AUTH287
Total Depth: 102.70 m **Area**: Bylong Station

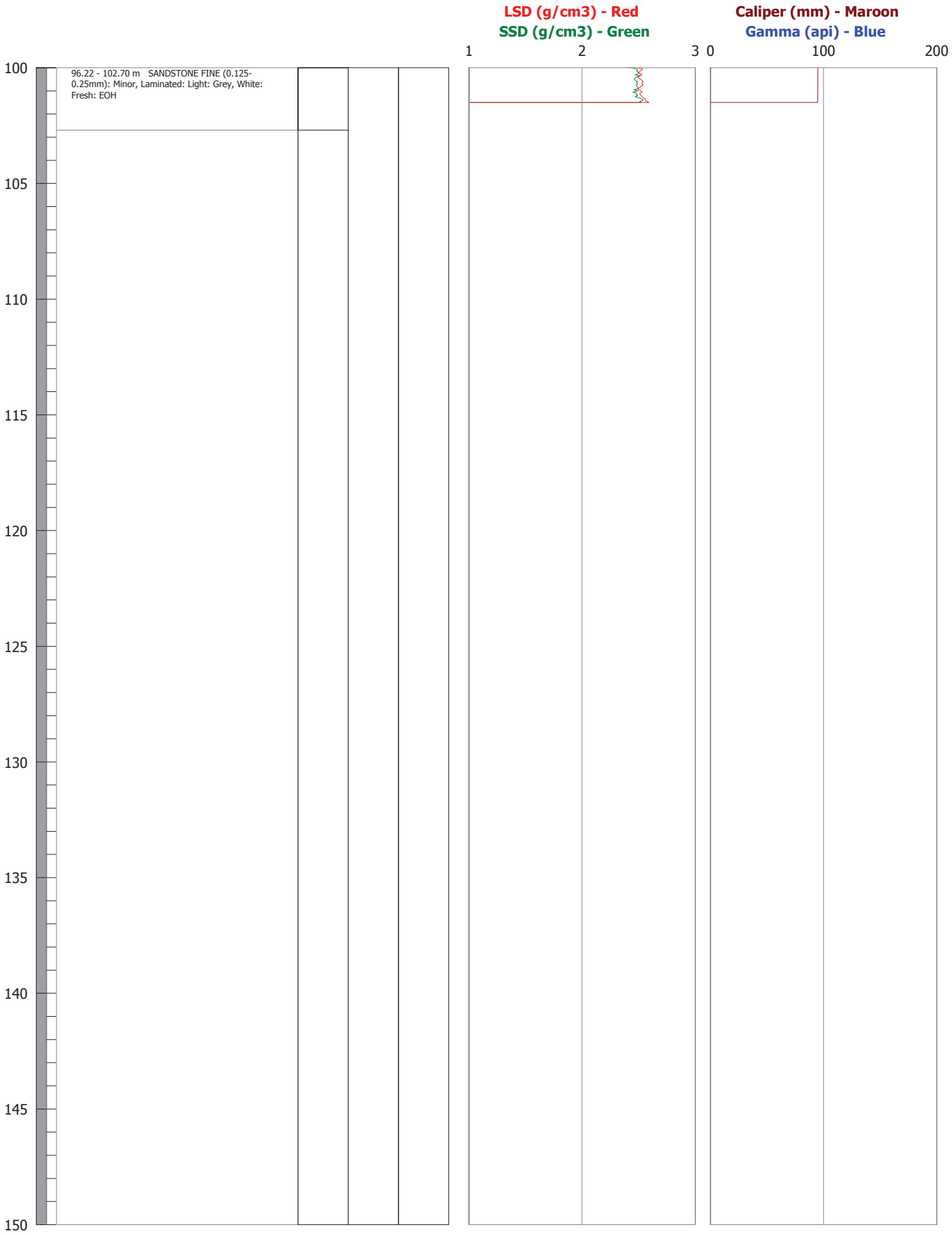
MGA94_56S
Easting: 230110.63
Northing: 6412947.60
Height: 247.24



Bylong: Drillhole Summary

Hole Number: BY0015CH **Hole Type**: Core Drilling
Date: 7/07/2011 **Tenement**: AUTH287
Total Depth: 102.70 m **Area**: Bylong Station

MGA94_56S
Easting: 230110.63
Northing: 6412947.60
Height: 247.24

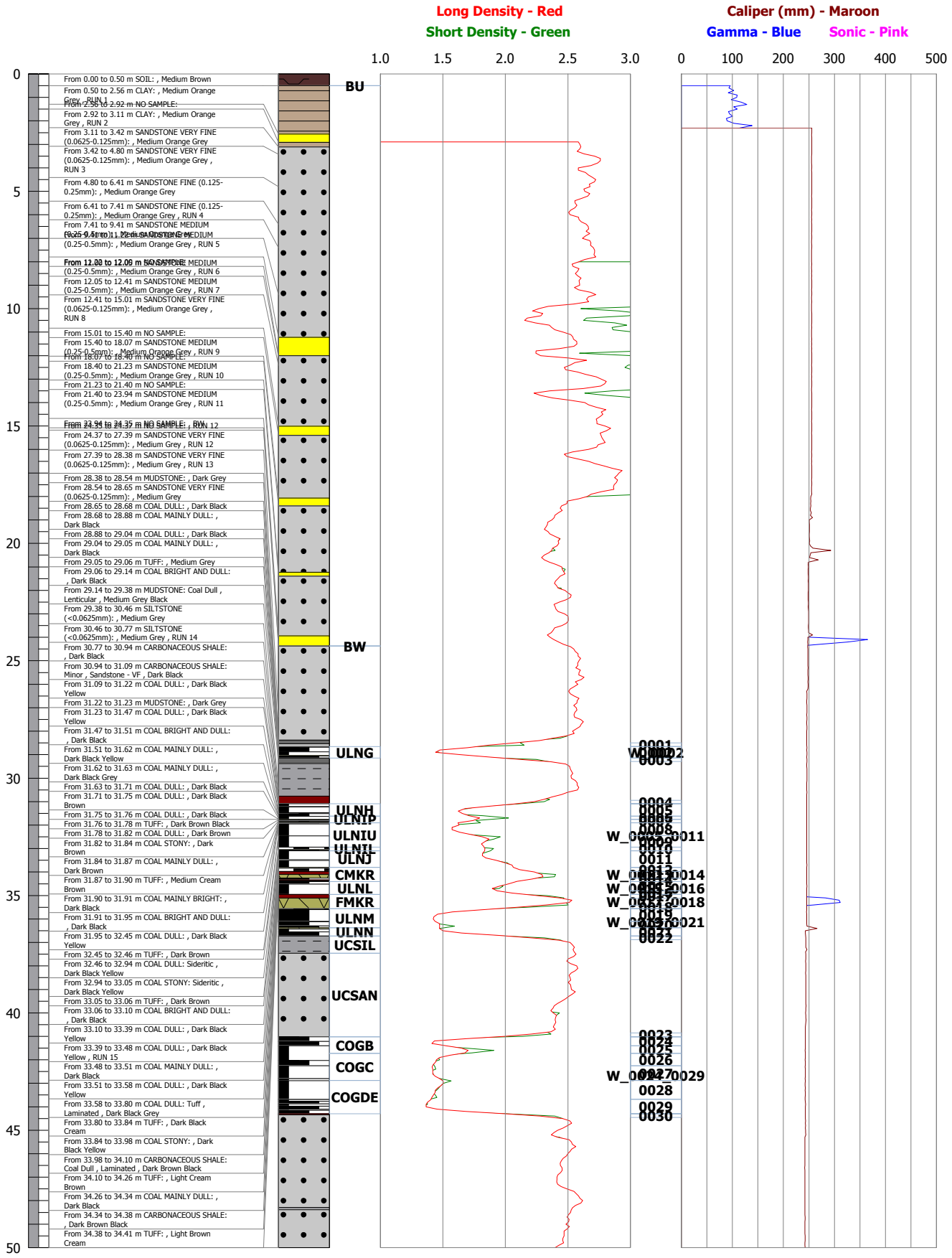


Bylong : Drillhole Summary

Hole Number : BY0016CH **Hole Type** : Fully Cored **Easting** : 231315.42

Date : 13/07/2011 **Tenement** : AUTH287 **Northing** : 6408236.37

Total Depth : 54.75 m **Area** : Bylong Station **Height** : 292.79 *MGA94_56S*

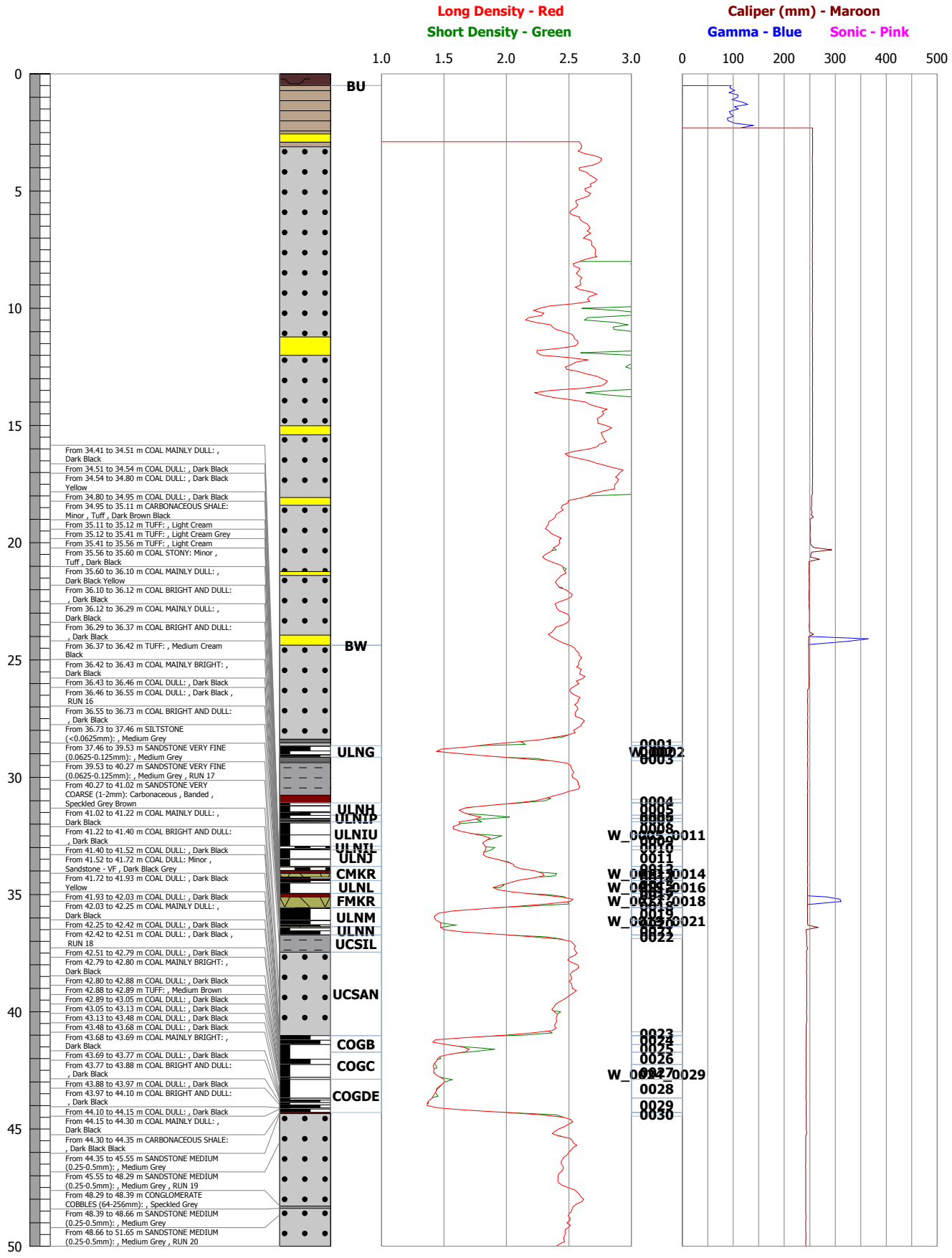


Bylong : Drillhole Summary

Hole Number : BY0016CH **Hole Type** : Fully Cored **Easting** : 231315.42

Date : 13/07/2011 **Tenement** : AUTH287 **Northing** : 6408236.37

Total Depth : 54.75 m **Area** : Bylong Station **Height** : 292.79 *MGA94_56S*

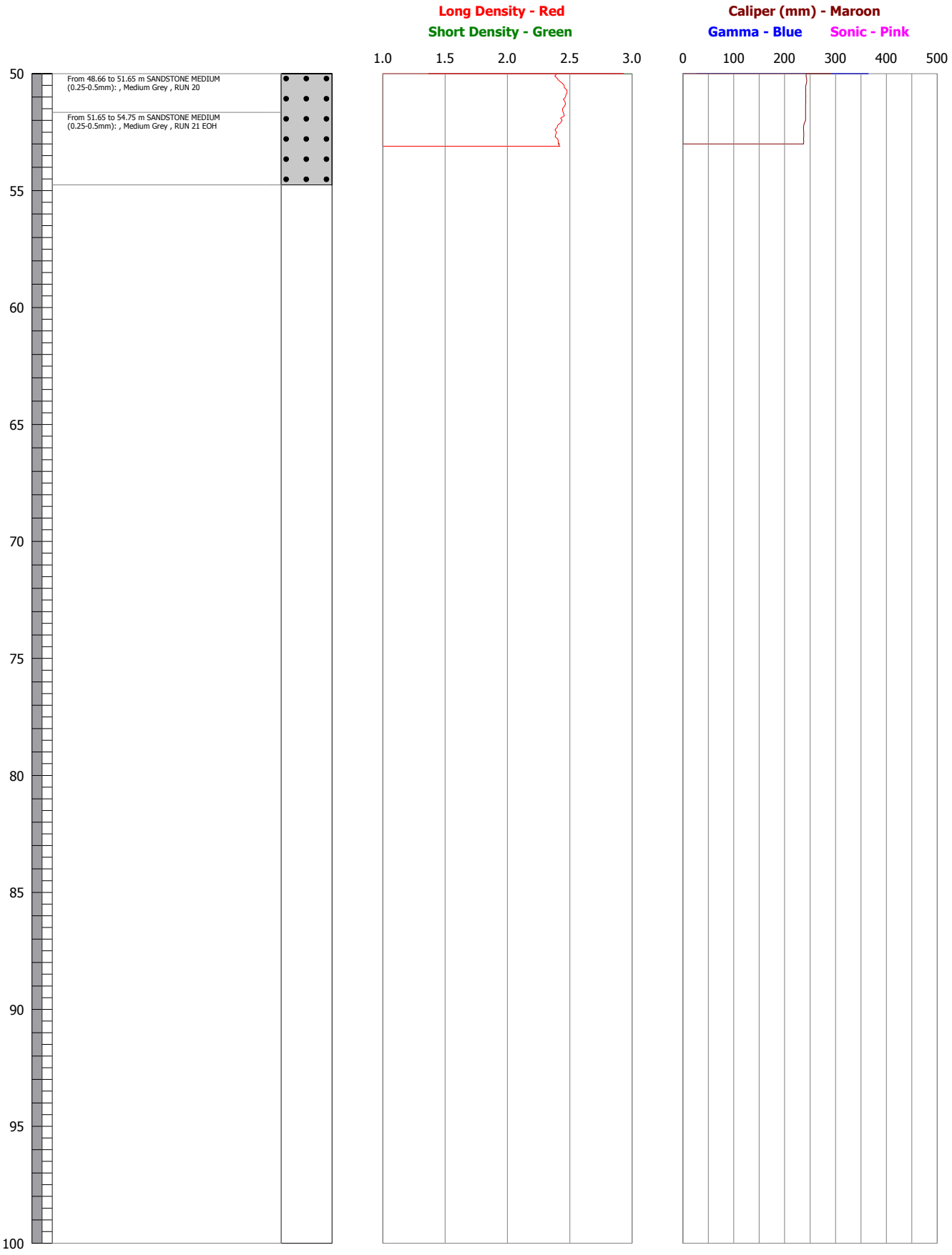


Bylong : Drillhole Summary

Hole Number : BY0016CH **Hole Type** : Fully Cored **Easting** : 231315.42

Date : 13/07/2011 **Tenement** : AUTH287 **Northing** : 6408236.37

Total Depth : 54.75 m **Area** : Bylong Station **Height** : 292.79 ***MGA94_56S***

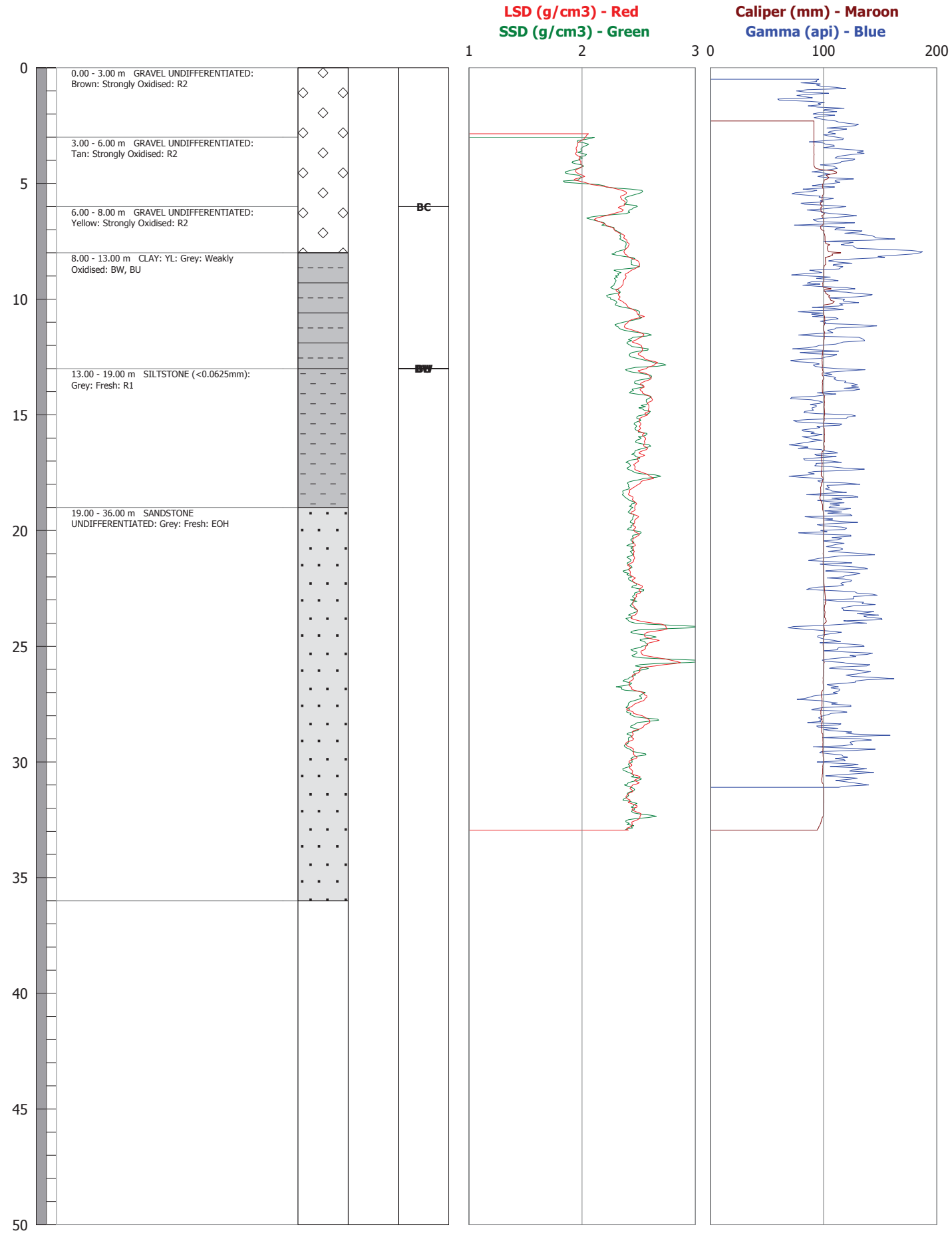


Bylong: Drillhole Summary

Hole Number: BY0020
Date : 14/07/2011
Total Depth : 36.00 m

Hole Type : Open (Chip) Drilling
Tenement : AUTH342
Area : Harley Hill

MGA94_56S
Easting : 230571.56
Northing : 6401183.53
Height : 332.37



BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 1 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
		CORE LOSS - 0.33m (0m to 0.33m)						0m: CORE LOSS: 330mm				
298	0.33	SANDY GRAVELLY CLAY - Very soft, light brown, medium to coarse grained sandy fine sized gravelly clay, M>Wp							pp			60 kPa
	1								pp			0 kPa
	1.25	CLAYEY SAND - (Dense to very dense), clayey fine to medium grained sand with trace fine sized gravel and silt							C	87	0	
299	2								pp			>400 kPa
									pp			130 kPa
									pp			190 kPa
									pp			210 kPa
									pp			220 kPa
									pp			>400 kPa
									pp			>400 kPa
	2.45	SANDSTONE - Extremely low to very low strength, extremely weathered, light brown fine to coarse grained sandstone with some fine to medium sized gravel							pp			>400 kPa
300	3								pp	100	0	>400 kPa
									C			
									pp			>400 kPa
301	4											
302	5								C	100	0	
		From 5.54m to 5.61m, cobble							GT001			PL(A) = 0.13 PL(D) = 0.05
303	6											
	6.6	CONGLOMERATE (VOLCANIC INTRUSION) - Very low strength, highly weathered, brown, fine to coarse grained sandstone with fine to medium sized gravel, some clay and trace cobbles up to 50mm										
304	7											
305	8								C	100	0	PL(A) = 0.16 PL(D) = 0.06
306	9											
								9.77m to 9.85m, J, 50°,	C	100	56	

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 2 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
308	11	CONGLOMERATE (VOLCANIC INTRUSION) - Very low strength, highly weathered, brown, fine to coarse grained sandstone with fine to medium sized gravel, some clay and trace cobbles up to 50mm *(continued)* From 10.4m, very low to low strength						pl,ro, Fe 10.06m to 10.12m, J,60°,pl, He 10.15m to 10.2m, J, 70°, ir, discontinuous Fe	C	100	56	PL(A) = 0.08 PL(D) = 0.06
309	12							12.03m to 12.07m, J,40°,pl, He, Fe 12.2m to 12.24m, J,45°,pl, He, Fe 12.23m to 12.27m, J,50°,pl, He, Fe 12.35m to 12.4m, J, 40°,pl, ro, Fe 12.89m to 12.95m, J,60°,pl,ro,Fe				
310	13	From 12.55m to 12.9m, extremely low strength										
311	14	From 13.46m, cobbles up to 80mm							C	100	88	
312	15								GT002			PL(A) = 0.51 PL(D) = 0.23
313	16							15.86m to 15.9m, J, 50°,ir,ro, Fe				
314	17	From 16.23m to 17.0m, extremely low strength						17.18m to 17.25m, J,60°,ir,ro, Fe	C	100	55	
315	18							17.67m: P,sh,pl,ro, Fe				
316	19											PL(A) = 0.15 PL(D) = 0.09
									C	100	99	
								19.53m: P,sh,pl,ro, Fe				

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 3 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
318	21	CONGLOMERATE (VOLCANIC INTRUSION) - Very low strength, highly weathered, brown, fine to coarse grained sandstone with fine to medium sized gravel, some clay and trace cobbles up to 50mm *(continued)*	EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	20.72m to 20.76m, J, 50°,pl, ro, Fe	C	100	99	PL(A) = 0.29 PL(D) = 0.16 PL(A) = 0.29 PL(D) = 0.21
		From 20.43m, low to medium strength, moderately weathered										
		From 20.83m, slightly weathered										
319	22	From 20.94m, fresh, with some coarse grained basalt and trace coarse grained quartz										PL(A) = 0.49 PL(D) = 0.3
		From 22.48m to 22.53m, cobble						22.6m to 22.64m, J, 40°, pl, He				
320	23	From 22.9m, trace highly weathered, low strength, green chert cobbles up to 10mm						22.75m to 23.1m, J,sv,pl, He	C	100	99	
		From 23.05m to 23.1m, cobble										
321	24	From 23.62m to 23.69m, cobble										
		From 24.27m to 24.33m, cobble										
322	25											PL(A) = 0.38 PL(D) = 0.27
								25.32m to 25.49m, J, 80°,pl, He calcite				
323	26	From 26.04m to 26.11m, cobble							C	100	98	
									GT003			
324	27	From 26.94m to 27.01m, extremely low strength, highly weathered, green chert, cobble										PL(A) = 0.37 PL(D) = 0.21
		From 27.55m to 27.85m, tuff, clast										
325	28	From 28.0m, medium strength										
								28.29m to 28.34m, J,60°,ir, He calcite				
326	29							28.45m to 28.47m, J, 20°,pl, He calcite	C	100	96	
								28.96m to 29.0m, J, 35°, pl, He calcite				
												PL(A) = 0.48 PL(D) = 0.32

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 4 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
328	31	CONGLOMERATE (VOLCANIC INTRUSION) - Very low strength, highly weathered, brown, fine to coarse grained sandstone with fine to medium sized gravel, some clay and trace cobbles up to 50mm *(continued)*						>>	C	100	96	
329	32								C	100	94	
330	33	From 32.64m to 32.95m, coarse grained sandstone						33.32m to 33.41m, J, 80°, ir, He calcite 33.49m: P,sh,pl, He calcite				PL(D) = 9.55
331	34	From 33.75m tp 33.94m, very high to extremely high strength, fresh, heat affected band From 34.0m, very low to low strength										PL(A) = 0.07 PL(D) = 0.16
332	35								GT004			
333	36	From 35.25m to 35.93m, some coal fragments up to 50mm thick From 35.3m to 35.73m, some tuff bands up to 100mm thick						>>	C	100	100	PL(A) = 0.06 PL(D) = 0.07
334	37	From 37.10m, to 37.68m, low to medium strength carbonaceous siltstone with some extremely low tuff bands up to 60mm thick										PL(D) = 0.98
335	38	From 37.9m to 38.04m, contact between extremely low to very low strength tuff and carbonaceous siltstone at 80°, 500mm thick From 38.55m, very low strength							C	93	53	PL(D) = 0.14
336	39	From 38.81m, low to medium strength,with some coarse grained basalt and trace coarse grained quartz							GT005			
									C	96	96	
									C	100	98	

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 5 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
338	41	CONGLOMERATE (VOLCANIC INTRUSION) - Very low strength, highly weathered, brown, fine to coarse grained sandstone with fine to medium sized gravel, some clay and trace cobbles up to 50mm *(continued)*										
		From 41.15m to 41.24m, contact between conglomerate and sandstone at 60°							C	100	98	
339	42	From 41.24m, medium to high strength, fresh, fine grained sandstone						41.75m to 41.78m, P,45°,pl,ro, calcite				PL(A) = 0.65 PL(D) = 0.56
		From 41.74m, siltstone with trace tuff bands up to 40mm thick						41.93m to 41.97m, P,60°, pl ro, calcite				
		At 42.22m to 42.55m, coal interbedded with tuff, bands up to 60mm thick										
340	43	From 42.55m to 42.74m, low strength, fresh, tuff band										
	43.44	CARBONACEOUS MUDSTONE - High strength, fresh, dark brown carbonaceous mudstone with some very low to low strength tuff bands up to 50mm thick										
341	44							43.98m to 44.03m, F, 25°,pl, He calcite	C	100	96	PL(A) = 1.74 PL(D) = 1.1
	44.35	COAL - Medium to high strength, fresh, black coal with some tuff bands up to 50mm thick										
342	44.85	SILTSTONE - low to medium strength, fresh, dark grey siltstone						44.64m to 44.71m, highly fractured				
	45	From 45.04m to 45.20m, coal lenses 2mm to 5mm thick at 50mm spacings						45.22m: P,sh,ir,ro, pyrite	GT006			PL(A) = 0.28 PL(D) = 0.21
	45.27	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone										
343	46							45.96m to 46.35m, J,80°,pl, He calcite				
	46.1	SILTSTONE - Medium to high strength, fresh, dark grey siltstone						46.28m to 46.35m, P, 40°,pl, ro calcite				PL(A) = 1.49 PL(D) = 0.71
344	47							47.02m to 47.06m, P, 45°,pl, ro calcite	C	100	91	
	47.53	SANDSTONE - High to very high strength, fresh, fine to medium grained sandstone						47.02m to 47.16m, J, 50°,pl, discont				
345	48							47.24m to 47.48m, J, 80°, ir,sm, calcite				
								47.49, to 47.51m, P,sh,ir,ro, calcite				PL(A) = 5.26 PL(D) = 4.53
								48.09m to 48.24m, F, 80°, pl, 20mm thick				
								48.3m to 48.46m, F, 80°,pl, 20mm thick				
346	49							48.68m to 48.74m, F, sv, ir, 15mm thick				
	49.11	From 49.11m, low to medium strength coal band						49.18m to 49.2m, J,30°,pl, He	C	100	85	
		SILTSTONE - Medium to high strength, fresh, dark grey siltstone						49.4m to 49.42m, Fr, 20°,pl, sm, calcite				PL(A) = 0.56
	49.82							49.41m to 49.46m, Fr, 50°, ir,sm, calcite				

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m

TYPE OF BORING: HQ3 to 147.72m

WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 6 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
348	51	SANDSTONE - Medium to high strength, fresh, grey to dark grey, fine to medium grained sandstone with trace fine sized gravel *(continued)*						49.48m to 49.52m, Fr, 45°,ir, He 49.69m to 49.8m, F, sv, ir, 10mm thick 49.77m to 49.92m, J, 60°, pl, sm, calcite 49.95m to 50m, F,45°, pl, 5mm thick 50.42m to 50.47m, F,30°,pl, 3mm thick 50.46m to 50.73m, F,sv, ir, 3mm thick	C	100	85	
349	52											
350	52.87								GT007			PL(A) = 1.51
	53	COAL - Medium to high strength, fresh, black coal						53.12m to 53.5m, J,sv,ir, He calcite 53.4m to 53.59m, F, 75°,ir, 3mm thick 53.6m to 53.67m, J, 60°,pl, cl	C	99	93	PL(A) = 0.8 PL(D) = 0.6
351	53.73	MUDSTONE - High strength, fresh, dark brown mudstone							GT008			
	54 53.99	SANDSTONE - Medium to high strength, fresh, dark grey fine grained sandstone										
352		From 54.62m, fine to medium grained										
	55								GT009			
353								55.19m to 59.23m, J,40°, pl, He, discont				PL(A) = 1.25
	56	From 56.03m, medium grained mica							C	100	99	
354	57											
355												
	58											
356									C	100	100	PL(A) = 1.43 PL(D) = 0.82
	59	From 59.07m, fine to coarse grained, high strength						>>				

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 7 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE - Medium to high strength, fresh, dark grey fine grained sandstone *(continued)*							C	100	100	
358	61											
359	62								C	100	99	
360	63	From 63.25m to 63.29m, extremely low strength tuff band From 63.34m to 63.41m, coal band						63.59m to 63.62m, F,50°,pl, 1mm thick 63.76m to 63.85m, Fr, 50°, pl, closed	GT010			PL(A) = 1.42 PL(A) = 0.43
361	64											
362	64.79	SILTSTONE - High strength, fresh, dark grey siltstone						64.77m to 64.79m, P,35°,pl, He	C	100	95	PL(A) = 0.92 PL(D) = 0.53
	65											
	65.14	MUDSTONE - High strength, fresh, dark brown mudstone with some very low to low strength tuff bands up to 60mm thick										
363	65.83	From 65.67m, some coal lenses up to 2mm thick										
	66	SANDSTONE - Medium to high strength, fresh, dark grey, fine to medium grained sandstone										
364		From 66.8m, coal lense 5mm thick						>>				
	67											
365		From 67.55m to 68.01m, fine grained										
	68								C	100	100	PL(A) = 1.17 PL(D) = 0.95
366	69											
	69.62	SILTSTONE - High strength, fresh, dark grey siltstone						69.33m to 69.64m, Fr,sv,pl,cl 69.74m to 69.82m, J,sv, pl,cl	C	100	93	

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 8 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
368	70.06	TUFF / CARBONACEOUS MUDSTONE - very low to low strengt, light grey, tuffaceous claystone interbedded with high strength carbonaceous mudstone bands up to 400mm thick						70.18m to 70.22m, J,sv,pl, cl 70.24m to 70.26m, J,sv,pl,cl				PL(A) = 0.13 PL(D) = 0.06
	71	From 70.55m to 70.56m, pyrite							GT011			
	71.11	From 70.88m, some coal lenses up to 2mm thick						70.98m to 71.02m, highly fractured				PL(A) = 1.63
369		SANDSTONE / SILTSTONE - High strength, fresh, grey to dark grey fine grained sandstone / siltstone						71.53m: P,sh,pl,He 71.7m: P,sh,pl,cl	C	100	93	
	72											
370	72.68	SANDSTONE - MEdium to high strength, fresh, grey to dark grey fine to medium grained sandstone										
	73							73.13m: P,sh,pl,cl	GT012			PL(A) = 1.74
								73.4m: P.sh,pl,cl 73.53m: P,sh,pl,ro				PL(D) = 0.87
371								73.89m: P,sh,pl,ro 73.94m: P,sh,pl,ro	C	100	98	PL(A) = 2.81 PL(D) = 1.58
	74											
372		From 74.57m, some interbedded siltstone bands up to 70mm thick										
	75											PL(A) = 1.09 PL(D) = 0.61
373												
	76	From 75.83m, coal band 5mm thick From 75.95m to 75.98m, tuffaceous mudstone						75.79m: P,sh,pl,ro, calcite 75.81m: P,sh,pl,ro, calcite 75.87m: P,sh,pl,ro, calcite				
	76.56	SILTSTONE - Medium to high strength, fresh, dark grey siltstone										
374	77								C	98	94	
		From 77.47m to 77.54m, sandstone band										
375	78											
								78.41m to 78.45m, J,sv,pl, cl, discont				
	78.64	From 78.61m, low to medium strength, grey tuff										
376	79	CARBONACEOUS MUDSTONE - High strength, fresh, dark brown carbonaceous mudstone							C	100	99	
	79.22	From 78.83m to 78.94m, some coal lenses up to 5mm thick										PL(A) = 1.88

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 9 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
378		TUFF / SILTSTONE - High strength, fresh, grey to dark grey tuff / siltstone *(continued)*										
	80.81	MUDSTONE - Medium to high strength, fresh, dark brown mudstone							C	100	99	
	81	From 81.24m, some coal lenses up to 5mm thick						81.33m to 81.37m, J,sv,pl, He, calcite				PL(A) = 0.58 PL(D) = 0.4
	81.53	SANDSTONE - High strength, fresh, grey to dark grey fine to medium grained sandstone										
379								81.88m: P,sh,pl, He				
	82							81.93m: P,sh,pl, He, Discont				
								81.99m: P,sh,pl, He				
380												
	83								C	100	96	
	83.2	LAMINITE - High strength, fresh, dark grey fine grained laminite										
	83.68	SILTSTONE - High strength, fresh, dark grey siltstone										
381	84							>>				
	84.41	From 84.34m, medium strength coal							GT013			
		CARBONACEOUS MUDSTONE - Medium to high strength, fresh, dark brown carbonaceous mudstone with trace coal lenses up to 5mm										PL(A) = 1.68
382	85											
	85.3	SANDSTONE - High strength, fresh, dark grey fine grained sandstone										
		From 85.63m, fine to medium grained										
383	86	From 86.04m, fine to coarse grained							C	100	100	
								86.6m: P,sh,pl,ro				
384	87											PL(A) = 4.14 PL(D) = 2.07
												PL(A) = 1.06 PL(D) = 0.77
385	88											
		From 88.32m to 88.84m, some carbonaceous siltstone lenses up to 1mm thick						88.37m: P,sh,pl,ro				
386									C	100	98	
	89	From 88.89m, high to very high strength										
		From 89.25m some coal lenses up to 5mm thick at 100mm spacings										
		From 89.26m to 89.67m, carbonaceous siltstone clasts up to 15mm										
	89.84											

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 10 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		CARBONACEOUS MUDSTONE - High strength, fresh, dark brown carbonaceous mudstone, trace coal lenses up to 5mm thick *(continued)*							C	100	98	
388	90.38	SILTSTONE - High strength, fresh, dark grey siltstone						90.48m to 90.53m, J,40°,ir, He 90.69m to 90.76m, J,sv,ir, He	GT014			PL(A) = 1.29 PL(D) = 0.87
	90.81	SANDSTONE - High strength, fresh, grey to dark grey, fine grained sandstone										
389	91	From 91.77m, fine to medium grained							C	100	98	PL(A) = 1.11 PL(D) = 0.77
390	92	From 92.64m, fine to coarse grained						>>				
391	93											PL(A) = 2.89 PL(D) = 3.22
392	94	From 94.39m, high to very high strength						94.38m: P,sh,pl,ro				
	95							95.14m: P,sh,pl,ro	C GT015	100	100	PL(A) = 3.6 PL(D) = 4.12
393	95.49	From 95.49m to 96.08m, high strength										
394	96											
395	97							>>				
396	98	From 97.85m, high strength							C GT016	99	95	PL(A) = 3.88 PL(D) = 3.9
	99	From 98.79m, pebbly sandstone with fine to medium sized subangular, subrounded gravel										
	99.11	From 98.95m, possibly heat affected						99.2m to 99.28m, highly fractured				
		COAL - Medium to high strength, fresh, black coal						99.25m to 99.87m, J,75°,pl, He, calcite	GT017			PL(A) = 1.11 PL(D) = 0.76
	99.96	From 99.28m to 99.91m, heat							C	99	98	

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 11 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		affected (possibly)						99.98m: P,sh,pl,ro 100.02m: P,sh,pl,ro				
	100.58	SILTSTONE / MUDSTONE - Medium to high strength, fresh, dark brown-grey siltstone / mudstone *(continued)*										PL(A) = 1.43
398									GT018			
	101	SANDSTONE - Medium to high strength, fresh, grey to dark grey fine to medium grained sandstone From 101.2m, high strength						101.01m: P,sh,pl,ro 101.23m to 101.58m, Fr, sv,pl, cl	C	99	98	
399	101.85	CARBONACEOUS MUDSTONE - High strength, fresh, dark brown carbonaceous mudstone						101.79m: P,sh,pl,ro	GT019			PL(A) = 2.81
	102	From 102.38m to 102.58m, coal band										PL(A) = 2.18
								102.45m: P,sh,pl, He calcite	GT020			
400	102.95	SANDSTONE - High strength, fresh, grey fine to medium grained sandstone From 103.15m to 103.3m, some tuff bands up to 3mm thick										
	103											
401									GT021			
	104								C	100	100	PL(A) = 1.57
402								104.76m to 104.87m, J,sv, pl, cl, Discont				
	105											
								105.41m: P,sh,pl,ro				
403												
	106							105.94m: P,sh,pl,ro				
	106.53	CARBONACEOUS MUDSTONE - Very high strength, fresh, dark brown carbonaceous mudstone										
404								106.81m to 106.83m, J,sv,pl,cl				PL(A) = 1.09 PL(D) = 0.71
	107								C	100	90	
								107.25m to 107.39m, J,sv,ir, He, pyrite	GT022			
	107.68	COAL - High strength, fresh, black coal						107.31m: P,sh,pl,ro 107.39m to 107.51m, J,sv,pl, He, pyrite				
405	107.93							107.51m to 107.54m, J,sv,ir, He, pyrite				
	108	SILTSTONE / SANDSTONE - Medium to high strength, fresh, grey to dark grey fine grained siltstone / sandstone						107.69m to 107.74m, J,sv,ir, He, pyrite 107.74m to 107.8m, J,40°,pl,ro, calcite	GT023			PL(A) = 1.25 PL(D) = 0.78
406	108.75	COAL - Medium to high strength, fresh, black coal From 108.76m, pyrite nodules										
	109											
								109.11m to 109.34, highly fractured	C	100	92	
	109.33											

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 12 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
408	111	CARBONACEOUS MUDSTONE - High to very high strength, fresh, dark brown carbonaceous mudstone with trace coal bands up to 100mm thick *(continued)* From 110.14m to 110.6m, stoney coal						110.12m: P,sh,pl,ro 110.94m: P,sh,pl,ro 111.3m: P,sh,pl,ro 111.55m: P,sh,pl,ro	GT024 GT025 C	100	92	PL(A) = 0.5 PL(D) = 0.73 PL(A) = 1.33 PL(D) = 0.97
409	111.72	TUFF - High strength, fresh, light grey tuff						111.69m: P,sh,pl,ro 111.78m: P,sh,pl,ro 111.95m: P,sh,pl,ro	GT026			PL(A) = 2.03
	112.08	From 111.8m, vertical mudstone lense 112.01m to 112.08m, 45° contact with mudstone						112.22m: P,sh,pl,ro				
410		COAL - High strength, fresh, black coal							GT027			PL(A) = 1.56
	113							113.0m to 113.18m, highly fractured	C	100	94	
	113.44	CARBONACEOUS SILTSTONE - High strength, fresh, dark brown carbonaceous siltstone, trace coal lenses up to 5mm thick										
411	113.8											
	114	SILTSTONE - Medium to high strength, fresh, grey to dark grey siltstone with some fine to medium grained sandstone bands up to 15mm thick							GT028			PL(A) = 1.62
412	115.01	SANDSTONE - High strength, fresh, grey to dark grey, fine to coarse grained sandstone with trace fine to medium sized subangular to subrounded gravel From 115.42m to 116.15m, pebbly sandstone						115.39m: P,sh,pl,ro				
413	116	From 116.15m, trace medium sized quartz						116.34m to 116.63m, F,sv, pl, 10mm thick	C	100	100	
414	117								GT029			PL(A) = 0.35 PL(D) = 0.29
	117.58	COAL - Medium to high strength, fresh, black coal										
415	118							117.79m to 118.12m, Fr,60°, pl, ro, pyrite	GT030			
416	119							118.53m to 118.62m, highly fractured 118.7m to 118.87m, Fr, 45°, pl, ro, calcite 118.84m to 18.94m, highly fractured 118.97m to 119.08m, J, 85°,pl, ro, pyrite 118.98m to 119.13m, J, 75°,pl,ro, pyrite, calcite	C	100	86	PL(A) = 1.4

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 13 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing			
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
418		COAL - Medium to high strength, fresh, black coal *(continued)*							C GT031	100	86	PL(A) = 0.78
	121											
	121.27	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone							GT032			PL(A) = 2 PL(D) = 1.25
419	122	From 121.95m to 122.05m, fine to coarse grained with some fine to medium subangular to subrounded gravel						122.2m: P,sh,pl,ro 122.21m to 122.49m, F,80°,ir, 3mm thick	C	100	100	
420	123											
421		From 123.75m to 124.08m, heat affected										PL(D) = 1.62
	124							124.05m: P,sh,pl,ro 124.15m: P,sh,pl,ro 124.18m to 124.43m, J,sv, pl, He, calcite 124.39m: P,sh,pl,ro 124.46m to 124.51m, J,sv, pl, He, calcite 124.97m: P,sh,pl,ro				
422	125											
	125.12	SILTSTONE - Medium to high strength, fresh, dark grey siltstone							C	100	96	PL(A) = 1.02
423	126											
	126.72	MUDSTONE - Medium strength, fresh, dark brown mudstone										PL(A) = 0.86 PL(D) = 0.68
424	127	From 127.05m, thinly laminated with some siltstone up to 10mm thick										
425	128							127.38m to 127.66m, J, 80°, pl, cl 127.63m to 127.9m, J,80°,pl, cl 128.32m to 128.34m, F, 20°, pl, 3mm offset 128.38m to 128.4m, F, 15°,pl, 5mm offset	C	100	96	
426	129								GT033			PL(A) = 0.86 PL(D) = 0.55
		From 129.32m to 129.46m, fine to coarse grained sandstone, laminated with some mudstone up to 10mm thick							C	100	96	PL(A) = 0.51

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 14 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
428	131	MUDSTONE - Medium strength, fresh, dark brown mudstone *(continued)*						130.23m to 130.33m, J,45°,ir, He, Ca 130.25m to 130.33m J, 45°, pl, He, Ca 130.88m to 131.06m, J,sv,ir, Cl and He (Ca) in parts 131.33m to 131.52m, J, sv to 80°, pl, Cl	C	100	96	PL(A) = 0.89 PL(D) = 0.88
429	132	From 131.59m to 132.7m, mudstone/sandstone band, fine to medium grained, light grey sandstone, thinly bedded with dark grey mudstone up to 70mm thick										PL(A) = 1.9
430	133	From 132.75m to 133.7m, fine to medium grained sandstone band										PL(A) = 2.37
431	134	From 134.35m to 134.5m, very low to low strength tuff band From 134.77m to 134.86m, sandstone/mudstone band, fine to medium sandstone						>>	C	100	100	PL(A) = 0.11 PL(D) = 0.06
432	135											
433	136	136.04 SANDSTONE - Medium strength, fresh, light grey, fine to coarse grained sandstone From 136.3m to 137.33m, some siltstone laminations up to 10mm										PL(A) = 2.03
									GT034			PL(A) = 0.84 PL(D) = 0.35
434	137	From 137.33m to 137.53m, trace siderite From 137.53m, slightly laminated with siltstone and trace siderite							C	100	100	PL(A) = 0.88 PL(D) = 0.36
435	138											
436	139											PL(A) = 0.8 PL(D) = 0.67
									GT035			PL(A) = 2.03
								139.3m to 139.39m, J,80°,pl, He, Ca 139.47m to 139.83m, J, sv to 80°,pl, He, Ca	C	100	90	PL(A) = 0.86 PL(D) = 0.39

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 297.21 AHD
EASTING: 230750.3
NORTHING: 6411475
DIP/AZIMUTH: 90°/--

BORE No: BY0077CH
PROJECT No: 49761.01
DATE: 26/5 - 22/9/2012
SHEET 15 OF 15

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
438	141	SANDSTONE - Medium strength, fresh, light grey, fine to coarse grained sandstone *(continued)* From 140.48m, medium strength, trace tuff laminations up to 2mm thick						140.64m to 141.11m, J, sv to 80°, pl, He, Ca 141.06m: P,sh, ir, He, Ca 141.23m to 141.4m, J, 75° to sh, pl, He, Ca 141.42m to 141.49m, J, 75° to sh, pl, He, Ca	C	100	90	PL(A) = 0.59 PL(D) = 0.36 PL(A) = 0.61 PL(D) = 0.34
439	141.86											
	142	LAMINITE - Medium strength, fresh, grey laminite with some siderite From 142.07m to 142.15m, medium strength, fine to medium strength sandstone with some tuff laminations up to 3mm thick						142.03m to 142.43m, J, sv to 80°, pl, He, Ca 142.07m to 142.18m, J, sv, Ir, He, Ca 142.14m to 142.52m, J,sv to 75°, He, Ca				
440	143							142.88m to 143.07m, J, sv, ir, He, Ca 142.92m to 142.94m, P,sh to 20°, ir, He, Ca 143m to 143.24m, J, sv, ir, He, Ca	C	100	78	PL(A) = 0.67 PL(D) = 0.43
441	143.72											
	144	SANDSTONE - Medium strength, fresh, light grey, fine to medium grained sandstone From 143.72m to 144.53m, some siltstone laminations and trace tuff laminations up to 2mm thick						143.77m to 143.83m, J,sh to 50°, pl, He, Ca 143.93m to 143.96m, P,sh to 45°, pl, He, Ca	GT036			PL(A) = 0.74
442	145	From 144.78m to 145.13m, laminite bands From 145.18m, some siltstone laminations										PL(A) = 0.48 PL(D) = 0.37
443	146											
	146.06	MUDSTONE - Medium strength, fresh, grey mudstone with some siltstone laminations and calcite veining						146.24m to 146.35m, J, sv, pl, He, Ca 146.68m to 146.78m, J, 45°, pl, He, Ca	C	100	90	PL(A) = 0.58 PL(D) = 0.41
444	147							147.33m to 147.36m, P,sh to 35°, pl, He, Ca 147.36m to 147.54m, J, 80°, pl, He, Ca	GT037			PL(A) = 0.35 PL(D) = 0.31
445	147.72	Bore discontinued at 147.72m, limit of investigation										
	148											
446	149											

RIG: MDR 105 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Fulham/Holden **CASING:** 100mm PVC to 12m
TYPE OF BORING: HQ3 to 147.72m
WATER OBSERVATIONS: Water depth: 46.03m as measured on 5.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 1 OF 24

RL	Depth (m)	Description of Strata	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
405	0	CORE LOSS - 1.55m (0m to 1.55m)	0m: CORE LOSS: 1550mm				
	1.55	GRAVELLY CLAYEY SAND - Brown, loose, gravely clayey fine to coarse sand, gravel subrounded to 20mm diameter, saturated	1.8m: Rock encountered	C	48	16	50 kPa
404	1.8	From 1.75m to 1.8, light grey clay (hard)		pp			>400 kPa
	1.96	COAL - Extremely low strength, highly weathered, black coal		pp			
	2.4	TUFF - Extremely low strength, highly weathered, brown with orange mottling tuffaceous claystone	2.6m to 2.75m, J,45°, pl,open, Fe 2.73m to 2.77m, J, sv,ir,op				
403	3	MUDSTONE - Very low to medium strength, moderately weathered, dark brown to dark grey mudstone	2.93m: P,sh,pl,ro 2.96m to 2.99m, J,45°,pl,op,di	C	100	93	PL(A) = 0.65 PL(D) = 0.51
	3.54	From 3.09m to 3.14m, highly weathered sandstone band	3.004m to 3.4m, J,75-80°, ir,cl				
402	3.61	CORE LOSS - 0.07m (3.54m to 3.61m)	3.54m: CORE LOSS: 70mm				
	4	MUDSTONE - Very low to medium strength, moderately weathered, dark brown to dark grey mudstone	4.0m to 4.04m, J, 45°,pl,cl				
	4.18	SANDSTONE - Low to medium strength, moderately to highly weathered, brown fine to medium grained sandstone	4.5m to 4.52m, P,sh,pl,op 4.57m: P,sh,pl,ro,Fe 4.8m to 5.06m, F,sv,pl, 5mm	C	97	75	PL(A) = 0.05 PL(D) = 0.03
401	4.58	MUDSTONE - Low to medium strength, highly to moderately weathered, dark brown to dark grey mudstone	4.88m to 5.1m, J,sv,pl,cl,Fe 5.46m to 5.52m, F,60°,pl,He,Fe				
	5	SANDSTONE - Very low to low strength, highly to moderately weathered, light grey brown fine to medium sandstone	6.05m to 6.14m, J,50°,ir,ro,Fe 6.21m: P,sh,ir,ro,Fe 6.29m: P,sh,pl,ro,Fe				
400	5.15	From 5.58m, medium to high strength	6.36m to 6.45m, J,70°,pl,ro,Fe				
	6	From 6.03m, fine to coarse grained sandstone	6.85m: P,sh,pl,ro,Fe				
	6.15	From 6.15m, fine sized gravel	7.45m: P,5°,pl,ro,Fe				
399	6.8	From 6.8m to 8.09m, no fine sized gravel, high strength band					PL(A) = 1.58 PL(D) = 1.83
	7	From 8.09m to 8.29m, slightly fine gravel		C	100	97	
	8	From 8.52m to 8.73m, fine to medium pebbly sandstone	8.41m: P,sh,pl,ro,Fe 8.46m: P,sh,pl,ro,Fe				
398	8.29	From 8.85m to 9.33m, fine to medium pebbly sandstone	8.75m: P,10°,pl,ro, Fe 8.9m to 8.93m, P,15°,pl,ro,Fe				
	8.73	From 9.53m, high strength	9.64m: P,sh,pl,ro,Fe 9.8m: P,sh,ir,ro,Fe	C	100	98	
397	9						
	9.33						
396	9.53						

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 2 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
395	11	SANDSTONE - Very low to low strength, highly to moderately weathered, light grey brown fine to medium sandstone *(continued)* From 10.5m to 11.4m, highly weathered						10.11m: P,sh,pl,ro,Fe 10.53m: P,sh,pl,ro,Fe 10.8m to 11.09m, J,30-90°, cu, He,Fe	C	100	98	
394	12	From 11.44m to 11.53m, low strength tuff band						11.37m: P,10°,pl,ro,Fe 11.44m: P,sh,pl,ro,He,Fe				PL(A) = 0.69 PL(D) = 0.88
393	12.89	From 12.14m to 12.2m, low strength tuff band From 12.3m to 12.39m, low strength tuff band						12.18m to 12.31m, J,sv,pl,ro,Fe, clay 12.53m to 12.71m, J,45°-90°, ir,He, Fe	GT003			PL(A) = 1.96 PL(D) = 0.07
392	13 13.28 13.68 14 14.0 14.35	SILTSTONE - Medium to high strength, slightly to moderately weathered, dark grey siltstone with numerous tuff laminations up to 2mm thick TUFF - Medium strength, highly weathered, light brown tuff From 13.5m, extremely low strength COAL - High strength, slightly weathered to fresh, black coal						12.89m to 13.05m, highly fractured 13.05m to 13.23m, J,60°,pl,ro,Fe 13.36m to 13.64m, J,cu, He, Fe	C	99	86	
391	14.6 14.78 15	TUFF - Very low strength, slightly weathered to fresh, light brown to grey tuff From 14.2m, low to medium strength COAL - High strength, fresh, black coal SILTSTONE - Medium to high strength, fresh, grey siltstone						15.03m to 15.11m, F,45°,pl, 2mm throw 15.28m to 15.38m, F,70°,ir, 5mm throw 15.66m: P,sh,pl,He				PL(A) = 0.92 PL(D) = 0.45
390	16	SANDSTONE - Medium to high strength, fresh, grey fine to medium grained sandstone						16.0m to 16.05m, J,45°,pl,cl 16.15m to 16.23m, J,cu, cl	GT001			PL(A) = 1.27 PL(D) = 0.51
389	17								C	100	96	
388	17.7 17.87 18 17.99 18.04 18.2	COAL - High to very high strength, fresh, black coal TUFF - Very low to low strength, fresh, light brown to grey tuff COAL - High to very high strength, fresh, black coal						18.36m: P,sh,pl, He	GT002			PL(A) = 0.56 PL(D) = 0.34
387	18.71 18.81 19 18.94 19.03 19.21	MUDSTONE - Medium to high strength, fresh, grey mudstone TUFF - Low to medium strength, fresh, grey tuff From 18.66m to 18.71m, some calcite							C GT004	100	88	PL(A) = 0.8 PL(D) = 1.15
386	19.59	COAL - High to very high strength, fresh, black coal						19.48m: P,5°, pl, sm	GT005			PL(A) = 3.79 PL(D) = 1.24

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 3 OF 24

RL	Depth (m)	Description of Strata	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
385	20.14	CARBONACEOUS SILTSTONE - High strength, fresh, dark grey to dark brown carbonaceous siltstone					
	20.44	TUFF - Extremely low to very low strength, fresh, grey to brown, tuff					
	21	COAL - High to very high strength, fresh, black coal		C	100	88	
	21.24	TUFF - Very low to low strength, fresh, grey to light grey, tuff					
	21.48	COAL - Very high strength, fresh, black coal *(continued)*					
384	21.52			GT006			PL(A) = 0.3
	22	TUFF - Extremely low to very low strength, fresh, light grey tuff					
	22.14	COAL - High to very high strength, fresh, black coal	22.14m to 22.22m, highly fractured				
		From 20.63m to 20.74m, very high strength mudstone band					
383	22.64	From 20.83m to 20.86m, very high strength mudstone					
	23 23.04	From 20.97m to 21.13m, very low to low strength mudstone and tuff band	22.92m to 22.96m, J,45°,pl, He, Ca	C	97	91	
		MUDSTONE - High strength, fresh, dark grey to dark brown mudstone					
382		TUFF - Low to medium strength, fresh, dark grey brown tuff					
	24			GT007			PL(A) = 3.15 PL(D) = 1.33
		SILTSTONE / TUFF - Low to medium strength, fresh, light to dark grey siltstone / tuff					
	24.52	From 21.95m to 21.98m, extremely low to very low strength	24.7m to 24.78m, P,45°,pl, He, Ca				
381		From 22.08m, extremely low to very low strength					
	25	COAL - High to very high strength, fresh, black coal					
		MUDSTONE / TUFF - Very low to low strength, fresh, dark grey mudstone / tuff	25.5m to 25.74m, highly fractured (healed with calcite)				
380	25.74 25.85		25.84m to 26.2m, highly fractured, He, Ca	C	99	68	PL(D) = 0.44
	26	COAL - High to very high strength, fresh, black coal					
		From 23.38m to 23.48m, extremely low to low strength black tuff band		GT008			PL(D) = 4.58
379	26.67 26.75	From 23.64m to 23.73m, very high strength siltstone band					
	27 27.06	From 23.85m to 23.96m, high to very high strength, light grey tuff band					
	27.52	From 24.47m, medium to high strength, dark grey carbonaceous mudstone band					
378	27.8		27.8m to 28m, J,80°,pl, op				
	28	TUFF - Low to medium strength, fresh, light to dark grey tuff with some siltstone	27.82m to 27.93m, J, 50°,pl, He, Ca				
	28.48	From 24.8m, medium to high strength	27.92m to 28.58m, J,45° to 90°, ir, ro				
377		From 25.28m to 25.34m, extremely low to very low strength	28.7m to 29m, J,45° to 80°, pl, He, Ca	C	100	97	PL(A) = 4.34 PL(D) = 8.24
	29	From 25.59m, high to very high strength					
		COAL - Very high strength, fresh, black coal		GT009			
376		TUFF - Medium to high strength, fresh, light grey tuff					

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 4 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
375	31	COAL - High to very high strength, fresh, black coal						29.98m: P,5° to 10°, pl, op, sm	C	100	97	
		MUDSTONE - High to very high strength, fresh, dark grey mudstone						30.4m to 30.69m, J, 80°, pl, He, Ca	GT010			
		From 26.8m to 26.9m, extremely low strength, light grey tuff band						30.78m to 31.06m, J,45°,pl, He				PL(A) = 9.16 PL(D) = 10.13
	31.13	From 26.92m to 26.96m, extremely low strength, light grey tuff band						31.15m: P,sh to 45°, ir, ro				
	31.54	TUFF - High strength, fresh, light grey tuff						31.34m to 31.39m, J, 45°, pl, ro				
374	31.81	From 27.41m, tuff welded						31.44m: P,sh, ir, ro, (green staining)				
	32	COAL - High to very high strength, fresh, black coal (heat affected)						31.92m to 32.07m, J,45°,pl, ro, Fe	C	99	91	
	32.42	VOLCANIC ROCK - High to very high strength, fresh, light grey brown to grey brown volcanic rock										
373	32.54	BASALT - Very high to extremely high strength, fresh, dark grey basalt *(continued)*										PL(A) = 3.93 PL(D) = 1.28
	33	VOLCANIC ROCK - High to very high strength, fresh, light grey volcanic rock							GT011			
372		COAL - High to very high strength, fresh, black coal										
	33.94	MUDSTONE - Very high strength, fresh, black mudstone						33.94m to 34.05m, J, 60°, pl, ro	GT012			
	34 34.34	TUFF - Extremely low to low strength, fresh, grey to dark grey tuff						34.1m: P,sh to 10°, pl, He, Ca				PL(D) = 0.7
371		COAL - High to very high strength, fresh, black coal						34.22m: P,sh to 10°, pl, He, Ca				
	35	From 32.72m to 32.75m, very high strength black mudstone						34.24m: P, 5° ti 10°, ir, ro	C	100	78	
	35.38	From 33.25m to 33.65m, very high strength black mudstone						34.31m: P,sh,pl, He, Ca 34.39m: P,sh,pl, He, Ca 34.41m: P,sh,pl, He, Ca	GT013			PL(A) = 0.16 PL(D) = 0.07
370		TUFF - Medium strength, fresh, light grey tuff						34.45m: P,sh,pl,ro 34.55m: P, sh to 10°, ir, ro				
	36 35.97	VOLCANIC ROCK - High to very high strength, fresh, light grey to grey volcanic rock						34.63m: P, 5°, ir, ro 34.76m: P,sh,ir,ro 34.84m to 34.93m, P, 30°, pl, He, Ca				
	36.43	COAL - Very low strength, moderately weathered, fresh, black coal						35.08m: P,sh to 10°, pl, He, Ca				
369	36.51	From 35.54m, very high strength										
	36.84 37	TUFF / SILTSTONE - Medium strength, fresh, light to dark grey tuff / siltstone							GT014			PL(A) = 0.51 PL(D) = 0.32
		From 36.31m, extremely low strength						37.32m: P,sh,pl,sm				
368	38	COAL - High to very high strength, fresh, black coal							C	100	100	
		CARBONACEOUS SILTSTONE - High to very high strength, fresh, dark grey carbonaceous siltstone										
367	38.65	SILTSTONE - Medium to high strength, fresh, dark grey siltstone, interbedded with fine to medium sandstone up to 20mm						38.71m: P,sh,pl, sm				
	39	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone										PL(A) = 0.68 PL(D) = 0.03
366	39.6								C	99	99	

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 5 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
365	41	GRAVELLY SANDSTONE - Medium to high strength, fresh, grey fine gravelly fine to coarse grained sandstone *(continued)*										
		From 41.28m to 41.4m, high strength, fresh, dark grey siltstone band							C	99	99	
364	42	From 42.06m to 42.15m, interbedded carbonaceous mudstone up to 30mm thick										
363									GT015			PL(A) = 1.92 PL(D) = 2.52
	43	From 42.94m to 42.96m, high to very high strength, coal lense										
		From 42.96m to 43.1m, fine to medium grained sandstone layer						>>				
362	44								C	100	100	
361	45											
									GT016			PL(A) = 0.57 PL(D) = 0.67
360		From 45.65m to 46.18m, fine to coarse grained sandstone layer										
	46	From 46.18m to 46.42m, some pebbles										
359	46.56	From 46.42m to 46.56m, fine to medium grained sandstone										
	47	PEBBLY SANDSTONE - High to very high strength, fresh, light grey pebbly sandstone							C	100	100	PL(A) = 2.38 PL(D) = 1.57
	47.31	From 46.97m to 47.15m, fine to coarse grained sandstone										
358		MUDSTONE / COAL - Medium strength, fresh, dark grey-brown mudstone / black coal (mudstone and coal interbedded)										
	48	From 47.32m to 47.34m, very low to low strength tuff lense							GT017			PL(A) = 0.48 PL(D) = 0.09
		From 47.44m to 47.74m, very low to low strength tuff lense										
357		From 47.66m to 47.71m, very low to low strength tuff lense										
	49	From 48.58m to 48.6m, very low strength tuff band							C	99	98	
	49.57	From 48.84m to 48.92m, very low to low strength tuff band										
356	49.84	From 49.07m to 49.09m, medium to										

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 6 OF 24

RL	Depth (m)	Description of Strata	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		high strength tuff band From 49.2m to 49.32m, very low to low strength tuff band From 49.47m to 49.49m, very low strength tuff lense		GT018			PL(A) = 1.45 PL(D) = 0.58
355	50.66 50.77	TUFF / SILTSTONE - Medium to high strength, fresh, light grey to grey tuff / siltstone		C	99	98	
	51	MUDSTONE / SILTSTONE - Medium to high strength, fresh, grey mudstone / siltstone *(continued)* From 50.4m, trace to some tuff		GT019			PL(A) = 0.8 PL(D) = 0.85
354	51.59	MUDSTONE - Medium to high strength, fresh, dark grey to brown mudstone					
	52	TUFF - Medium to high strength, fresh, light grey tuff	52.18m: P,sh, ir, cl	GT020			PL(A) = 1.02 PL(D) = 0.52
353	52.34 52.77	MUDSTONE - High to very high strength, fresh, dark grey brown mudstone From 51.93m to 51.97m, calcite veining	52.95m to 52.18m, J,sv, ir, cl	C	100	100	PL(A) = 1.77 PL(D) = 1.1
	53	TUFF - Medium to high strength, fresh, black and light grey tuff					
352	53.66 53.92	COAL - High to very high strength, fresh, black coal From 53.51m to 53.57m, extremely low to medium strength tuff					
	54	TUFF - Medium to high strength, fresh, light grey tuff					
351	54.79	MUDSTONE / COAL - High to very high strength, fresh, black coal / dark grey brown mudstone From 54.06m to 54.07m, medium to high strength tuff From 54.07m, some coal From 54.19m to 54.21m, low to medium strength tuff From 54.42m to 54.47m, very low to low strength tuff From 54.53m to 54.61m, medium strength tuff		GT21			
	55						
350			55.77m to 55.78m, P, 5°,pl, ro	C	99	97	PL(A) = 1.02 PL(D) = 0.48
	56						
349	56.82	From 54.77m, medium strength tuff lense					
	57	CARBONACEOUS SILTSTONE - Medium to high strength, fresh, dark grey carbonaceous siltstone From 55.42m to 55.43m, very low to low strength tuff lense From 55.53m to 55.57m, very low strength tuff lense From 56.23m to 56.25m, very low to low strength tuff / siltstone band From 56.25m to 56.82m, some fine grained sandstone interbeds					
348							
	58						PL(A) = 1.87 PL(D) = 0.8
347				C	100	100	
	59	SILTSTONE - Medium to high strength, fresh, dark grey siltstone From 57.56m to 59.29m, trace to some fine grained sandstone interbedded in layer	>>				
346		From 59.29m to 59.38m, high strength, fine to coarse grained					

Degree of Weathering: EW, HW, MW, SW, FS, FR
Graphic Log
Rock Strength: Ex Low, Very Low, Low, Medium, High, Very High, Ex High
Water
Fracture Spacing (m): 0.01, 0.05, 0.10, 0.50, 1.00

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m
TYPE OF BORING: HQ3 to 237.74m
WATER OBSERVATIONS: Free groundwater obscured by drilling fluids
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 7 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
345	61	sandstone with some extremely low to low strength tuff From 59.38m, high strength From 59.54m to 59.57m, medium to high strength, fine to coarse grained sandstone with some tuff							C	100	100	PL(A) = 2.15 PL(D) = 0.81
	61.08	SILTSTONE - Medium to high strength, fresh, dark grey siltstone *(continued)*										
344	61.69	GRAVELLY SANDSTONE - Medium to high strength, fresh, grey, fine gravelly fine to coarse grained sandstone with some to slightly carbonaceous lenses							C GT022	100	98	PL(A) = 1.09 PL(D) = 0.44
	62	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone From 61.72 to 61.74m, carbonaceous lense										
343	63	From 62.26m to 62.31m, some extremely low strength tuff From 62.67m to 62.8m, carbonaceous lenses interbedded in sandstone lenses up to 5mm thick										
342	64	From 63.23m to 63.35m, carbonaceous lenses interbedded in sandstone lenses up to 5mm thick										
	64.21	From 64.16m to 64.21m, high strength, fresh, dark grey siltstone band						>>				
341	65	SANDSTONE - High to very high strength, fresh, grey fine to coarse grained sandstone From 64.28m to 64.33m, high strength, fresh, dark grey siltstone From 64.4m to 64.53m, high strength, fresh, dark grey siltstone							C GT023	100	100	PL(A) = 5.2 PL(D) = 3.09
340	66	From 64.64m to 64.72m, high strength, fresh, dark grey siltstone										PL(A) = 1.86 PL(D) = 2.52
	66.26	From 66.25m, high strength, fresh, dark grey siltstone										
339	67	MUDSTONE - Medium to high strength, fresh, dark grey brown mudstone From 66.3m to 66.33m, medium strength, grey brown tuff band From 66.4m to 66.46m, medium strength, brown tuff band							GT024			PL(A) = 1.45 PL(D) = 0.48
338	68	From 66.57m, some extremely low to very low strength tuff bands ranging from 20-110mm thick							C	100	95	
	68.09	From 66.62m, some coal						68.22m to 68.37m, J, sh to sv, cu, He, Ca				
337	69	TUFF - Medium strength, fresh, light grey tuff							GT025			PL(A) = 0.72 PL(D) = 0.88
	69.5											
336									C	99	79	

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 8 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
335	70.1	TUFF / SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone and extremely low to very low strength, light grey tuff *(continued)*										
		MUDSTONE / COAL - Medium to high strength, fresh, dark brown mudstone and black coal							GT026			PL(A) = 1.11 PL(D) = 0.36
334	71	From 70.3m to 70.32m, very low to low strength, tuff							C	99	79	
		From 70.43m to 70.53m, very low to low strength tuff										
	72	From 71.64m to 71.74m, very low to low strength tuff										
		From 71.94m to 71.98m, very low to low strength tuff										PL(A) = 0.65 PL(D) = 0.01
333		From 72.56m to 72.58m, very low strength tuff										
	72.85	From 72.74m to 72.79m, very low strenght tuff										
	73	SANDSTONE - Medium to high strength, fresh, light grey fine grained sandstone with trace carbonaceous laminating up to 10mm thick										PL(A) = 1.83 PL(D) = 1.65
									GT027			
332	74	From 73.8m to 74.76m, high to very high strength							C	99	97	
331	75	From 74.76m, fine to medium grained sandstone										
330	76											PL(A) = 1.13 PL(D) = 0.14
329	77								C	100	100	
328	78											PL(A) = 0.74 PL(D) = 0.16
327	79								C	99	99	
326												PL(A) = 1.48

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m
TYPE OF BORING: HQ3 to 237.74m
WATER OBSERVATIONS: Free groundwater obscured by drilling fluids
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 9 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
325	81	SANDSTONE - Medium to high strength, fresh, light grey fine grained sandstone with trace carbonaceous laminating up to 10mm thick *(continued)*							C	99	99	PL(D) = 0.78
324	82	From 81.85m, high to very high strength						>>				PL(A) = 0.98 PL(D) = 0.21
323	83								C GT028	100	100	PL(A) = 2.52 PL(D) = 2.77
322	84											
321	85	From 84.47m, medium to high to very high strength, fine grained sandstone From 85.15m to 85.35m, high strength, dark grey tuff										PL(A) = 2.99 PL(D) = 1.14
320	86	From 85.57m to 85.85m, some high dark grey tuff interbeds							C	99	99	
319	87	From 86.32m to 86.55m, tuff / sandstone (fine grained) interbedded layers up to 40mm										
	87.46											PL(A) = 2.44 PL(D) = 1.31
318	88	SANDSTONE AND SILTSTONE - High strength, fresh, grey to dark grey, fine to medium grained sandstone and siltstone with trace, very high sideritic bands up to 50mm thick At 88.44m, coal lense 10mm thick										
317	89								C	100	100	
316												PL(A) = 1.87 PL(D) = 1.12

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m
TYPE OF BORING: HQ3 to 237.74m
WATER OBSERVATIONS: Free groundwater obscured by drilling fluids
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 10 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
315	91	SANDSTONE AND SILTSTONE - High strength, fresh, grey to dark grey, fine to medium grained sandstone and siltstone with trace, very high sideritic bands up to 50mm thick *(continued)* From 91.1m, medium to high strength							C	100	100	PL(A) = 0.81 PL(D) = 0.53
314	92							91.78m to 91.84m, P,30°, pl,ro 91.8m to 91.86m, F,sh to 45°, ir, 3mm throw 91.92m to 91.97m, F, sh to 15°,ir, 5mm throw 92.04m: P,sh,pl, He, Ca 92.46m to 92.5m, F, 45°, pl, 4mm throw	C	100	90	
313	92.83	SILTSTONE - High strength, fresh, dark grey siltstone							GT029			PL(A) = 2.99 PL(D) = 0.43
	93											
312	93.43	SANDSTONE - High strength, fresh, grey to dark grey fine to medium grained sandstone with some interbeded siltstone bands up to 50mm thick with trace very high strength sideritic bands up to 100mm thick From 93.74m to 93.96m, siltstone band						94.01m to 94.04m, F, 50°, pl, 4mm throw 94.07m to 94.09m, F, 60°, pl, 6mm throw				
311	94											
	95							94.93m to 94.99m, F, 45°, ir, 4mm throw	C	100	94	PL(A) = 2.72 PL(D) = 0.71
310	96							95.71m to 95.76m, F, 65°, pl, 7mm throw				PL(A) = 2.31 PL(D) = 1.19
309	97											
308	97.62	SILTSTONE - Medium to high strength, fresh, dark grey siltstone with some interbedded fine to medium grained sandstone up to 50mm thick From 98.5m, no sandstone							C	100	100	PL(A) = 1.89 PL(D) = 0.63
	98											
307	99							>>				
	99.22	SANDSTONE - High strength, fresh, light grey fine to medium grained sandstone										
306	99.54								C	100	99	PL(A) = 1.32

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m
TYPE OF BORING: HQ3 to 237.74m
WATER OBSERVATIONS: Free groundwater obscured by drilling fluids
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 11 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
305		SANDSTONE / SILTSTONE - High strength, fresh, dark to light grey fine to medium grained sandstone and siltstone laminations or interbedded up to 150mm thick *(continued)*										PL(D) = 1.03
	101	From 100.8m, some fine to medium grained sandstone							C	100	99	
304	101.69							101.43m to 101.47m, P, 15°,pl, ro 101.64m: P,sh,pl, ro				
	101.86	SILTSTONE - High strength, fresh, dark grey siltstone with some mudstone										
	102	MUDSTONE - Medium to high to very high strength, fresh, dark grey mudstone						102.04m to 102.14m, J, 45° to sh, pl, sm, Ca	GT030			PL(A) = 2.09 PL(D) = 0.87
303	103											PL(A) = 1.36 PL(D) = 0.78
302	104							>>	C	100	100	
301	105	From 104.76m, trace dark grey siltstone										
300	106							106.22m to 106.29m, J, 60°, pl, cl 106.23m to 106.28m, J,50°, pl, He, Ca	GT031			PL(A) = 1.42 PL(D) = 1.36
299	106.9								C	100	97	
	107	MUDSTONE / COAL - Medium to high strength, fresh, black coal / dark brown mudstone From 107.2m, extremely low strength, light brown tuff band							GT032			
298									GT033			PL(A) = 0.4 PL(D) = 0.61
	108											
	108.51	From 108.38m, medium to high grey tuff band										
297		TUFF / SILTSTONE - Low to medium strength, fresh, dark grey high strength siltstone interbedded with low to medium strength, light grey tuff up to 100mm thick							GT034			PL(A) = 0.86 PL(D) = 0.42
	109							109.1m: P, 5°,ir, sm, Ca	C	100	97	
296												

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m
TYPE OF BORING: HQ3 to 237.74m
WATER OBSERVATIONS: Free groundwater obscured by drilling fluids
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 12 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
295	110.01	TUFFACEOUS SILTSTONE - Medium to high strength, fresh, grey tuffaceous siltstone						110.21m: P,sh, P, sm, Ca				
		From 110.43m to to 110.46m, very low strength tuff bands										
		From 110.5m to 110.51m, very low strength tuff bands							C	100	97	
	111											
	111.24	TUFF - Low to medium strength, fresh, light grey tuff						111.13m to 111.23m, J,sv to 10°, P, cu, cl	GT035			
294												PL(A) = 0.54 PL(D) = 0.31
	112	From 111.95m, very low strength							GT036			
	112.21	COAL / MUDSTONE - High to very high strength, fresh, black / dark brown coal / mudstone						112.25m to 112.32m, moderately fractured, Ca				
	112.49											
293		MUDSTONE - High to very high strength, fresh, dark brown mudstone										
	113								C	98	94	
								113.46m: P,sh,pl, ro, Ca				
292								113.69m: P,sh, ir, He, Ca				
	114											
		From 114.23m, some grey to dark grey siltstone										
	114.44	SILTSTONE - Medium to high strength, fresh, dark grey siltstone with some fine to medium grained sandstone bands up to 7mm						114.38m: P,sh,pl, sm				PL(A) = 1.17 PL(D) = 0.59
291	114.88								GT037			
	115	SANDSTONE - High strength, fresh, light grey fine to medium grained sandstone with some interbedded dark grey siltstone up to 100mm										
290												
	116											
	116.04	MUDSTONE - Medium to high strength, fresh, dark brown mudstone with some light grey siltstone laminating						115.94m: P,sh,pl, ro, Ca	C	100	100	
289		From 116.49m, trace siltstone										PL(A) = 2.5 PL(D) = 0.95
	117											
	117.12	From 117.04m to 117.08m, very low to low strength, light brown tuff band							GT038			
		SILTSTONE - High to very high strength, fresh, grey to light grey siltstone with some fine to medium grained sandstone laminating up to 60mm										
288												
	118											PL(A) = 1.87 PL(D) = 1.11
287									C	100	100	
	119											
286												

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 13 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
285	121	SILTSTONE - High to very high strength, fresh, grey to light grey siltstone with some fine to medium grained sandstone laminating up to 60mm *(continued)*							C	100	100	
									GT039			PL(A) = 1.35 PL(D) = 1.18
284	121.5	MUDSTONE - Very high strength, fresh, dark grey mudstone										
	122	From 121.91m to 122.27m, very low to low strength, light grey tuff band						>>	C	100	100	
									GT040			PL(A) = 0.08 PL(D) = 0.06
	122.44	From 122.3m to 122.37m, very low to low strength, brown tuff band										PL(A) = 0.61 PL(D) = 0.66
283		COAL / MUDSTONE - High strength, fresh, dark brown mudstone / black coal										
	123	From 122.46m to 122.47m, very low to low strength tuff brown lenses										
	123.41	From 122.57m to 122.58m, very low to low strength tuff brown lenses										
282		From 122.97m to 123m, medium strength tuff brown lenses										
	124	From 123.1m to 123.13m, very low to low strength tuff brown lenses							GT041			PL(A) = 1.35 PL(D) = 1.91
		From 123.2m to 123.25m, very low to low strength tuff brown lenses										
281		SILTSTONE - High strength, fresh, dark grey siltstone										
	125	From 123.59m, high strength, some light grey fine to medium grained sandstone laminating up to 70mm							C	100	100	
	125.4	SANDSTONE - High strength, fresh, light grey fine to medium grained sandstone										
280	125.86	MUDSTONE - Medium to high strength, fresh, dark brown mudstone with trace siltstone laminating up to 5mm										PL(A) = 1.51 PL(D) = 0.73
	126	From 126.57m to 126.59m, medium to high strength tuff band										
279												
	127											
278		From 127.79m to 127.81m, high strength, fine to coarse, light grey sandstone with a fine gravel band							C	100	100	
	128	From 127.81m to 127.87m, high strength, fine to medium grained grey sandstone band						P,sh, ir, He, Ca				PL(A) = 1.22 PL(D) = 0.74
277	128.44	From 127.87 to 127.95m, high to very high strength siltstone and mudstone, laminated up to 5mm										
	129	From 128.3m to 128.31m, medium to high strength tuff lense						129m to 129.38m, J, 45°, pl, cl				
	129.16	MUDSTONE / COAL - High strength, fresh, dark brown mudstone / black coal							C	96	94	
276												

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 14 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
275		From 129.53m, slight siltstone content SILTSTONE / MUDSTONE - High strength, fresh, dark grey thinly laminated siltstone and mudstone, laminating up to 2mm *(continued)*										PL(A) = 1.44 PL(D) = 0.92
	131							130.96m to 131m, P, 30°, pl, sm 131.03m to 131.1m, F, 75°, Cu, 10mm throw	C	96	94	
274		From 131.4m, some siltstone										
	131.77	From 131.67m to 131.77m, fine to medium sandstone band										
	132.01	SANDSTONE / SILTSTONE - High strength, fresh, light grey sandstone, thinly laminated, dark grey siltstone, laminate up to 10mm							GT042			PL(A) = 2.25 PL(D) = 0.77
	132.42											
273		SILTSTONE - High strength, fresh, dark grey siltstone with some slight mudstone content, thinly laminated up to 2mm										
	133											
		SANDSTONE - High to very high strength, fresh, light grey fine to medium grained sandstone interbedded with bands of siltstone laminated with some fine to medium grained sandstone						>>				
272	134	From 132.52m, very high strength From 132.66m, gravelly sandstone, fine gravel, fine to coarse grained sandstone							C	100	100	PL(A) = 2.24 PL(D) = 1.61
	134.82	From 132.68m, very high strength siltstone laminated with some fine to medium grained sandstone										
271	135	From 133.07m to 133.13m, very high strength siltstone laminated with some fine to medium grained sandstone										
	135.48	From 133.13m, pebbly sandstone						135.53m to 135.76m, J,sv, ir, He, Ca				PL(A) = 3.43 PL(D) = 3.5
270	136	From 133.56m to 133.67m, very high strength siltstone laminations with some fine grained sandstone From 133.87m to 134m, very high strength siltstone laminations with some fine grained sandstone										
269	137	From 134.3m, fine to coarse grained sandstone							C	99	99	PL(A) = 1.02 PL(D) = 1.48
		From 134.53m, fine to medium grained sandstone From 134.64m to 134.69m, very high strenghth siltstone										
268	138	From 134.69m, fine to coarse sandstone										
		PEBBLY SANDSTONE - Very high strength, fresh, light grey fine to medium grained pebbly fine to coarse grained sandstone										
267	139	From 135.35m to 136.79m, high to very high strength, fresh siltstone, thinly laminated with fine to medium sandstone up to 10mm							C	98	98	PL(A) = 1.22 PL(D) = 0.59
		GRAVELLY SANDSTONE - Very high strength, fresh, light grey fine gravelly fine to medium grained sandstone										
266												

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 15 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
265	140.73	From 137.22m to 137.31m, high strength siltstone band From 138.09m to 138.14m, high to very high strength siltstone band From 138.33m to 138.35m, high to very high strength siltstone band							C	98	98	PL(A) = 3.97 PL(D) = 3.58
	141	From 138.52m to 139.02m, very high to extremely high strength, fine to medium grained sandstone From 139.28m to 139.39m, medium to high strength siltstone, laminated with some fine to medium sandstone up to 12mm thick							GT043			
264	142	From 139.39m to 139.62m, fine to medium grained sandstone From 139.62m to 139.64m, high strength siltstone band From 139.85m to 139.9m, high strength siltstone band										
263	143	GRAVELLY SANDSTONE - Very high strength, fresh, light grey fine gravelly fine to medium grained sandstone *(continued)*							C	100	100	
	143.21	From 140.18m to 140.37m, fine to medium grained sandstone										
262	144	SANDSTONE - Very high strength, fresh, light grey fine to coarse grained sandstone, trace to some fine grained gravel in parts From 142.59m to 143.18m, high to very high strength, dark grey siltstone laminated with some fine to medium grained sandstone up to 15mm							GT044			PL(A) = 1.89 PL(D) = 1.16
261	144.88											
	145	SILTSTONE - High to very high strength, fresh, dark grey siltstone laminated with some light grey fine to medium grained sandstone up to 40mm						>>	GT045			PL(A) = 1.08 PL(D) = 0.92
260	146	COAL - High to very high strength, fresh, black coal From 146.2m to 146.23m, very low to low strength brown tuff band							C	100	100	
	146.47											
259	146.68	From 146.27m to 146.28m, very low to low strength brown tuff band										
	147	SILTSTONE - High strength, fresh, dark grey siltstone From 146.57m to 146.61m, very low to low strength grey tuff band							GT046			PL(A) = 3.61 PL(D) = 2.87
258	147.69	SANDSTONE - Medium to high strength, grey, light grey fine to medium sandstone laminated with some to slight dark grey, high to very high strength siltstone up to 20mm										
	147.9											
	148											
257		SILTSTONE - High to very high strength, fresh, dark grey siltstone thinly laminated with light grey sandstone up to 10mm							C	100	100	PL(A) = 0.55 PL(D) = 0.27
	149								GT047			PL(A) = 0.76 PL(D) = 0.11
	149.3	MUDSTONE - Low to medium strength, dark brown mudstone										
	149.47	From 147.9m to 148.48m, trace siltstone laminations up to 5mm From 148.78m to 148.88m, very low										
256												

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m
TYPE OF BORING: HQ3 to 237.74m
WATER OBSERVATIONS: Free groundwater obscured by drilling fluids
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 16 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
255		strength tuff band From 148.88m, very high strength From 148.93m to 148.97m, very low to low strength tuff band From 149.01m to 149.3m, low to medium strength tuff band							C	100	100	
	151	COAL - High to very high strength, fresh, black coal										PL(A) = 1.93 PL(D) = 1.18
254		SILTSTONE - High to very high strength, fresh, dark grey siltstone, slightly laminated with light grey fine to medium grained sandstone up to 20mm thick *(continued)*										
	152	From 150.63m, trace sandstone							C	98	98	
	152.22	From 152.18m to 152.22m, high to very high strength mudstone band										PL(A) = 1.69 PL(D) = 1.13
253		SANDSTONE / SILTSTONE - High strength, fresh, dark grey siltstone, finely laminated with light grey fine to medium grained sandstone up to 40mm										
	153	From 153.1m to 153.28m, some siltstone										
	153.58	From 153.28m, some sandstone										
252		MUDSTONE - High to very high strength, fresh, dark brown mudstone, thinly laminated with some siltstone up to 3mm thick										
	154	From 154.41m to 154.47m, no siltstone										PL(A) = 2.01 PL(D) = 1.4
251		From 154.47m to 154.54m, very low to low strength tuff										
	155	From 154.59m to 154.79m, low to medium strength tuff							C	100	98	
		From 154.79m to 155.05m, high to very high strength, coal						155.38m to 155.44m, J,sv, ir, cl				PL(D) = 4.27 PL(A) = 2.23 PL(D) = 1.31
250	155.76	From 155.05m to 155.31m, trace siltstone										
	156	From 155.38m to 155.44m, siltstone siderite band										
		SILTSTONE / SANDSTONE - High to very high strength, fresh, dark to light grey siltstone thinly laminated with light grey fine to medium grained sandstone up to 30mm thick						156.53m: P, sh,pl,ro, Ca				
249	157											PL(A) = 1.82 PL(D) = 1.14
									GT048			
248		From 157.76m to 158.28m, some fine to medium grained sandstone										
	158								C	100	100	
247								>>				
	159	From 158.8m to 159.84m, some siltstone and trace siderite laminations										PL(A) = 5.03 PL(D) = 5.02
246	159.9	From 159.8m to 160.12m, thinly							C	100	100	

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 17 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		laminated with some siltstone up to 5mm thick From 159.84m, high strength siltstone / siderite										
245		MUDSTONE - Medium to high strength, fresh, dark brown mudstone *(continued)*										
	161	From 160.12m to 161.05m, trace siltstone From 161.21m to 161.25m, laminated with siderite						161.24m: P,sh,pl, He, Ca	C	100	100	PL(A) = 1.4 PL(D) = 0.83
244	161.74	SILTSTONE / SANDSTONE - High to very high strength, fresh, dark to light grey siltstone laminated with light grey fine to medium grained sandstone up to 100mm thick										PL(A) = 4.44 PL(D) = 1.79
	162	From 161.74m to 162.04m, some fine to medium grained sandstone										
243	162.66	From 162.04m to 162.53m, some siltstone From 162.53m to 162.62m, trace fine to medium grained sandstone										
	163	MUDSTONE - High to very high strength, fresh, dark brown mudstone										
242		From 162.66m to 162.87m, some light grey fine to medium grained sandstone laminations up to 5mm							C	99	99	PL(A) = 2.16 PL(D) = 0.6
	164	From 162.87m to 164.94m, trace siltstone laminations up to 2mm							GT049			
241		From 163.82m to 163.87m, high to very high strength siderite band										
	165	From 165.09m, trace tuff lenses up to 2mm										
	165.38	From 165.28m to 165.38m, very low to low strength tuff band										
240	165.62	COAL - High to very high strength, fresh, black coal						>>				
	166	MUDSTONE - High strength, fresh, dark brown mudstone From 165.62m to 166.1m, trace laminations up to 2mm										
239		From 166.1m to 167.27m, slightly laminated with light grey siltstone							C	100	100	PL(A) = 1.41 PL(D) = 0.99
	167	From 166.67m to 166.71m, high strength, siderite band From 167.27m, trace siltstone laminations										
238												
	168	From 168.23m to 168.48m, very high strength, fresh, black coal band										
237												
	168.91	From 168.81m to 168.88m, trace ca laminations up to 3mm thick										
	169	SILTSTONE / SANDSTONE - High to very high strength, fresh, dark to light grey siltstone laminated with light grey fine to medium grained sandstone up to 10mm							C	100	98	PL(A) = 1.24 PL(D) = 1.1
236												

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 18 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	170.23	From 168.91m to 169.47m, some sandstone laminations From 169.47m to 170.23m, some siltstone laminations						170.18m to 170.19m, P, 5°, ir, cl 170.2m to 170.23m, F,sh to 20°, ir, 5mm throw				PL(A) = 2.21 PL(D) = 1.2
235	170.66	SILTSTONE - High to very high strength, fresh, light grey siltstone laminated with some dark brown mudstone							C	100	98	
	171	MUDSTONE - High to very high strength, fresh, dark brown From 170.66m to 172.91m, thinly laminated with some siltstone up to 5mm thick										
234	172											
		From 172.41m to 172.46m, siderite band From 172.61m to 172.68m, very low to low strength tuff band From 172.68m to 173.21m, thinly laminated with trace siltstone From 173.21m to 173.3m, medium strength tuff band From 173.3m, very high strength										PL(A) = 1.87 PL(D) = 1.29
233	173								C	100	100	
	173.54											
232	173.94	COAL - Very high strength, fresh, black coal										
	174	SILTSTONE - High strength, fresh, grey siltstone From 173.94m to 174.69m, thinly laminated with some mudstone up to 10mm thick							GT050			PL(A) = 1.71 PL(D) = 1.05
231	175											
	175.21	SILTSTONE / SANDSTONE - High strength, fresh, dark to light grey siltstone laminated with light grey fine to medium grained sandstone						>>				
230	176								C	99	99	
		From 175.21m to 178.12m, some sandstone laminations up to 30mm thick										PL(A) = 1.39 PL(D) = 1.21
229	177											
	178	From 178.12m to 178.37m, high to very high strength, light grey fine to coarse grained sandstone band From 178.37m, trace fine to medium grained sandstone laminations up to 10mm										
228	178.89								C	100	100	PL(A) = 1.98 PL(D) = 0.89
	179	MUDSTONE / SILTSTONE - Medium to high strength, fresh, dark brown mudstone laminated with dark grey siltstone up to 5mm From 178.89m to 180.13m, trace siltstone laminations up to 5mm										
227												
226												

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m
TYPE OF BORING: HQ3 to 237.74m
WATER OBSERVATIONS: Free groundwater obscured by drilling fluids
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 19 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
225	180.63	MUDSTONE / SILTSTONE - Medium to high strength, fresh, dark brown mudstone laminated with dark grey siltstone up to 5mm *(continued)* From 180.33m to 180.55m, trace coal lenses up to 5mm From 180.55m to 180.63m, trace siltstone laminations							C	100	100	
224	181	MUDSTONE / COAL - Very high to extremely high strength, fresh, dark brown mudstone with coal lenses up to 20mm From 180.93m to 181.26m, medium to high strength tuff band From 181.66m to 182.33m, high to very high strength siltstone band						180.89m to 180.91m, J, 45° to sh, ir, He, Ca	GT051			PL(A) = 1.56 PL(D) = 0.56
223	182							181.72m to 181.76m, J, 45°, ir, cl 181.85m to 181.92m, J,sv to sh,ir, cl	C	99	90	
	183							182.76m to 182.8m, J, 45° to sh, ir, cl				
	183.07	SILTSTONE / MUDSTONE - High strength, fresh, dark brown mudstone thinly laminated with dark grey siltstone up to 5mm thick							GT052			PL(A) = 2.23 PL(D) = 0.59
222	183.67	SILTSTONE - High to very high strength, fresh, dark to light grey siltstone with some fine grained sandstone laminations up to 10mm										
221	184											
	185											
	185.09	SANDSTONE - Medium to high strength, fresh, light to dark grey, fine to medium grained sandstone							C	100	100	PL(A) = 2.67 PL(D) = 1.11
220	186	From 185.09m to 186.68m, thinly laminated with some siltstone up to 30mm thick From 186.14m to 186.39m, very high strength, fine to coarse grained sandstone band with some fine gravel										PL(A) = 2.19 PL(D) = 1.2
219	187	From 186.39m to 186.58m, thinly laminated, some to slightly with mudstone laminations up to 10mm thick From 186.68m to 189.7m, interbedded with high to very high strength mudstone bands up to 20mm thick From 187.38m to 187.8m, fine to coarse grained sandstone band From 187.8m to 188.16m, fine grained pebbly fine to coarse grained sandstone band From 189.04m to 189.34m, fine to coarse grained sandstone with trace to some fine gravel										
218	188								C	100	100	
217	189											PL(A) = 1.22 PL(D) = 0.95
216		From 189.7m to 190.86m, fine to coarse grained gravelly fine to							C	100	100	

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 20 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		coarse grained sandstone										PL(A) = 0.94 PL(D) = 0.99
		SANDSTONE - Medium to high strength, fresh, light to dark grey, fine to medium grained sandstone *(continued)*							GT053			
215	190.86	From 190.36m to 190.41m, high to very high strength siltstone / siderite band										
	191	MUDSTONE - Very high strength, fresh, dark brown mudstone							C	100	100	
		From 191.49m to 191.54m, very high to extremely high black coal band										
214	191.82											
	192	SANDSTONE - Medium to high strength, fresh, light grey fine to medium grained sandstone, slightly interbedded with thin mudstone bands up to 10mm thick										PL(A) = 1.86 PL(D) = 0.86
		From 192.67m, high to very high strength, trace siltstone laminations up to 10mm thick							GT056			
213	193											PL(A) = 3.06 PL(D) = 0.07
	193.92											
212	194	SILTSTONE / MUDSTONE - Very high strength, fresh, dark brown mudstone, thinly laminated with varying amounts of light to dark grey siltstone							C	100	100	PL(A) = 2.82 PL(D) = 1.13
		From 193.96m to 194.11m, some laminations of siltstone up to 5mm thick										
211	195	From 194.11m to 194.52m, very high strength coal band						>>				
		From 194.52m to 195.01m, trace siltstone laminations up to 2mm thick										
210	196	From 195.01m, to 197.0m, slightly laminated with siltstone up to 5mm thick										PL(A) = 3.43 PL(D) = 0.32
		From 195.22m to 197m, trace fine to medium grained sandstone laminations up to 10mm thick							GT054			
209	197											
	197.0	MUDSTONE - Very high strength, fresh, dark brown mudstone							C	100	100	
		From 197m to 197.38m, mudstone / fine to medium grained sandstone, thinly interbedded up to 10mm										
208	197.76	COAL - Medium to high strength, fresh, black coal										
	198	From 198.15m to 198.25m, very low to low strength tuff band										PL(A) = 2.24 PL(D) = 1.16
		From 198.32m to 198.36m, low to medium strength tuff band							GT055			
207												
	199								C	100	100	
206		From 199.85m to 200.03m, medium										

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 21 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
205		strength tuff band										
		COAL - Medium to high strength, fresh, black coal *(continued)*										PL(A) = 0.45 PL(D) = 0.91
		From 200.18m to 200.22m, medium strength tuff band										
	201	From 200.95m to 201.45m, medium strength tuff band							C	100	100	
									GT056			PL(A) = 1.01 PL(D) = 0.77
204	202											
		From 202.43m to 202.48m, medium to high strength tuff band										
203	202.75	From 202.7m, high to very high strength mudstone										
	203	SILTSTONE - High strength, fresh, dark grey siltstone							C	100	100	PL(A) = 2.72 PL(D) = 2.19
		From 202.93m to 204.0m, some laminations of fine to medium grained sandstone up to 10mm thick							GT057			PL(A) = 2.66 PL(D) = 1.39
202	204	From 204.0m to 205.59m, slightly laminated with fine to medium grained sandstone up to 20mm thick										
201	205	From 204.9m to 204.99m, high to very high strength, fine to coarse grained sandstone band										
	205.59	SANDSTONE - High strength, fresh, light grey fine to coarse grained sandstone										
200	206	From 205.59m to 206.19m, some to slightly fine to medium gravelly sandstone							C	100	100	
		From 206.19m to 206.25m, fine to medium grained pebbly fine to coarse grained sandstone										
199	207	From 206.25m to 206.72m, high to very high strength, dark grey siltstone band thinly laminated with trace fine grained sandstone up to 5mm							GT058			PL(A) = 0.25 PL(D) = 0.35
	207.88	From 206.85m to 206.88m, high to very high strength, dark grey siltstone band thinly laminated with trace sandstone						208.05 to 208.75m, highly fractured				
198	208	From 206.93m to 207.1m, high to very high strength fine to medium grained sandstone band, laminated slightly with siltstone up to 5mm thick							C	90	55	
	209	From 207.1m, low to medium strength, fine to coarse grained gravelly fine to coarse grained sandstone						208.05m to 210.21m, J,sv, pl, op				
197								209.5m to 209.83m, highly fractured				
196		COAL - High to very high strength, fresh, black coal										

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m

TYPE OF BORING: HQ3 to 237.74m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 22 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
195		COAL - High to very high strength, fresh, black coal *(continued)*							C	90	55	
	210.43	CORE LOSS - 0.41m (210.43m to 210.84m)						210.43m: CORE LOSS: 410mm				
	210.84	COAL - Very high strength, fresh, black coal						210.84m to 210.98m, highly fractured				
194	211											
	211.93	MUDSTONE - High to very high strength, fresh, dark brown mudstone							C GT059	97	92	PL(A) = 1.61 PL(D) = 1.43
193	212	SANDSTONE - Medium to high strength, fresh, light grey fine to medium grained sandstone										
	211.99	From 211.99m to 212.23m, some to slightly laminated thinly with siltstone up to 212.59m, 10mm thick										
		From 212.23m to 212.77m, fine to coarse grained sandstone, trace siltstone laminations up to 5mm thick										
192	213											
		From 212.96m to 213.77m, fine to coarse grained sandstone										PL(A) = 0.78 PL(D) = 0.83
		From 213.22m to 213.44m, slightly laminated thinly with siltstone up to 4mm										
191	214	From 213.77m to 214.12m, fine to medium grained sandstone / siltstone band										
		From 214.32m to 215.5m, some to slight siltstone content							C	100	100	
	215	From 215.54m to 215.55m, fine gravelly fine to medium grained sandstone										PL(A) = 2.09 PL(D) = 1.52
190		From 215.55m to 215.79m, fine to medium grained sandstone / siltstone band										
	216	From 215.79m to 215.91m, pebbly fine to coarse grained sandstone										
	216.5	From 215.91m, trace siltstone laminations up to 3mm thick										
189	217	SANDSTONE - High strength, fresh, light grey, fine to medium grained sandstone with sparse siltstone laminations							GT060			PL(A) = 1.92 PL(D) = 2
188												
	218								C	100	100	
187												
	219							>>				PL(A) = 2.96 PL(D) = 1.83
		From 219.34m to 219.83m, high strength siltstone band										PL(A) = 2.39 PL(D) = 1.91
186									C	100	100	

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m
TYPE OF BORING: HQ3 to 237.74m
WATER OBSERVATIONS: Free groundwater obscured by drilling fluids
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 23 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
185	221	SANDSTONE - High strength, fresh, light grey, fine to medium grained sandstone with sparse siltstone laminations *(continued)* From 220.03m to 220.25m, high strength siltstone band							C	100	100	PL(A) = 2.32 PL(D) = 2.25
184	222	From 222.05m, conglomerate bands 100mm thick, 200mm to 1m spacing										PL(A) = 3.04 PL(D) = 2.08
183	223											
182	224								C	100	100	
181	224.39	CONGLOMERATE - High to very high strength, fresh, light grey conglomerate (fine to cobble size subangular / subrounded gravel with sand matrix)										
	225											PL(A) = 3.91 PL(D) = 2.31
	225.1	SANDSTONE - High strength, fresh, grey, medium grained sandstone with thin coal and siltstone laminations										
180	225.3	SANDSTONE / SILTSTONE - High strength, fresh, grey, medium grained sandstone and siltstone with trace thin coal laminations with grey conglomerate and some fine to coarse gravel size, subangular / subrounded										PL(A) = 2.46 PL(D) = 1.93
	226								GT061			
179	226.64	CONGLOMERATE - High strength, fresh, grey conglomerate (fine to coarse gravel sized subangular / subrounded with medium grained sand)										
	227								C	100	100	
178	227.12	SILTSTONE - High strength, fresh, grey siltstone with very thin tuff laminations From 227.72m to 227.85m, low to medium strength tuff band						227.48m to 227.76m, J,sv,pl He, Ca				PL(A) = 2.92 PL(D) = 2 PL(A) = 0.3
	228											
177	228.36	From 228.19m, high strength tuff band LAMINITE - High strength, fresh, grey laminite										PL(A) = 1.55 PL(D) = 1.1
	229								C	100	97	
176	229.95							>>				

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m
TYPE OF BORING: HQ3 to 237.74m
WATER OBSERVATIONS: Free groundwater obscured by drilling fluids
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 405.73 AHD
EASTING: 233295.2
NORTHING: 6409002.3
DIP/AZIMUTH: 90°/--

BORE No: BY0080CH
PROJECT No: 49761.01
DATE: 7/6 - 25/9/2012
SHEET 24 OF 24

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
175		SANDSTONE - High strength, fresh, light grey, fine to medium grained sandstone, laminated / very thin bedded with siltstone up to 30mm thick *(continued)*										
	231							231.18m to 231.27m, J, sv, pl, He, Ca	C	100	97	
174									GT062			
	232											PL(A) = 2.81 PL(D) = 2.19
	232.4	SANDSTONE - High strength, fresh, light grey, fine to medium sandstone										
173	233											
	233.25	SANDSTONE / SILTSTONE - High strength, fresh, grey, fine to medium grained sandstone, interbedded with siltstone up to 200mm thick							C	100	99	
172		From 233.3m to 234.43m, medium strength, very thinly bedded with trace tuff up to 10mm thick										
	234							234.4m to 234.56m, J,sv, pl, He, Ca				
171		From 234.69m, medium strength, interbedded with tuff up to 20mm thick						234.55m to 234.58m, J,80°, pl, He, Ca 234.78m to 235.04m, J,sv, pl, He, Ca				PL(A) = 0.71
	235							235.32m to 235.35m, J, sv, pl, He, Ca				
170		From 235.45m to 235.71m, high strength, fine to medium grained sandstone band										
	236							235.98m to 236.09m, J,sv, pl, He, Ca	C	100	93	
169								236.65m to 236.72m, J,sv, pl, He, Ca 236.68m to 236.82m, J, 80°, ir, He, Ca				PL(A) = 0.56
	237								GT063			
168	237.74	Bore discontinued at 237.74m, limit of investigation										
	238											
167												
	239											
166												

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Macquarie Drilling (Myers) **LOGGED:** Holden **CASING:** 100mm PVC to 1.5m
TYPE OF BORING: HQ3 to 237.74m
WATER OBSERVATIONS: Free groundwater obscured by drilling fluids
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.78 AHD
EASTING: 231772.9
NORTHING: 6410454.3
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH-B
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
364	0.2	TOPSOIL - Red-brown silty gravelly sand topsoil, generally comprising fine to medium grained sand, fine to medium sized, rounded to subrounded gravel, humid			0.0				Stickup=0.7m From 0m to 0.4m, bentonite
	0.5	BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt		C					
365	1	CORE LOSS - 1.87m (0.5m to 2.37m)							
				C	1.85				
366	2								
	2.37	BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt		C	2.47				
				C	2.72				
	3				2.93				
367	3.16	CORE LOSS - 0.36m (3.16m to 3.52m)		C					
	3.52	BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt		C	3.52				
				C	3.77				
	4				4.03				
368	4.27			C	4.3				
	4.36	CORE LOSS - 0.09m (4.27m to 4.36m)							
		BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt			4.76				
	5								
369				C					
	6								From 0.4m to 11.4m, grout
370									
	6.59				6.59				
	6.63	CORE LOSS - 0.04m (6.59m to 6.63m)							
		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt							
371	7			C					
	8				8.01				
372				C					
					8.7				
	9			C					From 0.7m to 17.0m, Class 18 PVC Casing
					9.25				
				C					
					9.64				
				C					

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Cox / Myers / Gartside / Macquarie Drilling **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 23m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.78 AHD
EASTING: 231772.9
NORTHING: 6410454.3
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH-B
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
374		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt *(continued)*		C					
				C	10.62				
	11								11
375				C	11.25				
	12								12
376				C	12.33				
				C	12.67				
	13								13
377				C	13.38				
									From 11.4m to 16m, bentonite
	14								14
378				C					
	15								15
379				C	15.28				
					15.63				
	16								16
380									
	17			C					17
381									
	18								18
382				C	18.18				
	18.48								
	18.56	CORE LOSS: 0.08m (18.48m - 18.56m)			18.56				
		BASALT - High strength, slightly weathered, grey with some ironstaining basalt							
	19			C					19
					19.44				From 16m to 23m, gravel
				C					

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Cox / Myers / Gartside / Macquarie Drilling **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 23m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.78 AHD
EASTING: 231772.9
NORTHING: 6410454.3
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH-B
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
384		BASALT - High strength, slightly weathered, grey with some ironstaining basalt *(continued)*		C					From 17.0m to 23.0m, Class 18 PVC Screen
	20.46				20.46				
	20.57	CORE LOSS - 0.11m (20.46m to 20.57m)		C					
	20.88	BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt			20.88				
385	21 20.96	CORE LOSS - 0.08m (20.88m to 20.96m)		C					21
		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt			21.46				
386	22			C					22
					21.98				
				C					
					22.38				
	23 23.0	Bore discontinued at 23.0m, limit of investigation							23 End cap
387									
	24								24
388									
	25								25
389									
	26								26
390									
	27								27
391									
	28								28
392									
	29								29

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Cox / Myers / Gartside / Macquarie Drilling **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 23m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.79 AHD
EASTING: 231772.9
NORTHING: 6410454.3
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH-S
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
364	0.2	TOPSOIL - Red-brown silty gravelly sand topsoil, generally comprising fine to medium grained sand, fine to medium sized, rounded to subrounded gravel, humid			0.0				Stickup=0.6m From 0m to 0.4m, asphalt
	0.5	BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt		C					
365	1	CORE LOSS - 1.87m (0.5m to 2.37m)							
	2				1.85				
366				C					
	2.37	BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt		C	2.47				
				C	2.72				
	3				2.93				
367	3.16	CORE LOSS - 0.36m (3.16m to 3.52m)		C					
	3.52	BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt		C	3.52				
	4			C	3.77				
				C	4.03				
368	4.27				4.3				
	4.36	CORE LOSS - 0.09m (4.27m to 4.36m)		C					
		BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt			4.76				
	5								
369				C					
	6								
370									
	6.59				6.59				
	6.63	CORE LOSS - 0.04m (6.59m to 6.63m)							
		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt							
371	7			C					
	8				8.01				
372				C					
					8.7				
	9			C					
					9.25				
				C					
					9.64				
				C					

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Cox / Myers / Gartside / Macquarie Drilling **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 36m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.79 AHD
EASTING: 231772.9
NORTHING: 6410454.3
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH-S
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
374		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt *(continued)*		C					
					10.62				
	11			C					11
375					11.25				
				C					
	12								12
376					12.33				
				C					
					12.67				
	13			C					13 From 0.4m to 25.5m, grout
377					13.38				
				C					
	14								14
378									
	15								15
379					15.28				
				C					From 0.7m to 30.0m, Class 18 PVC Screen
					15.63				
	16								16
380									
	17			C					17
381									
	18								18
382					18.18				
				C					
					18.56				
		From 18.6m, slightly weathered							
	19			C					19
					19.44				
				C					

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Cox / Myers / Gartside / Macquarie Drilling **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 36m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.79 AHD
EASTING: 231772.9
NORTHING: 6410454.3
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH-S
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
384		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt *(continued)*		C					
	20.46				20.46				
	20.57	CORE LOSS - 0.11m (20.46m to 20.57m)		C					
	20.88	BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt			20.88				
21	20.96	CORE LOSS - 0.08m (20.88m to 20.96m)		C					21
385		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt			21.46				
				C					
22					21.98				22
386				C					
		From 22.29m, extremely weathered			22.38				
23									23
387		From 23.26m, moderately weathered		C					
		From 23.39m, slightly weathered							
24					24.08				24
388				C					
		From 24.6m to 26.0m, highly weathered			24.64				
25									25
389									
				C					
26									26
390									
					26.73				
27				C					27
391					27.11				
				C					From 25.5m to 29.5, bentonite
					27.67				
28				C					28
392									
	28.65				28.65				
	28.87	CORE LOSS - 0.22m (28.65m to 28.87m)		C					
29		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt			29.25				29
		From 29.19m, extremely weathered		C					
	29.65				29.65				
	29.75	CORE LOSS - 0.10m (29.65m to 29.75m)		C					

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Cox / Myers / Gartside / Macquarie Drilling **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 36m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.79 AHD
EASTING: 231772.9
NORTHING: 6410454.3
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH-S
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
394		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt *(continued)*		C	30.35				
				C					
	31 31.0				31.05				31
395	31.05	SANDSTONE - Medium strength, extremely weathered, orange, fine grained sandstone							
		CORE LOSS - 0.81m (31.05m to 31.86m)							
	31.86								
	32	SANDSTONE - Medium to high strength, extremely weathered, orange fine grained sandstone with some tuff							32
396	32.16	SANDSTONE - High strength, moderately to slightly weathered, grey, fine to medium grained sandstone with trace to some siltstone (heat affected unil 33.04m)		C					From 29.5m to 36m, gravel
	33								33 From 30.0m to 36.0m, Class 18 PVC Screen
397					33.23		PL(A) = 1.49 PL(D) = 1.16		
		From 33.65m, slightly weathered			33.65				
	34								34
398		From 34.3m, slightly weathered to fresh							
		From 34.82m, medium strength, fresh			35.0		PL(A) = 0.48 PL(D) = 0.31		
	35								35
399		At 35.4m, coal lense, 2mm thick		C					
	36 36.0								36 End cap
		Bore discontinued at 36.0m, limit of investigation							
400									
	37								37
401									
	38								38
402									
	39								39

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Cox / Myers / Gartside / Macquarie Drilling **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 36m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 1 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
364	0.2	TOPSOIL - Red-brown silty gravelly sand topsoil, generally comprising fine to medium grained sand, fine to medium sized, rounded to subrounded gravel, humid						From 0.2m to 0.5m, highly fractured/fragmented				
	0.5	BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt						0.5m: CORE LOSS: 1870mm	C	27	0	
365	1	CORE LOSS - (0.5m to 2.37m)										
	2								C	16	0	
366	2.37	BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt						From 2.37m to 3.16m, highly fractured/fragmented	C	100	0	
									C	100	0	
	3											
	3.16	CORE LOSS - (3.16m to 3.52m)						3.16m: CORE LOSS: 360mm	C	39	0	
367	3.52	BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt						From 3.52m to 4.27m, highly fractured/fragmented	C	100	0	
									C	100	0	
	4								C	89	0	
368	4.27											
	4.36	CORE LOSS - (4.27m to 4.36m)						4.27m: CORE LOSS: 90mm	C	87	0	
		BASALT - High strength, moderately weathered, grey with some brown, red-brown and yellow, highly fractured / fragmented basalt						From 4.36m to 4.57m, highly fractured/fragmented From 4.63m to 4.76m, highly fractured/fragmented 4.78m: J,45°,pl,ro 4.83m: J,sh,pl,ro 4.86m: J,sh,pl,ro From 4.90m to 4.93m, fragmented From 4.97m to 5.10m, J,sv,pl, closed From 5.20m to 6.53m, J,sv,pl,ro	C	100	0	
	5											
369												
	6											
370	6.59											
	6.63	CORE LOSS - (6.59m to 6.63m)						5.34m: J,sh,pl,ro 5.35m: J,sh,pl,ro 5.36m: J,sh,pl,ro From 5.40m to 5.58m, highly fractured 5.65m: J,sh,pl,ro 6.09m: J,sh,pl,ro 6.18m: J,sh,pl,ro 6.22m: J,sh,pl,ro 6.26m: J,sh,pl,ro 6.3m: J,30°,pl,ro	C	97	15	
		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt										
	7											
371												
	8											
372								6.36m: J,sh,pl,ro 6.42m: J,sh,pl,ro 6.45m: J,sh,pl,ro 6.53m: J,sh,pl,ro 6.56m: J,sh,pl,ro	C	100	0	
								6.59m: CORE LOSS: 40mm From 6.63m to 6.65m, fragmented	C	100	0	
	9							From 6.76m to 6.82m, fragmented 6.92m: P,sh,pl,ro	C	100	0	
								7.02m: P,sh,pl,ro From 7.10m to 7.78m,	C	100	0	

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 203.59m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 2 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
374		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt *(continued)*						J,sv,pl-fr,ro 7.36m: J,sh,pl,ro 7.65m: J,sh,pl,ro 7.68m: J,sh,pl,ro 7.73m: J,sh,pl,ro	C	100	0	
	11							From 7.77m to 8.01m, J,sv,pl,ro 7.78m: J,sh,pl,ro 7.85m: J,45°,pl,ro	C	100	0	
375								7.88m: J,sh,pl,ro 7.94m: J,sh,pl,ro 7.98m: J,sh,pl,ro				
	12							From 8.01m to 8.82m, highly fractured/fragmented From 8.82m to 9.20m, J,sv,pl,ro	C	100	0	
376								8.85m: J,sh,pl,ro 8.9m: J,sh,pl,ro 8.96m: J,sh,pl,ro	C	100	0	
	13							9.08m: J,sh,pl,ro 9.2m: J,sh,pl,ro	C	100	0	
377								From 9.25m to 11.25m, highly fractured/fragmented From 9.84m to 10.53m, J,sv,pl,ro From 11.29m to 12.33m, J,sv,pl,ro				
	14							11.35m: J,sh,pl,ro 11.43m: J,sh,pl,ro 11.48m: J,sh,pl,ro 11.5m: J,sh,pl,ro	C	100	82	
378								From 11.54m to 11.69m, J,70°,pl,ro 11.56m: J,sh,pl,ro From 11.74m to 12.07m, highly fractured 12.22m: J,sh,pl,ro				
	15							From 12.33m to 12.90m, highly fractured	C	100	0	
379								From 12.92m to 13.30m, J,sv,pl,ro,Fe 12.96m: P,sh,pl,ro,Fe 13.04m: P,sh,pl,ro,Fe 13.17m: P,5°,pl,ro,Fe 13.31m: P,sh,pl,ro,Fe From 13.40m to 13.52m, J,70°,pl,ro,Fe 13.55m: P,sh,pl,ro,Fe				
	16							From 13.58m to 13.69m, J,sv,pl,ro,Fe From 13.60m to 13.93m, J,sv,pl,ro,Fe 13.97m: P,sh,pl,ro,Fe From 13.97m to 14.80m, J,sv,pl,ro,Fe 14.69m: P,sh,pl,ro,Fe 14.74m: P,sh,pl,ro,Fe 14.8m: P,sh,pl,ro,Fe	C	100	68	
380								From 15.20m to 15.46m, highly fractured From 15.46m to 15.63m, J,sv,ir,he,Fe	C	83	87	
	17							From 15.63m to 15.82m, highly fractured From 15.82m to 16.22m, J,sv-80°,cu,ro,Fe From 15.82m to 16.44m, J,sv,Pt,ro,Fe	C	100	38	
381								From 16.01m to 16.04m, J,35°,pl,ro,Fe From 16.40m to 16.62m, J,sv,pl,ro,Fe	C	100	21	
	18											
382		From 18.6m, slightly weathered										
	19											

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 3 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
384		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt						16.45m: P,sh,pl,ro,Fe 16.56m: P,sh,pl,ro,Fe 16.71m: P,sh,pl,ro,Fe	C	100	21	
	20.46	*(continued)*						From 16.76m to 17.74m, J,sv,pl,ro,Fe 17.07m: P,40°,cu,ro,Fe	C	74	0	
	20.57	CORE LOSS - (20.46m to 20.57m)						17.22m: P,sh,pl,ro,Fe				
	20.88	BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt						17.36m: P,sh,pl,ro,Fe 17.61m: P,sh,pl,ro,Fe 17.64m: P,sh,pl,ro,Fe 17.7m: P,sh,pl,ro,Fe	C	86	0	
385	21 20.96	CORE LOSS - (20.88m to 20.96m)						From 17.76m to 18.07m, J,sv,pl,ro,Fe 17.87m: P,sh,pl,ro,Fe	C	100	38	
		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt						From 17.95m to 17.98m, J,45°,ir,ro,Fe	C	100	0	
	22							From 17.98m to 18.0m, P,35°,cu,ro,Fe 18.18m: P,sh,pl,ro,Fe From 18.18m to 18.36m, J,sv,pl,ro,Fe From 18.24m to 18.48m, J,80°,pl,ro,Fe				
386		From 22.29m, extremely weathered										
	23							From 18.28m to 18.50m, J,75°,pl,ro,Fe 18.38m: P,sh,pl,ro From 18.48m to 18.56m, highly fractured 18.61m: P,sh,pl,ro,Fe	C	100	70	
387		From 23.26m, moderately weathered										
		From 23.39m, slightly weathered										
	24							From 18.61m to 18.88m, J,sv,pl,ro,Fe From 18.61m to 18.93 From 18.73m to 18.87m, J,sv,ir,ro,Fe	C	100	59	
388		From 24.6m to 26.0m, highly weathered						18.88m: P,8°,ir,ro,Fe From 18.91m to 19.04m, J,sv,pl,he,Fe From 18.94m to 19.13m, J,sv,ir,ro,Fe From 19.07m to 19.17m, J,55°,pl,ro,Fe From 19.19m to 19.39m, J,80°,pl,ro,Fe 19.24m: P,sh,pl,ro,Fe 19.31m: P,sh,pl,ro,Fe From 19.38m to 19.48m, highly fractured From 19.48m to 19.56m, J,sv,pl,ro,Fe From 19.58m to 19.70m, J,80°,pl,ro,Fe	C	100	68	
	25											
389												
	26											
390												
	27							From 19.60m to 19.66m, J,sv,pl,ro,Fe	C	100	26	
391								From 19.63m to 19.66m, P,40°,pl,ro,Fe 19.67m: P,sh,pl,ro,Fe	C	100	46	
	28							From 19.69m to 19.92m, J,45°-85°,ir,he,Fe 19.75m: P,sh,pl,he,Fe From 19.78m to 20.09m, J,sv,ir,ro,Fe From 19.80m to 19.87m, J,sv,ir,ro,Fe From 19.96m to 20.34m, J,40°-90°,cu,ro,Fe	C	100	61	
392	28.65	CORE LOSS - (28.65m to 28.87m)										
	28.87	BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt						20.15m: P,sh,pl,ro,Fe From 20.22m to 20.46m, highly fractured	C	63	50	
	29	From 29.19m, extremely weathered						20.46m: CORE LOSS: 110mm From 20.57m to 20.88m, highly fractured	C	100	0	
	29.65											
	29.75	CORE LOSS - (29.65m to 29.75m)						20.88m: CORE LOSS: 80mm	C	93	0	

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 203.59m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 4 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
394		BASALT - High strength, moderately to slightly weathered, grey with some ironstaining basalt *(continued)*						From 20.96m to 21.23m, highly fractured	C	93	0	
								From 21.23m to 21.39m, J,sv,pl,ro,Fe 21.3m: P,sh,ir,ro,Fe From 21.32m to 21.46m, J,80°,pl,ro,Fe	C	100	31	
	31 31.0							From 21.47m to 21.90m, J,sv,pl,ro,Fe 21.49m: P,sh,pl,ro,Fe 21.54m: P,sh,pl,ro,Fe 21.57m: P,sh,pl,ro,Fe 21.64m: P,sh,pl,ro,Fe				
395	31.05	SANDSTONE - Medium strength, extremely weathered, orange, fine grained sandstone										
		CORE LOSS - (31.05m to 31.86m)										
	31.86							From 21.64m to 21.89m, J,70°-90°,ir,ro,Fe From 21.64m to 21.89m, J,sv,pl,ro,Fe				
	32											
396	32.16	SANDSTONE - Medium to high strength, extremely weathered, orange fine grained sandstone with some tuff From 32.05m to 32.09m, low strength						21.69m: P,sh,pl,ro,Fe From 21.89m to 22.29m, highly fractured	C	68	60	
		SANDSTONE - High strength, moderately to slightly weathered, grey, fine to medium grained sandstone with trace to some siltstone (heat affected unil 33.04m)						From 22.29m to 22.38m, J,85°,pl,ro,Fe From 22.29m to 22.38m, J,80°,pl,he,Fe From 22.38m to 22.76m, J,80°,pl,ro,Fe 22.59m: P,sh,pl,ro,Fe				PL(A) = 1.49 PL(D) = 1.16
397	33	From 33.65m, slightly weathered						22.69m: P,sh,pl,ro,Fe 22.81m: P,sh,pl,ro,Fe From 23.0m to 23.27m, J,60°-90°,sv,op,Fe From 23.36m to 23.74m, J,75°,ir,ro,Fe 23.4m: P,sh,pl,ro,calcite From 23.71m to 23.74m, P,25°,pl,ro,Fe				
	34	From 34.3m, slightly weathered to fresh						From 23.78m to 23.97m, J,60°,pl,ro,Fe 23.89m: P,sh,pl,ro,Fe	C	100	92	PL(A) = 0.48 PL(D) = 0.31
398	35	From 34.82m, medium strength, fresh						From 23.90m to 24.17m, highly fractured 24.17m: P,sh,pl,ro,Fe From 24.17m to 24.64m, J,sv,pl,he,Fe				
	36	At 35.4m, coal lense, 2mm thick						From 24.17m to 24.64m, J,sv,ir,he,Fe	GT001			
399								From 24.28m to 24.36m. P,40°,pl,ro,Fe From 24.37m to 24.64m, J,85°,ir,ro,Fe				PL(A) = 0.53 PL(D) = 0.36
	37							24.59m: P,sh,pl,ro,Fe From 24.64m to 25.26m, J,80°,pl,ro,Fe From 24.64m to 25.27m, J,sv,pl,he,Fe 25.09m: P,sv,cu,ro,Fe 25.11m: P,sv,pl,ro,Fe From 25.15m to 25.43m, J,70°-80°,cu, he, Fe				
401								From 25.20m to 25.82m, J,sv,Pt,he,quartz From 25.47m to 25.69m, J,sv,cu,he	C	99	99	PL(A) = 0.37 PL(D) = 0.27
	38	From 38.0m, low to medium strength						From 25.82m to 26.20m, J,sv,pl,he,quartz (in parts) From 26.05m to 26.73m, J,75°,pl,ro,Fe 26.14m: P,sh,pl,ro,Fe From 26.16m to 26.73m, J,80°,pl,ro,Fe 26.21m: P,sh,pl,ro,Fe				
402								26.25m: P,sh,pl,ro,Fe 26.28m: P,sh,pl,he,Fe	C	100	100	
	39											

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 5 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
404		SANDSTONE - High strength, moderately to slightly weathered, grey, fine to medium grained sandstone with trace to some siltstone (heat affected unil 33.04m) *(continued)*						From 26.51m to 26.67m, J,80°,pl,he,Fe 26.67m: P,5°,pl,ro,Fe From 26.73m to 26.88m, highly fractured From 26.88m to 27.11m, J,sv,pl,ro,Fe From 26.88m to 27.11m, J,85°,pl,ro,Fe From 26.88m to 27.11m, J,80°,pl,ro,Fe From 26.93m to 26.97m, P,40°,pl,ro,Fe From 27.0m to 27.01m, P,5°,pl,ro,Fe 27.11m: P,sh,ir,ro,calcite From 27.12m to 27.14m, P,5°,pl,ro,Fe 27.18m: J,sv,ir,ro,Fe 27.19m: J,80°-sv,ir,ro,Fe From 27.22m to 27.24m, P,8°,pl,ro,Fe From 27.26m to 27.67m, J,80°,pl,ro,Fe 27.33m: P,sh,pl,ro,Fe 27.41m: P,sh,pl,ro,ca 27.57m: P,5°,ir,ro,ca From 27.70m to 28.65m, J,60°-sv,ir,ro,Fe From 27.70m to 28.65m, J,sv,ir,ro,Fe From 27.70m to 28.65m, J,55°-sv,ir,he,Fe From 27.76m to 27.88m, highly fractured 27.97m: P,sh,pl,ro,Fe 28.01m: P,sh,pl,ro,Fe From 28.06m to 28.07m, P,sh,ir,ro,Fe 28.21m: P,sh,pl,ro,Fe 28.24m: P,sh,pl,ro,Fe 28.28m: P,sh,pl,ro,Fe 28.51m: P,sh,pl,ro,calcite 28.65m: CORE LOSS: 220mm From 28.65m to 28.87m, J,sv,pl,ro,Fe From 28.87m to 29.25m, J,sv,pl,ro,Fe From 28.87m to 29.25m, J,80°,ir,ro,Fe From 28.87m to 29.25m, J,sv,ir,ro,Fe From29.02m to 29.25m, J,50°,pl,ro,Fe 29.08m: P,sh,ir,ro,Fe 29.1m: P,sh,pl,ro,Fe From 29.25m to 29.65m, highly fractured 29.65m: CORE LOSS: 100mm From 29.75m to 29.84m, highly fractured 29.87m: P,sh,ir,ro,Fe From 29.88m to 30.02m, J,70°,pl,ro,Fe From 29.96m to 30.15m, J,75°,pl,ro,Fe 30.09m: P,sh,pl,ro,Fe From 30.09m to 30.19m, J,70°,pl,ro,Fe From 30.12m to 30.26m,	C	100	100	PL(A) = 0.52 PL(D) = 0.37 PL(A) = 0.21 PL(D) = 0.24 PL(A) = 0.73 PL(D) = 0.59 PL(A) = 0.63 PL(D) = 0.58
405	41											
406	42											
407	43	From 43.7m, medium strength										
408	44											
409	45											
410	46											
411	47											
412	48								GT002			PL(A) = 0.74 PL(D) = 0.78
	49	From 48.8m, slightly interbedded with siltstone bands up to 100mm thick										

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 203.59m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 6 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
414		SANDSTONE - High strength, moderately to slightly weathered, grey, fine to medium grained sandstone with trace to some siltstone (heat affected unil 33.04m) *(continued)*						J,65°,pl,ro,Fe 30.15m: P,sh,pl,ro,Fe From 30.26m to 30.40m, highly fractured From 30.40m to 30.73m, J,sv,pl,ro,Fe From 30.50m to 30.83m, J, 85°,pl,ro,Fe From 30.61m to 31.0m, J,75°,pl,ro,Fe From 30.72m to 31.0m, J,45°-90°,ir,ro,Fe				PL(A) = 0.51 PL(D) = 0.32
415	51								C	100	100	
416	52							From 30.75m to 30.96m, J,60°,ir,ro,Fe 30.95m: P,sh,ir,ro,Fe From 31.0m to 31.05m, highly fractured 31.05m: CORE LOSS: 810mm From 31.86m to 31.92m, highly fractured From 31.92m to 31.96m, J,75°,pl,ro,Fe From 31.92m to 31.99m, J,sv,pl,ro,Fe 32m: P,sh,pl,ro,Fe From 32.16m to 33.03m, J,45°-90°,ir,ro,Fe From 32.37m to 32.72m, J,40°-70°,ir,ro,Fe From 33.57m to 33.65m, J,60°,pl,ro,Fe 33.79m: P,sh,pl,ro,Fe 34.29m: P,sh,pl,ro,Fe 34.7m: P,sh,pl,he.Fe 34.79m: P,sh,pl,he,Fe 34.82m: P,sh,pl,ro,Fe From 48.77m to 48.84m, J,sv,ir,discon From 51.04m to 51.35m, J, sv,ir,he, discon				PL(A) = 0.89 PL(D) = 0.62
417	53								C	99	99	PL(A) = 0.47 PL(D) = 0.33
418	54											
419	55	From 54.69m, low to medium strength										PL(A) = 0.57 PL(D) = 0.25
420	56							From 56.12m to 56.25m, F,sv,pl,12mm throw	C	100	100	
421	57											
422	58								GT003			PL(A) = 0.26 PL(D) = 0.35
	59								C	100	100	PL(A) = 0.34 PL(D) = 0.24

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 7 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
424		SANDSTONE - High strength, moderately to slightly weathered, grey, fine to medium grained sandstone with trace to some siltstone (heat affected unil 33.04m) *(continued)*							C	100	100	
	61	From 60.78 to 60.83m, siderite band										
425												PL(A) = 0.21 PL(D) = 0.14
	62							From 61.96m to 62.0m, F,45°,pl,3mm throw	C	97	97	
426								From 62.59m to 62.64m, F, sv,cu,15mm throw				
	63											
427		From 63.28m to 63.3m, tuff band										PL(A) = 0.09 PL(D) = 0.04
		From 63.59m to 64.08m, very low strength						From 63.59m to 64.08m, very low strength				
	64											
428												
	65								C	100	84	PL(A) = 0.27 PL(D) = 0.06
429	65.41	From 65.31m, very low to low strength										
		MUDSTONE - Fresh, dark grey mudstone										
	66											PL(A) = 0.46 PL(D) = 0.06
430												
	67											
431								>>				
	68								C	100	100	PL(A) = 0.41 PL(D) = 0.27
432		From 68.4m, medium strength with some siltstone										PL(A) = 0.7 PL(D) = 0.2
									GT004			
	69											
									C	100	95	

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 8 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		MUDSTONE - Fresh, dark grey mudstone *(continued)*										PL(A) = 0.54 PL(D) = 0.32
434	71								GT005			
	71.19	COAL - Medium to high strength, fresh, dark brown (stoney) coal (possibly heat affected) From 71.42m to 71.73m, extremely to very low strength tuff						From 71.57m to 71.73m, extremely low to very low strength	C	100	95	PL(A) = 1.03 PL(D) = 0.55 PL(A) = 0.04
435	72								GT006			
436		From 72.32m, carbonaceous mudstone							GT007			PL(A) = 2.34 PL(D) = 0.14
	72.59	TUFF - Low to medium strength, fresh, light grey to grey tuff, slightly interbedded with siltstone bands up to 30mm thick										
437	73											PL(A) = 0.88 PL(D) = 0.24
438	74								C	100	100	
	75							From 74.64m to 75.65m, J,sv,ir,he,calcite				
439		From 75.67m, medium strength										PL(D) = 1.78
	76	From 76.4m, low to medium strength							GT008			
440												PL(D) = 1.91
	77											PL(A) = 0.36 PL(D) = 0.25
441	77.34	From 77.26m, very low to low strength							C	100	100	PL(A) = 0.63 PL(D) = 0.19
	77.6	COAL - Medium to high strength, fresh, black (stoney) coal										
	78	CARBONACEOUS MUDSTONE - High strength, fresh, brown to black carbonaceous mudstone						>>				
442												PL(A) = 2.56 PL(D) = 1.2
	79								C	100	93	
	79.52											PL(A) = 0.21

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 203.59m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 9 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
444		SANDSTONE AND SILTSTONE - Low to medium strength, fresh, grey to dark grey fine to medium grained sandstone interbedded with siltstone bands up to 10mm thick *(continued)*										PL(D) = 0.16
	80.89								C	100	93	
445	81	MUDSTONE - Medium to high strength, fresh, dark grey mudstone										PL(A) = 1.47 PL(D) = 0.16
		From 81.43m, trace very low strength tuff bands										
	82											PL(A) = 0.38 PL(D) = 0.21
446		From 82.13m, low to medium strength, interbedded fine to medium grained sandstone							GT009			
												PL(A) = 0.79 PL(D) = 0.55
	83											
	83.12	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone							C	100	99	
447												
	84											
448												PL(A) = 1.78 PL(D) = 1
	85											
	85.25	MUDSTONE - Medium to high strength, fresh, black coal with trace high tuff bands up to 60mm thick										
449									GT010			PL(A) = 0.63 PL(D) = 0.45 PL(D) = 0.13
	86 85.99	COAL - Medium to high strength, fresh, black coal with trace high strength tuff bands up to 60mm thick							C	100	100	
450								>>				PL(A) = 0.05 PL(D) = 0.57
	87 86.93	SILTSTONE - Medium to high strength, fresh, dark grey siltstone with some fine to medium grained sand							GT011			PL(A) = 1.11 PL(D) = 0.78
451	87.88											
	88	SANDSTONE - High strength, fresh, grey to dark grey fine to coarse grained sandstone with trace to some siltstone bands up to 30mm thick							C	99	99	PL(A) = 2.13 PL(D) = 1.55
452												
	89											

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 203.59m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 10 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
454		SANDSTONE - High strength, fresh, grey to dark grey fine to coarse grained sandstone with trace to some siltstone bands up to 30mm thick *(continued)*							C	99	99	PL(A) = 1.36 PL(D) = 1.05
455	91	From 90.28m to 91.00m, medium to high strength, fine sized pebbly sandstone						91.37m: B,5°,ir,ro,coal				
456	92								C	100	100	PL(A) = 2.4 PL(D) = 1.76
457	93							92.55m: P,sh.ir,ro 92.83m: B,3°,pl,ro,coal				
458	94											PL(A) = 0.92 PL(D) = 0.96
459	95								C	92	92	PL(A) = 4.09 PL(D) = 3.71
								95.45m: B,sh,pl,ro,coal	GT012			
460	96											PL(A) = 3.1 PL(D) = 2.26
461	96.9 97	MUDSTONE - Medium to high strength, fresh, dark brown mudstone with some coal lenses up to 10mm thick										PL(A) = 1.28 PL(D) = 0.27
462	98 98.21	SILTSTONE AND SANDSTONE - Medium to high strength, fresh, grey to dark grey siltstone and interbedded fine to medium grained sandstone up to 150mm thick							C	99	99	PL(A) = 1.39 PL(D) = 0.48
	99								C	100	100	

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 11 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
464												
	100.57	SANDSTONE - Medium to high strength, fresh, grey to dark grey fine to coarse grained sandstone							GT013			PL(A) = 1.01 PL(D) = 0.93
	101											
465									C	100	100	
	102	From 102.00m, high strength with trace fine sized gravel										
466									GT014			
	103											PL(A) = 2.32 PL(D) = 1.57
467	103.59	COAL - Medium to high strength, fresh black coal										
	104											PL(A) = 0.24 PL(D) = 0.33
468	104.74	SILTSTONE - Medium to high strength, fresh, dark grey siltstone with trace to some fine grained sand							C GT015	100	100	
	105											PL(A) = 0.61 PL(D) = 0.37
469									GT016			
	106								C	99	99	
470		From 106.38m to 106.86m, carbonaceous										PL(A) = 1.73 PL(D) = 1.78
	107											
471	107.21	TUFF - Very low to low strength, fresh, light grey tuff From 107.43m, medium strength							GT017			PL(A) = 0.38 PL(D) = 0.18
	107.81	COAL - Medium to high strength, fresh black coal										PL(A) = 0.58 PL(D) = 0.17
472	107.97 108.22	At 107.86m, extremely low to very low strength, tuff band 20mm thick MUDSTONE - Medium to high strength, fresh, grey mudstone							C	100	93	PL(A) = 0.52 PL(D) = 0.33
	109	SILTSTONE AND SANDSTONE - Medium strength, fresh, grey to dark grey siltstone and interbedded fine to medium grained sandstone up to 150mm thick						109.2m: P,sh,pl,ro,discon				
	109.94											

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 203.59m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 12 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
474		MUDSTONE - Medium to high strength, fresh, grey mudstone *(continued)*										
	110.46	COAL - Medium to high strength, fresh black coal						110.51m: B,sh,pl,ro (coal and tuff)	C	100	93	PL(A) = 4.26 PL(D) = 2.67
111	111.0	From 110.51m, interbedded tuff bands up to 90mm thick										
475		SILTSTONE AND SANDSTONE - Medium to high strength, fresh, grey to dark grey siltstone and interbedded fine to medium grained sandstone up to 150mm thick										
	112											PL(A) = 1.82 PL(D) = 0.3
476												
	113								C	100	100	
477												
	114											PL(A) = 0.82 PL(D) = 0.6
478												
	115											
479												
	116								C	100	95	
480	116.35	MUDSTONE/COAL - Medium strength, fresh, dark brown to black mudstone/coal with some extremely low to very low strength tuff bands up to 110mm thick										PL(A) = 0.59 PL(D) = 0.12
	117							From 117.0m to 117.01m, B,5°,pl,ro,coal 117.04m: B,sh,pl,ro,coal From 117.21m to 117.22m, B,5°,pl,ro,coal 117.26m: B,sh,pl,ro,coal				
481	117.28	SILTSTONE AND SANDSTONE - Medium to high strength, fresh, grey to dark grey siltstone and interbedded fine to medium grained sandstone up to 150mm thick										PL(A) = 1.71 PL(D) = 0.89
	118											
482									GT018			PL(A) = 2.19 PL(D) = 1.01
								From 118.70m to 118.83m, J,75°,pl,he	C	100	100	
	119											
	119.23	MUDSTONE - Medium to high strength, fresh, dark brown mudstone with some siderite										PL(A) = 2.88

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 203.59m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 13 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
484		MUDSTONE - Medium to high strength, fresh, dark brown mudstone with some siderite *(continued)*						From 120.26m to 120.88m, J,80°,pl,he	C	100	100	PL(D) = 1.18
485	121											
486	122								C	100	100	
		From 122.60m to 122.81m, coal band						From 122.63m to 122.36m, J,sv,pl,ro				PL(A) = 1.03 PL(D) = 0.9
487	123	From 123.08m, thinly laminated with tuff										
488	124											PL(A) = 1.18 PL(D) = 0.63
	124.92	From 124.71m, coal with come calcite							C	100	98	
489	125	SILTSTONE AND SANDSTONE - Medium to high strength, fresh, grey to dark grey siltstone and interbedded fine to medium grained sandstone up to 150mm thick						From 125.41m to 125.48m, J,sv,pl,he				
490	126	From 125.97m, trace to some tuff laminations up to 2mm thick						From 125.98m to 126.08m, J,75°,pl,he From 126.11m to 126.37m, J,70°-90°,ir,he	GT019			PL(A) = 0.97 PL(D) = 0.35
491	127							126.92m: P,sh,pl,ro				
		From 127.40m to 127.86m, carbonaceous mudstone with trace coal lenses up to 2mm thick							C	100	100	PL(A) = 1.55 PL(D) = 0.44
492	128	From 127.86m, high strength										PL(A) = 2.61 PL(D) = 1.19
	129							From 128.68m to 128.87m, J,70°,ir,he, discon (mudstone) From 129.06m to 129.25m, J,65°,ir,he,discon				
	129.71							From 129.40m to 129.61m, J,50°,ir,he,discon	C	100	100	

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 14 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
494		SANDSTONE - High strength, fresh, grey fine to coarse grained sandstone *(continued)*						130.44m: P,5°,pl,ro,coal				PL(A) = 2.12 PL(D) = 1.81
495	131								C	100	100	
	132											
496		From 132.35m, trace to some fine to medium sized gravel						>>				PL(A) = 1.85 PL(D) = 1.66
497	133											
	134								C	100	100	PL(A) = 2.53 PL(D) = 1.86
498								134.73m: P,sh,ir,ro				
	135											
499												
	136											
500												PL(A) = 0.69 PL(D) = 1.27
	137								GT020 C	100	100	
501								From 137.43m to 137.44m, P,5°,ir,ro,coal				
	138											
502	138.46	CARBONACEOUS MUDSTONE - High strength, fresh, dark brown mudstone with some coal lenses up to 5mm thick										PL(A) = 3.34 PL(D) = 0.51
	138.96	SANDSTONE - High to very high strength, fresh grey fine to medium grained sandstone						139.31m: P,sh,pl,ro	C	100	100	
	139											

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 15 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
504		SANDSTONE - High to very high strength, fresh grey fine to medium grained sandstone *(continued)*										PL(A) = 2.97 PL(D) = 2.1
	141							>>	C	100	100	
505												
	142											PL(A) = 3.63 PL(D) = 2.85
506												PL(A) = 4.35 PL(D) = 2.52
	142.71	CARBONACEOUS MUDSTONE - High strength, fresh, dark brown mudstone with some coal lenses up to 5mm thick From 142.94m, slightly tuffy						142.72m: P,sh,ir,ro,coal From 142.84m to 142.88m, P,40°,pl,ro	GT021			
	143								C	100	95	
	143.17								GT022			PL(A) = 0.31 PL(D) = 0.08
507		COAL - High strength, fresh, black coal						From 143.44m to 143.67m, J,80°,ir,ro,coal 143.74m: P,sh,pl,ro,coal From 143.74m to 143.77m, J,85°,ir,ro,coal 143.77m: P,sh,pl,ro,coal				
	144											
	144.05	SILTSTONE AND SANDSTONE - Medium to high strength, fresh, grey to dark grey siltstone and interbedded fine to medium grained sandstone up to 150mm thick							GT023			PL(A) = 2.01 PL(D) = 0.61
508												
	145											PL(A) = 1.63 PL(D) = 0.49
509												
	146								C	100	100	PL(A) = 3.56 PL(D) = 1.85
510								>>				
	147											
511												
	148											
512												
	148.5	SANDSTONE - Medium strength, fresh, fine to medium grained sandstone							C	99	99	
	149											
								149.86m: P,sh,pl,ro,coal				

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 203.59m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 16 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
514		SANDSTONE - Medium strength, fresh, fine to medium grained sandstone *(continued)*						150.32m: P,sh,ir,ro,coal	C	99	99	PL(D) = 0.05
515	151	From 150.98m, fine to coarse grained with trace fine sized gravel										
516	152								C GT024	100	100	PL(A) = 0.9 PL(D) = 1.86 PL(A) = 0.74 PL(D) = 0.42
	152.51	MUDSTONE - Medium strength, dark brown carbonaceous mudstone						>>				PL(A) = 1.55 PL(D) = 0.04
517	153	From 153.10m, slightly fine to medium grained sandy										
518	154											PL(A) = 2.42 PL(D) = 0.44 PL(A) = 3.34 PL(D) = 0.2
519	155							154.93m: P,sh,pl,ro	C GT025	99	99	
	155.49	COAL - High strength, fresh, black coal										
	156											
520	156.15	SANDSTONE - High strength, fresh, dark grey fine grained sandstone with some siltstone bands up to 20mm thick										
521	157							>>				
	158								GT026 C	100	100	PL(A) = 2.75 PL(D) = 1.18
522	158.52	From 158.36m, carbonaceous siltstone										PL(A) = 2.16 PL(D) = 0.66
		COAL - Medium to high strength, fresh, black coal										
	159	From 159.19m, trace calcite and siderite							GT027			PL(A) = 1.39 PL(D) = 0.05
								159.66m: P,sh,ir,ro From 159.70m to	C	99	98	PL(A) = 1.13 PL(D) = 0.38

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 17 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
524		COAL - Medium to high strength, fresh, black coal *(continued)*						160.47m, J,sv,ir,he,discon				PL(A) = 0.84 PL(D) = 0.98
		From 160.52m to 160.91m, low to medium strength, tuff band						From 160.61m to 160.66m, P,40°,pl,ro				PL(A) = 0.27
	161											
525								From 161.09m to 161.60m, J,80°,ir,ro	C	99	98	
	161.48	TUFF - High to very high strength, fresh, light grey tuff										PL(A) = 3.55 PL(D) = 2.01
	162											
	162.09	COAL - Medium to high strength, fresh, black coal										
526								From 162.30m to 162.96m, J,sv,pl,ro				PL(A) = 3.2 PL(D) = 0.58
	163											
	163.22	SILTSTONE - Medium to high strength, fresh, dark grey siltstone with some fine to medium grained sand and trace to some fine to medium sized gravel						163.22m: P,sh,pl,ro 163.35m: P,sh,pl,ro 163.49m: P,sh,pl,ro				PL(A) = 2.76 PL(D) = 1.33
527									GT028			
	164								C	100	100	PL(A) = 2.46 PL(D) = 0.74 PL(D) = 1.18 PL(D) = 0.78 PL(D) = 0.92 PL(D) = 0.95 PL(D) = 0.47
528												PL(D) = 0.86 PL(D) = 0.78 PL(D) = 0.32 PL(D) = 0.51
	165											PL(D) = 0.35 PL(D) = 0.56 PL(D) = 0.73 PL(D) = 0.42 PL(D) = 0.67 PL(D) = 2.09 PL(D) = 1.17 PL(D) = 1.37 PL(D) = 1.38 PL(D) = 1.12
	165.15	SANDSTONE - Medium to high strength, fresh, grey to dark grey fine to coarse grained sandstone, quartzone in parts										
529												
	166											
530								>>				
	167								C	100	100	PL(D) = 0.45 PL(D) = 0.94 PL(D) = 0.87 PL(D) = 1.47 PL(D) = 1.12
531									GT029			PL(D) = 1.46 PL(D) = 0.92
	168	From 168.00m, low to medium strength										PL(D) = 0.84 PL(D) = 1.27 PL(D) = 0.7 PL(D) = 0.67 PL(A) = 1.45
532												PL(D) = 1.09 PL(D) = 1.69 PL(D) = 2.06 PL(D) = 0.26 PL(D) = 0.2
	169								C	98	97	PL(D) = 0.48 PL(D) = 0.63 PL(D) = 0.55 PL(D) = 0.61
	169.25	COAL - Medium to high strength, fresh, black coal						169.32m: P,sh,ir,ro				PL(D) = 0.67
								From 169.79m to				

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 18 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
534		COAL - Medium to high strength, fresh, black coal *(continued)*						169.97m, J,70°,pl,ro				PL(D) = 0.93
								From 170.28m to 170.73m, J,80°-85°,ir,ro				PL(D) = 0.51 PL(D) = 0.87 PL(D) = 0.45 PL(D) = 0.57
									C	98	97	PL(A) = 0.8 PL(D) = 0.33 PL(D) = 0.45
535	171							From 171.07m to 171.15m, J,50°,pl,ro	GT030			PL(A) = 0.68 PL(D) = 0.26 PL(A) = 1.12
								From 171.50m to 172.1m, J,45°-90°-ir, ro				PL(D) = 0.23
536	172											
								From 172.63m to 172.78m, highly fractured	C	100	100	PL(A) = 2.17 PL(D) = 0.57
537	173.33	SANDSTONE - High to very high strength, fresh, grey fine to coarse grained sandstone										PL(A) = 2.77 PL(D) = 2.09
									GT031			
538	174											PL(A) = 3.15 PL(D) = 1.41
	175											
539								From 175.71m to 175.86m, J,50°,ir,ro	C	100	97	PL(A) = 3.57 PL(D) = 2.65
540	176							From 176.30m to 176.59m, J,sv,pl,he				
								From 176.55m to 177.31m, J,80°-90°,ir,he (may have been broken during drilling)				
541	177							From 177.31m to 177.41m, J,45°,pl,he				
								From 177.33m to 177.44m, J,45°,pl,he				
	178											PL(A) = 3.51 PL(D) = 1.88 PL(A) = 3.88 PL(D) = 2.48
542		From 178.70m, trace to some siltstone laminations up to 2mm thick							C	100	100	
	179											PL(A) = 2.98 PL(D) = 0.57
												PL(A) = 2.8

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 203.59m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 19 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
544		SANDSTONE - High to very high strength, fresh, grey fine to coarse grained sandstone *(continued)*							C	100	100	PL(D) = 1.14
	180.65											
	181	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone, thinly laminated with trace to some siltstone										
545		From 181.63m to 181.87m, siltstone band thinly laminated with some fine to medium strength sandstone										
	182											
546												PL(A) = 3.26 PL(D) = 1.8
									GT032 C	100		
	183											
547												
	184	From 183.86m to 183.90m, carbonaceous siltstone band						183.86m: P,sh,pl,sm 183.9m: P,sh,pl,sm				
548		From 184.26m to 184.36m, fine to coarse grained sand										
		From 184.55m to 184.18m, conglomerate (fine to medium gravel in a fine to coarse sand matrix)										
	185											PL(A) = 2.58 PL(D) = 1.67
549		From 185.05m to 185.11m, carbonaceous siltstone							C	100	100	
		From 185.69m to 185.77m, low strength tuff						>>	C	100	100	
	186	From 186m, grading into laminite										
	186.2	LAMINITE - High to very high strength, fresh, grey laminite							C	100	100	PL(A) = 3.65 PL(D) = 1.38
550	187											
	187.17	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone										
551	187.47	SILTSTONE - High strength, fresh, grey siltstone						187.47m to 187.96m, J, sv to 80°, ir, He, Ca				
	188							187.9m to 188.43m, J, sv, pl, He, Ca				
552								187.97m to 188.32m, J, sv to 80°,pl, He, Ca	C	100	96	
								188.25m to 188.85m, J, sv to 80°, pl, He, Ca				
	188.85								GT033			PL(A) = 1.63
	188.97	TUFF - Medium strength, fresh, grey tuff										
		From 188.95m to 188.97m, very low strength										
		SILTSTONE - High strength, fresh, grey, siltstone										

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased

TYPE OF BORING: HQ3 from 0m to 203.59m

WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 20 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
554		SILTSTONE - High strength, fresh, grey, siltstone *(continued)*										
		From 190.4m, grading into sandstone						>>				
	190.62	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone laminated with trace siltstone										
555	191								C	100	96	
	191.91											
	192	SILTSTONE / SANDSTONE - High strength, fresh, grey siltstone interbedded with fine to medium grained sandstone up to 400mm thick, spaced up to 300mm apart										PL(A) = 1.69 PL(D) = 1.03
556		At 192.39m, very low strength clay seam						192.39m: Clay seam				
		From 192.5m to 192.98m, very high strength, fine to medium grained sandstone band, laminated with trace siltstone						192.76m: Clay seam				
	193	At 192.76m, very low strength clay seam										PL(A) = 7.22 PL(D) = 4.17
557												PL(A) = 1.08
	194											PL(A) = 1.49
558												
	195											
559		From 195.31m to 195.36m, medium strength, thinly laminated with very low strength clay seams						195.31m to 195.36m, multiple clay seams up to 1mm thick spaced 5mm apart				PL(D) = 2.07
		From 195.42m to 195.44m, very low strength clay seam						195.42m to 195.44m, clay seam	C	100	69	
	196	From 195.91m to 195.64m, medium strength, thinly laminated with very low strength clay seams						195.51m to 195.64m, multiple clay seams up to 5mm thick, spaced up to 20mm apart	GT034			
560		From 196.23m to 197.12m, medium strength, thinly laminated with very low strength clay seams						196.23m to 197.12m, multiple clay seams up to 20mm thick, spaced up to 100mm apart				
	197											PL(A) = 0.91
561								197.47m to 197.57m, J, 55°, pl, He, Qz, 20mm infill				
		From 197.63m to 197.68m, medium strength, thinly laminated with very low strength clay seams						197.63m to 197.68m, multiple clay seams up to 5mm thick, spaced up to 40mm apart				
	198	From 197.88m to 198.25m, medium strength, thinly laminated with very low strength clay seams						197.88m to 198.25m, multiple clay seams up to 15mm thick, spaced up to 40mm apart				PL(A) = 1.29
562		From 198.34m to 198.54m, medium strength, thinly laminated with very low strength clay seams						198.34m to 198.54m, multiple clay seams up to 2mm thick, spaced up to 5mm apart				
	199	From 199.02m to 199.15m, medium strength, thinly laminated with very low strength clay seams						199.55m to 199.67m, J,sv, pl, He, Ca	C	100	87	
								199.62m to 199.64m,				PL(A) = 1.09

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong, NSW

SURFACE LEVEL: 363.70 AHD
EASTING: 231772.9
NORTHING: 6410454.29
DIP/AZIMUTH: 90°/--

BORE No: BY0091CH
PROJECT No: 49761.01
DATE: 8/7 - 1/11/2012
SHEET 21 OF 21

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
564	200.42	From 200.33m to 200.42m, very low strength clay seam						P,sh,pl, He, Ca	GT035			
		SILTSTONE - Medium to high strength, fresh, grey siltstone						200.23m to 200.42m, clay seam				
	201	From 201.14m to 201.2m, low strength, very thinly laminated with clay seams						200.59m: P,sh,pl, He, Ca 200.63m: P,sh,pl, He, Ca 200.64m: P,sh,pl, He, Ca 200.78m to 200.79m, P,sh, pl, He, Ca 201.26m to 201.29m, J, 30°, pl, He, Ca, 3mm infill	C	100	87	
565	202							202.4m to 202.49m, J, sv, pl, He, Ca 202.49m to 202.51m, P,sh to 10°, pl, He, Ca 202.55m to 202.61m, J,sv to 55°, pl, He, Ca				
566	203	From 203.0m, medium strength From 203.08m to 203.12m, tuffaceous siltstone										PL(A) = 0.96
567	203.59	From 203.2m to 203.3m, tuffaceous siltstone						203.4m to 203.47m, J,sv to 55°, pl, He, Ca				
		Bore discontinued at 203.59m, limit of investigation										
568	204											
	205											
569	206											
570	207											
571	208											
572	209											

RIG: MDR 104 Hydrapower Explorer **DRILLER:** Coix / Myers / Gartside **LOGGED:** Fulham/Holden **CASING:** Uncased
TYPE OF BORING: HQ3 from 0m to 203.59m
WATER OBSERVATIONS: Water depth: 36.88m as measured on the 19.7.12
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 326.48 AHD
EASTING: 230858.02
NORTHING: 6404063.52
DIP/AZIMUTH: 90°/--

BORE No: BY0188/OP020
PROJECT No: 49761
DATE: 4/4/2013
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
326	0	SANDSTONE -							Stick up = 0.50m From 0m to 0.4m, asphalt
325	1								
324	2								
323	3								
322	4								
321	5								
320	6								
319	7								
318	8								
317	9								

RIG: DRS106 **DRILLER:** Lucas Drilling **LOGGED:** Cockatoo Coal **CASING:** HW to 24.0m

TYPE OF BORING: Open hole to 43.56m (drilling method unknown)

WATER OBSERVATIONS: Free groundwater observed at 31.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 327.18 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 326.48 AHD
EASTING: 230858.02
NORTHING: 6404063.52
DIP/AZIMUTH: 90°/--

BORE No: BY0188/OP020
PROJECT No: 49761
DATE: 4/4/2013
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
316	11	SANDSTONE - *(continued)*							
315	12	12.0 CORE LOSS -							From 0.4m to 23.9m, grout
314	13								
313	14								
312	15								
311	16								
310	17								
309	18								
308	19								
307									

RIG: DRS106 **DRILLER:** Lucas Drilling **LOGGED:** Cockatoo Coal **CASING:** HW to 24.0m

TYPE OF BORING: Open hole to 43.56m (drilling method unknown)

WATER OBSERVATIONS: Free groundwater observed at 31.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 327.19 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 326.48 AHD
EASTING: 230858.02
NORTHING: 6404063.52
DIP/AZIMUTH: 90°/--

BORE No: BY0188/OP020
PROJECT No: 49761
DATE: 4/4/2013
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
306	21	CORE LOSS - *(continued)*							21
305	22								22
304	23								23
303	24 24.0	SANDSTONE -							24
302	25 25.0	CORE LOSS -							25 From 23.9m to 26.3m, bentonite
301	26								26
300	27 27.0								27
	27.08	COAL -							
299	27.35	TUFF -							
	27.56	COAL -							
		TUFF -							
	28								28
	28.32								
298	28.47	COAL -							
		TUFF -							
	29								29 From 26.3m to 32.6m, 5mm gravel From 26.5m to 32.5m, Class 18 PVC Screen
297	30.0								

RIG: DRS106 **DRILLER:** Lucas Drilling **LOGGED:** Cockatoo Coal **CASING:** HW to 24.0m

TYPE OF BORING: Open hole to 43.56m (drilling method unknown)

WATER OBSERVATIONS: Free groundwater observed at 31.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 327.19 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 326.48 AHD
EASTING: 230858.02
NORTHING: 6404063.52
DIP/AZIMUTH: 90°/--

BORE No: BY0188/OP020
PROJECT No: 49761
DATE: 4/4/2013
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
296	31	CORE LOSS -							31
295	32 32.0	SANDSTONE -							32
294	33								33
293	34								34 From 32.5m to 35.5m, Class 18 Blank (sump) From 32.6m to 35.5m, bentonite
292	35								35
291	36 36.0	SILTSTONE -							End cap 36
290	37								37
289	38								38
288	39 39.0	SANDSTONE -							39
287									

RIG: DRS106 **DRILLER:** Lucas Drilling **LOGGED:** Cockatoo Coal **CASING:** HW to 24.0m

TYPE OF BORING: Open hole to 43.56m (drilling method unknown)

WATER OBSERVATIONS: Free groundwater observed at 31.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 327.19 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 326.48 AHD
EASTING: 230858.02
NORTHING: 6404063.52
DIP/AZIMUTH: 90°/--

BORE No: BY0188/OP020
PROJECT No: 49761
DATE: 4/4/2013
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
286	41	SANDSTONE - *(continued)*							41
285	42								42
284	43								43
283	43.56	Bore discontinued at 43.56m							
282	44								44
281	45								45
280	46								46
279	47								47
278	48								48
277	49								49

RIG: DRS106 **DRILLER:** Lucas Drilling **LOGGED:** Cockatoo Coal **CASING:** HW to 24.0m

TYPE OF BORING: Open hole to 43.56m (drilling method unknown)

WATER OBSERVATIONS: Free groundwater observed at 31.5m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 327.19 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 296.75 AHD
EASTING: 232615.78
NORTHING: 6405078.96
DIP/AZIMUTH: 90°/--

BORE No: BY0204CH/CP063
PROJECT No: 49761
DATE: 8/4/2013
SHEET 1 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
296	0	CLAY -							Stick up = 0.74m From 0m to 0.4m, asphalt
295	1								
294	2								
293	3								
292	4								
291	5								
290	6								
289	7								
288	8	8.0 SANDSTONE -							
287	9								

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 13.0m

TYPE OF BORING: HQ3 to 63.0m

WATER OBSERVATIONS: Free groundwater observed at 5.3m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 297.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 296.75 AHD
EASTING: 232615.78
NORTHING: 6405078.96
DIP/AZIMUTH: 90°/--

BORE No: BY0204CH/CP063
PROJECT No: 49761
DATE: 8/4/2013
SHEET 2 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE - *(continued)*							
286	11 11.0	MUDSTONE -							
285	12								
284	13								
283	14								
282	14.66	CARBONACEOUS SHALE -							
	14.77	COAL -							
	15 15.08								
	15.11	CORE LOSS -							
	15.22								
	15.36	COAL -							
	15.39	CARBONACEOUS SHALE -							
281	15.84	SILTSTONE -							
	16 15.93	CARBONACEOUS SHALE -							
	16.14	MUDSTONE -							
280	17								
279	17.88	CARBONACEOUS SHALE -							
	18 18.01	COAL -							
	18.11	CARBONACEOUS SHALE -							
	18.25	COAL -							
278	18.68	SHALE -							
	18.76	SILTSTONE -							
	19	SANDSTONE -							
	19.34	SILTSTONE -							
277	19.77								
	19.97								

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 13.0m

TYPE OF BORING: HQ3 to 63.0m

WATER OBSERVATIONS: Free groundwater observed at 5.3m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 297.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 296.75 AHD
EASTING: 232615.78
NORTHING: 6405078.96
DIP/AZIMUTH: 90°/--

BORE No: BY0204CH/CP063
PROJECT No: 49761
DATE: 8/4/2013
SHEET 3 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE - *(continued)*							
276	20.92	SILTSTONE -							
	21.22	CORE LOSS -							
	21.39	SILTSTONE -							
275	21.7	MUDSTONE -							
	22.36	CARBONACEOUS SHALE -							
	22.39	TUFF -							
	22.41	MUDSTONE -							
274	22.71	COAL -							
	22.74	CARBONACEOUS SHALE -							
	22.78	SILTSTONE -							
	23.2	CARBONACEOUS SHALE -							
	23.48	SILTSTONE -							
	23.55	CARBONACEOUS SHALE -							
273	23.67	COAL -							
		CARBONACEOUS SHALE -							
		SILTSTONE -							
272									
	25.46	SANDSTONE -							
271									
270									From 0.4m to 53.4m, grout
269									
268									
267									

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 13.0m

TYPE OF BORING: HQ3 to 63.0m

WATER OBSERVATIONS: Free groundwater observed at 5.3m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 297.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 296.75 AHD
EASTING: 232615.78
NORTHING: 6405078.96
DIP/AZIMUTH: 90°/--

BORE No: BY0204CH/CP063
PROJECT No: 49761
DATE: 8/4/2013
SHEET 4 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
266	30.15	MUDSTONE -							
	30.8	SANDSTONE -							
	31.26	MUDSTONE -							
265	31.67	SILTSTONE -							
	32.0								
	32.11	CARBONACEOUS SHALE -							
		COAL -							
	32.44	TUFF -							
264	33.03								
	33.22	COAL -							
	33.32	CORE LOSS -							
	33.38	CARBONACEOUS SHALE -							
263	33.66								
	33.67	COAL -							
	33.81	SILTSTONE -							
	34.13	COAL -							
		CARBONACEOUS SHALE -							
262		SILTSTONE -							
	35								
261	36								
260	37								
259	38								
	38.22	CARBONACEOUS SHALE -							
	38.62								
258	38.63	TUFF -							
	39	CARBONACEOUS SHALE -							
	39.18								
	39.22	SILTSTONE -							
	39.42	MUDSTONE -							
257		SILTSTONE -							

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 13.0m

TYPE OF BORING: HQ3 to 63.0m

WATER OBSERVATIONS: Free groundwater observed at 5.3m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 297.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 296.75 AHD
EASTING: 232615.78
NORTHING: 6405078.96
DIP/AZIMUTH: 90°/--

BORE No: BY0204CH/CP063
PROJECT No: 49761
DATE: 8/4/2013
SHEET 5 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTSTONE - *(continued)*							
256	41								41
	41.53	SANDSTONE -							
255	41.73	SILTSTONE -							
	42								42
254	42.71	SHALE -							
	42.77								
	43 42.8	SANDSTONE -							43
	43.17	COAL -							
		SILTSTONE -							
253	44								44
252	45								45
	45.31	CORE LOSS -							
	45.47	SILTSTONE -							
251	46								46
	46.25	CARBONACEOUS SHALE -							
	46.36								
	46.47	MUDSTONE -							
250	46.48								
	46.67	TUFF -							
	46.73								
	47 46.84	CARBONACEOUS SHALE -							47
	46.93								
	46.95	SILTSTONE -							
	47.18								
	47.21	CARBONACEOUS SHALE -							
	47.47								
249		COAL -							
	47.82	CARBONACEOUS SHALE -							
	48								48
		COAL -							
		CARBONACEOUS SHALE -							
		COAL -							
248	48.74	SANDSTONE -							
	48.79								
	49	CARBONACEOUS SHALE -							49
		COAL -							
	49.26	CARBONACEOUS SHALE -							
247	49.69	MUDSTONE -							
		CARBONACEOUS SHALE -							

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 13.0m

TYPE OF BORING: HQ3 to 63.0m

WATER OBSERVATIONS: Free groundwater observed at 5.3m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 297.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 296.75 AHD
EASTING: 232615.78
NORTHING: 6405078.96
DIP/AZIMUTH: 90°/--

BORE No: BY0204CH/CP063
PROJECT No: 49761
DATE: 8/4/2013
SHEET 6 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CARBONACEOUS SHALE - *(continued)*							
	50.42	COAL -							
246	50.71	TUFF -							
	50.73	COAL -							
	50.82								
51	50.85	SANDSTONE -							51
	51.27	COAL -							
	51.51	TUFF -							
245	51.63	COAL -							
	51.67								
	51.72	CARBONACEOUS SHALE -							
52	52.05	TUFF -							52
	52.11	COAL -							
	52.59	CARBONACEOUS SHALE -							
244	52.61	TUFF -							
	52.63	COAL -							
53	52.68	CARBONACEOUS SHALE -							53
	53.2	SILTSTONE -							
	53.38								
243									
54									54 From 53.4m to 54.8m, bentonite
242									
55									55
	55.36	SANDSTONE -							
241									
	56.04	COAL -							
56	56.62								56
	56.63	SILTSTONE -							
240		COAL -							
57									57
239									
	57.87								
58	57.89	SILTSTONE -							58 From 54.8m to 61.2m, 5mm gravel From 55.0m to 61.0m, Class 18 PVC Screen
		COAL -							
238									
59									59
	59.36								
	59.37	SILTSTONE -							
237		COAL -							

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 13.0m

TYPE OF BORING: HQ3 to 63.0m

WATER OBSERVATIONS: Free groundwater observed at 5.3m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 297.49 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 296.75 AHD
EASTING: 232615.78
NORTHING: 6405078.96
DIP/AZIMUTH: 90°/--

BORE No: BY0204CH/CP063
PROJECT No: 49761
DATE: 8/4/2013
SHEET 7 OF 7

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		COAL - *(continued)*							
236	60.59								
	60.66	SILTSTONE -							
		SANDSTONE -							
	61								61
235									
	62								62 From 61.2m to 63.0m, bentonite From 61.0m to 62.5m, Class 18 Blank (sump) End cap
234	63 63.0								63
233	64								64
	64.27	SILTSTONE -							
232	65								65
231	65.77	SANDSTONE -							
	66								66
	66.34	SILTSTONE -							
230	67								67
229	67.72	SANDSTONE -							
	68								68
228	68.74	SILTSTONE -							
	69								69
	69.24								
	69.36	CARBONACEOUS SHALE -							
227		SILTSTONE - Bore discontinued at 63.0m							

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** Leone (Cockatoo Coal) **CASING:** HW to 13.0m

TYPE OF BORING: HQ3 to 63.0m

WATER OBSERVATIONS: Free groundwater observed at 5.3m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS: Top of pipe RL 297.49 AHD. Coordinates in MGA.

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C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

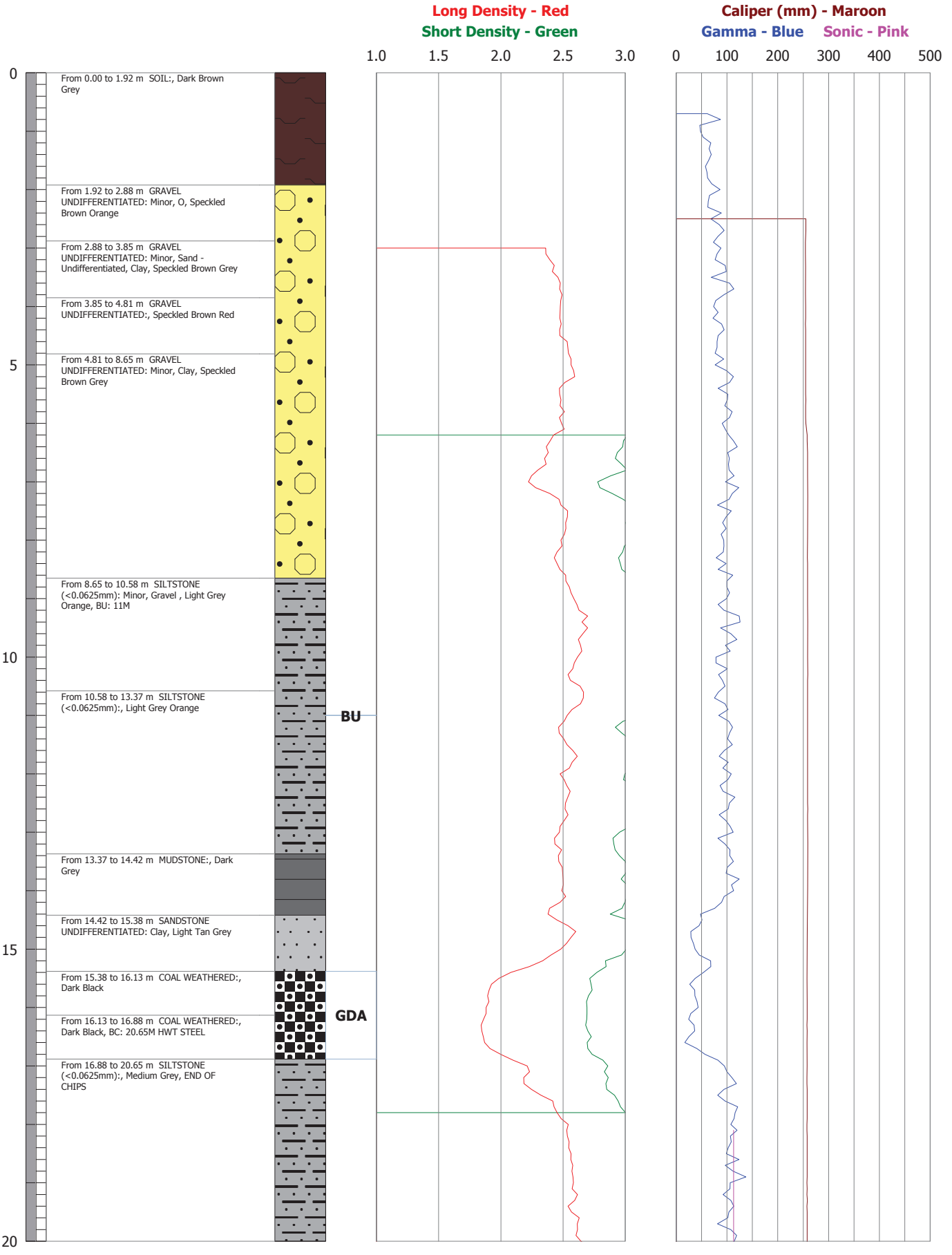
Douglas Partners
Geotechnics / Environment / Groundwater

Bylong : Drillhole Summary

Hole Number : BY0208CH **Hole Type** : Fully Cored **Easting** : 234269.38

Date : 4/04/2013 **Tenement** : AUTH342 **Northing** : 6403672.42

Total Depth : 108.60 m **Area** : Wallings Pastora **Height** : 327.08 ***MGA94_56S***



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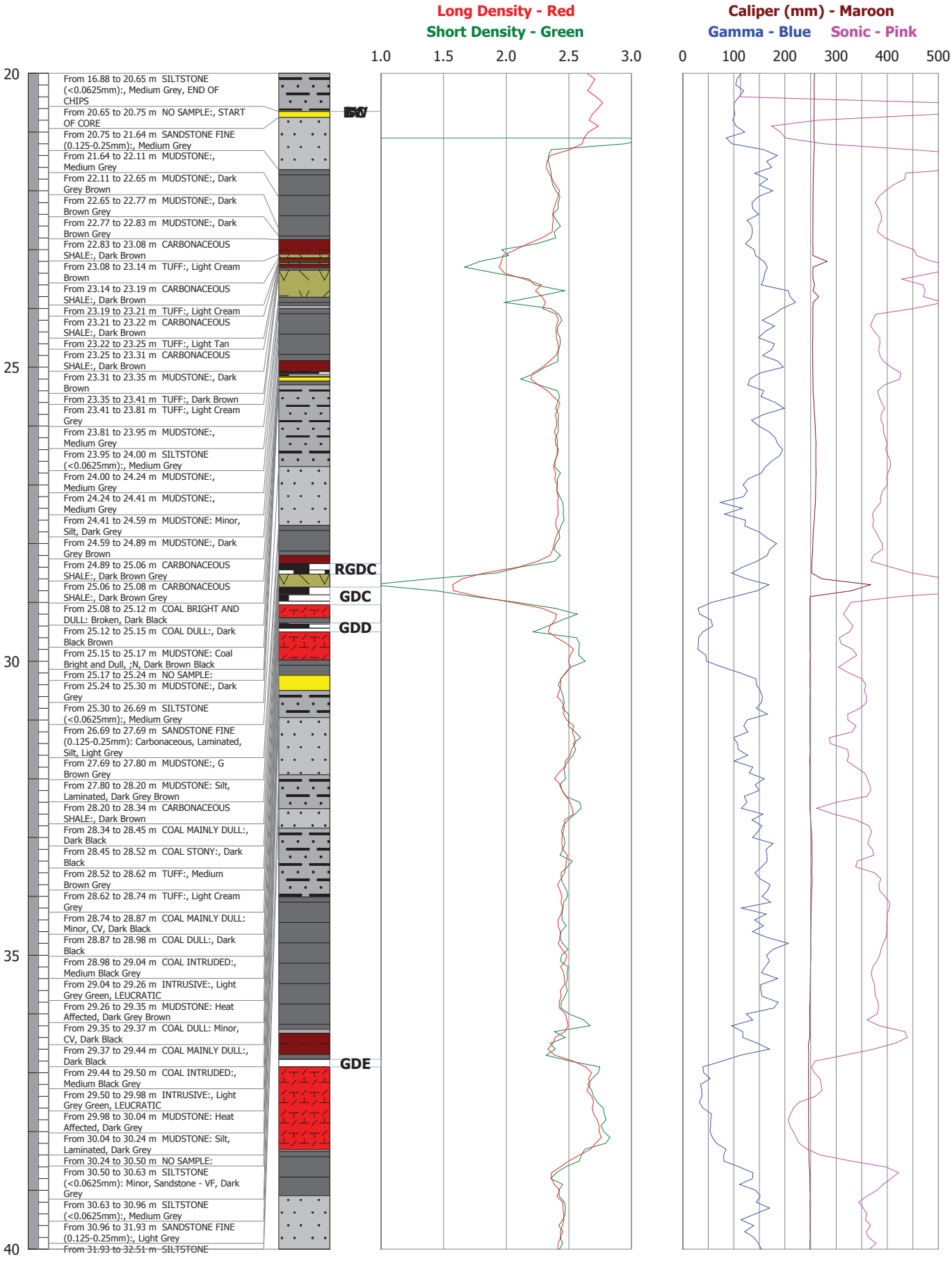

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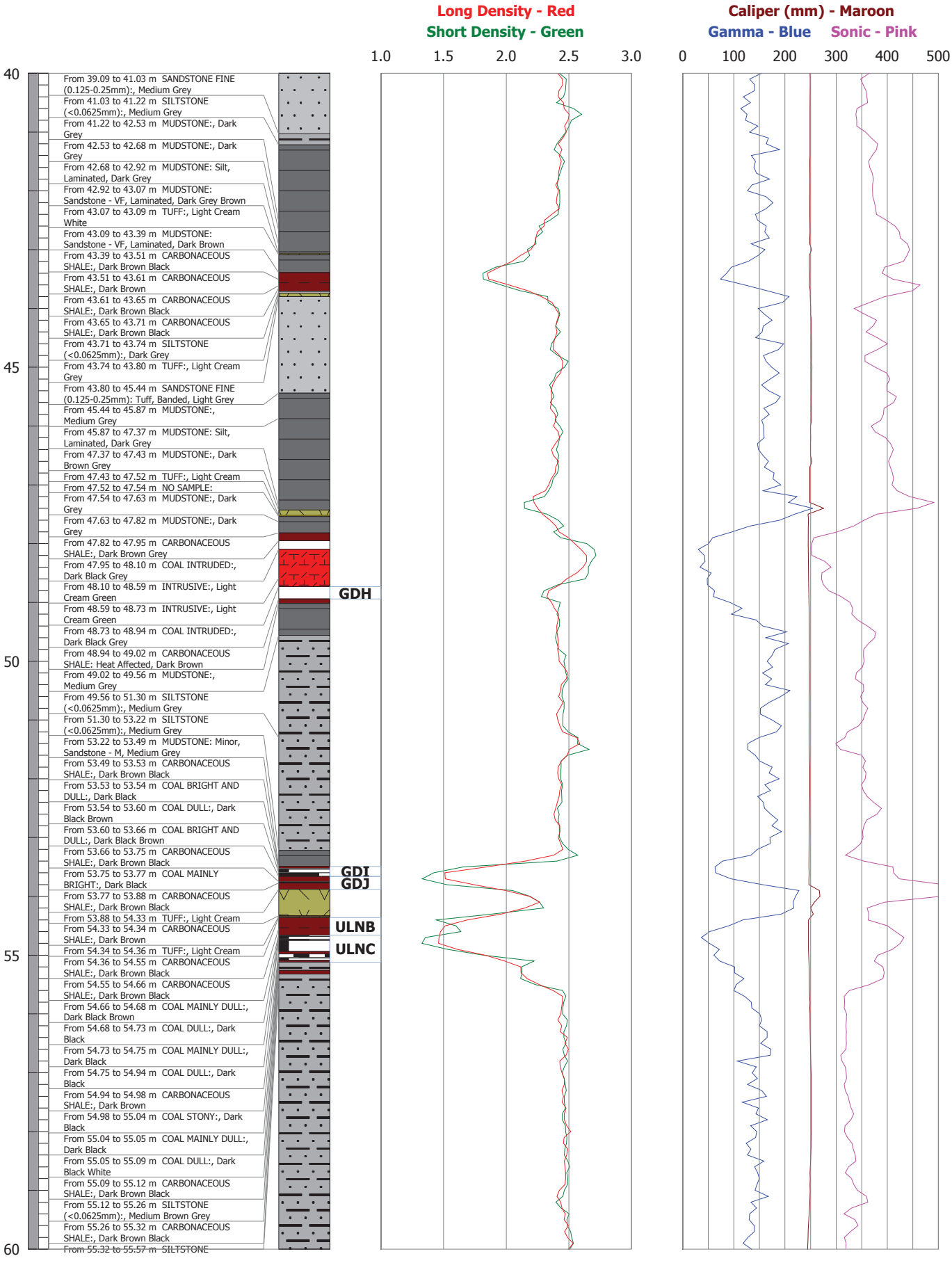

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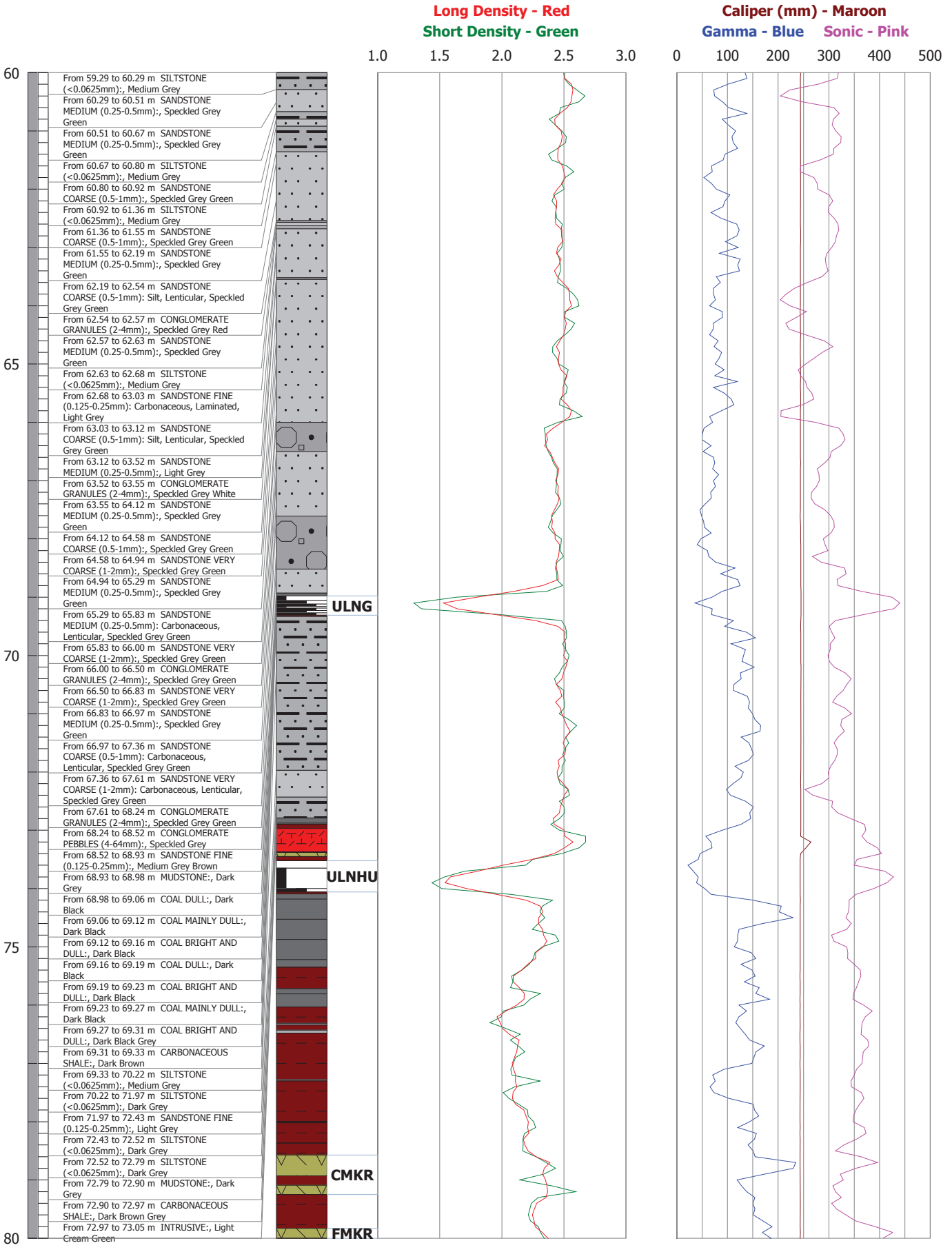

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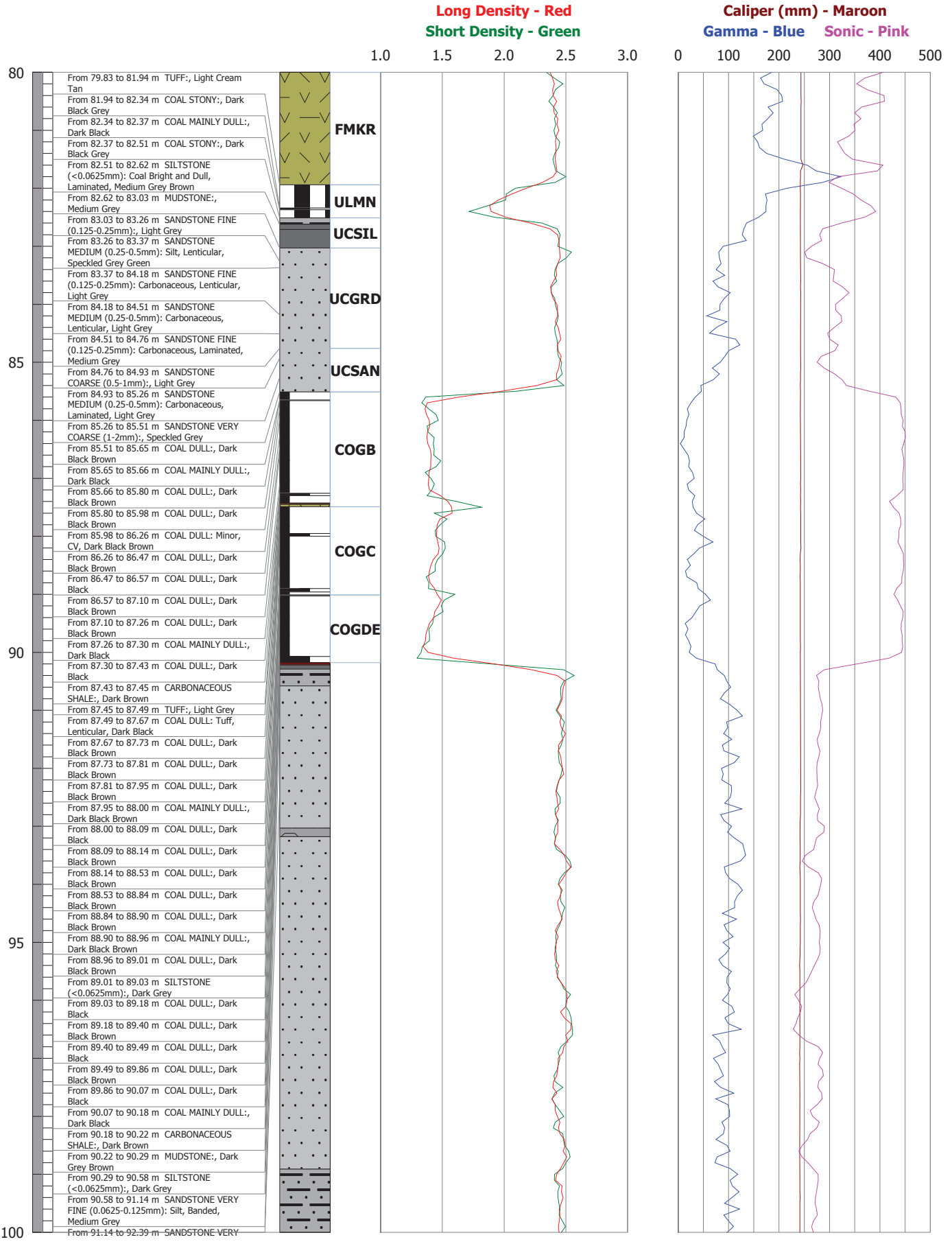
Hole Number : BY0208CH **Hole Type** : Fully Cored **Easting** : 234269.38

Date : 4/04/2013 **Tenement** : AUTH342 **Northing** : 6403672.42

Total Depth : 108.60 m **Area** : Wallings Pastora **Height** : 327.08 ***MGA94_56S***



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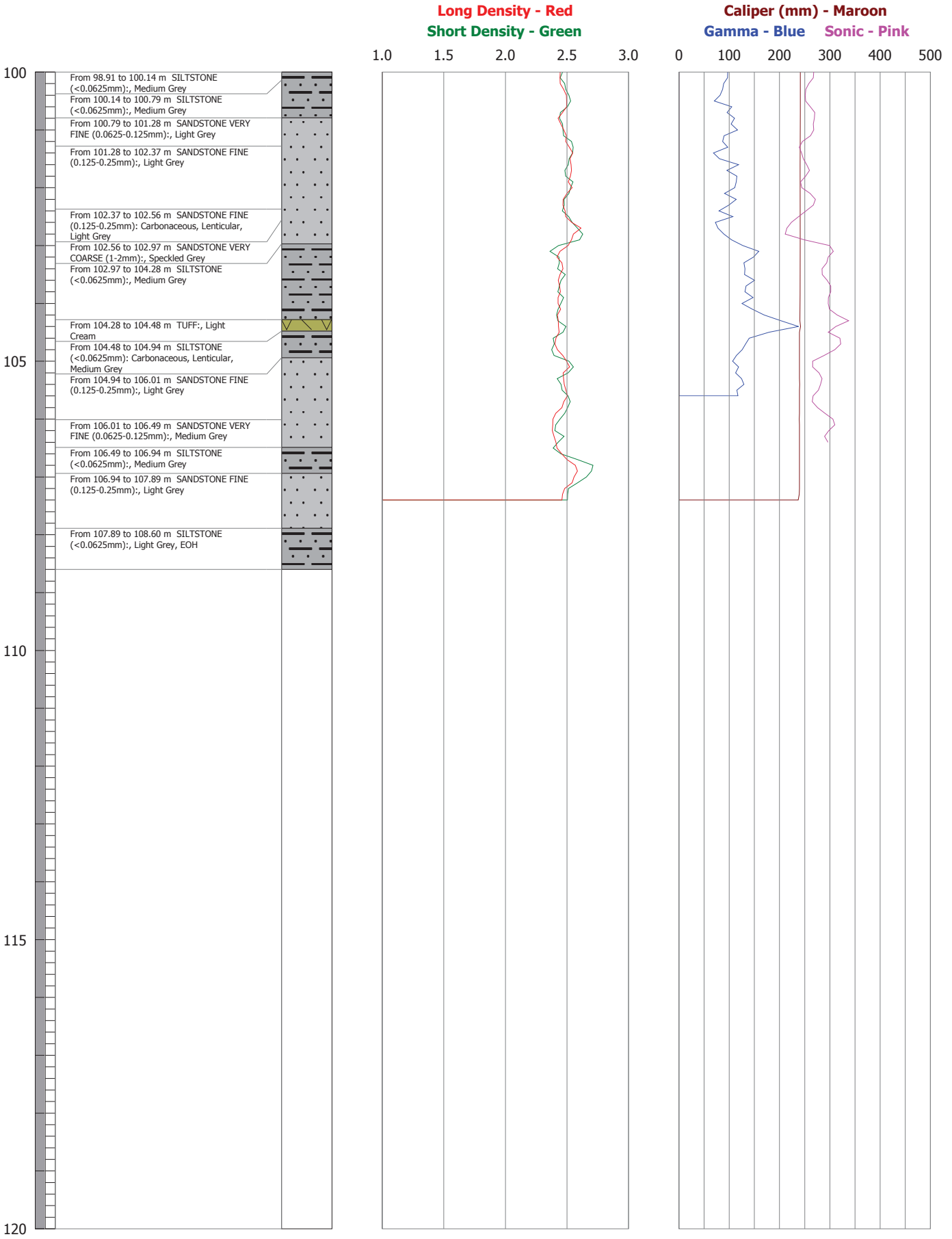


Bylong : Drillhole Summary

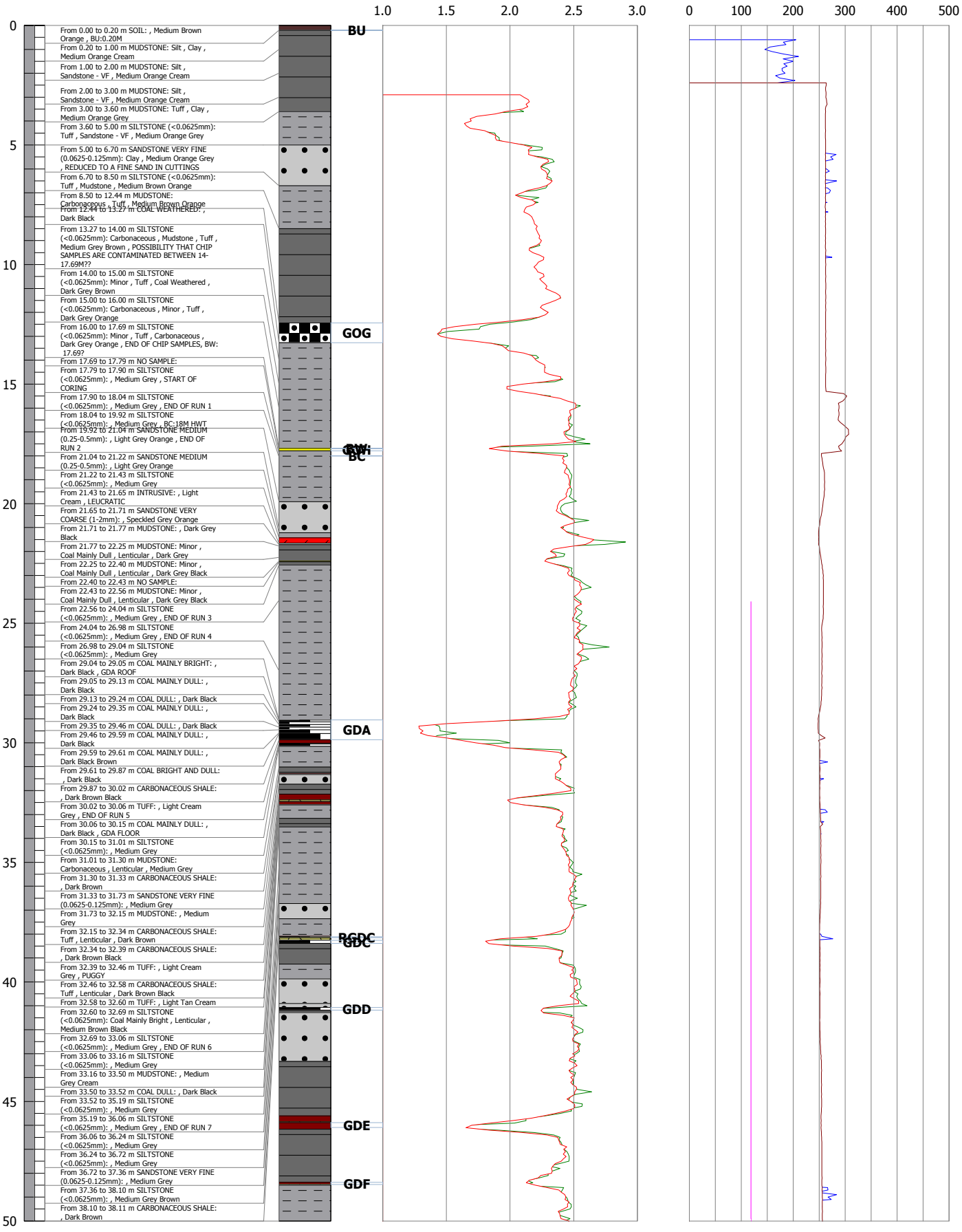
Hole Number : BY0513CH | **Hole Type** : Fully Cored | **Easting** : 231141.98

Date : 18/02/2017 | **Tenement** : AUTH287 | **Northing** : 6408585.11

Total Depth : 111.23 m | **Area** : Bylong Station | **Height** : 323.45 *MGA94_56S*

(PIEZO INSTALLATION)

Long Density - Red
Short Density - Green
Caliper (mm) - Maroon
Gamma - Blue **Sonic - Pink**



Bylong : Drillhole Summary

Hole Number : BY0513CH
Hole Type : Fully Cored
Easting : 231141.98
Date : 18/02/2017
Tenement : AUTH287
Northing : 6408585.11
Total Depth : 111.23 m
Area : Bylong Station
Height : 323.45
MGA94_56S

(PIEZO INSTALLATION)

Long Density - Red
Short Density - Green
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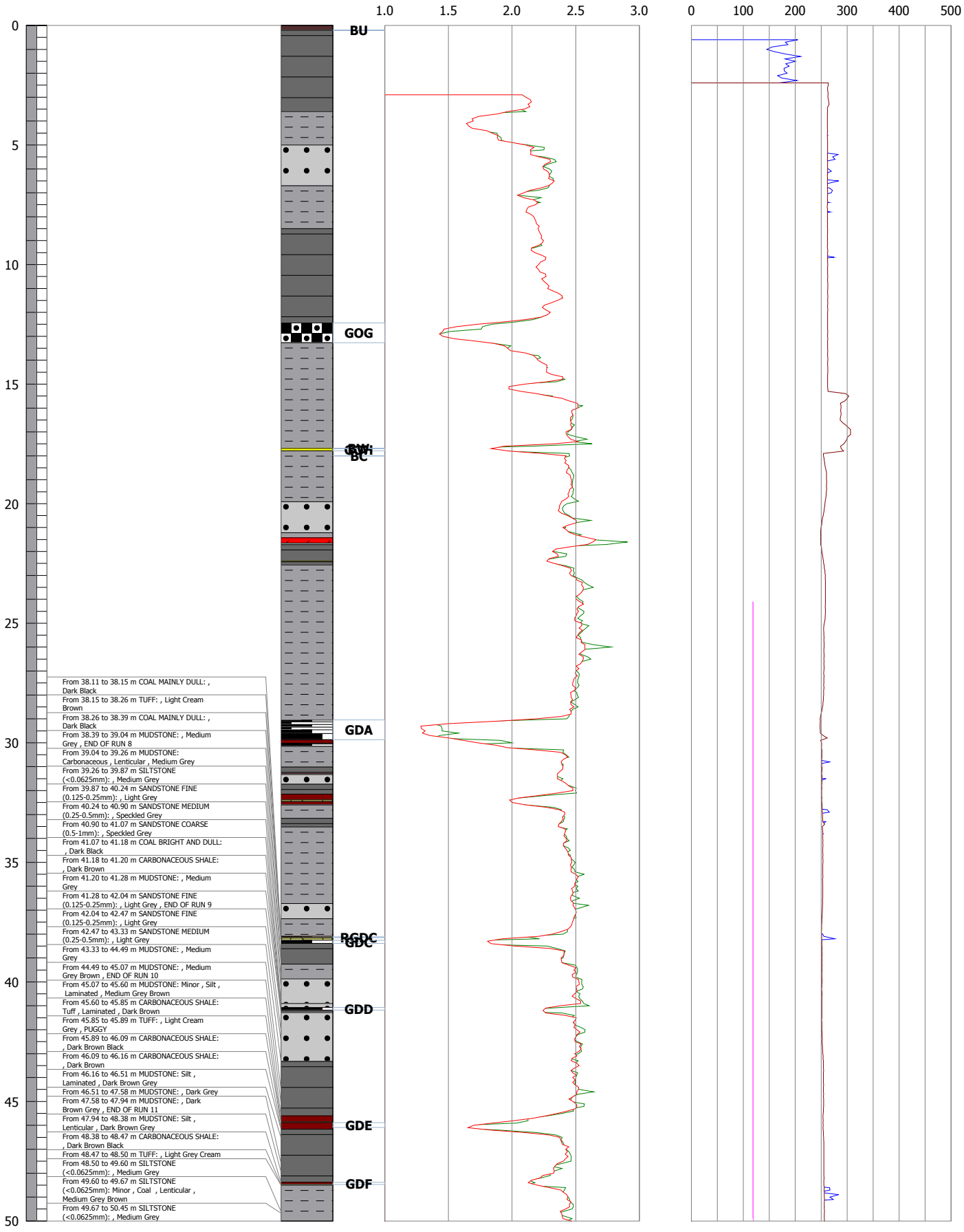

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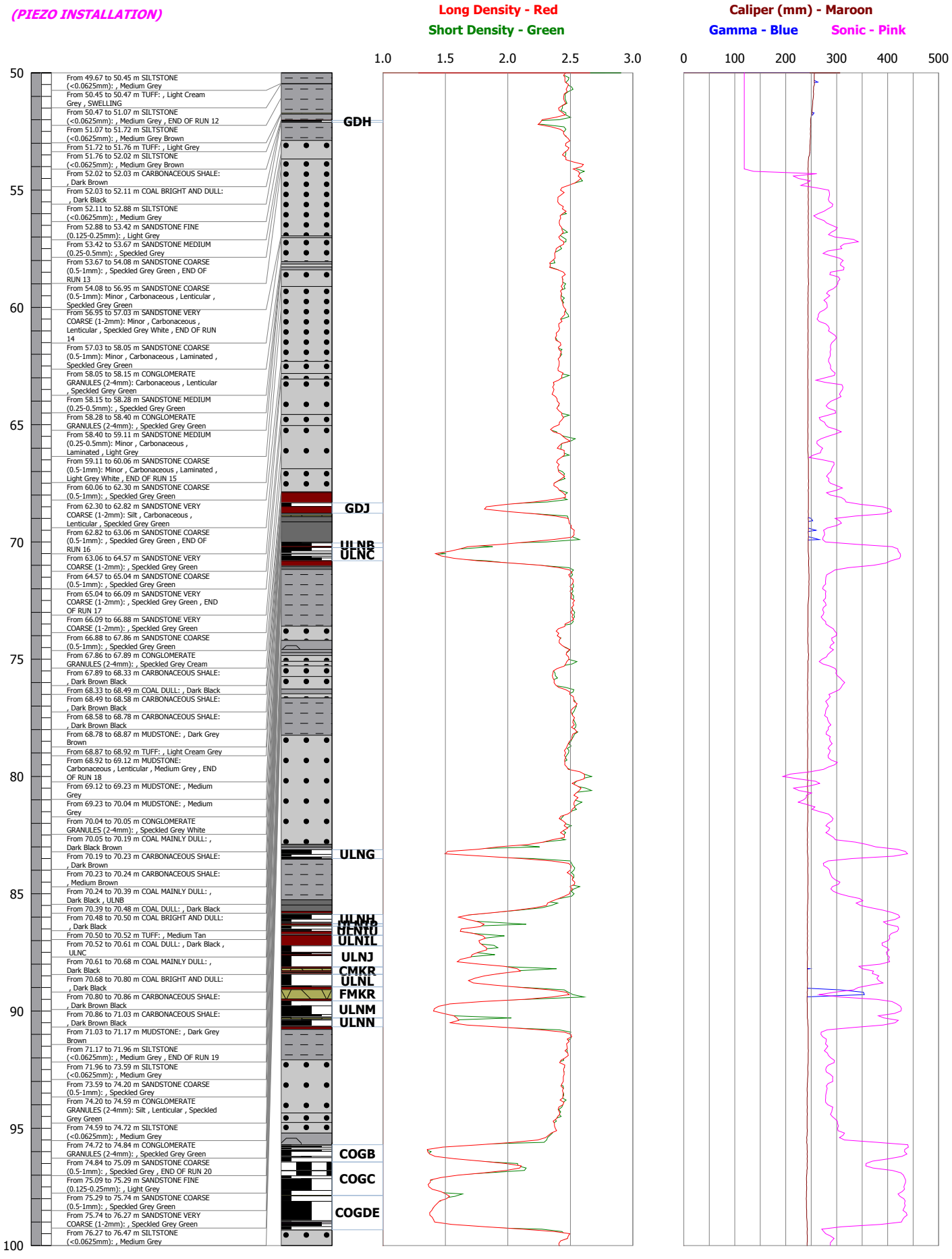

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Hole Number : BY0513CH | **Hole Type** : Fully Cored | **Easting** : 231141.98

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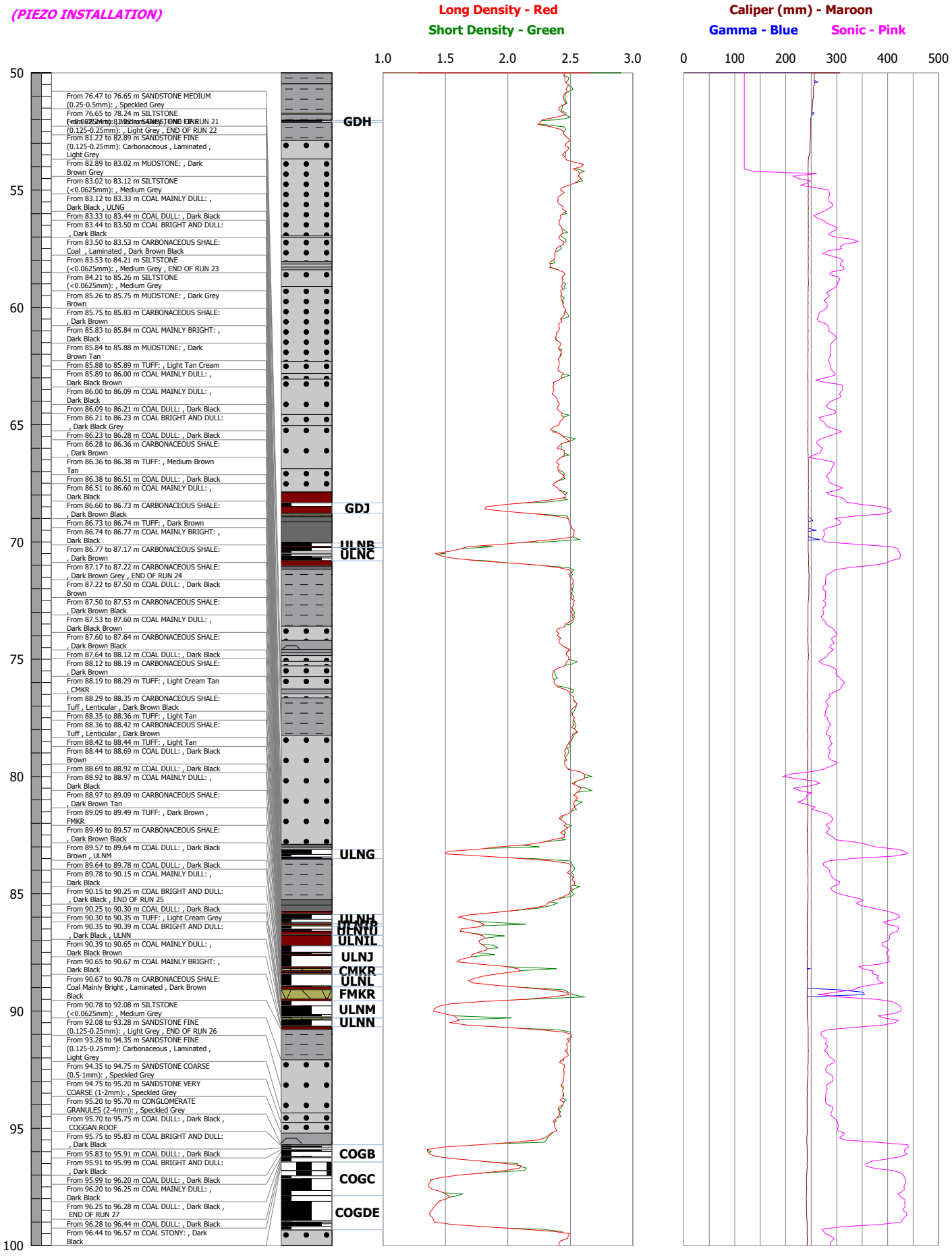
(PIEZO INSTALLATION)



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Hole Number : BY0513CH
Date : 18/02/2017
Total Depth : 111.23 m

Hole Type : Fully Cored
Tenement : AUTH287
Area : Bylong Station

Easting : 231141.98
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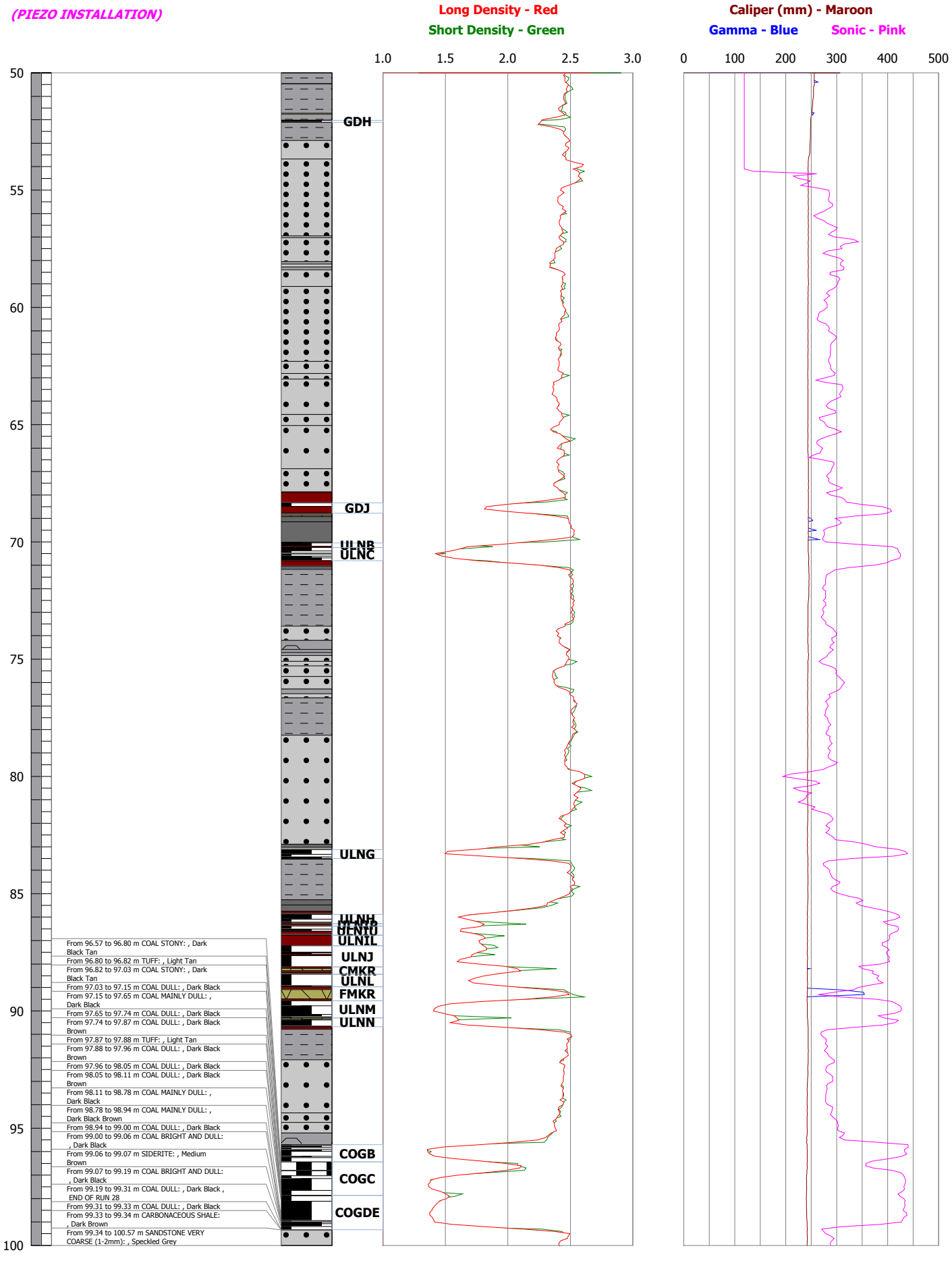

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Hole Number : **BY0513CH** **Hole Type** : Fully Cored **Easting** : 231141.98

Date : 18/02/2017 **Tenement** : AUTH287 **Northing** : 6408585.11

Total Depth : 111.23 m **Area** : Bylong Station **Height** : 323.45 ***MGA94_56S***

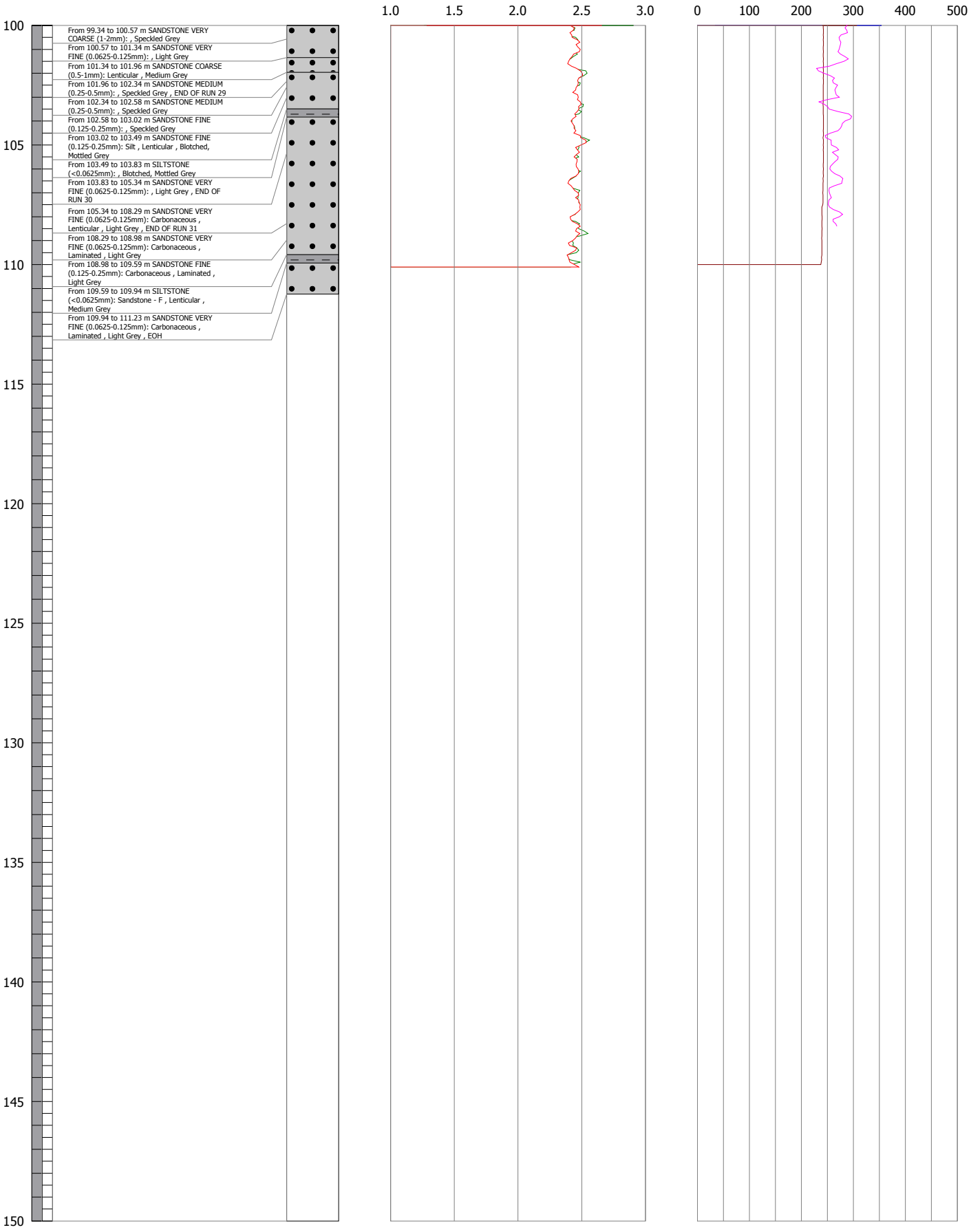
(PIEZO INSTALLATION)

Long Density - Red

Short Density - Green

Caliper (mm) - Maroon

Gamma - Blue **Sonic - Pink**



BOREHOLE LOG

CLIENT:
PROJECT:
LOCATION: Bylong

SURFACE LEVEL: 323.45 AHD
EASTING: 231141.98
NORTHING: 6408585.11
DIP/AZIMUTH: 90°/--

BORE No: BY0513CH
PROJECT No: 49761.04
DATE: 18/2/2017
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
	0.2	SOIL							TOC = 0.75m
		MUDSTONE							
	3.6	SILTSTONE							
	5.0	SANDSTONE							
	6.7	SILTSTONE							
	8.5	MUDSTONE							
	12.44								
	13.27	COAL							
		SILTSTONE							
	19.92	SANDSTONE							
	21.71								
	22.56	MUDSTONE							
		SILTSTONE							
	29.04	COAL							
	31.01	SILTSTONE							
	38.1	CARBONACEOUS SHALE / MUDSTONE							
	39.26								
	39.87	SILTSTONE							
		SANDSTONE							
	43.33	MUDSTONE							From 0m to 94.7m grout
	48.5	SILTSTONE							From 0m to 95.35m, Class 18 Blank
	52.88	SANDSTONE						12-10-17	

RIG: Lucas **DRILLER:** Lucas **LOGGED:** McMeekan **CASING:**

TYPE OF BORING:

WATER OBSERVATIONS: Free groundwater observed at 56.0m on 21.10.17

REMARKS: For full borehole log see Bylong: Drillhole Summary BY0513CH

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT:
PROJECT:
LOCATION: Bylong

SURFACE LEVEL: 323.45 AHD
EASTING: 231141.98
NORTHING: 6408585.11
DIP/AZIMUTH: 90°/--

BORE No: BY0513CH
PROJECT No: 49761.04
DATE: 18/2/2017
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
	61	SANDSTONE *(continued)*							
	68.33								
	68.78	COAL							
	70.05	MUDSTONE							
	71.03	COAL (ULNB, ULNC)							
	73.59	SILTSTONE							
	76.65	SANDSTONE							
	78.24	SILTSTONE							
	83.12	SANDSTONE							
	83.53	COAL (ULNG)							
	85.75	SILTSTONE							
	90.72	COAL (ULAN SEAM)							
	92.08	SILTSTONE							
	95.2	SANDSTONE							
	95.7	CONGLOMERATE							
	99.34	COAL (COGGAN SEAM)							
	111.23	SANDSTONE							From 94.7m to 94.8m, bentonite From 94.8m to 99.85m, 5mm gravel From 95.35m to 99.85m, Class 18 Screen From 99.85m to 100.85m, Class 18 Blank
		Bore discontinued at 111.23m							

RIG: Lucas **DRILLER:** Lucas **LOGGED:** McMeekan **CASING:**

TYPE OF BORING:

WATER OBSERVATIONS: Free groundwater observed at 56.0m on 21.10.17

REMARKS: For full borehole log see Bylong: Drillhole Summary BY0513CH

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
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BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

Bylong : Drillhole Summary

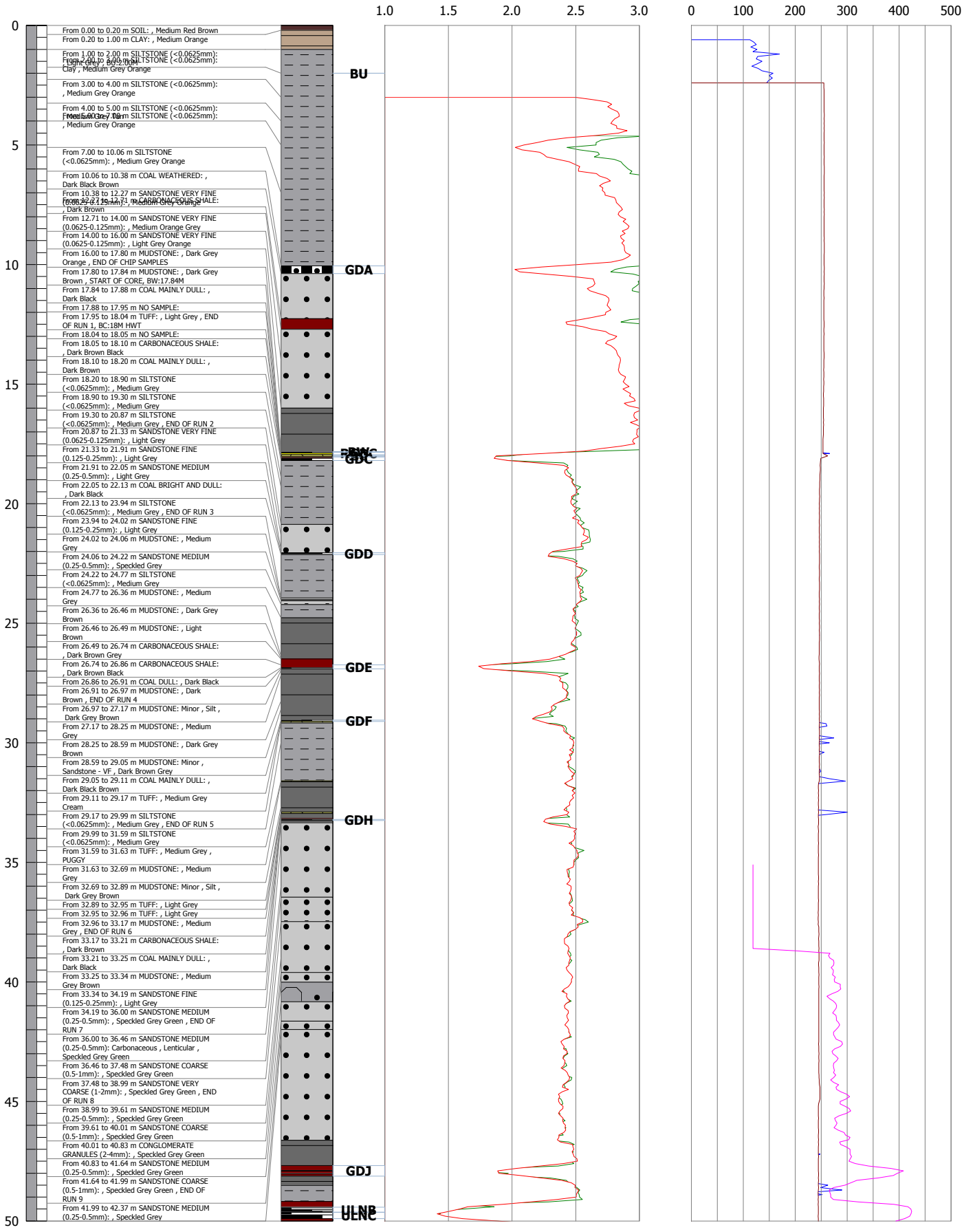
Hole Number : BY0514CH | **Hole Type** : Fully Cored | **Easting** : 231229.09

Date : 22/02/2017 | **Tenement** : AUTH287 | **Northing** : 6408493.68

Total Depth : 93.21 m | **Area** : Bylong Station | **Height** : 308.00 *MGA94_56S*

(PACKER TEST)

Long Density - Red
Short Density - Green
Caliper (mm) - Maroon
Gamma - Blue **Sonic - Pink**



Bylong : Drillhole Summary

Hole Number : BY0514CH
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Easting : 231229.09
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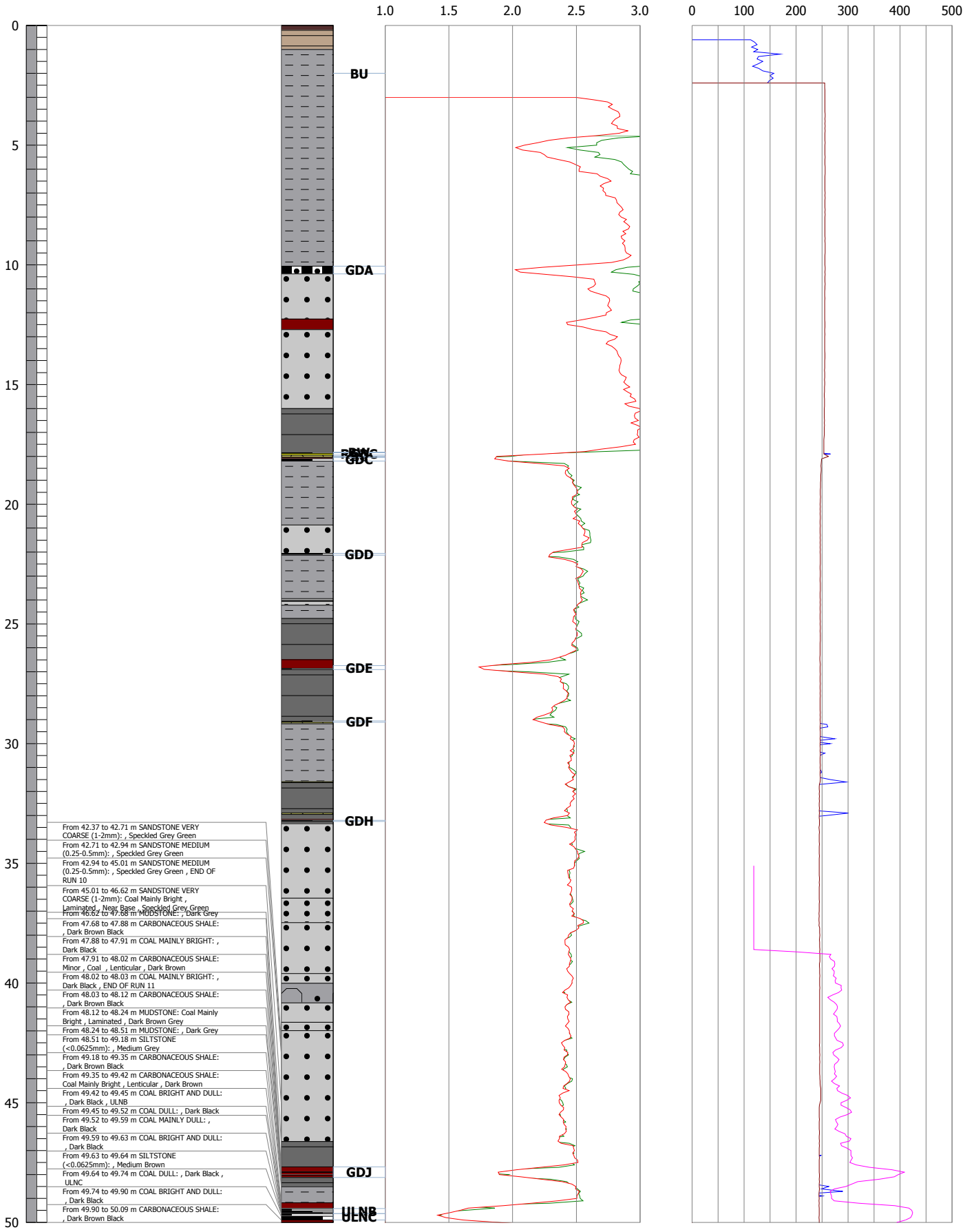

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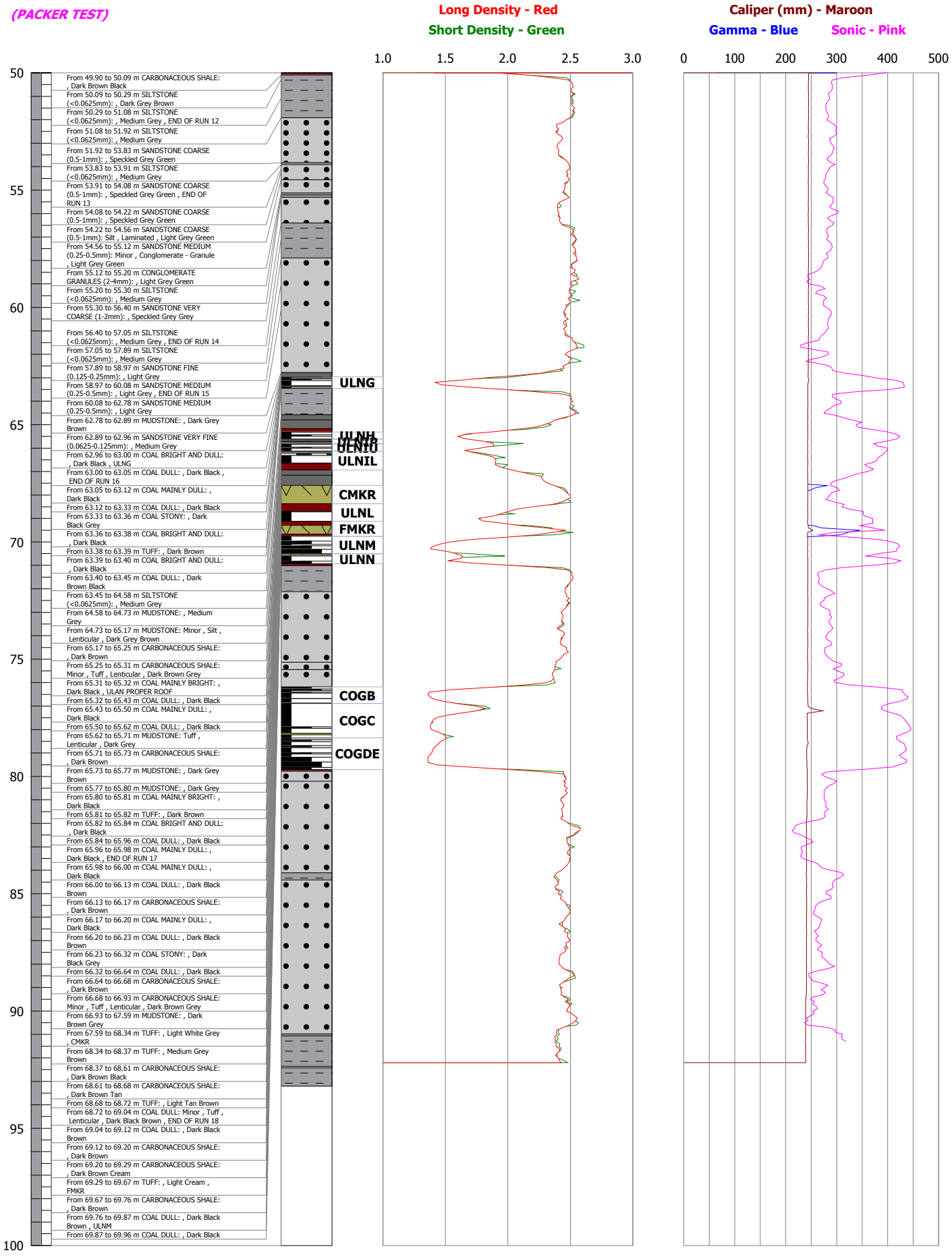

Bylong : Drillhole Summary

Hole Number : BY0514CH | **Hole Type** : Fully Cored | **Easting** : 231229.09

Date : 22/02/2017 | **Tenement** : AUTH287 | **Northing** : 6408493.68

Total Depth : 93.21 m | **Area** : Bylong Station | **Height** : 308.00 *MGA94_56S*

(PACKER TEST)

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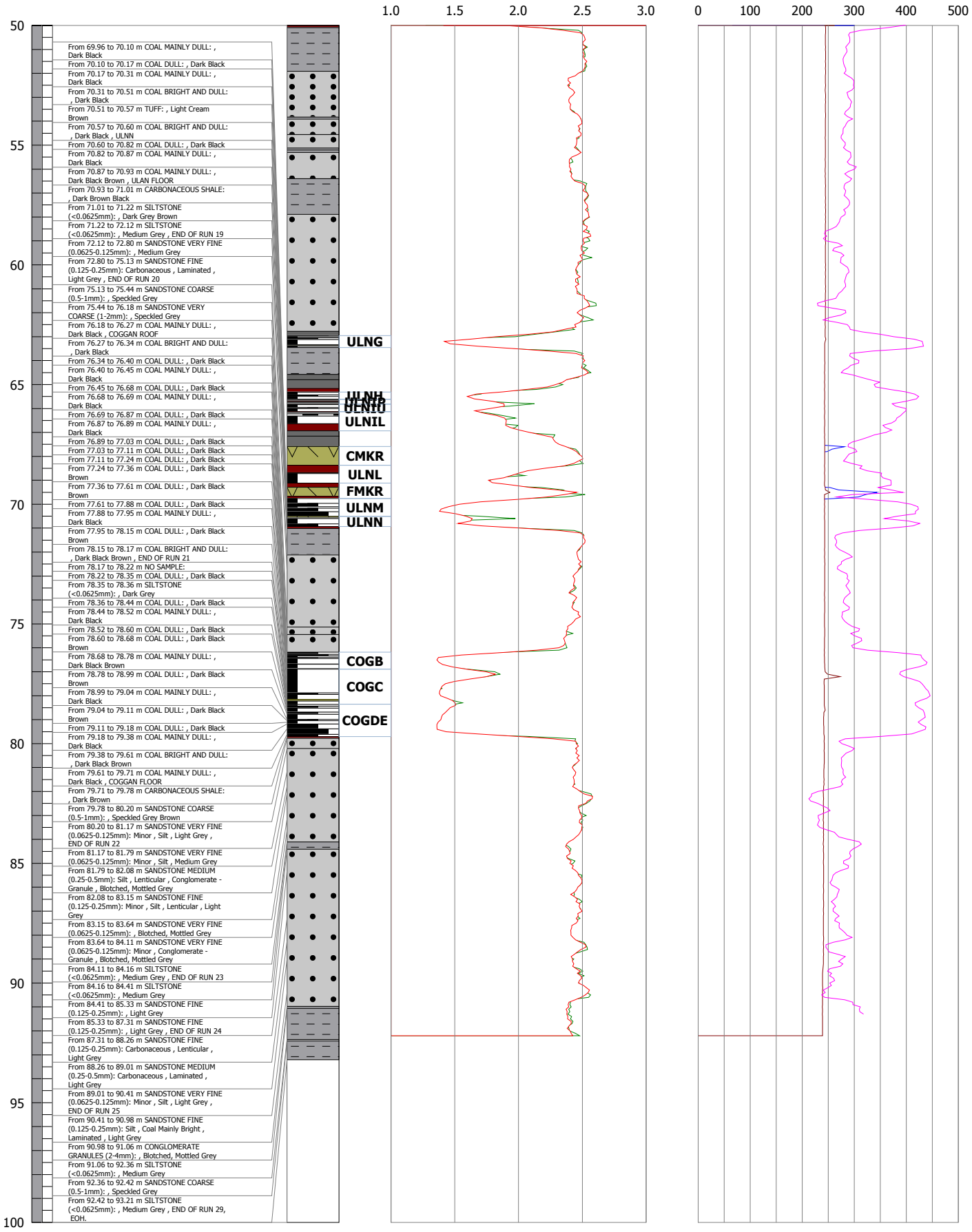
Short Density - Green
Caliper (mm) - Maroon
Gamma - Blue **Sonic - Pink**



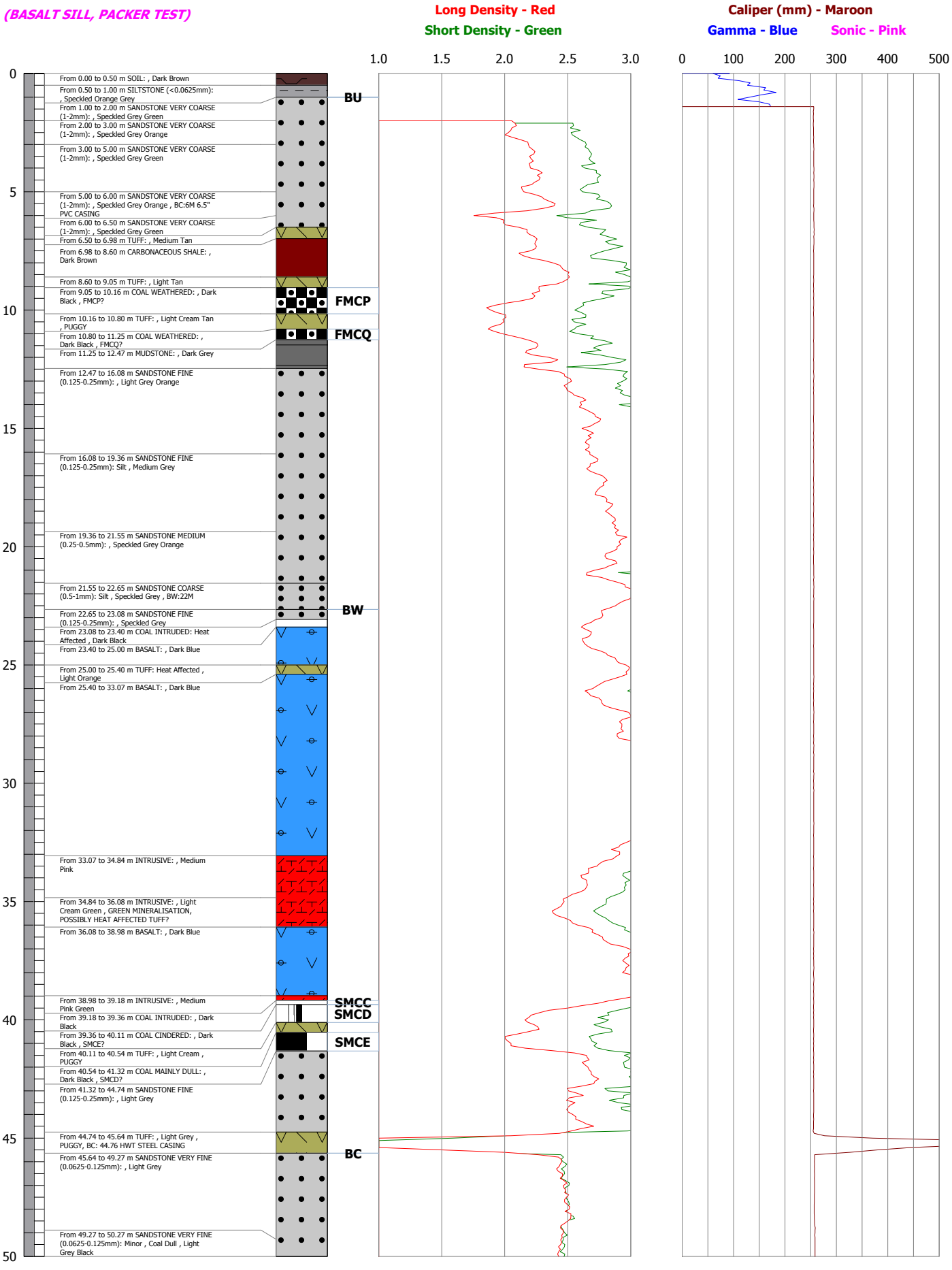
Bylong : Drillhole Summary

Hole Number : BY0516CH | **Hole Type** : Partially Cored | **Easting** : 231582.22

Date : 16/03/2017 | **Tenement** : AUTH287 | **Northing** : 6409088.77

Total Depth : 183.33 m | **Area** : Bylong Station | **Height** : 392.41 *MGA94_56S*

(BASALT SILL, PACKER TEST)



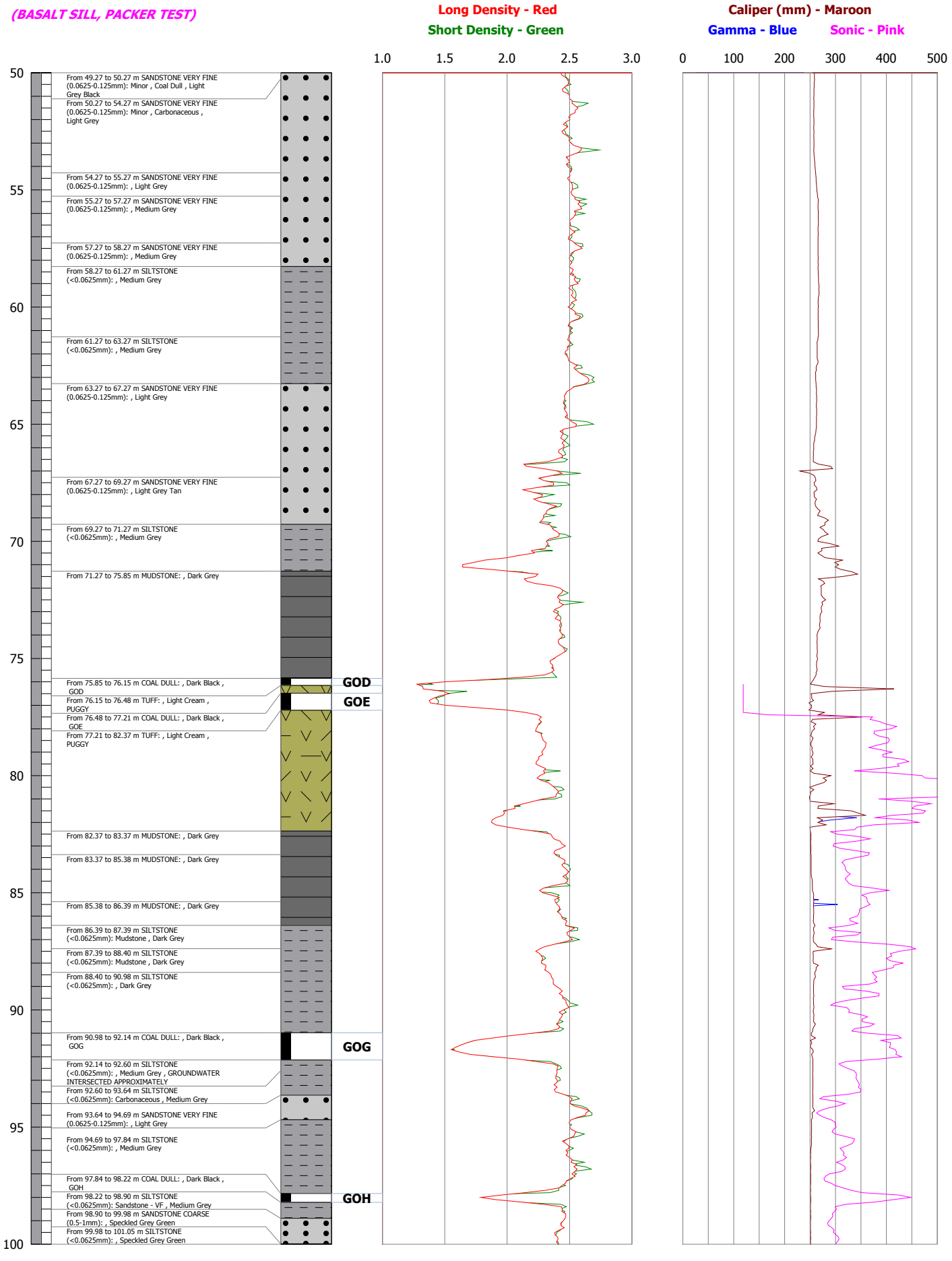
Bylong : Drillhole Summary

Hole Number : BY0516CH
Date : 16/03/2017
Total Depth : 183.33 m

Hole Type : Partially Cored
Tenement : AUTH287
Area : Bylong Station

Easting : 231582.22
Northing : 6409088.77
Height : 392.41 *MGA94_56S*

(BASALT SILL, PACKER TEST)



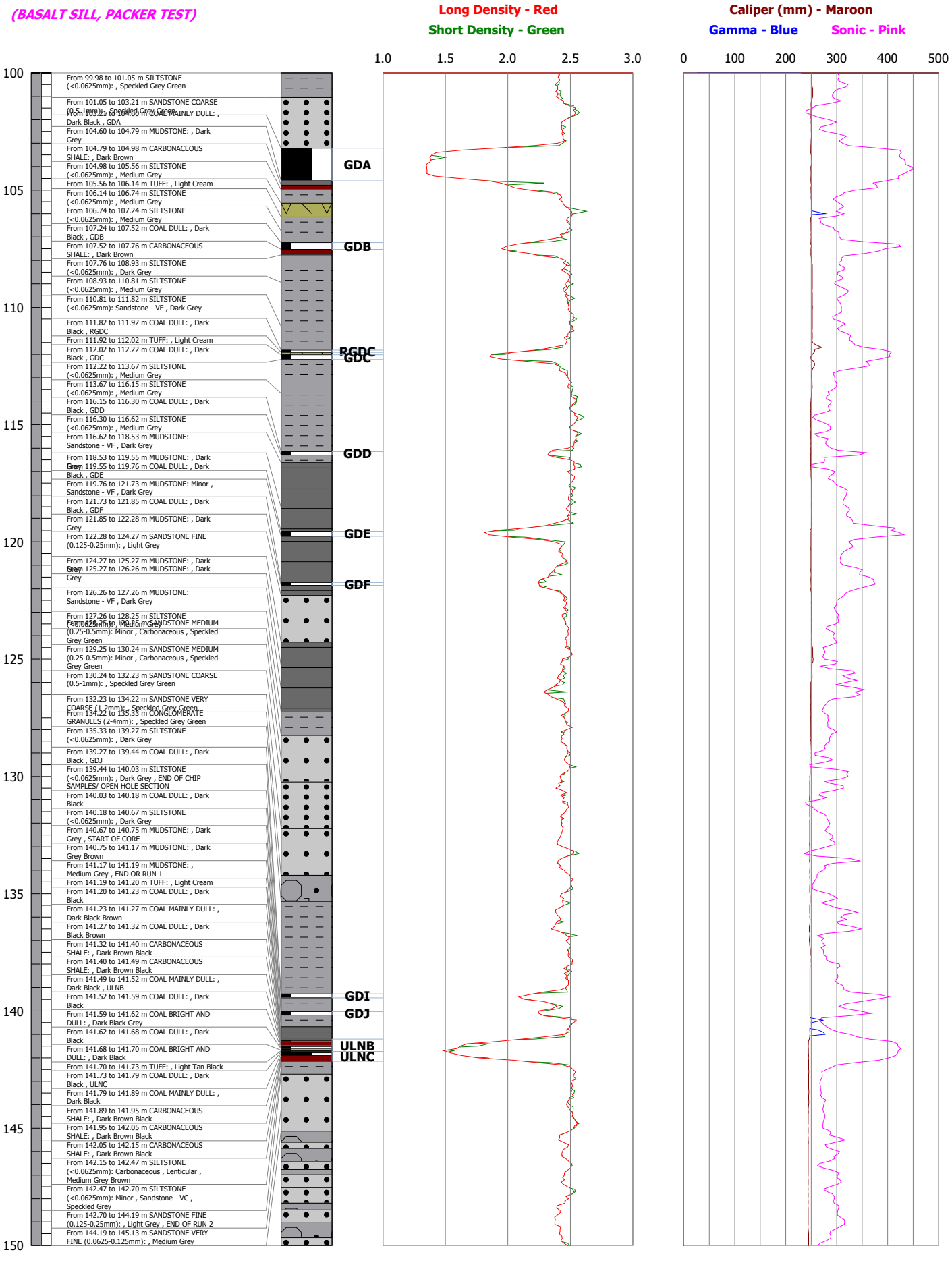
Bylong : Drillhole Summary

Hole Number : BY0516CH | **Hole Type** : Partially Cored | **Easting** : 231582.22

Date : 16/03/2017 | **Tenement** : AUTH287 | **Northing** : 6409088.77

Total Depth : 183.33 m | **Area** : Bylong Station | **Height** : 392.41 *MGA94_56S*

(BASALT SILL, PACKER TEST)



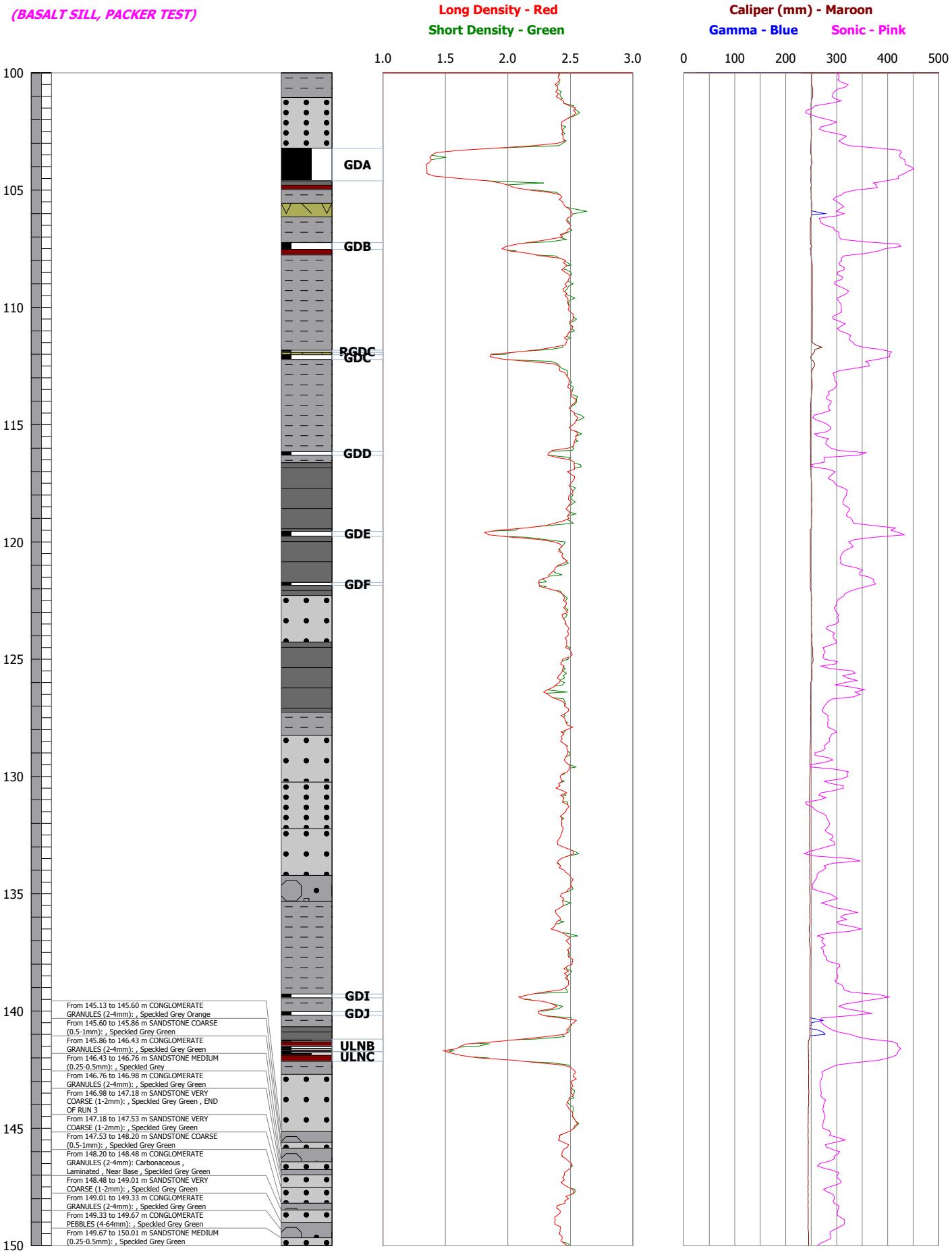
Bylong : Drillhole Summary

Hole Number : BY0516CH
Date : 16/03/2017
Total Depth : 183.33 m

Hole Type : Partially Cored
Tenement : AUTH287
Area : Bylong Station

Easting : 231582.22
Northing : 6409088.77
Height : 392.41 *MGA94_56S*

(BASALT SILL, PACKER TEST)



Bylong : Drillhole Summary

Hole Number : BY0516CH | **Hole Type** : Partially Cored | **Easting** : 231582.22

Date : 16/03/2017 | **Tenement** : AUTH287 | **Northing** : 6409088.77

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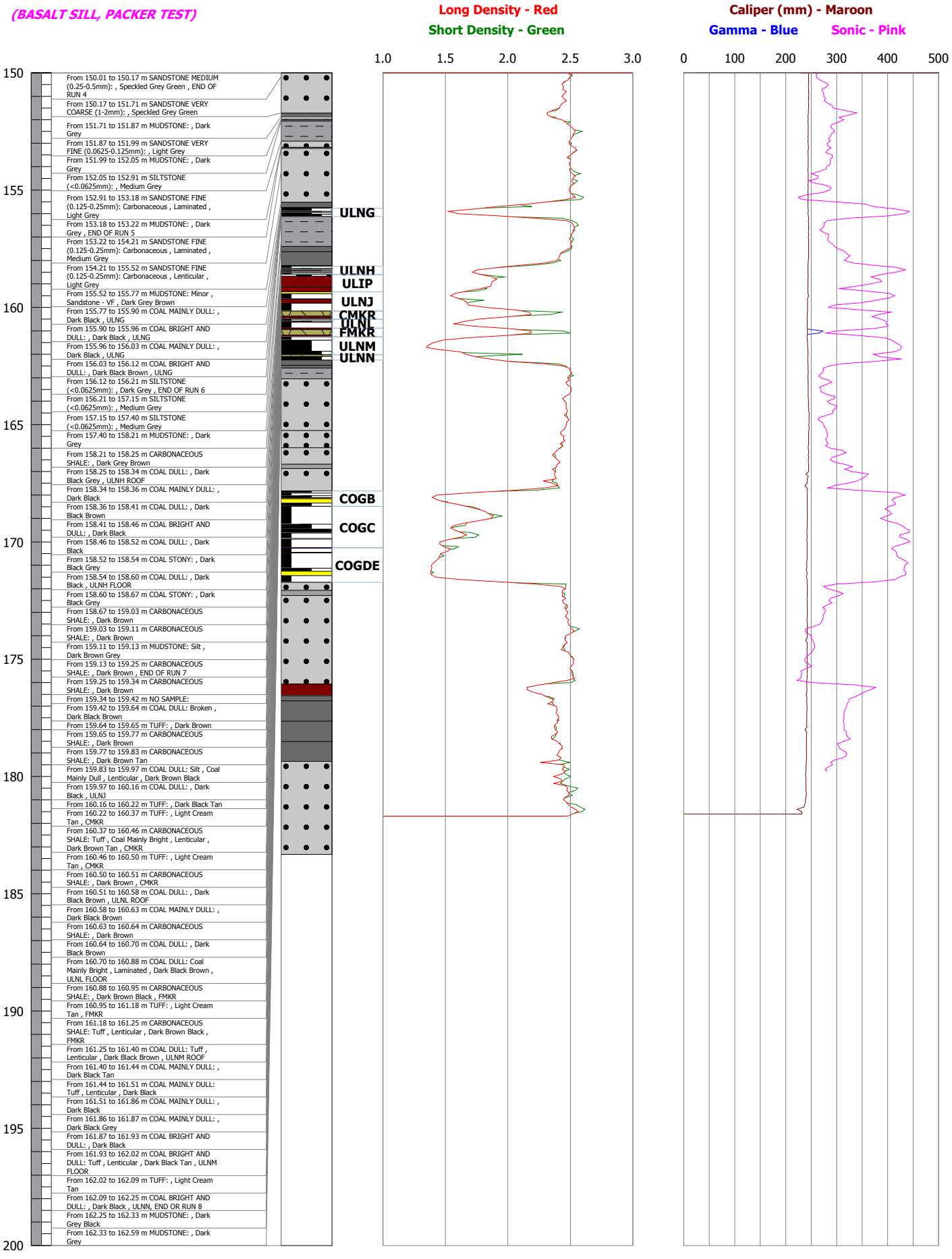


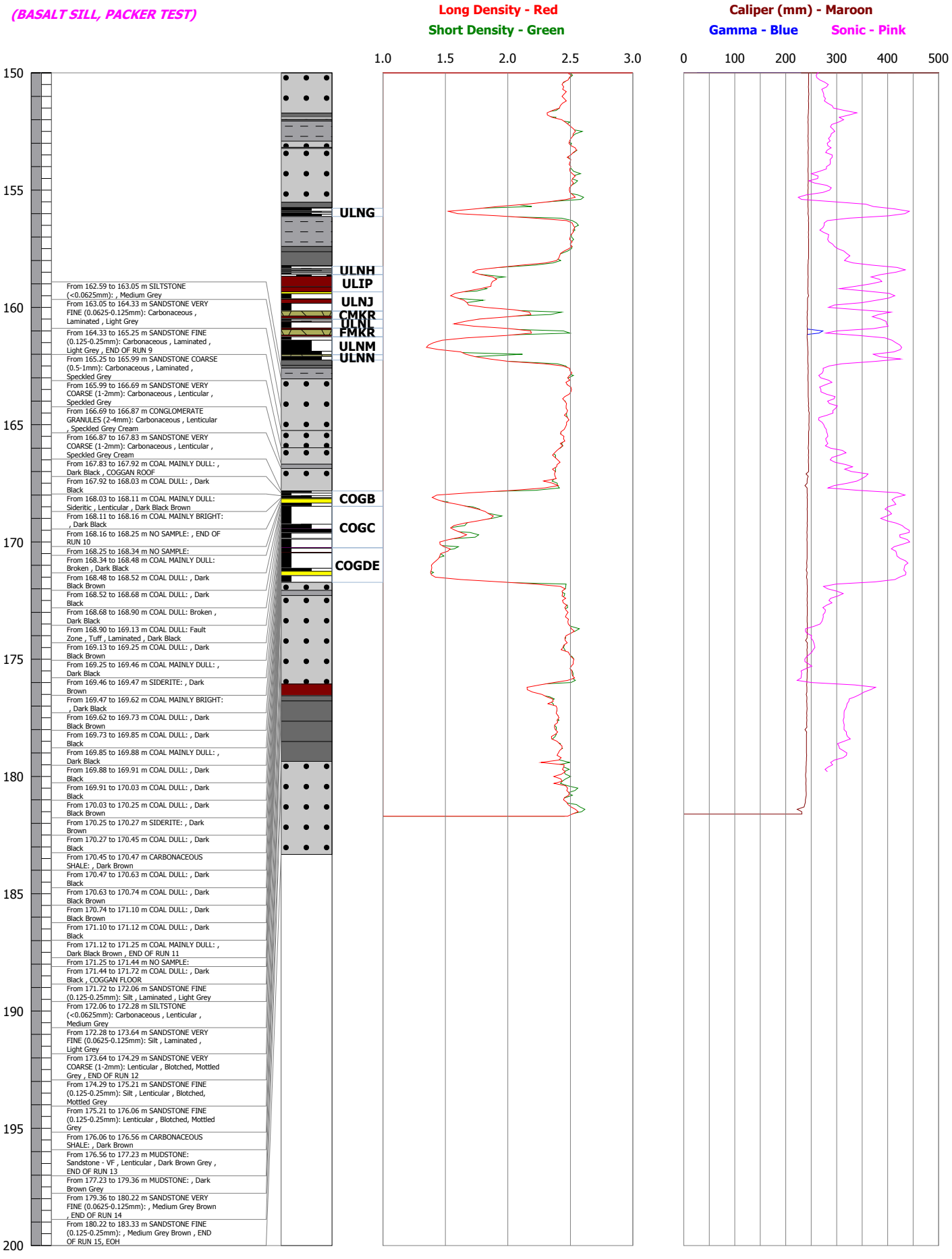
Bylong : Drillhole Summary

Hole Number : BY0516CH | **Hole Type** : Partially Cored | **Easting** : 231582.22

Date : 16/03/2017 | **Tenement** : AUTH287 | **Northing** : 6409088.77

Total Depth : 183.33 m | **Area** : Bylong Station | **Height** : 392.41 *MGA94_56S*

(BASALT SILL, PACKER TEST)



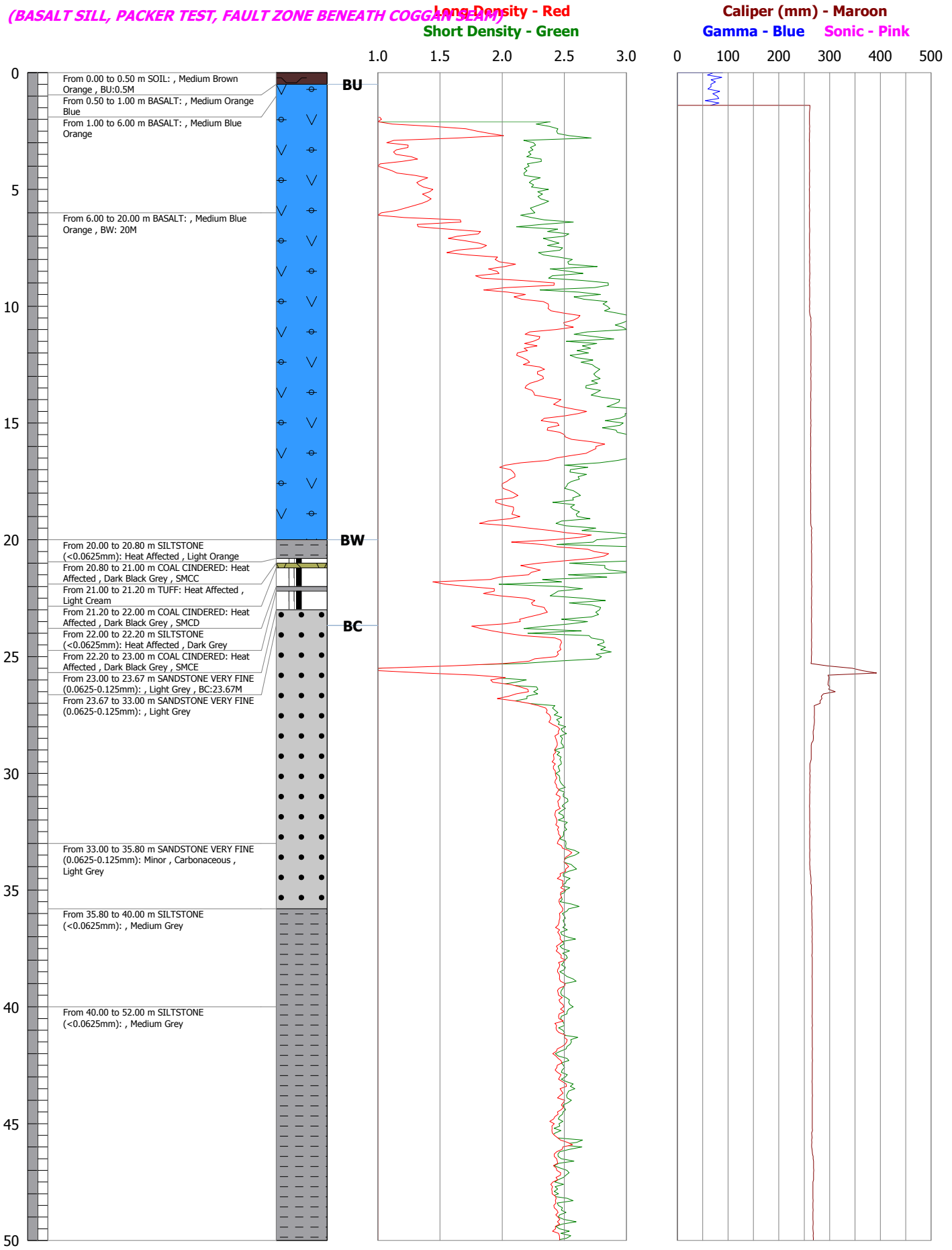
Bylong : Drillhole Summary

Number : BY0527CH **Hole Type** : Partially Cored **Easting** : 231936.51

Date : 21/05/2017 **Tenement** : AUTH287 **Northing** : 6409489.48

Total Depth : 174.31 m **Area** : Bylong Station **Height** : 377.43 ***MGA94_56S***

(BASALT SILL, PACKER TEST, FAULT ZONE BENEATH COGGAN SEAM)



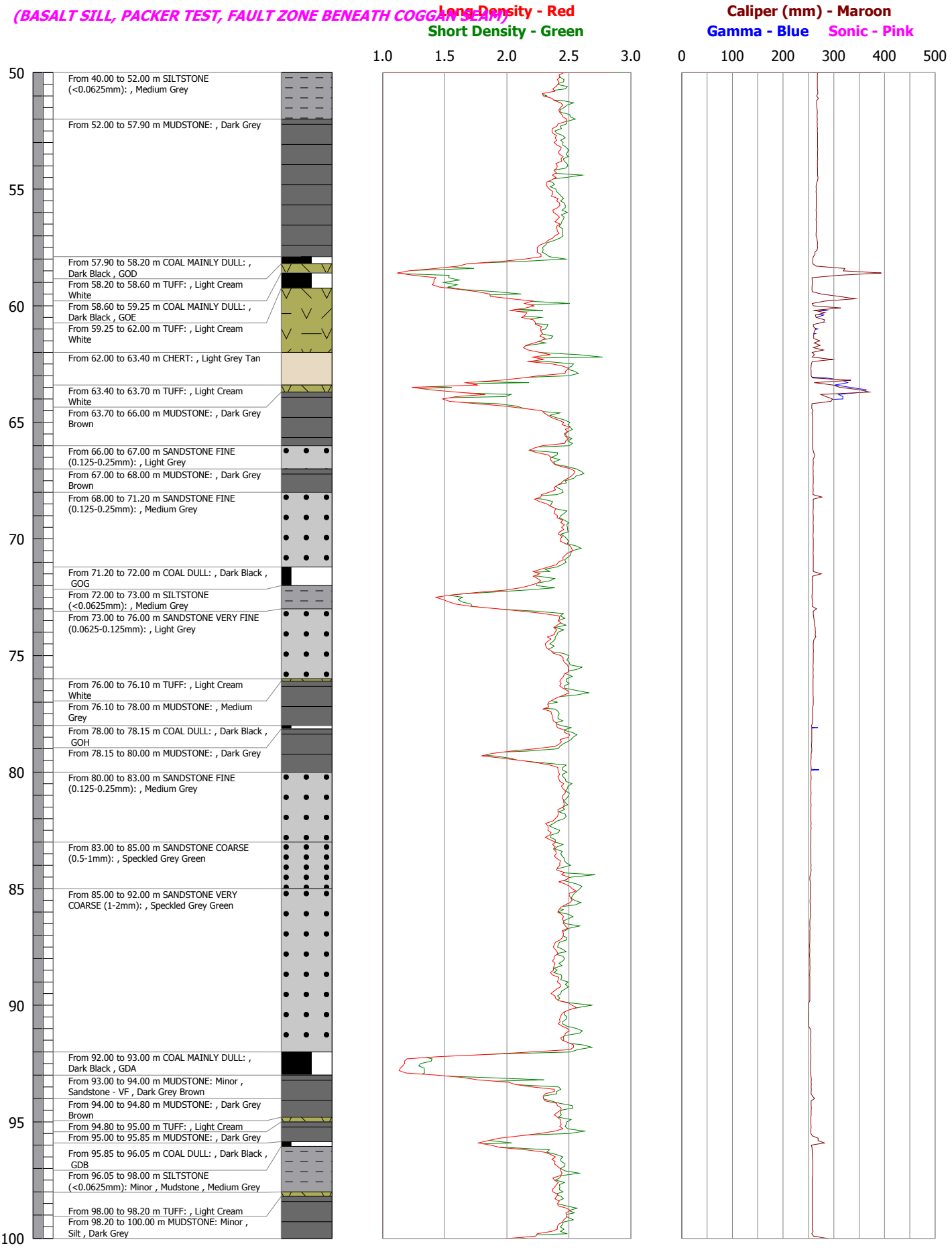
Bylong : Drillhole Summary

Number : BY0527CH **Hole Type** : Partially Cored **Easting** : 231936.51

Date : 21/05/2017 **Tenement** : AUTH287 **Northing** : 6409489.48

Total Depth : 174.31 m **Area** : Bylong Station **Height** : 377.43 ***MGA94_56S***

(BASALT SILL, PACKER TEST, FAULT ZONE BENEATH COGGAN SEAM)



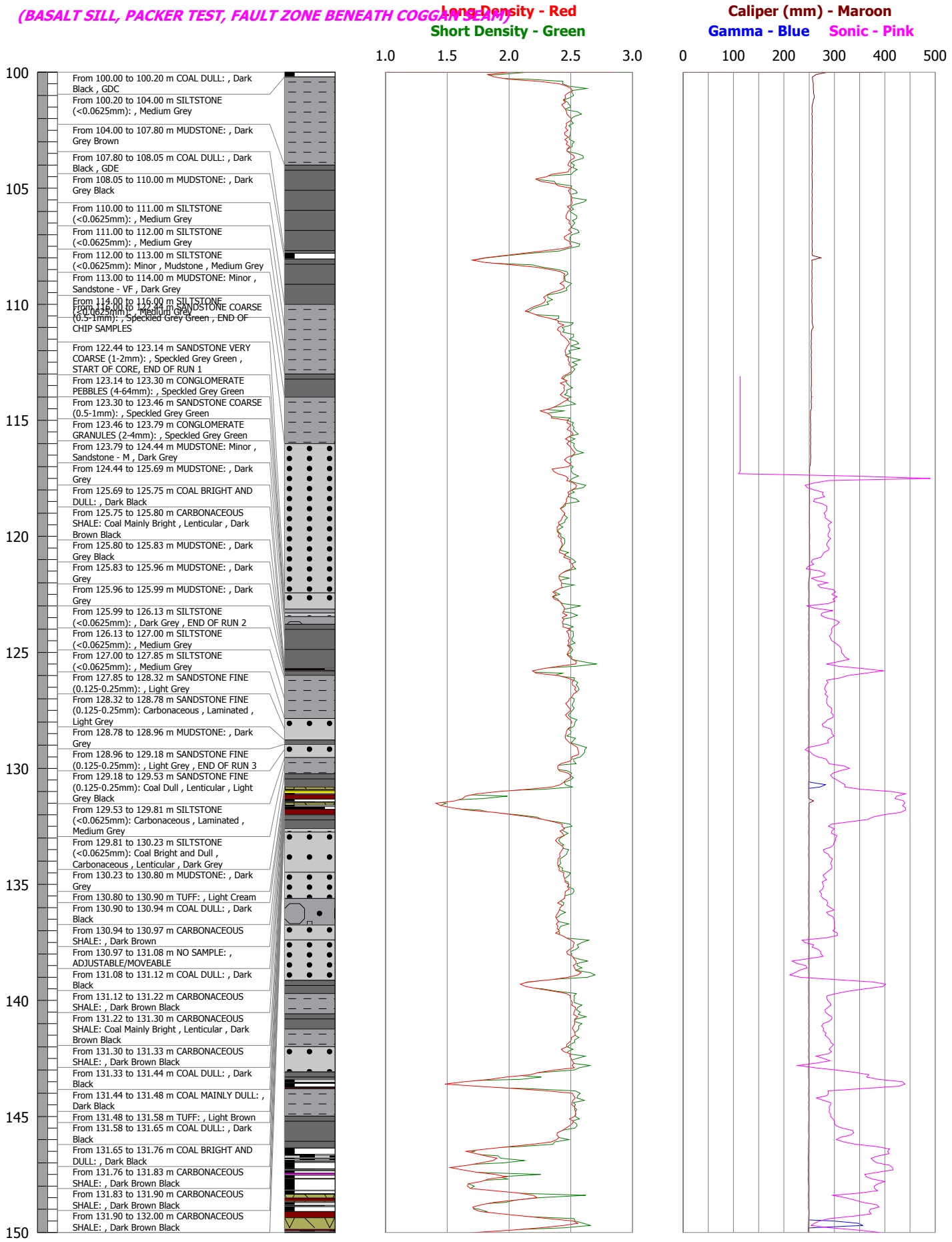
Bylong : Drillhole Summary

Number : BY0527CH **Hole Type** : Partially Cored **Easting** : 231936.51

Date : 21/05/2017 **Tenement** : AUTH287 **Northing** : 6409489.48

Total Depth : 174.31 m **Area** : Bylong Station **Height** : 377.43 ***MGA94_56S***

(BASALT SILL, PACKER TEST, FAULT ZONE BENEATH COGGAN SEAM)



Bylong : Drillhole Summary

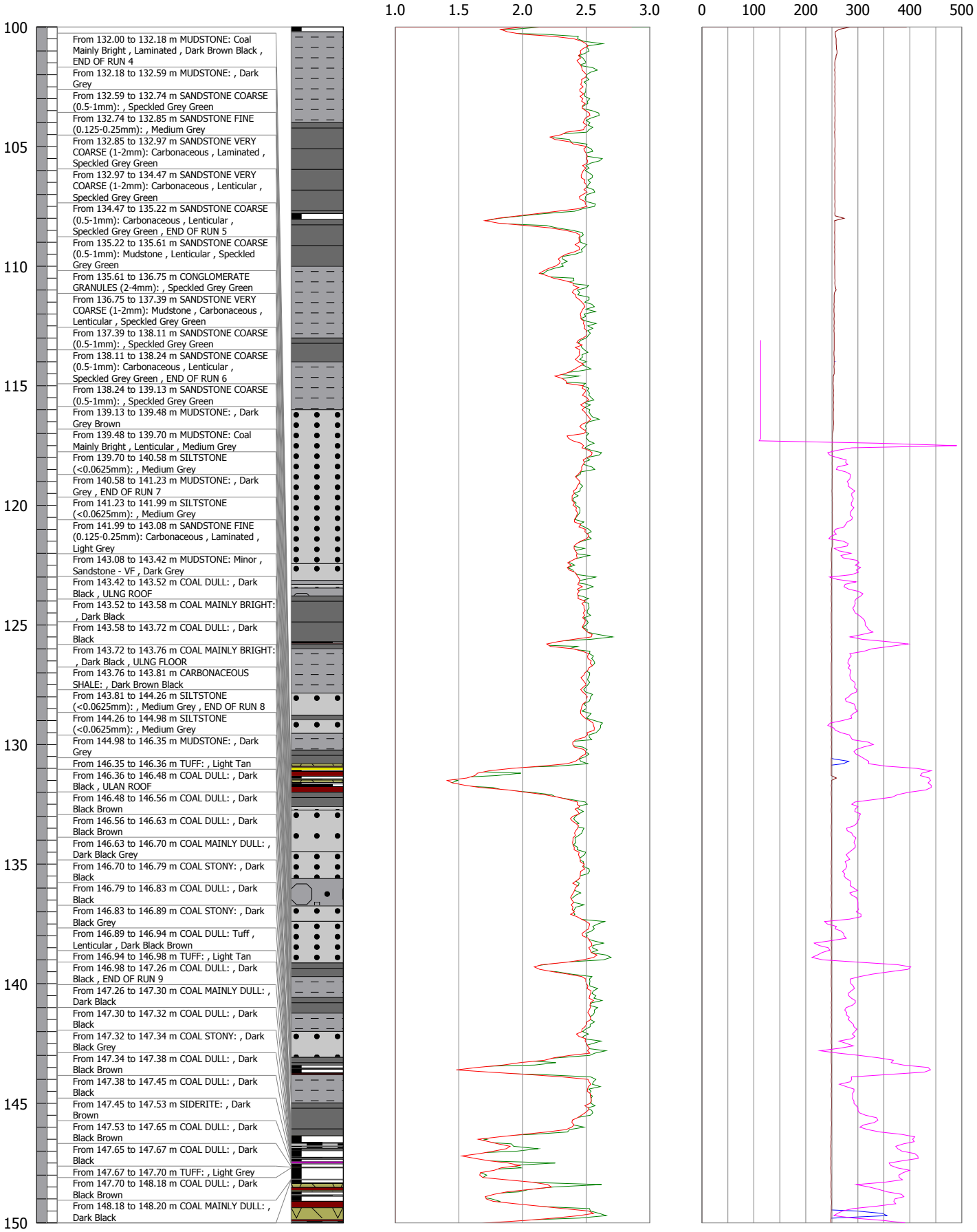
Number : BY0527CH **Hole Type** : Partially Cored **Easting** : 231936.51

Date : 21/05/2017 **Tenement** : AUTH287 **Northing** : 6409489.48

Total Depth : 174.31 m **Area** : Bylong Station **Height** : 377.43 ***MGA94_56S***

(BASALT SILL, PACKER TEST, FAULT ZONE BENEATH COGGAN SEAM)

Long Density - Red
Short Density - Green
Caliper (mm) - Maroon
Gamma - Blue **Sonic - Pink**



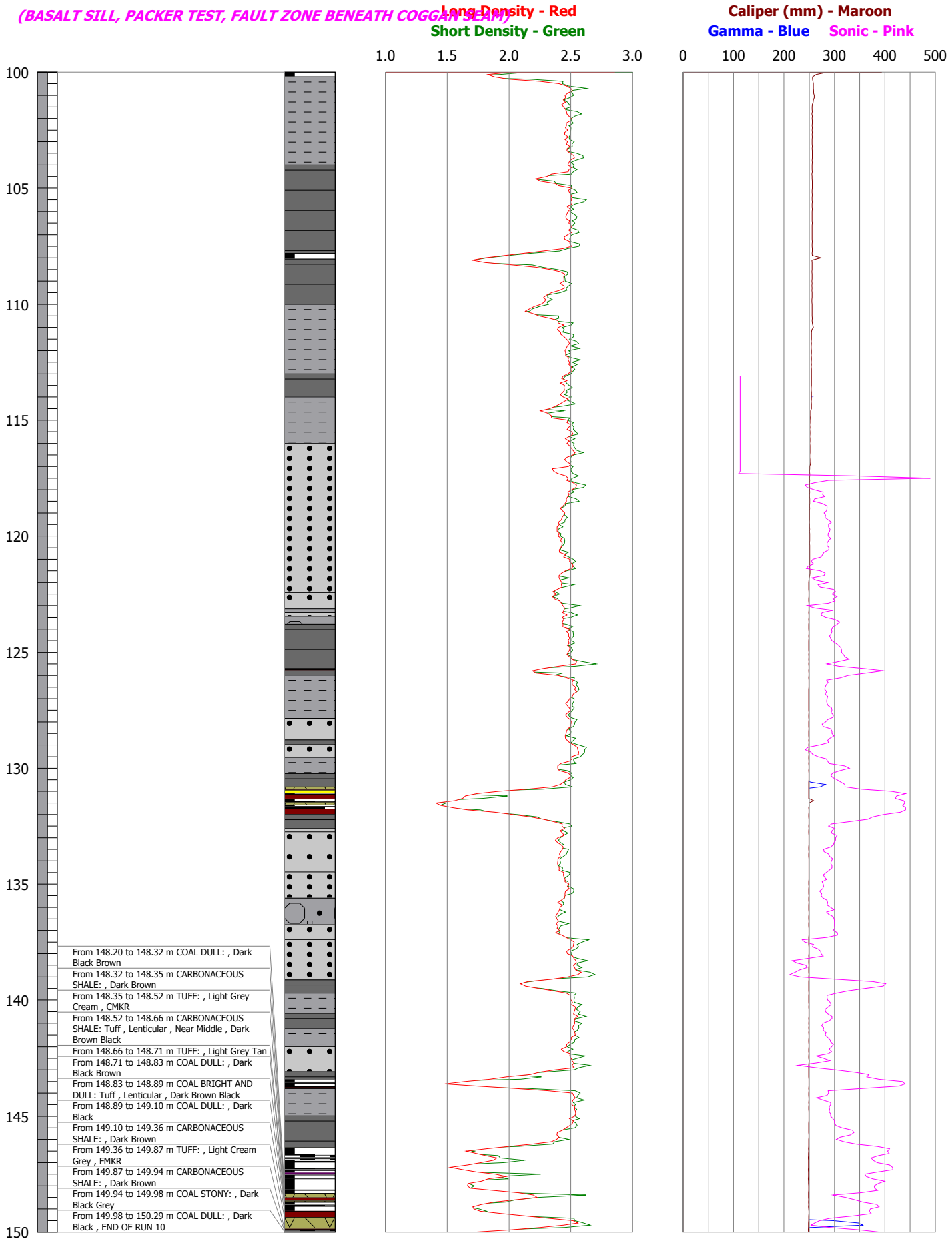
Bylong : Drillhole Summary

Number : BY0527CH **Hole Type** : Partially Cored **Easting** : 231936.51

Date : 21/05/2017 **Tenement** : AUTH287 **Northing** : 6409489.48

Total Depth : 174.31 m **Area** : Bylong Station **Height** : 377.43 ***MGA94_56S***

(BASALT SILL, PACKER TEST, FAULT ZONE BENEATH COGGAN SEAM)



Bylong : Drillhole Summary

Number : BY0527CH **Hole Type** : Partially Cored **Easting** : 231936.51

Date : 21/05/2017 **Tenement** : AUTH287 **Northing** : 6409489.48

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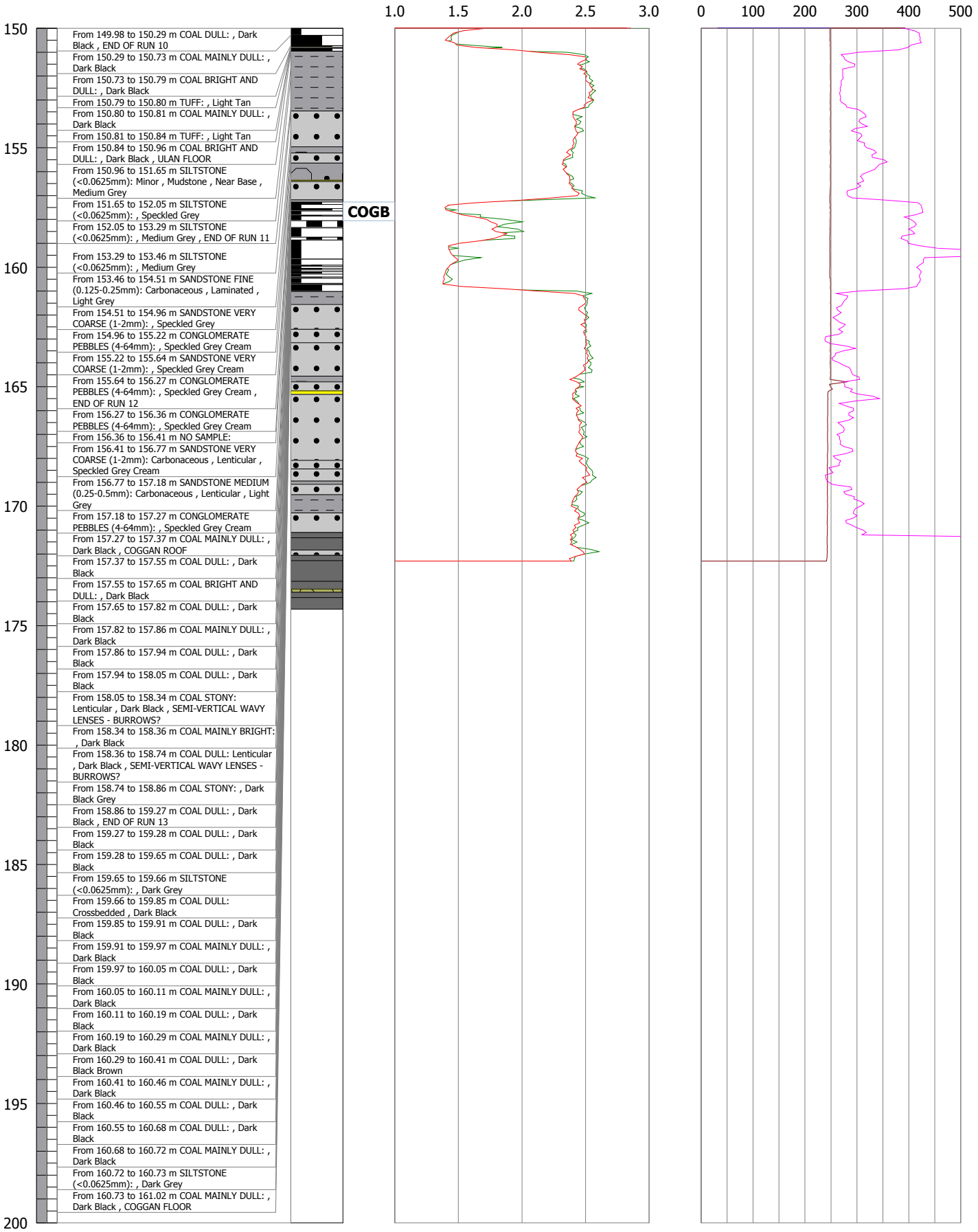
(BASALT SILL, PACKER TEST, FAULT ZONE BENEATH COGGAN SEAM)

Long Density - Red
Short Density - Green
Caliper (mm) - Maroon
Gamma - Blue **Sonic - Pink**



Bylong : Drillhole Summary

Number : BY0527CH **Hole Type** : Partially Cored **Easting** : 231936.51

Date : 21/05/2017 **Tenement** : AUTH287 **Northing** : 6409489.48

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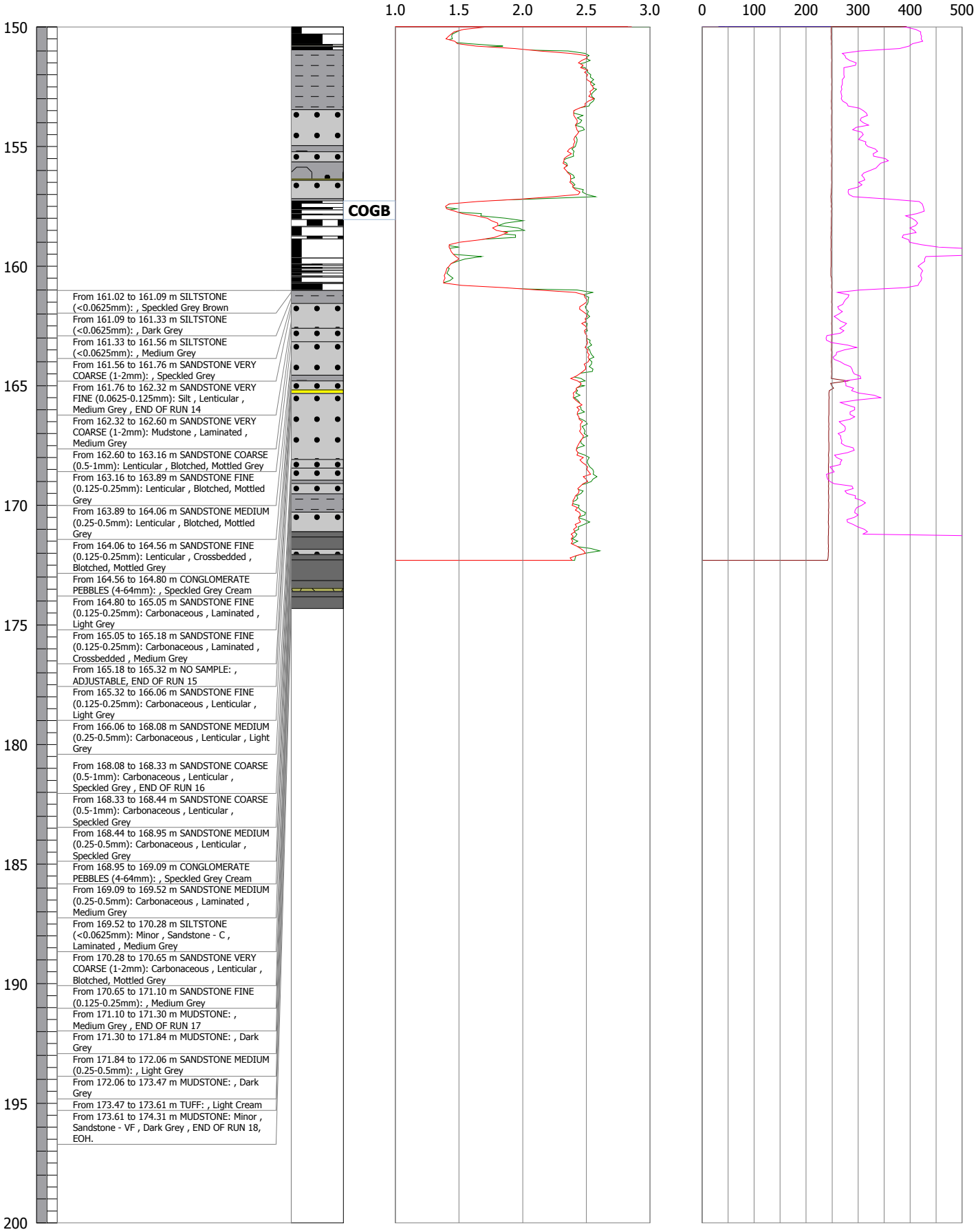
(BASALT SILL, PACKER TEST, FAULT ZONE BENEATH COGGAN SEAM)

Long Density - Red
Short Density - Green
Caliper (mm) - Maroon
Gamma - Blue **Sonic - Pink**



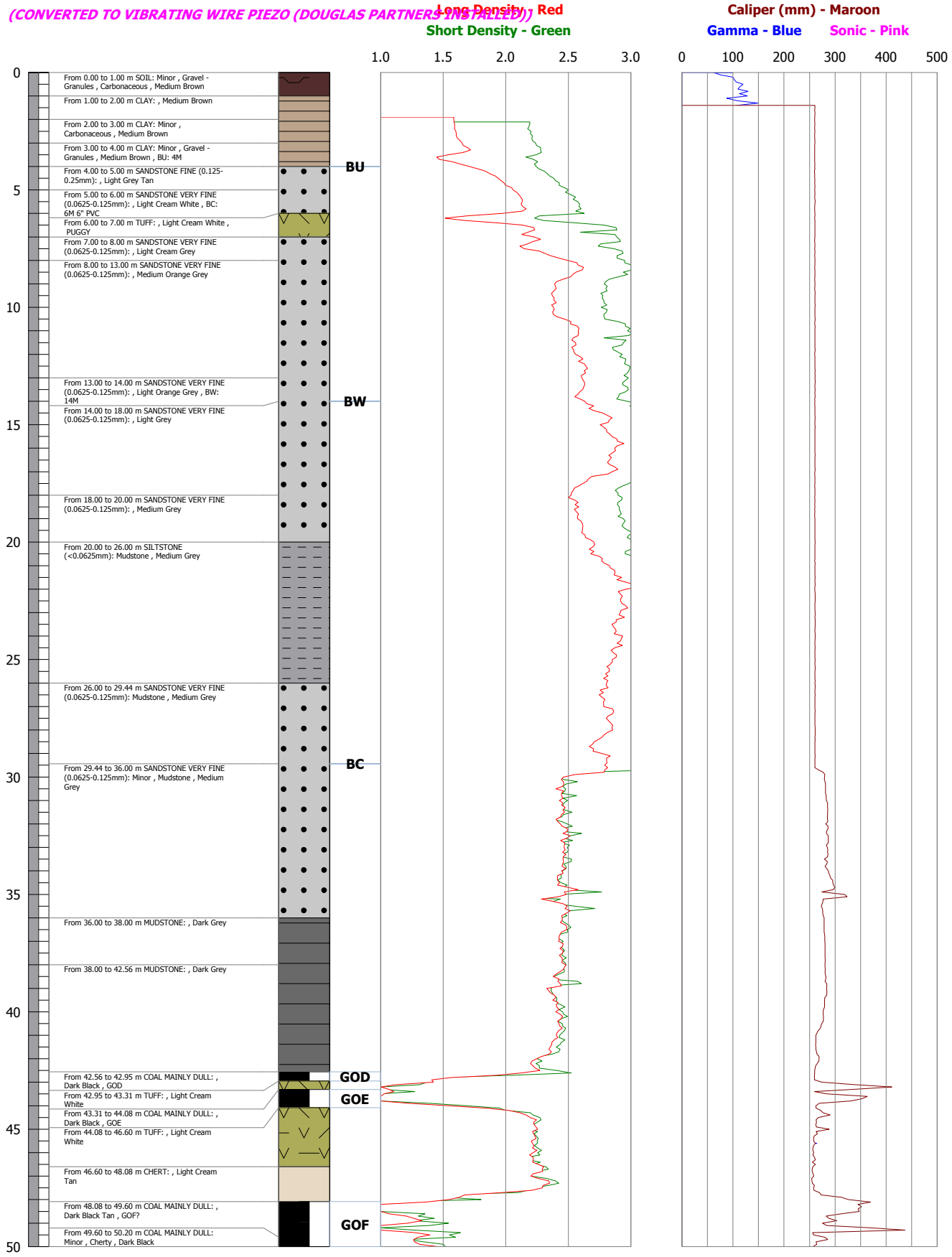
Bylong : Drillhole Summary

Hole Number : BY0531CH **Hole Type** : Partially Cored **Easting** : 231959.42

Date : 5/06/2017 **Tenement** : AUTH287 **Northing** : 6409600.25

Total Depth : 159.25 m **Area** : Bylong Station **Height** : 358.82 ***MGA94_56S***

(CONVERTED TO VIBRATING WIRE PIEZO (DOUGLAS PARTNERS INSTALLED))



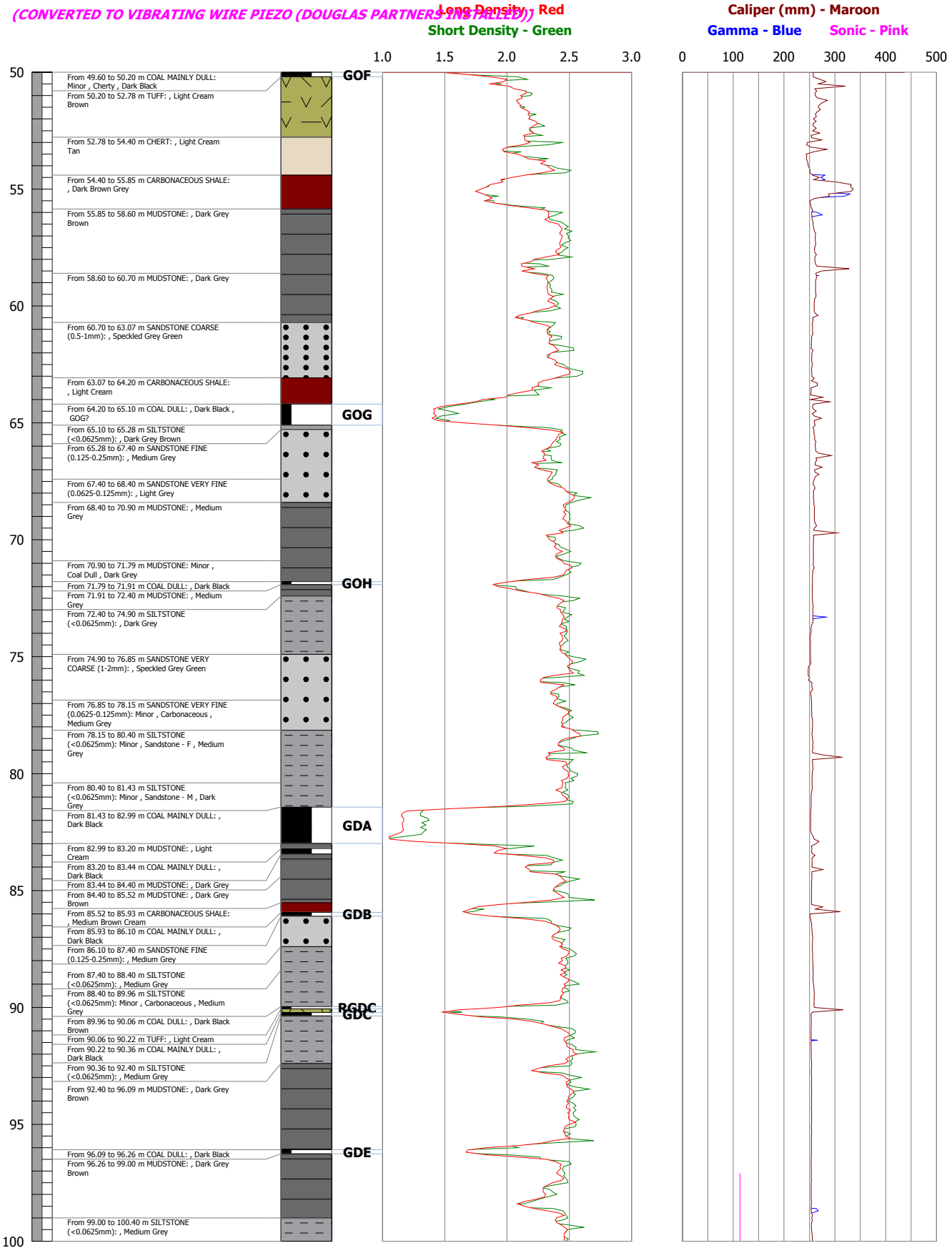
Bylong : Drillhole Summary

Hole Number : BY0531CH **Hole Type** : Partially Cored **Easting** : 231959.42

Date : 5/06/2017 **Tenement** : AUTH287 **Northing** : 6409600.25

Total Depth : 159.25 m **Area** : Bylong Station **Height** : 358.82 ***MGA94_56S***

(CONVERTED TO VIBRATING WIRE PIEZO (DOUGLAS PARTNERS INSTALLED))



Bylong : Drillhole Summary

Hole Number : BY0531CH **Hole Type** : Partially Cored **Easting** : 231959.42

Date : 5/06/2017 **Tenement** : AUTH287 **Northing** : 6409600.25

Total Depth : 159.25 m **Area** : Bylong Station **Height** : 358.82 ***MGA94_56S***

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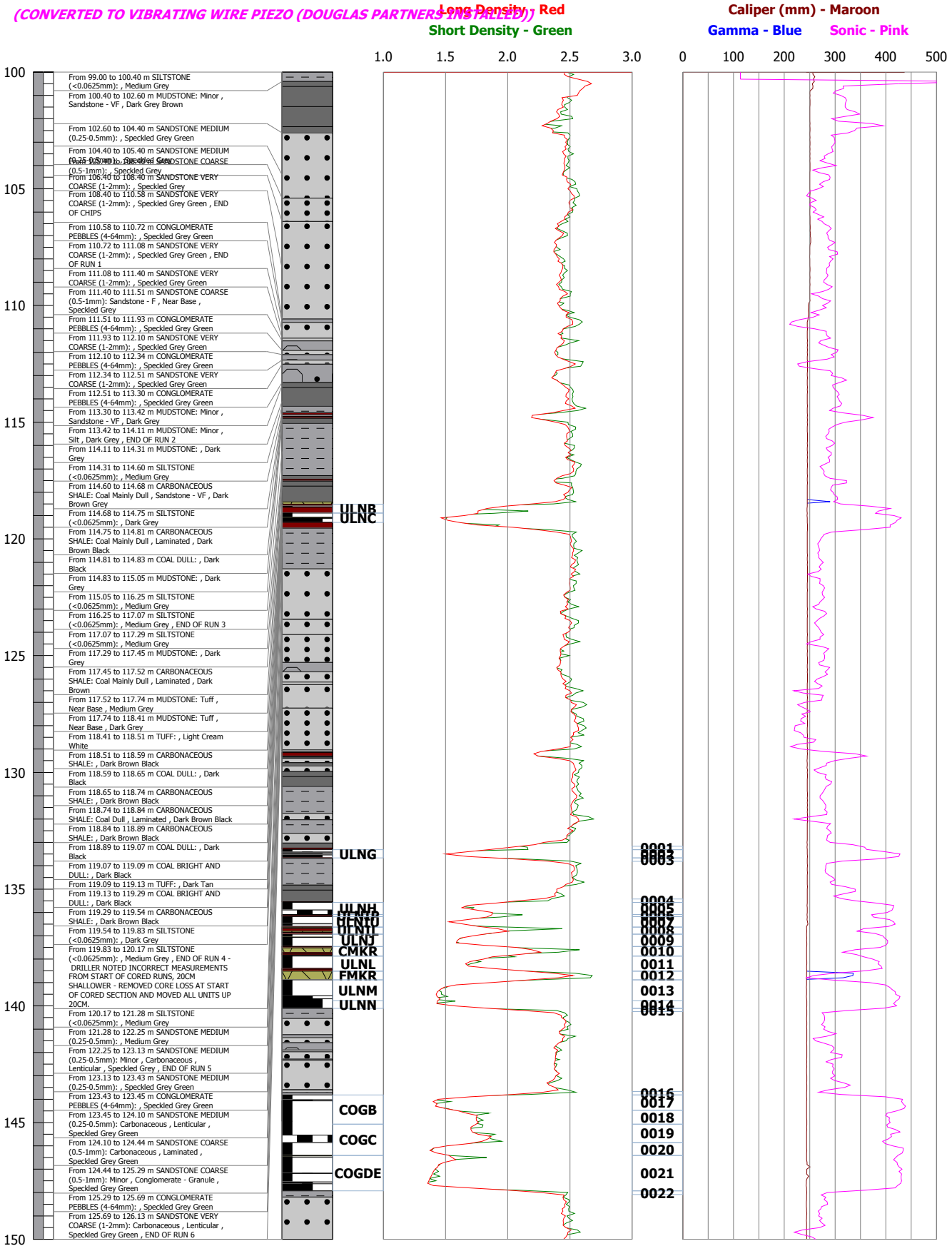


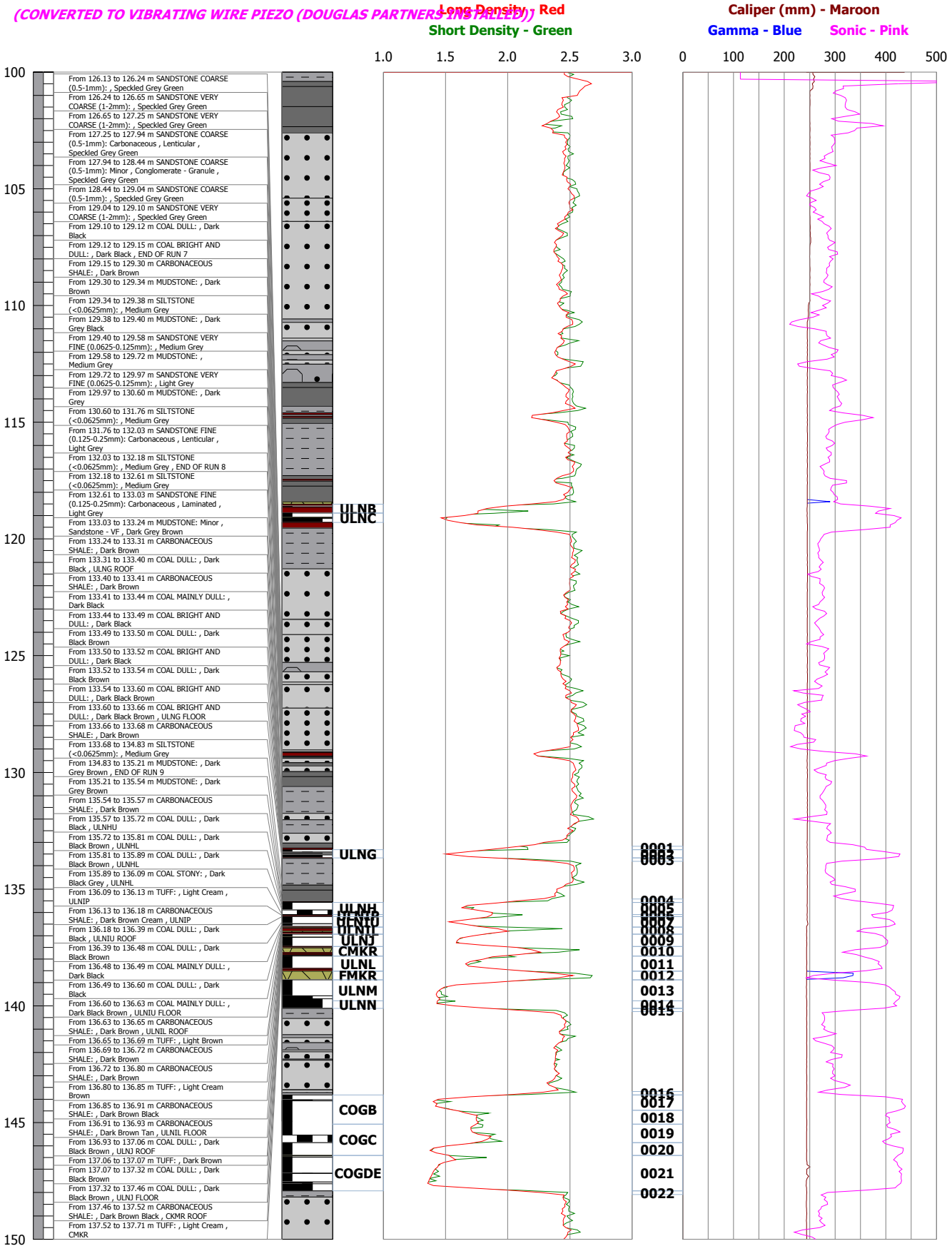
Bylong : Drillhole Summary

Hole Number : BY0531CH **Hole Type** : Partially Cored **Easting** : 231959.42

Date : 5/06/2017 **Tenement** : AUTH287 **Northing** : 6409600.25

Total Depth : 159.25 m **Area** : Bylong Station **Height** : 358.82 ***MGA94_56S***

(CONVERTED TO VIBRATING WIRE PIEZO (DOUGLAS PARTNERS INSTALLED))



Bylong : Drillhole Summary

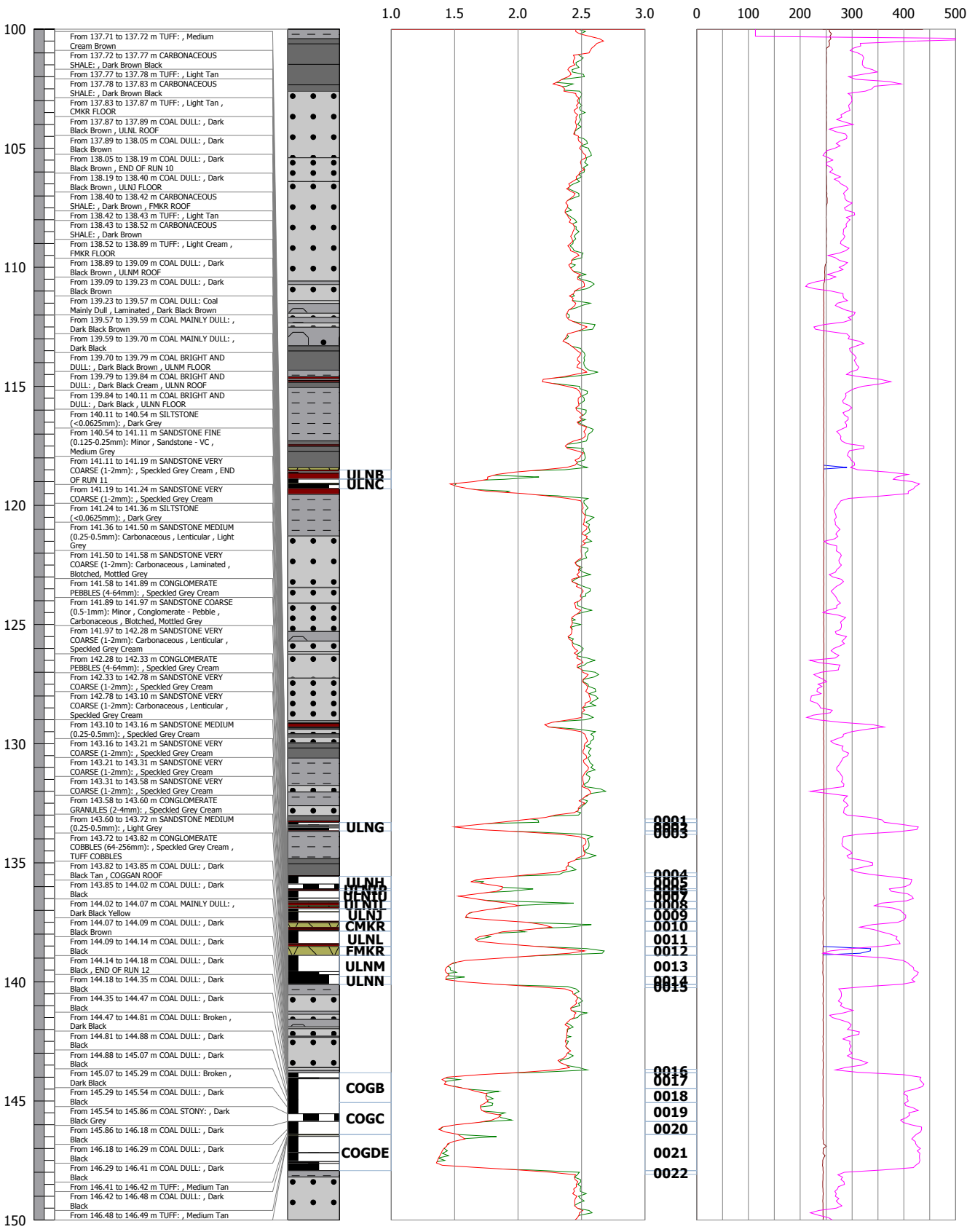
Hole Number : BY0531CH **Hole Type** : Partially Cored **Easting** : 231959.42

Date : 5/06/2017 **Tenement** : AUTH287 **Northing** : 6409600.25

Total Depth : 159.25 m **Area** : Bylong Station **Height** : 358.82 ***MGA94_56S***

(CONVERTED TO VIBRATING WIRE PIEZO (DOUGLAS PARTNERS INSTALLED))

Long Density - Red
Short Density - Green
Caliper (mm) - Maroon
Gamma - Blue
Sonic - Pink



Bylong : Drillhole Summary

Hole Number : BY0531CH **Hole Type** : Partially Cored **Easting** : 231959.42

Date : 5/06/2017 **Tenement** : AUTH287 **Northing** : 6409600.25

Total Depth : 159.25 m **Area** : Bylong Station **Height** : 358.82 ***MGA94_56S***

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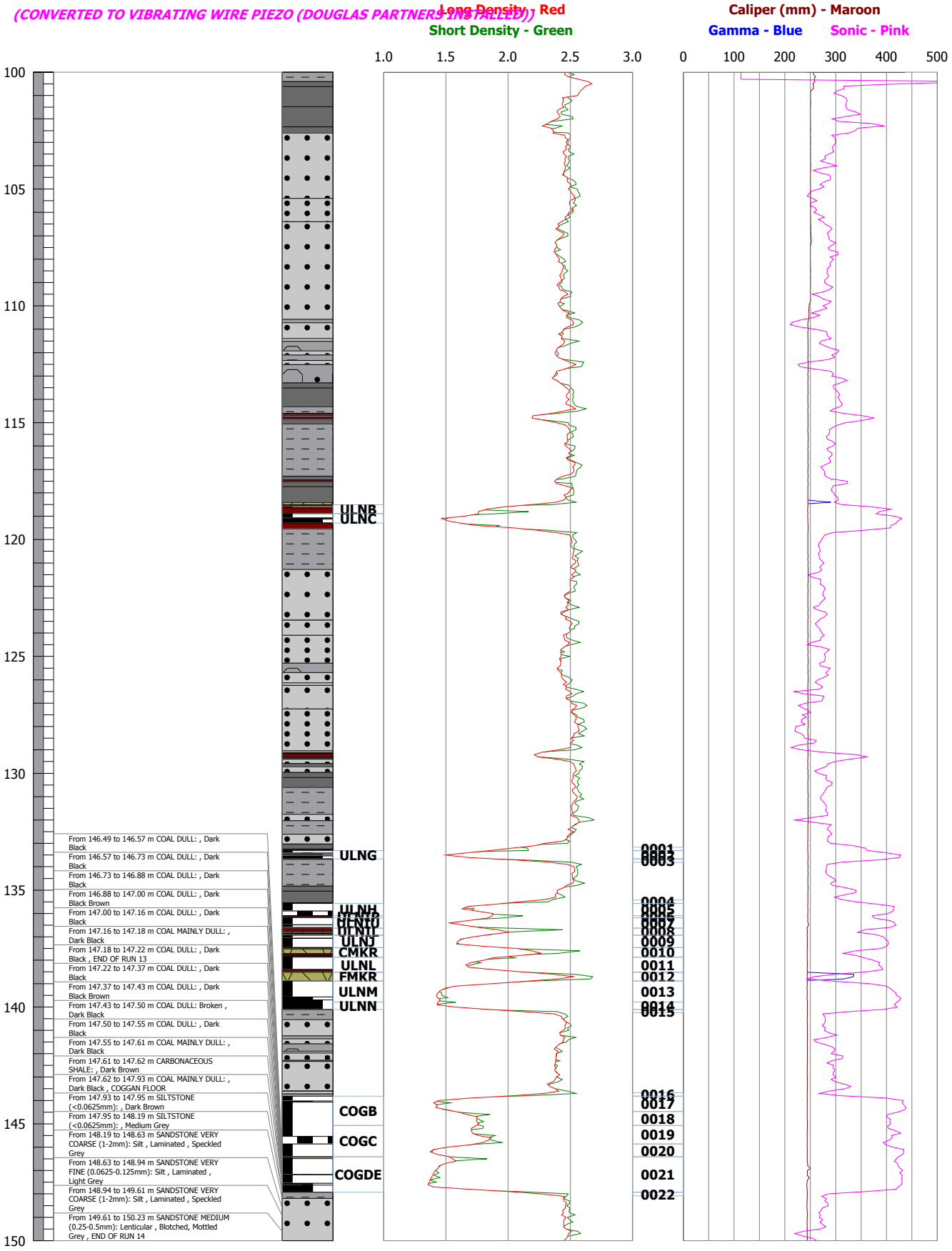

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Date : 5/06/2017 **Tenement** : AUTH287 **Northing** : 6409600.25

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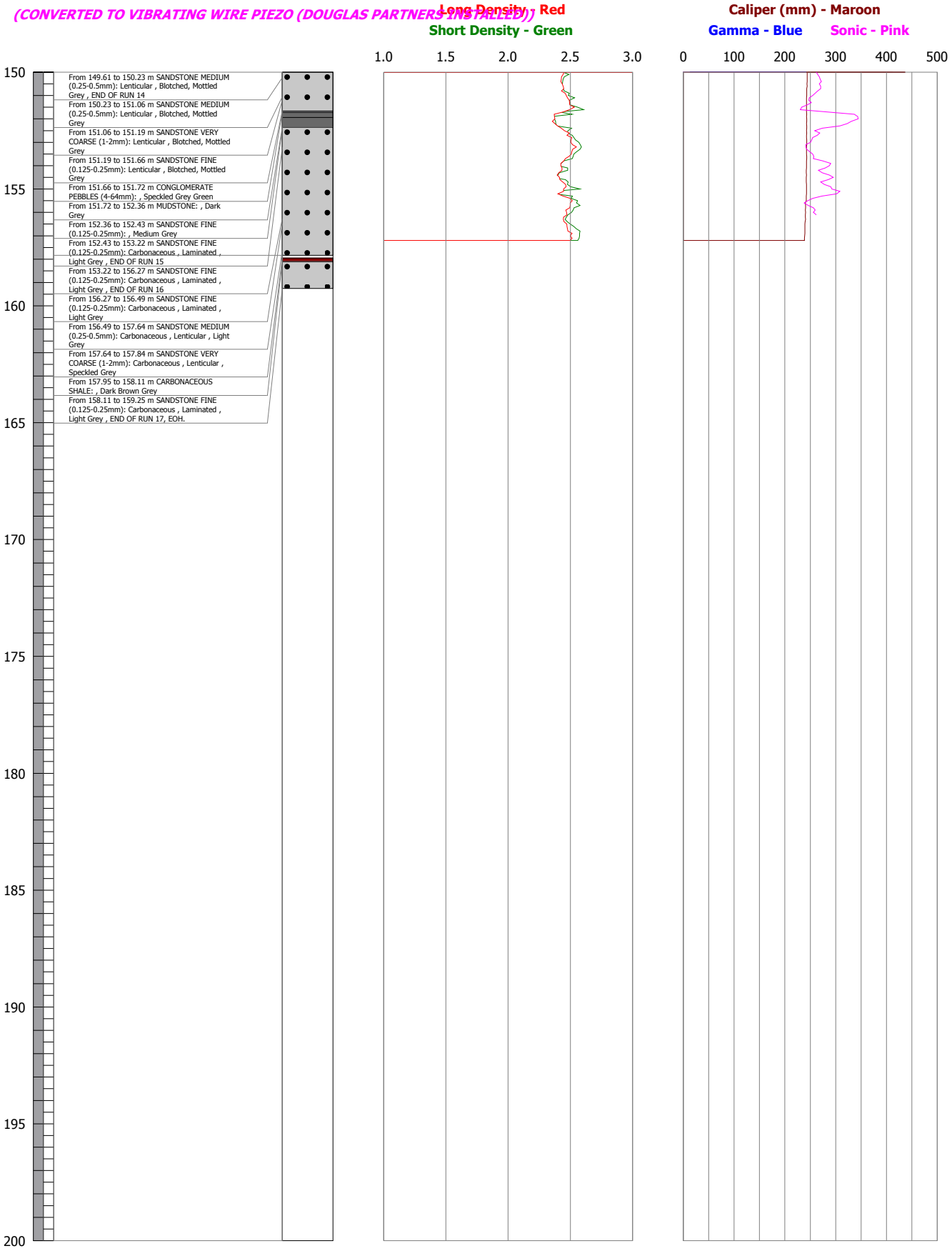

BOREHOLE LOG

CLIENT:
PROJECT:
LOCATION: Bylong

SURFACE LEVEL: 159.25 AHD
EASTING: 231959.42
NORTHING: 6409600.25
DIP/AZIMUTH: 90°/--

BORE No: BY0531CH
PROJECT No: 49761.04
DATE: 5/6/2017
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
159	1.0	GRAVEL							
		CLAY							
155	4.0	SANDSTONE							
154	6.0	TUFF							
153	7.0	SANDSTONE							
139	20.0	SILTSTONE							
133	26.0	SANDSTONE							
130	29.0	SILTSTONE							
	30.0	SANDSTONE							
123	36.0	MUDSTONE							
116	42.4								
	42.75	COAL							
115	43.1	TUFF							
	43.75	COAL							
113	46.4	TUFF							
112	47.0	CHERT							
		COAL							
109	50.2	TUFF							
107	52.78	CHERT							
105	54.4	CARBONACEOUS SHALE							
104	55.85	MUDSTONE							
103									
102									
101									
100									

RIG: Lucas **DRILLER:** Lucas **LOGGED:** McMeekan **CASING:**
TYPE OF BORING:
WATER OBSERVATIONS:
REMARKS: For full borehole log see Bylong: Drillhole Summary BY0531CH

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT:
PROJECT:
LOCATION: Bylong

SURFACE LEVEL: 159.25 AHD
EASTING: 231959.42
NORTHING: 6409600.25
DIP/AZIMUTH: 90°/--

BORE No: BY0531CH
PROJECT No: 49761.04
DATE: 5/6/2017
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
	60.7	SANDSTONE							
	63.07	CARBONACEOUS SHALE							
	64.2	COAL (GOG)							
	65.1	SANDSTONE							
	68.4	MUDSTONE							
	71.79	COAL (GOH)							
	71.91	MUDSTONE							
	72.4	SILTSTONE							
	74.9	SANDSTONE							
	78.15	SILTSTONE							
	81.43	COAL (DGA)							
	83.44	MUDSTONE							
	85.52	CARBONACEOUS SHALE / COAL (GDB)							
	86.1	SANDSTONE							
	87.4	SILTSTONE							
	89.96	COAL (RGDC + GDC)							
	90.36	SILTSTONE							
	92.4	MUDSTONE							
	96.09	COAL (GDE)							
	96.26	MUDSTONE							
	99.0	SILTSTONE							
	100.4	MUDSTONE							
	102.4	SANDSTONE							
	111.37	CONGLOMERATE							
	113.16	MUDSTONE							
	114.17	SILTSTONE							
	117.75	MUDSTONE							
	118.37	COAL / CARBONACEOUS SHALE							
	119.4								

VWP Construction Details: 110VWP1

RIG: Lucas **DRILLER:** Lucas **LOGGED:** McMeekan **CASING:**
TYPE OF BORING:
WATER OBSERVATIONS:
REMARKS: For full borehole log see Bylong: Drillhole Summary BY0531CH

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT:
PROJECT:
LOCATION: Bylong

SURFACE LEVEL: 159.25 AHD
EASTING: 231959.42
NORTHING: 6409600.25
DIP/AZIMUTH: 90°/--

BORE No: BY0531CH
PROJECT No: 49761.04
DATE: 5/6/2017
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
	121.14	SILTSTONE *(continued)*							
	122	SANDSTONE							
	125.15								
	125.55	CONGLOMERATE							
	127	SANDSTONE							
	129.1								
	129.3	COAL							
	129.6	SANDSTONE							
	130.6	MUDSTONE							
	132.61								
	133.03	SILTSTONE							
	133.31								
	133.66	SANDSTONE							
	134.83								
	135.54	MUDSTONE							
	137	COAL							VWP2
	138	SILTSTONE							
	139	MUDSTONE							
	140.11								
	140.54	COAL (ULAN)							
	142	SILTSTONE							
	143.82	SANDSTONE							
	145	COAL (COGGAN)							VWP3
	147.93								
	148.19	SILTSTONE							
	149	SANDSTONE							
	151.72								
	152.36	MUDSTONE							
	153	SANDSTONE							VWP4
	157.95								
	158.11	CARBONACEOUS SHALE							
	159.25	SANDSTONE							
		Bore discontinued at 159.25m							

RIG: Lucas **DRILLER:** Lucas **LOGGED:** McMeekan **CASING:**
TYPE OF BORING:
WATER OBSERVATIONS:
REMARKS: For full borehole log see Bylong: Drillhole Summary BY0531CH

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 290.93 AHD
EASTING: 231033.87
NORTHING: 6406771.27
DIP/AZIMUTH: 90°/--

BORE No: CPT13/BY0174CH
PROJECT No: 49761
DATE: 5/4/2013
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
290	0.0	CLAY -							Stick up = 0.62m From 0m to 0.4m, asphalt
289	2.0	SANDSTONE -							
283	8.0	SILTSTONE -							
282	9.04	COAL -							
	9.12	TUFF -							
	9.14	COAL -							
	9.28	CARBONACEOUS SHALE -							
	9.31								
	9.53								
	9.56								
281	9.71								

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** McMeeken (Cockatoo) **CASING:** HW to 9m

TYPE OF BORING: HW3 to 39.4m

WATER OBSERVATIONS: Free groundwater at 15.35m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 290.93 AHD
EASTING: 231033.87
NORTHING: 6406771.27
DIP/AZIMUTH: 90°/--

BORE No: CPT13/BY0174CH
PROJECT No: 49761
DATE: 5/4/2013
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
280	9.75	COAL -							
	9.8								
	9.81	TUFF -							
	9.87								
	9.94	COAL -							
		CARBONACEOUS SHALE -							
	11	COAL -							11
		CARBONACEOUS SHALE -							
		COAL -							
	11.48	CARBONACEOUS SHALE -							
		SILTSTONE - *(continued)*							
279	12	MUDSTONE -							12
	12.43	CARBONACEOUS SHALE -							
278	13								13
	13.21	MUDSTONE -							
277	14								14
	14.54	SANDSTONE -							
276	15								15
275	16								16
274	17								17
273	18								18
	18.59								
	18.71	MUDSTONE -							
	18.81	SANDSTONE -							
272	19	COAL -							19
	19.26								
	19.35	MUDSTONE -							
		SILTSTONE -							
271									

From 0.4m to 27.0m, grout

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** McMeeken (Cockatoo) **CASING:** HW to 9m

TYPE OF BORING: HW3 to 39.4m

WATER OBSERVATIONS: Free groundwater at 15.35m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 290.93 AHD
EASTING: 231033.87
NORTHING: 6406771.27
DIP/AZIMUTH: 90°/--

BORE No: CPT13/BY0174CH
PROJECT No: 49761
DATE: 5/4/2013
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTSTONE - *(continued)*							
	20.27	MUDSTONE -							
	20.66	TUFF -							
270	20.67	COAL -							
	21								21
269	22 22.0	CARBONACEOUS SHALE -							22
	22.13	TUFF -							
	22.15	CARBONACEOUS SHALE -							
	22.2	TUFF -							
	22.21	COAL -							
	22.61	TUFF -							
	22.66	COAL -							
268	22.74	TUFF -							
	23 22.75	COAL -							23
	22.95	TUFF -							
	22.96	COAL -							
	23.23	TUFF -							
	23.29	COAL -							
	23.37	TUFF -							
	23.47	COAL -							
267	23.51	TUFF -							
	24 23.74	COAL -							24
	23.9	CARBONACEOUS SHALE -							
	24.22	TUFF -							
	24.27	COAL -							
	24.62	TUFF -							
	24.67	COAL -							
266	24.68	TUFF -							
	25	COAL -							25
	25.48	TUFF -							
		COAL -							
		TUFF -							
265		COAL -							
	26	CARBONACEOUS SHALE -							26
		COAL -							
		SILTSTONE -							
264		SANDSTONE -							
	27								27
									From 27.0m to 28.5m, bentonite
263									
	28								28
	28.33	CARBONACEOUS SHALE -							
	28.35	SANDSTONE -							
262									
	29								29
	29.43	CONGLOMERATE -							
	29.48	COAL -							
261	29.94								

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** McMeeken (Cockatoo) **CASING:** HW to 9m
TYPE OF BORING: HW3 to 39.4m
WATER OBSERVATIONS: Free groundwater at 15.35m (determined by dipping open hole prior to installation of well and after completion of drilling)
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 290.93 AHD
EASTING: 231033.87
NORTHING: 6406771.27
DIP/AZIMUTH: 90°/--

BORE No: CPT13/BY0174CH
PROJECT No: 49761
DATE: 5/4/2013
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
260	29.96	TUFF -							
		COAL - *(continued)*							
	31								From 28.5m to 33.7m, 5mm gravel From 28.9m to 33.4m, Class 18 PVC Screen
259	32								
258	32.8	SILTSTONE -							
	33								
	33.09	SANDSTONE -							
	33.29								
	33.35	SILTSTONE -							
		SANDSTONE -							
257	34								
256	34.92	SILTSTONE -							From 33.4m to 36.4m, Class 18 Blank (sump)
	35								
	35.27								
	35.36	CONGLOMERATE -							
		SANDSTONE -							
255	36								End cap
	36.55								From 33.7m to 39.4m, bentonite
	36.58	CONGLOMERATE -							
254		SANDSTONE -							
	37								
253	38								
252	39								
	39.31								
	39.4	CONGLOMERATE -							
	39.43	SANDSTONE -							
251		Bore discontinued at 39.4m							

RIG: DRS081 **DRILLER:** Lucas Drilling **LOGGED:** McMeeken (Cockatoo) **CASING:** HW to 9m

TYPE OF BORING: HW3 to 39.4m

WATER OBSERVATIONS: Free groundwater at 15.35m (determined by dipping open hole prior to installation of well and after completion of drilling)

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 285.63 AHD
EASTING: 231051.06
NORTHING: 6405928.4
DIP/AZIMUTH: 90°/--

BORE No: CPT15/BY0173CH
PROJECT No: 49761
DATE: 29/5/2013
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		TOPSOIL - Brown, silty sand topsoil, generally comprising fine to medium grained sand, abundant rootlets, humid			0.0				
	0.2	SILTY SAND - Brown, fine to medium grained silty sand, with some fine sized subrounded gravel, humid		D					
		From 0.4m, with some to slightly clayey							
	0.5	CLAYEY SAND - Red/brown, fine to medium grained clayey sand, with some silt and fine sized subrounded gravel, humid			0.5				Stickup=0.63m
285	0.8	SILTY CLAYEY SAND - Hard, red/brown, fine to medium grained silty clayey sand, with trace to some silt, M<<Wp							
	1			S	1.0		15,12,16 N = 28		1
					1.45				
					1.5				
284				U_{75}					
	2				2.07		pp = >400		2
				D	2.1				
	2.5	SILTY SAND - Medium dense, red/brown, fine to medium grained silty sand, with some clay, humid			2.5				
283				S			7,12,15 N = 27		
					2.95				
	3	3.0 SILTY CLAY - Hard, red/brown silty clay, M<Wp			3.0				3 From 0.0m to 5.9m, grout
				D					
282									
	4	From 4.0m, with some fine to medium grained sand			4.0				4 From 0.63m to 7.21m, Class 18 blank casing
				S			5,10,14 N = 24 pp = >400		
					4.45				
281					4.8				
				U_{75}					

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.5m

TYPE OF BORING: Solid flight auger TC to 10.45m, Rock Roll to 10.73m, HQ3 to 14.91m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 286.27 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 285.63 AHD
EASTING: 231051.06
NORTHING: 6405928.4
DIP/AZIMUTH: 90°/--

BORE No: CPT15/BY0173CH
PROJECT No: 49761
DATE: 29/5/2013
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTY CLAY - Hard, red/brown silty clay, M<Wp *(continued)*			5.05		pp = >400		
	5.5	CLAYEY SAND - Medium dense, grey/brown, fine to medium grained clayey sand, trace to some silt, humid		S	5.5		6,10,11 N = 21 pp = >400		
280					5.95				
	6				6.3				6
				U_{75}					From 5.9m to 6.85m, bentonite
					6.48		pp = >400		
279									
	7				7.0				7
				S			9,16,20 N = 36		
					7.45				
278									
	8								8
	8.5	GRAVELLY CLAYEY SAND - Very dense, orange/brown gravelly clayey sand, generally comprising fine to coarse grained sand, fine to coarse sized, subangular gravel, humid		S	8.5		18,26/130mm,- refusal		
277					8.78				
	9								9
		From 9.8m, moist to wet							
276	10.0								

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.5m

TYPE OF BORING: Solid flight auger TC to 10.45m, Rock Roll to 10.73m, HQ3 to 14.91m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 286.27 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 285.63 AHD
EASTING: 231051.06
NORTHING: 6405928.4
DIP/AZIMUTH: 90°/--

BORE No: CPT15/BY0173CH
PROJECT No: 49761
DATE: 29/5/2013
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
					10.0				From 6.85m to 13.4m, 5mm gravel From 7.21m to 13.21m, Class 18 PVC screen
	10.25	SILTY CLAY - Stiff to very stiff, brown/grey yellow/brown silty clay, possible extremely low strength extremely weathered siltstone, M>>Wp From 10.1m, firm to stiff		S			4,10,21 N = 31		
		SILTSTONE - Extremely low to very low strength, extremely weathered, grey/white siltstone			10.45				
275	10.73				10.73				
		CLAYSTONE - Extremely low strength, extremely weathered, white/yellow claystone with some fine to medium grained sand			10.83		pp = >400		
	10.95				10.92		pp = 400		
	11	META SILTSTONE - Medium to high strength, slightly weathered, grey meta siltstone			11.11		PL(A) = 1.57 PL(D) = 0.68		11
		From 11.01m to 11.07m, fragmented clay infill From 11.10m, moderately to slightly weathered							
	11.3			C	11.3		pp = 400		
	11.38	CLAYSTONE - Extremely low strength, extremely weathered, white/yellow claystone (possible tuff)			11.37		pp = >400		
274		SILTSTONE - Low to medium strength, moderately weathered, grey/brown siltstone (possible extremely weathered coal)			11.67		pp = >400		
		From 11.65m to 11.69m, extremely low strength, extremely weathered claystone (tuff?)							
	12	From 11.76m to 11.79m, extremely low strength, extremely weathered claystone (tuff?)			11.95		PL(A) = 0.17		12
		From 11.86m to 11.88m, extremely low strength, extremely weathered claystone (tuff?)			11.98		PL(D) = 0.09		
		From 12.32m, light grey/brown and yellow/brown							
	12.46			C					
273		CLAYSTONE - Extremely low to very low strength, extremely to highly weathered, grey/brown and yellow/brown claystone			12.55		pp = 350		
		From 12.65m to 12.68m, white			12.62		pp = 400		
		From 12.68m, extremely low strength, extremely weathered, brown			12.81		pp = 150		
	12.92				12.89		pp = 250		
	13	CORE LOSS - 0.13m (12.92m-13.05m)							13
	13.05	SILTSTONE - Medium to high strength, moderately to slightly weathered, grey/brown with some orange siltstone			13.05				
	13.3	From 13.22m, fresh, grey			13.27		PL(A) = 1.4 PL(D) = 0.66		
		LAMINITE - Medium to high strength, fresh, grey fine to medium grained laminite							
272		From 13.50m, medium to coarse grained band, 3mm thick			13.74		PL(A) = 3.13 PL(D) = 1.34		
	14			C					14
									From 13.21m to 14.91m, Class 18 blank casing From 13.4m to 14.91m, bentonite
271		From 14.73m to 14.76m, medium to coarse grained band			14.85		PL(A) = 1.45 PL(D) = 0.43		End cap
	14.91	Bore discontinued at 14.91m, limit of investigation			14.91				

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.5m

TYPE OF BORING: Solid flight auger TC to 10.45m, Rock Roll to 10.73m, HQ3 to 14.91m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 286.27 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 297.37 AHD
EASTING: 230967.96
NORTHING: 6405353.76
DIP/AZIMUTH: 90°/--

BORE No: CPT18
PROJECT No: 49761
DATE: 23/5/2013
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
297	0	SANDY CLAY/CLAYEY SAND - Very dense, grey/brown, fine to coarse grained clayey sand/sandy clay with some fine sized gravel, trace silt, humid, M<<Wp From 0.1m, red/brown		D	0.5				Stickup = 0.48m
	1			S	1.0		13,24,25/110mm refusal		
296					1.41				
				D	1.5				
	2				2.0				
295					2.5				
				S			9,14,20 N = 34		
	3				2.95				
294				D	3.0				
	3.5	CLAYEY SAND - Dense, red/brown, fine to coarse grained clayey sand, with some fine to medium sized subrounded-rounded gravel, trace silt, humid							
	4				4.0				
293				S			17,19,21 N = 40		
					4.45				
					4.5				From 0.0m to 9.0m, grout
				D					

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 19.2m

TYPE OF BORING: Solid flight auger TC to 10.45m, wash bore to 19.5m, NMLC to 21.72m, HQ3 to 23.53m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 297.83 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 297.37 AHD
EASTING: 230967.96
NORTHING: 6405353.76
DIP/AZIMUTH: 90°/--

BORE No: CPT18
PROJECT No: 49761
DATE: 23/5/2013
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
292		CLAYEY SAND - Dense, red/brown, fine to coarse grained clayey sand, with some fine to medium sized subrounded-rounded gravel, trace silt, humid *(continued)*		D					
	5.5	CLAYEY SAND/SANDY CLAY - Dense/hard, red/brown, fine to medium grained clayey sand/sandy clay, humid			5.5				
				S			8,12,18 N = 30		From 0.0m to 11.50m, Class 18 blank casing
	6				5.95				6
291									
	7				7.0				7
				S			11,19,25/140mm refusal		
290					7.44				
	8								8
289					8.5				
				S			8,14,22 N = 36		
	9				8.95				9
288									From 9.0m to 10.55m, bentonite

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 19.2m

TYPE OF BORING: Solid flight auger TC to 10.45m, wash bore to 19.5m, NMLC to 21.72m, HQ3 to 23.53m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 297.83 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 297.37 AHD
EASTING: 230967.96
NORTHING: 6405353.76
DIP/AZIMUTH: 90°/--

BORE No: CPT18
PROJECT No: 49761
DATE: 23/5/2013
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
287		CLAYEY SAND/SANDY CLAY - Dense/hard, red/brown, fine to medium grained clayey sand/sandy clay, humid *(continued)*		S	10.0		9,14,24 N = 38		
		From 10.0m, with some fine sized subrounded-rounded gravel			10.45				
	11								11
286	11.6	CLAYEY SILTY SAND - Dense, red/brown, fine to medium grained clayey silty sand, with some clay and fine sized subrounded gravel		S	11.6		13,17,24 N = 41		
	12				12.05				12
285					12.55				
				S			11,16,18 N = 34		
	13				13.0				13
284									
	14								14
	14.05	SANDY GRAVEL - Dense, brown sandy gravel, generally comprising fine to coarse grained sand, fine to medium sized, subangular, subrounded gravel		S	14.05		10,25,22 N = 47		
283					14.5				From 10.55m to 19.0m, 5mm gravel

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 19.2m

TYPE OF BORING: Solid flight auger TC to 10.45m, wash bore to 19.5m, NMLC to 21.72m, HQ3 to 23.53m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 297.83 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 297.37 AHD
EASTING: 230967.96
NORTHING: 6405353.76
DIP/AZIMUTH: 90°/--

BORE No: CPT18
PROJECT No: 49761
DATE: 23/5/2013
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
282		SANDY GRAVEL - Dense, brown sandy gravel, generally comprising fine to coarse grained sand, fine to medium sized, subangular, subrounded gravel *(continued)*							From 11.5m to 19.0m, Class 18 PVC screen
	15.55	SILTY SAND - Dense, grey/red/brown, fine to medium grained silty sand, with some to slightly clay		S	15.55		11,14,16 N = 30		
281	16				16.0				16
	17	From 17.0m, grading to sandy clay		S	17.05		6,10,14 N = 24		17
280					17.5				
	17.8	SILTSTONE - Extremely low to very low strength, extremely to highly weathered, grey/brown siltstone							
	18								18
279				S	18.5		25/140mm,-,- refusal		
					18.64				
	19								19 End cap
278									
	19.5	SANDSTONE - Medium strength, slightly weathered, grey/brown, fine to medium grained sandstone		C	19.5 19.53		PL(A) = 1.57 PL(D) = 1.37		From 19.0m to 19.90m, bentonite

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 19.2m

TYPE OF BORING: Solid flight auger TC to 10.45m, wash bore to 19.5m, NMLC to 21.72m, HQ3 to 23.53m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 297.83 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 297.37 AHD
EASTING: 230967.96
NORTHING: 6405353.76
DIP/AZIMUTH: 90°/--

BORE No: CPT18
PROJECT No: 49761
DATE: 23/5/2013
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
277	20.06	From 19.95m, fine to coarse sized subrounded/subangular gravel							
		CORE LOSS - 0.33m (20.06m - 20.39m)							
	20.39	STONEY COAL - Low to medium strength, fresh, black stoney coal							
		From 20.39m to 20.64m, fragmented		C	20.72		PL(A) = 0.31 PL(D) = 0.08		
	21								21
276					21.22		PL(A) = 1.03 PL(D) = 0.12		
					21.72				From 19.90m to 23.53m, 5mm gravel
	22	From 22.07m, stone band 10mm thick							22
275					22.4		PL(A) = 1 PL(D) = 0.33		
				C					At 22.75m, vibrating wire piezometer
	23								23
274	23.47								
	23.53	SILTSTONE - Medium to high strength, fresh, dark grey/grey siltstone with some carbonaceous wisps			23.5 23.53		PL(A) = 0.93 PL(D) = 1.36		
		Bore discontinued at 23.53m, limit of investigation							
	24								24
273									

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 19.2m

TYPE OF BORING: Solid flight auger TC to 10.45m, wash bore to 19.5m, NMLC to 21.72m, HQ3 to 23.53m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 297.83 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 297.37 AHD
EASTING: 230967.96
NORTHING: 6405353.76
DIP/AZIMUTH: 90°/--

BORE No: CPT18
PROJECT No: 49761
DATE: 23/5/2013
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
297		SANDY CLAY/CLAYEY SAND - Very dense, grey/brown, fine to coarse grained clayey sand/sandy clay with some fine sized gravel, trace silt, humid, M<<Wp							D			
	1	From 0.1m, red/brown							S			13,24,25/110mm refusal
296									D			
	2											
295									S			9,14,20 N = 34
	3											
294	3.5	CLAYEY SAND - Dense, red/brown, fine to coarse grained clayey sand, with some fine to medium sized subrounded-rounded gravel, trace silt, humid							D			
	4								S			17,19,21 N = 40
293									D			

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 19.2m

TYPE OF BORING: Solid flight auger TC to 10.45m, wash bore to 19.5m, NMLC to 21.72m, HQ3 to 23.53m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 297.83 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 297.37 AHD
EASTING: 230967.96
NORTHING: 6405353.76
DIP/AZIMUTH: 90°/--

BORE No: CPT18
PROJECT No: 49761
DATE: 23/5/2013
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
292		CLAYEY SAND - Dense, red/brown, fine to coarse grained clayey sand, with some fine to medium sized subrounded-rounded gravel, trace silt, humid *(continued)*							D			
	5.5	CLAYEY SAND/SANDY CLAY - Dense/hard, red/brown, fine to medium grained clayey sand/sandy clay, humid							S			8,12,18 N = 30
291	6											
290	7								S			11,19,25/140mm refusal
289	8								S			8,14,22 N = 36
288	9											

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 19.2m

TYPE OF BORING: Solid flight auger TC to 10.45m, wash bore to 19.5m, NMLC to 21.72m, HQ3 to 23.53m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 297.83 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 297.37 AHD
EASTING: 230967.96
NORTHING: 6405353.76
DIP/AZIMUTH: 90°/--

BORE No: CPT18
PROJECT No: 49761
DATE: 23/5/2013
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
287		CLAYEY SAND/SANDY CLAY - Dense/hard, red/brown, fine to medium grained clayey sand/sandy clay, humid *(continued)*							S			9,14,24 N = 38
		From 10.0m, with some fine sized subrounded-rounded gravel										
286	11											
	11.6	CLAYEY SILTY SAND - Dense, red/brown, fine to medium grained clayey silty sand, with some clay and fine sized subrounded gravel							S			13,17,24 N = 41
	12											
285									S			11,16,18 N = 34
	13											
284												
	14											
	14.05	SANDY GRAVEL - Dense, brown sandy gravel, generally comprising fine to coarse grained sand, fine to medium sized, subangular, subrounded gravel							S			10,25,22 N = 47
283												

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 19.2m

TYPE OF BORING: Solid flight auger TC to 10.45m, wash bore to 19.5m, NMLC to 21.72m, HQ3 to 23.53m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 297.83 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 297.37 AHD
EASTING: 230967.96
NORTHING: 6405353.76
DIP/AZIMUTH: 90°/--

BORE No: CPT18
PROJECT No: 49761
DATE: 23/5/2013
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	B - Bedding J - Joint S - Shear F - Fault				
282		SANDY GRAVEL - Dense, brown sandy gravel, generally comprising fine to coarse grained sand, fine to medium sized, subangular, subrounded gravel *(continued)*										
	15.55	SILTY SAND - Dense, grey/red/brown, fine to medium grained silty sand, with some to slightly clay							S			11,14,16 N = 30
281	16											
	17	From 17.0m, grading to sandy clay							S			6,10,14 N = 24
280												
	17.8	SILTSTONE - Extremely low to very low strength, extremely to highly weathered, grey/brown siltstone							S			25/140mm,-,- refusal
	18											
279												
	19											
278	19.5	SANDSTONE - Medium strength, slightly weathered, grey/brown, fine to medium grained sandstone							C	85	52	PL(A) = 1.57 PL(D) = 1.37

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 19.2m

TYPE OF BORING: Solid flight auger TC to 10.45m, wash bore to 19.5m, NMLC to 21.72m, HQ3 to 23.53m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 297.83 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 297.37 AHD
EASTING: 230967.96
NORTHING: 6405353.76
DIP/AZIMUTH: 90°/--

BORE No: CPT18
PROJECT No: 49761
DATE: 23/5/2013
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
277	20.06	From 19.95m, fine to coarse sized subrounded/subangular gravel CORE LOSS - 0.33m (20.06m - 20.39m)						20.06m: CORE LOSS: 330mm				
	20.39	STONEY COAL - Low to medium strength, fresh, black stoney coal From 20.39m to 20.64m, fragmented						From 20.39m to 20.64m, Fg 20.66m: J, sv, Pl, ro 20.71m: P, sh, Pl, ro 20.9m: J, sv, Pl, ro, Fe 21.04m: P, sh, Pl, ro 21.25m: P, sh, Pl, ro 21.45m: P, sh, Pl, ro 21.48m: J, sv, Pl, ro, Fe	C	85	52	PL(A) = 0.31 PL(D) = 0.08 PL(A) = 1.03 PL(D) = 0.12
276	21											
	22	From 22.07m, stone band 10mm thick						From 21.95m to 22.06m, Fg 22.31m: P, sh, Pl, ro 22.39m: P, sh, Pl, ro From 22.8m to 23.45m, J, sv, Pl, ro	C	100	88	PL(A) = 1 PL(D) = 0.33
275	23											
274	23.47 23.53	SILTSTONE - Medium to high strength, fresh, dark grey/grey siltstone with some carbonaceous wisps Bore discontinued at 23.53m, limit of investigation						From 23.27m to 23.30m, Fg 23.48m: P, sh, Pl, ro				PL(A) = 0.93 PL(D) = 1.36
	24											
273												

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 19.2m

TYPE OF BORING: Solid flight auger TC to 10.45m, wash bore to 19.5m, NMLC to 21.72m, HQ3 to 23.53m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids

REMARKS: Top of pipe RL 297.83 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 1 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
301	0.0	TOPSOIL - Brown sandy silt topsoil, generally comprising fine to medium grained sand, abundant rootlets, trace clay, humid		D	0.0				TOC = 0.62m From 0m to 0.4m, concrete
	0.5				0.5				
	0.7	SANDY GRAVEL - Medium dense, red, brown, sandy gravel, generally comprising fine to coarse grained sand, fine to medium sized subrounded, subangular gravel, humid		S	1.0		8,9,11 N = 20		
300	1.35	SILTY SAND - Medium dense, orange, grey brown, fine to medium grained silty sand with some to slightly clayey, humid			1.45				
				U,pp$_{75}$	1.8 2.01		>400 kPa		
299		From 2.3m, with some fine to medium sized subangular gravel and ironstained cemented parts		S	2.5		7,9,16 N = 25		
					2.95				
298				D	3.0				
	3.5	SANDSTONE - Low to medium strength, moderately weathered, grey brown, fine to medium grained sandstone		D	3.5 3.7				From 0.4m to 7.65m, bentonite
297	4.5	SANDSTONE - Low to medium strength, moderately weathered, brown, fine to medium grained sandstone From 4.56m to 4.69m, extremely low strength, extremely weathered, fragmented From 4.74m, clay seam 10mm thick From 5.03m, clay seam 10mm thick From 5.14m to 5.30m, intermixed clay seams through joints, 1-60mm thick From 5.39m to 5.41m, extremely low strength, extremely weathered		C	4.5				
296					5.92				
295	6.2	From 5.71m to 5.73m, clay seam From 6.11m to 6.2m, extremely low strength, extremely weathered, fragmented		C					
	6.85	SILTSTONE - Very low to low strength, highly to moderately weathered, grey brown siltstone		pp	6.9		350 kPa		
	7.21	CLAYSTONE - Extremely low strength, extremely weathered, dark brown claystone		pp pp	6.93 7.0		>400 kPa >400 kPa		
294	7.35	From 6.88m, white		pp	7.15		300 kPa		
	7.47	From 6.98m, yellow brown		pp	7.18 7.3		>400 kPa		
		CORE LOSS - 0.14m		C					
293	8.0	CLAYSTONE - Extremely low strength, extremely weathered, white, yellow brown, dark brown claystone			8.45				
		SANDSTONE - Low to medium strength, slightly weathered, grey, brown, fine to medium grained sandstone		C					
	8.8	From 7.6m to 7.63m, extremely low strength, extremely weathered, yellow brown			8.97				
292		From 7.8m, moderately to slightly weathered, brown			9.19		PL(A) = 0.68 PL(D) = 0.42		
		SANDSTONE - Low to medium strength, slightly to moderately weathered, brown, fine to medium grained sandstone		C					
	9.92	SILTSTONE - Low to medium strength, slightly							

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 2 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
291		weathered, brown siltstone laminated with some sandstone		C	10.2		PL(A) = 0.62		
		MUDSTONE - Moderately weathered, fresh, dark grey mudstone *(continued)*			10.3				
	11			C	11.33		PL(A) = 0.76 PL(D) = 0.81		
290		From 11.41m to 11.45m, slightly weathered							From 7.65m to 15.5m, 5mm gravel From 8.0m to 15.5m, Class 18 PVC Screen
	12 12.0	MUDSTONE / SILTSTONE - Medium strength, fresh, dark grey mudstone, thinly laminated with some siltstone			12.0				12
289	12.9								
	13	MUDSTONE - Medium strength, fresh, dark grey mudstone			13.41				13
288	13.61			C GT001					
		SILTSTONE - Medium strength, fresh, light and dark grey siltstone			13.78 13.82		PL(A) = 0.63 PL(D) = 0.45		
	14								14
287									
	15				15.0				15
286	15.4	MUDSTONE - Medium strength, fresh, dark grey laminated with some light grey siltstone							
	16				16.0		PL(A) = 0.66 PL(D) = 0.43		16
285	16.47	From 16.29m to 16.47m, low strength, coal / carbonaceous mudstone band		C					
		SILTSTONE - Medium strength, fresh, grey							
	17				17.2		PL(A) = 0.69 PL(D) = 0.6		17
284	17.48	LAMINITE - Medium strength, fresh, grey laminite							
	17.75	From 17.68m to 17.74m, low strength, very thinly laminated with clay seams							
	18	From 17.74m, very low strength clay seam			18.0				18
283		SILTSTONE - Medium strength, fresh, light and dark grey siltstone							
		From 17.75m to 18.17m, thinly laminated with some fine sandstone			18.6				
				GT002					
	19 19.03	From 18.17m to 18.27m, fine sandstone		C	18.99		PL(A) = 0.89 PL(D) = 0.83		19
282		MUDSTONE / SILTSTONE - Medium strength, fresh, dark grey			19.0				
		From 19.7m to 19.9m, low strength coal seam							
	19.9								

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 3 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTSTONE - Medium strength, fresh, grey *(continued)*		C	20.17		PL(A) = 0.63		
281	21				21.0				21
	21.4	From 21.18m to 21.19m, coal lense From 21.21m to 21.22m, coal lense From 21.3m to 21.31m, coal lense							
280	21.77	From 21.36m to 21.37m, coal lense From 21.39m to 21.4m, tuff lense (heat affected)			21.67		PL(A) = 0.88		
	22	CARBONACEOUS SILTSTONE / COAL - Medium strength, fresh, dark grey carbonaceous siltstone laminated with black coal		C					22
279		SILTSTONE - High strength, fresh, grey			22.67		PL(A) = 1.36		
	23								23
	23.23	LAMINITE - High strength, fresh, light and dark grey laminite							
278					23.96		PL(A) = 2.04		
	24	From 23.95m, grading into sandstone			24.0				24
	24.26	SANDSTONE - Very high strength, fresh, light grey, fine to medium grained sandstone From 24.56m to 24.64m, siltstone band							
277	25				25.12				25
				GT003 C	25.56		PL(A) = 4.63		
276					25.61				
	26								26
		From 26.22m to 26.33m, fine to coarse grained sandstone, trace fine gravel							
275		From 26.7m to 27.81m, fine to coarse grained sandstone, trace fine gravel							
	27				27.0				27
274									
	28								28
	28.19	SILTSTONE - Very high strength, fresh, grey							
273	28.44	CARBONACEOUS SILTSTONE / COAL - High strength, fresh, dark brown carbonaceous siltstone laminated with black coal		C GT004	28.4 28.44		PL(A) = 3.79		
	28.89				28.8		PL(A) = 1.21		
	29	TUFF - High strength, fresh, light grey tuff (heat affected?)		GT005	28.84 28.94				29
272	29.36	CARBONACEOUS SILTSTONE / COAL - High strength, fractured, dark brown carbonaceous siltstone laminated with black coal			29.36				
					30.0		PL(A) = 2.02		

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 4 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
					30.0				From 15.5m to 44.5m, bentonite
271	30.44	From 30.34m to 30.36m, tuff laminations		C					
		SILTSTONE - High strength, fresh, grey siltstone			30.95		PL(A) = 1.27		
	31				31.0				
270									
	32	32.0 SILTSTONE / SANDSTONE - Very high strength, fresh, dark grey siltstone, thinly bedded with light grey fine grained sandstone		C					
269					32.9		PL(A) = 2.68		
	33				33.0				
		From 33.2m, medium bedded							
268					33.96		PL(A) = 7.22 PL(D) = 5.32		
	34								
267				C					
		From 34.59m, fine to medium grained sandstone band							
	34.83	MUDSTONE - High strength, fresh, dark grey black mudstone							
	35								
266					35.38		PL(A) = 1.63		
	35.56	From 35.43m to 35.45m, coal lense							
		SILTSTONE / SANDSTONE - High strength, fresh, dark grey siltstone laminated with fine grained sandstone							
	36				36.0		PL(A) = 2.18		
					36.05		PL(D) = 1.51		
265									
	37			C					
264		From 37.41m, thinly bedded							
					37.97				
	38				38.0				
				GT006					
263					38.41		PL(A) = 2.53		
				C	38.46		PL(D) = 2.04		
	39				39.0				
262	39.38	COAL - Medium strength, fresh, black		C					
	39.7	SILTSTONE - High strength, fresh, dark grey							

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 5 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTSTONE - High strength, fresh, dark grey *(continued)*							
261	40.52	LAMINITE - High strength, fresh, light and dark grey laminite		C	40.83		PL(A) = 2.56 PL(D) = 1.76		
260	41				41.53		PL(A) = 0.4		
	41.71	MUDSTONE - High strength, fresh, dark grey black			42.0				
259	42				42.64		PL(A) = 0.45 PL(D) = 0.42		
	42.67	COAL - Medium strength, fresh, black							
	43 43.05	SILTSTONE / SANDSTONE - High strength, fresh, grey		C					
258		From 43.51m to 44.18m, some fine grained sandstone laminations			43.76		PL(A) = 2.59		
	44			GT007	43.81				
257					44.24				
	44.81	STONEY COAL - Medium strength, fresh, black							
	44.93 45 44.99	CORE LOSS - 0.06m			45.0				
	45.27	STONEY COAL - Medium strength, fresh, black							
256	45.37	TUFF - Medium strength, fresh, light grey							
		CARBONACEOUS MUDSTONE / COAL - High strength, fresh, black carbonaceous mudstone / coal			45.86		PL(A) = 1.25		
	46 46.07	From 45.45m to 45.5m, brown tuff band							
255		From 45.9m to 45.93m, light grey tuff band		C					
		From 46.02m to 46.07m, light grey tuff band							
		MUDSTONE - High strength, fresh, black							
		From 46.6m to 46.91m, thinly laminated weathered tuff							
	47				47.35		PL(A) = 1.68		From 44.5m to 50.5m, 2mm gravel At 47.75m, vibrating wire piezometer
254		From 47.65m, grading into tuff							
	48 47.95	TUFF - Medium strength, fresh, light brown tuff			48.0				
				GT008					
253	48.46	MUDSTONE - High strength, fresh, black			48.46 48.5		PL(A) = 2.77		
	48.73	TUFF - Medium strength, fresh, light brown			48.8		PL(A) = 0.57		
	48.9 49	SILTSTONE - High strength, fresh, dark grey black		C					
252									

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 6 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTSTONE - High strength, fresh, dark grey black *(continued)*							
251	50.45	COAL / CARBONACEOUS MUDSTONE - High strength, fresh, dark brown black		C					
	50.69	SILTSTONE / SANDSTONE - High strength, fresh, light grey, fine to medium, light grey fine sandstone mixed with dark grey siltstone			51.0				
250	51				51.5		PL(A) = 2.38		
	51.92	SILTSTONE - High strength, fresh, dark grey siltstone laminated with some fine sandstone			52.09				
249	52			GT009					From 50.5m to 54.25m, bentonite
	52.57	SANDSTONE - High strength, fresh, light grey, fine to medium grained sandstone laminated with some siltstone		C	52.43 52.46		PL(A) = 2.62		
248	53				53.4		PL(A) = 2.21 PL(D) = 1.58		
	54				54.0				
247	54.63	COAL - High strength, fresh, black coal							
246	55			C					
	56				55.84		PL(A) = 1.5		
245					56.44		PL(A) = 1.63		
	57			GT010	56.48 56.85 57.0				From 54.25m to 58.9m, 2mm gravel At 56.75m, vibrating wire piezometer
244	58			C	58.18		PL(A) = 1.41		
243	58.87								
	59	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone							From 58.9m to 59.11m, betonite
	59.15	Bore discontinued at 59.15m, limit of investigation			59.15				
242									

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 1 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	B - Bedding J - Joint S - Shear F - Fault				
301	0.0	TOPSOIL - Brown sandy silt topsoil, generally comprising fine to medium grained sand, abundant rootlets, trace clay, humid							D			
	0.7	SANDY GRAVEL - Medium dense, red, brown, sandy gravel, generally comprising fine to coarse grained sand, fine to medium sized subrounded, subangular gravel, humid							S			8,9,11 N = 20
300	1.35	SILTY SAND - Medium dense, orange, grey brown, fine to medium grained silty sand with some to slightly clayey, humid From 2.3m, with some fine to medium sized subangular gravel and ironstained cemented parts							U,pp75			>400 kPa
299									S			7,9,16 N = 25
298	3.5	SANDSTONE - Low to medium strength, moderately weathered, grey brown, fine to medium grained sandstone							D			
									D			
297	4.5	SANDSTONE - Low to medium strength, moderately weathered, brown, fine to medium grained sandstone From 4.56m to 4.69m, extremely low strength, extremely weathered, fragmented From 4.74m, clay seam 10mm thick From 5.03m, clay seam 10mm thick From 5.14m to 5.30m, intermixed clay seams through joints, 1-60mm thick						4.78m-5.03m, J,75°,pl,cy, closed 5.03m: P,sh,pl,ro 5.1m: J,60°,pl, cy, closed 5.46m: P,sh,pl,ro 5.5m-5.69m, J,sv, st, closed 5.69m: P,sh,pl,ro 5.83m-5.87m, Fg 6.05m: J, 65°,pl, cy, closed 6.11m-6.2m, Fg	C	100		
296												
295	6.2	From 5.39m to 5.41m, extremely low strength, extremely weathered From 5.71m to 5.73m, clay seam From 6.11m to 6.2m, extremely low strength, extremely weathered, fragmented						6.45m-6.75m, J, sv, ir, cy, closed	C	93	50	
	6.85								pp			350 kPa
	7.21							7.21m: CORE LOSS: 140mm	pp			>400 kPa
294	7.35	SILTSTONE - Very low to low strength, highly to moderately weathered, grey brown siltstone							pp			>400 kPa
	7.47								pp			300 kPa
									pp			>400 kPa
								7.56m: P,sh,pl,ro				
	8.0	CLAYSTONE - Extremely low strength, extremely weathered, dark brown claystone From 6.88m, white From 6.98m, yellow brown						7.81m: P,sh,pl,ro 7.91m: P,sh,pl,ro 7.94m: P,sh,pl,ro 8.05m: P,sh,pl,ro 8.1m: P,sh,pl,ro	C	96	93	
293		CORE LOSS - 0.14m						8.43m: P,sh,pl,ro	C	100	77	
	8.8	CLAYSTONE - Extremely low strength, extremely weathered, white, yellow brown, dark brown claystone						8.59m: P,sh,pl,ro 8.67m: P,sh,pl,ro 8.69m: P,sh,pl,ro 8.71m: P,sh,pl,ro 8.85m: P,sh,pl,ro 9.23m: P,sh, pl, sm				PL(A) = 0.68 PL(D) = 0.42
292		SANDSTONE - Low to medium strength, slightly weathered, grey, brown, fine to medium grained sandstone						9.29m-9.32m, J, 40°, pl,ro, Fe 9.53m: P,sh,pl,sm, Fe	C	98	90	
	9.92											

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 2 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
291		From 7.6m to 7.63m, extremely low strength, extremely weathered, yellow brown From 7.8m, moderately to slightly weathered, brown						10.01m: P,sh,pl,sm, Fe	C	98	90	PL(A) = 0.62
	11	SANDSTONE - Low to medium strength, slightly to moderately weathered, brown, fine to medium grained sandstone						10.67m: P,sh,ir,ro, Fe 10.67m-10.73m, J,sv,pl,ro 10.73m: P,sh,pl,sm	C	99	94	PL(A) = 0.76 PL(D) = 0.81
290		SILTSTONE - Low to medium strength, slightly weathered, brown siltstone laminated with some sandstone						11.41m: P,sh,pl,sm, Fe 11.43m: Clay seam				
	12 12.0	MUDSTONE - Moderately weathered, fresh, dark grey mudstone *(continued)* From 11.41m to 11.45m, slightly weathered						12.19m-12.21m, P,sh,ir,ro 12.21m-12.31m, J, sv to 60°,ir, ro 12.28m: P,sh,ir,ro 12.34m-12.43m, J, 85°,ir,ro 12.43m: P,sh,ir,ro 12.48m: P,sh,pl,sm				
289	12.9 13	MUDSTONE / SILTSTONE - Medium strength, fresh, dark grey mudstone, thinly laminated with some siltstone										
288	13.61	MUDSTONE - Medium strength, fresh, dark grey mudstone						12.75m-12.87m, Fg, cbs 12.78m-12.87m, J, sv, pl,sm 13.41m: P,sh,pl,sm	C GT001	99	86	PL(A) = 0.63 PL(D) = 0.45
	14	SILTSTONE - Medium strength, fresh, light and dark grey siltstone						14.04m: P,sh,pl,sm				
287	15											
286	15.4	MUDSTONE - Medium strength, fresh, dark grey laminated with some light grey siltstone										PL(A) = 0.66 PL(D) = 0.43
	16											
285	16.47	From 16.29m to 16.47m, low strength, coal / carbonaceous mudstone band						16.28m: P,sh,pl,ro, cbs 16.34m: P,sh,pl,ro, cbs 16.4m: P,sh,pl,ro, cbs 16.4m-16.43m, J,sv, ir,ro 16.43m-16.47m, Fg	C	99	93	
	17	SILTSTONE - Medium strength, fresh, grey						16.9m: P,sh,pl,sm 17.16m: P,sh,pl,sm x 3				PL(A) = 0.69 PL(D) = 0.6
284	17.48	LAMINITE - Medium strength, fresh, grey laminite										
	17.75	From 17.68m to 17.74m, low strength, very thinly laminated with clay seams From 17.74m, very low strength clay seam						17.74m: Very low strength clay seam 17.91m: P,sh,pl,sm				
283	18	SILTSTONE - Medium strength, fresh, light and dark grey siltstone							GT002			
	19 19.03	From 17.75m to 18.17m, thinly laminated with some fine sandstone From 18.17m to 18.27m, fine sandstone							C	99	97	PL(A) = 0.89 PL(D) = 0.83
282		MUDSTONE / SILTSTONE - Medium strength, fresh, dark grey						19.58m: P,sh,pl,ro, cbs 19.62m: P,sh,pl,ro				
	19.9											

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 3 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
281		From 19.7m to 19.9m, low strength coal seam SILTSTONE - Medium strength, fresh, grey *(continued)*						19.91m: P,sh,pl,ro, cbs 20.65m: P,sh,pl,ro 20.88m: P,sh,pl,ro	C	99	97	PL(A) = 0.63
	21											
280	21.4	From 21.18m to 21.19m, coal lense From 21.21m to 21.22m, coal lense From 21.3m to 21.31m, coal lense										
	21.77	From 21.36m to 21.37m, coal lense From 21.39m to 21.4m, tuff lense (heat affected) CARBONACEOUS SILTSTONE / COAL - Medium strength, fresh, dark grey carbonaceous siltstone laminated with black coal							C	98	98	PL(A) = 0.88
279	22											PL(A) = 1.36
	23	SILTSTONE - High strength, fresh, grey										
278	23.23	LAMINITE - High strength, fresh, light and dark grey laminite										PL(A) = 2.04
	24	From 23.95m, grading into sandstone										
277	24.26	SANDSTONE - Very high strength, fresh, light grey, fine to medium grained sandstone From 24.56m to 24.64m, siltstone band						>>	GT003 C	100	100	PL(A) = 4.63
276	25											
	26											
275		From 26.22m to 26.33m, fine to coarse grained sandstone, trace fine gravel From 26.7m to 27.81m, fine to coarse grained sandstone, trace fine gravel										
274	27											
	28											
273	28.19	SILTSTONE - Very high strength, fresh, grey							C GT004	98	98	PL(A) = 3.79
	28.44	CARBONACEOUS SILTSTONE / COAL - High strength, fresh, dark brown carbonaceous siltstone laminated with black coal										PL(A) = 1.21
	28.89								GT005			
	29	TUFF - High strength, fresh, light grey tuff (heat affected?)										
272	29.36							29.66m-29.78m, J, 70°, ir,ro				

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 4 OF 6

RL	Depth (m)	Description of Strata	Graphic Log	Type	Core Rec. %	RQD %	Test Results & Comments
		CARBONACEOUS SILTSTONE / COAL - High strength, fractured, dark brown carbonaceous siltstone laminated with black coal *(continued)*					PL(A) = 2.02
271	30.44	From 30.34m to 30.36m, tuff laminations		C	100	100	
	31	SILTSTONE - High strength, fresh, grey siltstone					PL(A) = 1.27
270							
	32 32.0	SILTSTONE / SANDSTONE - Very high strength, fresh, dark grey siltstone, thinly bedded with light grey fine grained sandstone		C	99	99	
269							PL(A) = 2.68
	33	From 33.2m, medium bedded					
268							PL(A) = 7.22 PL(D) = 5.32
	34						
267		From 34.59m, fine to medium grained sandstone band		C	97	97	
	34.83	MUDSTONE - High strength, fresh, dark grey black mudstone					
	35	From 35.43m to 35.45m, coal lense					PL(A) = 1.63
266	35.56	SILTSTONE / SANDSTONE - High strength, fresh, dark grey siltstone laminated with fine grained sandstone					35.62m-35.81m, J,sv, ir,cl
	36						PL(A) = 2.18 PL(D) = 1.51
265							
	37	From 37.41m, thinly bedded		C	100	100	
264							
	38			GT006			
263				C	100	100	PL(A) = 2.53 PL(D) = 2.04
	39						
262	39.38	COAL - Medium strength, fresh, black		C	99	99	
	39.7	SILTSTONE - High strength, fresh, dark grey					

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 5 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		B - Bedding J - Joint S - Shear F - Fault	EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00					
261		SILTSTONE - High strength, fresh, dark grey *(continued)*										
	40.52	LAMINITE - High strength, fresh, light and dark grey laminite										PL(A) = 2.56 PL(D) = 1.76
	41								C	99	99	
260												PL(A) = 0.4
	41.71	MUDSTONE - High strength, fresh, dark grey black										
	42											
259								42.35m-42.84m, J, sv, ir, cl				
	42.67	COAL - Medium strength, fresh, black						42.66m-42.81m, J, sv, ir,cl				PL(A) = 0.45 PL(D) = 0.42
	43 43.05	SILTSTONE / SANDSTONE - High strength, fresh, grey From 43.51m to 44.18m, some fine grained sandstone laminations							C	98	92	
258												PL(A) = 2.59
	44								GT007			
257												
	44.81	STONEY COAL - Medium strength, fresh, black										
	44.93 45 44.99	CORE LOSS - 0.06m						44.93m: CORE LOSS: 60mm				
	45.27							>>				
256	45.37	STONEY COAL - Medium strength, fresh, black										
		TUFF - Medium strength, fresh, light grey										PL(A) = 1.25
	46 46.07	CARBONACEOUS MUDSTONE / COAL - High strength, fresh, black carbonaceous mudstone / coal From 45.45m to 45.5m, brown tuff band From 45.9m to 45.93m, light grey tuff band From 46.02m to 46.07m, light grey tuff band							C	100	99	
255												
	47											
		MUDSTONE - High strength, fresh, black From 46.6m to 46.91m, thinly laminated weathered tuff From 47.65m, grading into tuff						47.74m-47.77m, J, 30°,pl, op, sm				PL(A) = 1.68
254	47.95 48								GT008			
		TUFF - Medium strength, fresh, light brown tuff										PL(A) = 2.77
253	48.46	MUDSTONE - High strength, fresh, black										PL(A) = 0.57
	48.73 48.9 49	TUFF - Medium strength, fresh, light brown							C	100	100	
		SILTSTONE - High strength, fresh, dark grey black										
252												

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 301.42 AHD
EASTING: 232343.35
NORTHING: 6404982.41
DIP/AZIMUTH: 90°/--

BORE No: CPT36
PROJECT No: 49761
DATE: 30/5-7/6/13
SHEET 6 OF 6

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
251	50.45	SILTSTONE - High strength, fresh, dark grey black *(continued)*										
	50.69	COAL / CARBONACEOUS MUDSTONE - High strength, fresh, dark brown black							C	100	100	
250	51	SILTSTONE / SANDSTONE - High strength, fresh, light grey, fine to medium, light grey fine sandstone mixed with dark grey siltstone						>>				PL(A) = 2.38
249	51.92	SILTSTONE - High strength, fresh, dark grey siltstone laminated with some fine sandstone							GT009			
	52.57	SANDSTONE - High strength, fresh, light grey, fine to medium grained sandstone laminated with some siltstone							C	99	99	PL(A) = 2.62
248	53											PL(A) = 2.21 PL(D) = 1.58
247	54											
	54.63	COAL - High strength, fresh, black coal						54.88m-55.12m, J,sv,pl,ro 55.02m-55.08m, J,50°,pl,ro 55.06m-55.13m, J,sv, pl, ro 55.28m-55.38m, J,75°,pl,ro 55.34m-55.51m, Fg 55.34m-55.46m, J,sv, ir,ro 55.46m-55.59m, J,sv to 60°,ir, ro 55.72m-55.81m, J, 45°,pl, sm 56.05m-56.2m, J, 70°, (concave), pl, sm 56.85m-57.07m, J,sv, pl, sm 57.05m-57.18m, J,sv, pl, sm 57.26m-57.37m, J,sv, pl, sm 57.42m-57.53m, Fg 57.82m-58.04m, J,sv, pl, cl 58.24m-58.34m, J, sv, pl,cl 58.55m-58.61m, J, 50°,pl,ro	C	100	83	
246	55											PL(A) = 1.5
245	56											PL(A) = 1.63
244	57								GT010			
243	58								C	99	83	PL(A) = 1.41
	58.87	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone										
	59											
242	59.15	Bore discontinued at 59.15m, limit of investigation										

RIG: TD Rig 106 **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger (TC) to 3.8m, rock roller to 4.5m, HQ3 to 59.15m

WATER OBSERVATIONS: Free groundwater observed at 12.05m

REMARKS: Top of pipe RL 302.05 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 306.47 AHD
EASTING: 231241.22
NORTHING: 6405086.38
DIP/AZIMUTH: 90°/--

BORE No: CPT39
PROJECT No: 49761
DATE: 15 - 17/5/2013
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
306	0	SILTY SAND - Brown, fine to medium grained silty sand, with trace to some fine to medium sized subrounded-rounded gravel, abundant rootlets to 0.2m depth with trace to some clay, humid		D	0.5				Stickup = 0.65m
	1			S	1.0		10,25 refusal		
305				D	1.3				
	2				2.0				
304				S	2.5		14,26,25/100mm refusal		
	3				2.9				
303				D	3.05				
	4				3.8				
302				S	4.0		13,21,26/100 refusal		
	5				4.4				
301				S	5.5		9,14,15 N = 29		
	6				5.95				From 0.0m to 11.85m, grout
300	7	7.0 CLAYEY SAND - Very dense, brown, fine to medium grained clayey sand, with trace to some fine to medium sized, subrounded-rounded gravel, grading to weathered sandstone		S	7.0		13,26/130mm refusal		
299					7.28				
	8			S	8.5		15,25/125mm refusal		From 0.0m to 16.0m, Class 18 PVC blank casing
298					8.78				
	9								
297		9.3 SANDSTONE - Extremely low to very low strength, extremely to highly weathered, yellow/brown fine to medium grained sandstone					11/30mm		

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.0m

TYPE OF BORING: Solid flight auger TC to 10.03m, Rock Roll to 10.35m, HQ3 to 41.96m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: 5-10% water loss from 11.5m. Top of pipe RL 307.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 306.47 AHD
EASTING: 231241.22
NORTHING: 6405086.38
DIP/AZIMUTH: 90°/--

BORE No: CPT39
PROJECT No: 49761
DATE: 15 - 17/5/2013
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
				S	10.0		refusal		
					10.03				
296	10.35	CLAYSTONE - Extremely low to very low strength, extremely to highly weathered, grey/white and yellow/brown claystone with some fine to medium grained sand			10.35				
	11			C					11
	11.25								
295	11.41	CORE LOSS - 0.13m (11.28m - 11.41m)			11.45				
		CLAYSTONE - Extremely low strength, extremely weathered, dark brown claystone		C	11.65				
	11.75	From 11.65m, yellow/brown		C					
	12				11.95				12
	12.07	BASALT - High strength, slightly weathered, grey basalt							
294		SANDSTONE - Medium strength, moderately weathered, brown with some grey, fine to medium grained sandstone			12.48		PL(A) = 0.42 PL(D) = 0.18		
	13								13
293				C					From 11.85m to 14.6m, bentonite
					13.83		PL(A) = 0.4 PL(D) = 0.04		
	14								14
292					14.63		PL(A) = 0.74 PL(D) = 0.23		
	15				14.95				15
	15.25	CLAYSTONE - Very low to low strength, highly to moderately weathered, brown claystone							
291	15.8	SILTSTONE - Very low to low strength, moderately weathered, brown with some grey siltstone							
	16				16.17		PL(A) = 0.05 PL(D) = 0.07		16
	16.24	CARBONACEOUS CLAYSTONE - Very low to low strength, highly to moderately weathered, dark brown/black carbonaceous claystone		C					
290		From 16.81m to 16.85m, extremely low strength, extremely weathered							
	17								17
	17.15	SILTSTONE - Low to medium strength, fresh, grey siltstone			17.26		PL(A) = 0.58 PL(D) = 0.21		
289	17.56	LAMINITE - Low to medium strength, fresh, grey, fine grained laminite							
	17.91				17.95				
	18	SANDSTONE - Medium to high strength, slightly weathered to fresh, grey, fine grained sandstone							18
		From 18.19m, slightly weathered, brown			18.46		PL(A) = 1.54		From 14.6m to 22.1m, 5mm gravel
288		From 18.49m to 19.0m, with some carbonaceous siltstone bands			18.46		PL(D) = 0.91		
					18.47		PL(A) = 1.71		
							PL(A) = 2.07		
	19			C					19
									From 16.0m to 22.1m, Class 18 PVC screen
287					19.65		PL(A) = 1.49 PL(D) = 2.83		

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.0m

TYPE OF BORING: Solid flight auger TC to 10.03m, Rock Roll to 10.35m, HQ3 to 41.96m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: 5-10% water loss from 11.5m. Top of pipe RL 307.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 306.47 AHD
EASTING: 231241.22
NORTHING: 6405086.38
DIP/AZIMUTH: 90°/--

BORE No: CPT39
PROJECT No: 49761
DATE: 15 - 17/5/2013
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
286		SANDSTONE - Medium to high strength, slightly weathered to fresh, grey, fine grained sandstone *(continued)*		C	20.69		PL(A) = 3.02 PL(D) = 2.35		
		From 20.22m to 20.25m, carbonaceous band							
	20.87								
285	20.99	LAMINITE - Medium to high strength, slightly weathered to fresh, grey/dark grey, fine grained laminite			20.97				21
	21.14	CARBONACEOUS SILTSTONE - Medium strength, slightly weathered, dark grey/black carbonaceous siltstone							
	21.48	COAL - Low to medium strength, fresh, black coal							
284	22	SILTSTONE - Medium to high strength, fresh, grey siltstone with some fine to medium grained sand bands		C	21.93		PL(A) = 1.77 PL(D) = 1.02		22
					22.69		PL(A) = 1.15 PL(D) = 0.44		From 22.1m to 23.1m, bentonite
	23								23
	23.08	STONEY COAL - Medium strength, fresh, black stoney coal			23.39		PL(A) = 1.72 PL(D) = 0.18		
283		From 23.45m, tuff band 6mm thick							
	24	From 23.95m to 24.28m, fragmented (possibly drilling induced)			23.95				24
282					24.83		PL(A) = 1.97 PL(D) = 0.48		
	25	From 24.89m to 25.05m, interbedded sandstone lenses		C					25 At 25.0m, vibrating wire piezometer
	25.35								
281	25.46	COAL - Low to medium strength, fresh, black coal							
		STONEY COAL - Medium to high strength, fresh, black stoney coal							
	26	From 25.82m to 25.88m, extremely to very low strength			26.02		PL(A) = 0.28 PL(D) = 0.15		26
		From 25.88m, tuff band, 12mm thick			26.05				
		From 25.93m, tuff band, 7mm thick							
280		From 25.99m to 26.04m, tuff band		C					From 23.1m to 30.0m, gravel
		From 26.13m to 26.15m, stone band							
		From 26.53m to 26.55m, tuff band			26.9		PL(A) = 1.79 PL(D) = 1.01		
	27				26.9				27
					26.93		PL(A) = 1.64		
	27.23	TUFF - Low to medium strength, fresh, grey/white tuff			27.35		PL(A) = 0.41 PL(D) = 0.16		
279		From 27.23m to 27.36m, intermixed with stoney coal/carbonaceous mud							
	27.63								
		STONEY COAL - Medium strength, fresh, black stoney coal		C					
	28								28
	28.1	From 27.78m to 27.82m, tuff band							
278		TUFF - Medium strength, fresh, grey/white tuff			28.41		PL(A) = 1.84 PL(D) = 0.19		
	28.62	STONEY COAL - Medium strength, fresh, black stoney coal			28.67				
	29			C					29
277					29.42				
		From 29.55mm, tuff band, 13mm thick		C	29.74		PL(A) = 1.83 PL(D) = 1.01		

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.0m

TYPE OF BORING: Solid flight auger TC to 10.03m, Rock Roll to 10.35m, HQ3 to 41.96m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: 5-10% water loss from 11.5m. Top of pipe RL 307.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 306.47 AHD
EASTING: 231241.22
NORTHING: 6405086.38
DIP/AZIMUTH: 90°/--

BORE No: CPT39
PROJECT No: 49761
DATE: 15 - 17/5/2013
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	30.01								
	30.15	CARBONACEOUS SILTSTONE - Medium strength, fresh, dark grey/black carbonaceous siltstone		C					
276		SILTSTONE - Medium to high strength, fresh, dark grey/grey siltstone			30.45		PL(A) = 1.88		
				C	30.54		PL(D) = 0.86		
		From 30.22m, with some medium to coarse sized, subrounded to rounded gravel							From 30.0m to 31.7m, bentonite
	30.84				30.91				
	31	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone		C					31
	31.32	From 30.88m to 31.0m, with carbonaceous siltstone lamination			31.43				
275		COAL - Medium strength, fresh, black coal							
		From 31.75m, stoney band, 8mm thick							
	32	From 32.05m, stoney band, 5mm thick		C	32.15		PL(A) = 1.64 PL(D) = 0.37		32
274									
					32.94		PL(A) = 0.41		
	33				32.99		PL(D) = 0.76		33 At 33.0m, vibrating wire piezometer From 31.7m to 34.7m, gravel
		From 33.22m to 33.44m, fragmented							
273		From 33.59m to 33.63m, fragmented		C					
	34				34.07		PL(A) = 1.38 PL(D) = 0.33		34
					34.07		PL(A) = 1.33		
272					34.5				
	34.72								
		SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone			34.79		PL(A) = 1.65 PL(D) = 1.75		
	35	From 35.07m, with some carbonaceous lamination		C	35.23		PL(A) = 1.82 PL(D) = 2.07		35
271		From 35.26m, fine to coarse grained							
	36				36.0		PL(A) = 2.63		36
					36.03		PL(D) = 1.18		
270									
	37				37.14		PL(A) = 2.35 PL(D) = 2.4		37
269		From 37.50m, high to very high strength, At 37.50m, fine to coarse sized, subrounded, subangular gravel		C	37.56		PL(D)=>14.64		
	38				38.23		PL(D)=>14.55		38
268		At 38.50m, medium to coarse sized, subrounded, subangular gravel							From 34.7m to 41.96m, bentonite
	39				38.99		PL(A) = 3.5		39
					39.02		PL(D) = 2.36		
267				C					

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.0m

TYPE OF BORING: Solid flight auger TC to 10.03m, Rock Roll to 10.35m, HQ3 to 41.96m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: 5-10% water loss from 11.5m. Top of pipe RL 307.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 306.47 AHD
EASTING: 231241.22
NORTHING: 6405086.38
DIP/AZIMUTH: 90°/--

BORE No: CPT39
PROJECT No: 49761
DATE: 15 - 17/5/2013
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
266	41	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone *(continued)*		C	41.13		PL(A) = 3.44 PL(D) = 2.81		41
265									
264	42 41.96	Bore discontinued at 41.96m, limit of investigation			41.93 41.96		PL(A) = 5.12 PL(D) = 2.07		42
263	43								43
262	44								44
261	45								45
260	46								46
259	47								47
258	48								48
257	49								49

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.0m

TYPE OF BORING: Solid flight auger TC to 10.03m, Rock Roll to 10.35m, HQ3 to 41.96m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: 5-10% water loss from 11.5m. Top of pipe RL 307.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 306.47 AHD
EASTING: 231241.22
NORTHING: 6405086.38
DIP/AZIMUTH: 90°/--

BORE No: CPT39
PROJECT No: 49761
DATE: 15 - 17/5/2013
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
306	0	SILTY SAND - Brown, fine to medium grained silty sand, with trace to some fine to medium sized subrounded-rounded gravel, abundant rootlets to 0.2m depth with trace to some clay, humid							D			
	1								S			10,25 refusal
305									D			
	2											
304									S			14,26,25/100mm refusal
	3											
303									D			
	4								S			13,21,26/100 refusal
302												
	5											
301									S			9,14,15 N = 29
	6											
300												
	7	7.0 CLAYEY SAND - Very dense, brown, fine to medium grained clayey sand, with trace to some fine to medium sized, subrounded-rounded gravel, grading to weathered sandstone							S			13,26/130mm refusal
299												
	8											
298									S			15,25/125mm refusal
	9											
297		9.3 SANDSTONE - Extremely low to very low strength, extremely to highly weathered, yellow/brown fine to medium grained sandstone										11/30mm

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.0m

TYPE OF BORING: Solid flight auger TC to 10.03m, Rock Roll to 10.35m, HQ3 to 41.96m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: 5-10% water loss from 11.5m. Top of pipe RL 307.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 306.47 AHD
EASTING: 231241.22
NORTHING: 6405086.38
DIP/AZIMUTH: 90°/--

BORE No: CPT39
PROJECT No: 49761
DATE: 15 - 17/5/2013
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Type	Core Rec. %	RQD %	Test Results & Comments
			S			refusal
296	10.35	CLAYSTONE - Extremely low to very low strength, extremely to highly weathered, grey/white and yellow/brown claystone with some fine to medium grained sand	C	88	0	
	11					
	11.25					
295	11.41	CORE LOSS - 0.13m (11.28m - 11.41m)				
	11.75	CLAYSTONE - Extremely low strength, extremely weathered, dark brown claystone	C	100	0	
	12	From 11.65m, yellow/brown	C	100	0	
	12.07	BASALT - High strength, slightly weathered, grey basalt				
294		SANDSTONE - Medium strength, moderately weathered, brown with some grey, fine to medium grained sandstone				PL(A) = 0.42 PL(D) = 0.18
	13					
293			C	100	61	
	14					PL(A) = 0.4 PL(D) = 0.04
292						PL(A) = 0.74 PL(D) = 0.23
	15					
	15.25	CLAYSTONE - Very low to low strength, highly to moderately weathered, brown claystone				
291	15.8	SILTSTONE - Very low to low strength, moderately weathered, brown with some grey siltstone				
	16					PL(A) = 0.05 PL(D) = 0.07
	16.24	CARBONACEOUS CLAYSTONE - Very low to low strength, highly to moderately weathered, dark brown/black carbonaceous claystone	C	100	89	
290	17	From 16.81m to 16.85m, extremely low strength, extremely weathered				PL(A) = 0.58 PL(D) = 0.21
	17.15	SILTSTONE - Low to medium strength, fresh, grey siltstone				
289	17.56	LAMINITE - Low to medium strength, fresh, grey, fine grained laminite				
	17.91	SANDSTONE - Medium to high strength, slightly weathered to fresh, grey, fine grained sandstone				PL(A) = 1.54 PL(D) = 0.91 PL(A) = 1.71 PL(A) = 2.07
	18	From 18.19m, slightly weathered, brown				
288		From 18.49m to 19.0m, with some carbonaceous siltstone bands	C	100	95	
	19					
287						PL(A) = 1.49 PL(D) = 2.83

Degree of Weathering: EW, HW, MW, SW, FS, FR
Graphic Log
Rock Strength: Ex Low, Very Low, Low, Medium, High, Very High, Ex High
Water
Fracture Spacing (m): 0.01, 0.05, 0.10, 0.50, 1.00

Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)

11.28m: CORE LOSS: 130mm
11.81m: P, sh, Pl, ro
11.85m: P, sh, Pl, ro
11.91m: P, sh, Pl, ro
12.03m: J, 40°, pl, ro
12.07m: K, 30°, Pl, ro
12.15m: P, sh, Pl, ro
From 12.21m to 12.25m, Fg
12.32m: P, sh, Pl, ro
12.36m: J, 30°, Pl, ro
12.51m: P, sh, Pl, ro
12.59m: P, sh, Pl, ro
12.7m: P, sh, Pl, ro
12.75m: P, sh, Pl, ro
12.93m: P, sh, Pl, ro
13.19m: P, sh, Pl, ro
13.2m: P, sh, Pl, ro
13.28m: P, sh, Pl, ro
13.43m: P, sh, Pl, ro
13.58m: P, sh, Pl, ro
13.59m: P, sh, Pl, ro
13.65m: Clay seam 7mm thick
13.73m: P, sh, Pl, ro
14m: J, 60°, Pl, closed
14.01m: Clay seam 3mm thick
14.09m: P, sh, Pl, ro
From 14.18m to 14.20m, Fg
14.68m: P, sh, Pl, ro
14.71m: P, sh, Pl, ro
From 14.79m to 14.20m, Fg
14.89m: P, sh, Pl, ro
14.99m: P, sh, Pl, ro
15.06m: J, 70°, Pl, closed
15.09m: P, sh, Pl, ro
15.15m: P, sh, Pl, ro
15.18m: P, sh, Pl, ro
15.25m: P, sh, Pl, ro
15.32m: P, sh, Pl, ro
15.61m: J, 60°, Pl, ro
15.8m: J, 10°, Pl, ro
From 16.17m to 16.84m, J, 80°, Pl, closed
16.35m: P, sh, Pl, closed
16.5m: P, sh, Pl, closed
16.53m: P, sh, Pl, closed
17.22m: P, sh, Pl, ro
17.71m: P, sh, Pl, ro
17.85m: P, sh, Pl, ro
17.91m: P, sh, Pl, ro
17.98m: P, sh, Pl, ro
18.46m: P, sh, Pl, ro
18.71m: P, sh, Pl, ro
18.8m: J, 70°, Pl, ro

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.0m

TYPE OF BORING: Solid flight auger TC to 10.03m, Rock Roll to 10.35m, HQ3 to 41.96m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: 5-10% water loss from 11.5m. Top of pipe RL 307.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 306.47 AHD
EASTING: 231241.22
NORTHING: 6405086.38
DIP/AZIMUTH: 90°/--

BORE No: CPT39
PROJECT No: 49761
DATE: 15 - 17/5/2013
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
286		SANDSTONE - Medium to high strength, slightly weathered to fresh, grey, fine grained sandstone *(continued)*	19m: J, 70°, Pl, ro 19.18m: J, 70°, Pl, ro 19.19m: J, 70°, Pl, ro 19.21m: J, 70°, Pl, ro 19.47m: J, 70°, Pl, ro 19.6m: J, 70°, Pl, ro 20.21m: J, 70°, Pl, ro 20.71m: J, 70°, Pl, ro	C	100	95	PL(A) = 3.02 PL(D) = 2.35
	20.87	From 20.22m to 20.25m, carbonaceous band					
	21 20.99	LAMINITE - Medium to high strength, slightly weathered to fresh, grey/dark grey, fine grained laminite					
	21.14						
285	21.48	CARBONACEOUS SILTSTONE - Medium strength, slightly weathered, dark grey/black carbonaceous siltstone	21.66m: J, 70°, Pl, ro				PL(A) = 1.77 PL(D) = 1.02
	22	COAL - Low to medium strength, fresh, black coal					
284		SILTSTONE - Medium to high strength, fresh, grey siltstone with some fine to medium grained sand bands		C	100	100	PL(A) = 1.15 PL(D) = 0.44
	23 23.08	STONEY COAL - Medium strength, fresh, black stoney coal					PL(A) = 1.72 PL(D) = 0.18
283		From 23.45m, tuff band 6mm thick	23.6m: J, 80°, Pl, closed				
	24	From 23.95m to 24.28m, fragmented (possibly drilling induced)	From 23.95m to 24.28m, Fg 24.4m: P, sh, Pl, ro 24.44m: P, sh, Pl, ro				
282			24.8m: P, sh, Pl, ro				PL(A) = 1.97 PL(D) = 0.48
	25	From 24.89m to 25.05m, interbedded sandstone lenses		C	100	82	
	25.35						
281	25.46	COAL - Low to medium strength, fresh, black coal					
		STONEY COAL - Medium to high strength, fresh, black stoney coal					PL(A) = 0.28 PL(D) = 0.15
	26	From 25.82m to 25.88m, extremely to very low strength From 25.88m, tuff band, 12mm thick From 25.93m, tuff band, 7mm thick From 25.99m to 26.04m, tuff band From 26.13m to 26.15m, stone band From 26.53m to 26.55m, tuff band	26.33m: P, sh, Pl, ro	C	100	100	
280			26.77m: P, sh, Pl, ro				PL(A) = 1.79 PL(D) = 1.01
	27						PL(A) = 1.64
	27.23	TUFF - Low to medium strength, fresh, grey/white tuff	27.4m: P, 45°, Pl, ro				PL(A) = 0.41 PL(D) = 0.16
279	27.63	From 27.23m to 27.36m, intermixed with stoney coal/carbonaceous mud	27.63m: P, sh, Pl, ro 27.7m: P, sh, Pl, ro 27.82m: P, sh, Pl, ro	C	100	96	
	28	STONEY COAL - Medium strength, fresh, black stoney coal					
	28.1	From 27.78m to 27.82m, tuff band					PL(A) = 1.84 PL(D) = 0.19
278		TUFF - Medium strength, fresh, grey/white tuff					
	28.62	STONEY COAL - Medium strength, fresh, black stoney coal					
	29			C	100	100	
277		From 29.55mm, tuff band, 13mm thick		C	100	100	PL(A) = 1.83 PL(D) = 1.01

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.0m

TYPE OF BORING: Solid flight auger TC to 10.03m, Rock Roll to 10.35m, HQ3 to 41.96m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: 5-10% water loss from 11.5m. Top of pipe RL 307.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 306.47 AHD
EASTING: 231241.22
NORTHING: 6405086.38
DIP/AZIMUTH: 90°/--

BORE No: CPT39
PROJECT No: 49761
DATE: 15 - 17/5/2013
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
276	30.01	CARBONACEOUS SILTSTONE - Medium strength, fresh, dark grey/black carbonaceous siltstone							C	100	100	
	30.15	SILTSTONE - Medium to high strength, fresh, dark grey/grey siltstone						30.45m: P, sh, Pl, ro 30.57m: P, sh, Pl, ro	C	100	100	PL(A) = 1.88 PL(D) = 0.86
	30.84	From 30.22m, with some medium to coarse sized, subrounded to rounded gravel							C	100	100	
275	31.32	SANDSTONE - Medium to high strength, fresh, grey, fine to medium grained sandstone										
	32	From 30.88m to 31.0m, with carbonaceous siltstone lamination							C	100	100	PL(A) = 1.64 PL(D) = 0.37
274		COAL - Medium strength, fresh, black coal										
		From 31.75m, stoney band, 8mm thick										
	33	From 32.05m, stoney band, 5mm thick										PL(A) = 0.41 PL(D) = 0.76
273		From 33.22m to 33.44m, fragmented						From 33.22m to 33.44m, Fg				
		From 33.59m to 33.63m, fragmented						From 33.59m to 33.63m, Fg	C	100	83	
	34											PL(A) = 1.38 PL(D) = 0.33 PL(A) = 1.33
272	34.72	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone										PL(A) = 1.65 PL(D) = 1.75
	35	From 35.07m, with some carbonaceous lamination										PL(A) = 1.82 PL(D) = 2.07
271		From 35.26m, fine to coarse grained						35.2m: P,sh,pl,ro	C	100	100	
								35.66m: P,sh,pl,ro				
	36											PL(A) = 2.63 PL(D) = 1.18
270												
	37											PL(A) = 2.35 PL(D) = 2.4
269		From 37.50m, high to very high strength,						37.5m: P,sh,pl,ro	C	100	100	PL(D)=>14.64
	38	At 37.50m, fine to coarse sized, subrounded, subangular gravel										PL(D)=>14.55
268		At 38.50m, medium to coarse sized, subrounded, subangular gravel						38.54m: P,sh,pl,ro				
	39											PL(A) = 3.5 PL(D) = 2.36
267									C	100	100	

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.0m

TYPE OF BORING: Solid flight auger TC to 10.03m, Rock Roll to 10.35m, HQ3 to 41.96m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: 5-10% water loss from 11.5m. Top of pipe RL 307.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 306.47 AHD
EASTING: 231241.22
NORTHING: 6405086.38
DIP/AZIMUTH: 90°/--

BORE No: CPT39
PROJECT No: 49761
DATE: 15 - 17/5/2013
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
266	41	SANDSTONE - High strength, fresh, grey, fine to medium grained sandstone *(continued)*						39.94m: P,sh,pl,ro 40.09m: P,sh,pl,ro 40.4m: J, 70°, Pl, ro 40.8m: J, 80°, Pl, ro	C	100	100	PL(A) = 3.44 PL(D) = 2.81
265	41.96	Bore discontinued at 41.96m, limit of investigation						41.88m: P,sh,pl,ro				PL(A) = 5.12 PL(D) = 2.07
264	42											
263	43											
262	44											
261	45											
260	46											
259	47											
258	48											
257	49											

RIG: TD106 **DRILLER:** (Total) Sawyer **LOGGED:** Cowan **CASING:** HW to 10.0m

TYPE OF BORING: Solid flight auger TC to 10.03m, Rock Roll to 10.35m, HQ3 to 41.96m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: 5-10% water loss from 11.5m. Top of pipe RL 307.10 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 277.77 AHD
EASTING: 227089.13
NORTHING: 6408369.69
DIP/AZIMUTH: 90°/--

BORE No: M1
PROJECT No: 49761
DATE: 11/12/2013
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
277	0	SILTY CLAY - (Stiff), brown silty clay with some fine grained sand, M<<Wp		A	0.1				Stickup = 0.454m
				A	0.25				
		From 0.5m, red/brown		A	0.5				
	1	From 1.0m, hard		A	1.0				
				S			13,18,21 N = 39		
				pp	1.45		>400 kPa		
276	2								
		From 2.5m, M<Wp			2.5				
				S			15,25/130mm refusal		
				pp	2.7		>400 kPa		
275	3				2.78				
274	4	From 4.0m, trace medium sized subangular gravel			4.0				
				S			14,26/130mm refusal		
					4.28				
273									

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 6.0m

TYPE OF BORING: Solid flight auger to 5.9m, rotary to 6.5m, HQ to 23.95m

WATER OBSERVATIONS: Free groundwater measured at 16.20m at completion of drilling, groundwater measured at 10.2m 12/12/2013

REMARKS: Top of Pipe RL 278.22 AHD. Coordinates in MGA
50% water loss at 11.59m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 277.77 AHD
EASTING: 227089.13
NORTHING: 6408369.69
DIP/AZIMUTH: 90°/--

BORE No: M1
PROJECT No: 49761
DATE: 11/12/2013
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
272	5.8	SILTY CLAY - (Stiff), brown silty clay with some fine grained sand, M<<Wp *(continued)*							
		From 5.5m, mottled brown and dark brown		pp	5.5		>400 kPa		
				S	5.8		10,26/150mm refusal		
	6	SANDSTONE - Low strength, moderately weathered, brown, fine grained sandstone		S	5.9 5.94		4/50mm refusal bouncing		6
	6.5	SANDSTONE - High strength, moderately weathered, orange, fine to medium grained sandstone with some very low strength tuff bands			6.5				
271				C	6.65		PL(A) = 0.05		
	7								7
					7.3		PL(A) = 2.17		From 0.0m to 14.4m, grout
					7.4		PL(A) = 0.6 PL(D) = 0.74		
		From 7.45m, medium strength			7.45				
					7.55		PL(A) = 1.35		From -0.45m to 15.5m, Class 18 blank
270	8			C	8.1		PL(A) = 0.62 PL(D) = 0.81		8
269					8.66		PL(A) = 2.13 PL(D) = 1.68		
	9				8.98				9
				C	9.26		PL(A) = 2.13 PL(D) = 1.19		
					9.59				
268				C	9.75		PL(A) = 4.06 PL(D) = 4		
					10.0		PL(A) = 2.31		

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 6.0m

TYPE OF BORING: Solid flight auger to 5.9m, rotary to 6.5m, HQ to 23.95m

WATER OBSERVATIONS: Free groundwater measured at 16.20m at completion of drilling, groundwater measured at 10.2m 12/12/2013

REMARKS: Top of Pipe RL 278.22 AHD. Coordinates in MGA
50% water loss at 11.59m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 277.77 AHD
EASTING: 227089.13
NORTHING: 6408369.69
DIP/AZIMUTH: 90°/--

BORE No: M1
PROJECT No: 49761
DATE: 11/12/2013
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE - High strength, moderately weathered, orange, fine to medium grained sandstone with some very low strength tuff bands *(continued)*					PL(D) = 2.38		
		From 10.47m, brown			10.52		PL(A) = 1.41		
267	11			C	11.04		PL(A) = 1.24		11
					11.3		PL(A) = 0.73 PL(D) = 0.31		
266					11.89		PL(A) = 0.73 PL(D) = 0.41		
	12				11.93				12
					12.33		PL(A) = 1.39		
					12.52		PL(A) = 1.47		
					12.58				
265				GT001					
					12.9		PL(A) = 3.43		
	13				12.94				13
				C					
264					13.7		PL(A) = 4.87		
	14				13.98		PL(A) = 2.9 PL(D) = 1.63		14
					14.29		PL(A) = 4.14		
263									From 14.4m to 15.2m, bentonite
				C	14.93		PL(A) = 0.65		

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 6.0m

TYPE OF BORING: Solid flight auger to 5.9m, rotary to 6.5m, HQ to 23.95m

WATER OBSERVATIONS: Free groundwater measured at 16.20m at completion of drilling, groundwater measured at 10.2m 12/12/2013

REMARKS: Top of Pipe RL 278.22 AHD. Coordinates in MGA
50% water loss at 11.59m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 277.77 AHD
EASTING: 227089.13
NORTHING: 6408369.69
DIP/AZIMUTH: 90°/--

BORE No: M1
PROJECT No: 49761
DATE: 11/12/2013
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE - High strength, moderately weathered, orange, fine to medium grained sandstone with some very low strength tuff bands *(continued)*			14.94				
		From 15.04m, fresh stained							
262	16				15.96		PL(A) = 2.35 PL(D) = 1.15		16
		From 16.33m, fresh, grey		C					
261	17				16.82		PL(A) = 2.97 PL(D) = 2.33		17
260	18				17.93				18
				C	18.33		PL(A) = 4.13 PL(D) = 3.8		
259	19				18.86		PL(A) = 3.25		19
					19.22				From 15.5m to 23.0m, Class 18 machine slotted
	19.63	SILTSTONE - High strength, fresh, dark grey siltstone		C					From 15.2m to 23.95m, gravel
258		From 19.9m to 20.1m, sandstone band			19.79		PL(A) = 2.29 PL(D) = 1.17		

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 6.0m

TYPE OF BORING: Solid flight auger to 5.9m, rotary to 6.5m, HQ to 23.95m

WATER OBSERVATIONS: Free groundwater measured at 16.20m at completion of drilling, groundwater measured at 10.2m 12/12/2013

REMARKS: Top of Pipe RL 278.22 AHD. Coordinates in MGA
50% water loss at 11.59m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 277.77 AHD
EASTING: 227089.13
NORTHING: 6408369.69
DIP/AZIMUTH: 90°/--

BORE No: M1
PROJECT No: 49761
DATE: 11/12/2013
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
257	21	SILTSTONE - High strength, fresh, dark grey siltstone *(continued)*		C	20.27				21
					20.73		PL(A) = 1.42		
					21.19				
				GT002	21.43				
256	22			C	21.7		PL(A) = 2.61 PL(D) = 1.59		22
					22.26		PL(A) = 0.53		
	22.59	SANDSTONE - Medium strength, fresh, grey, fine to medium grained sandstone with some siltstone laminations							
255	23				22.99				23
				C	23.51		PL(A) = 0.71		From 23.0m to 23.95m, Class 18 blank
254	23.95				23.95				End cap
	24	Bore discontinued at 23.95m, limit of investigation							24
253									

RIG: Hydropower Scout **DRILLER:** (Total Drilling) Sawyer **LOGGED:** Fulham **CASING:** HW to 6.0m

TYPE OF BORING: Solid flight auger to 5.9m, rotary to 6.5m, HQ to 23.95m

WATER OBSERVATIONS: Free groundwater measured at 16.20m at completion of drilling, groundwater measured at 10.2m 12/12/2013

REMARKS: Top of Pipe RL 278.22 AHD. Coordinates in MGA
50% water loss at 11.59m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Bylong Confidential
LOCATION: Bylong

SURFACE LEVEL: 262.8 AHD
EASTING: 227518.53
NORTHING: 6409099.11
DIP/AZIMUTH: 90°/--

BORE No: M2
PROJECT No: 49761
DATE: 11/12/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
262	0.8	SILTY CLAY - (Stiff), brown silty clay, M<<Wp		A	0.1				TOC = 0.495m
				A	0.25				
				A	0.5				
	1	CLAY - (Hard), light brown clay with trace to some silt, M<<Wp At 1.0m, cobble		A	1.0				From 0m to 2.1m, grout From -0.5m to 2.9m, Class 18 blank
				S	1.15		25/150mm		
261	2								
	2.2	GRAVEL - Dense, brown, fine to medium sized subangular / subrounded gravel, slightly medium grained sandy with some clay, damp			2.5				From 2.1m to 2.6m, bentonite
				S			13,14,19 N = 33		
260	3				2.95				
		From 3.5m, trace sand and trace clay, moist		D	3.5				
259	4	From 3.9m to 4.05m, clay band From 4.05m, some gravel up to 35mm in diameter		pp	4.0		230 kPa		From 2.6m to 5.9m, gravel From 2.9m to 5.9m, Class 18 machine slotted
				S			8,24, 14/75mm		
258	5	From 5.0m, wet with some fine to medium grained sand			4.38				
					5.5				
	5.68			S			18, 12/60 (bouncing)		
257		SANDSTONE - Medium strength, moderately weathered, brown, fine to medium grained sandstone			5.71				End cap
	5.95	Bore discontinued at 5.95m, limit of investigation		S	6.0		3/0 (bouncing)		
256	7								
255	8								
254	9								
253									

RIG: Hydropower Scout **DRILLER:** Total Drilling (Sawyer) **LOGGED:** Fulham **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 5.95m

WATER OBSERVATIONS: Free groundwater observed at 5.6m

REMARKS: Top of Pipe RL 263.30 AHD. Coordinates in MGA

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Cockatoo Coal Limited
PROJECT: Proposed Coal Mine
LOCATION: Bylong

SURFACE LEVEL: 382.99 AHD
EASTING: 229258.08
NORTHING: 6400152.31
DIP/AZIMUTH: 90°/--

BORE No: OP032
PROJECT No: 49761
DATE: 12/12/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SILTY SAND - (Medium dense), red brown silty, fine to medium grained sand, trace fine grained subangular gravel, humid							From 0m to 0.3m, concrete
	0.75	From 0.5m, slightly clayey, some fine sized subangular gravel							
382	1	SILTY CLAY - Hard, brown silty clay, some fine grained subangular gravel and fine to medium grained sand, M>Wp		pp	1.0 1.0		>500kPa		1
	1.2			S	1.25		8,27,30 N = 57		
	1.5	SANDSTONE - Medium strength, highly weathered, grey, fine to medium grained sandstone			1.45 1.5				
	1.67	CORE LOSS - 0.17m							
381	2	SILTSTONE/SANDSTONE - Medium strength, slightly to moderately weathered, grey, fine to medium grained sandstone (moderately weathered), thinly bedded with siltstone (slightly weathered)		C	2.0		PL(A) = 0.91 PL(D) = 0.32		2 From 0m to 4.85m, Class 18 PVC From 0.3m to 4.85m, bentonite
		From 1.95m to 2.02m, moderately weathered, sandstone band							
	2.79	From 2.34m to 2.47m, moderately weathered sandstone band							
380	3	SANDSTONE - High strength, moderately weathered, grey, fine to medium grained sandstone			2.95 3.0		PL(A) = 1.14 PL(D) = 0.89		3
		From 3.92m, fine to coarse grained, medium strength							
379	4				4.22		PL(A) = 0.85 PL(D) = 0.66		4
	4.74			C					
	4.92	COAL - Extremely low strength, extremely weathered, black coal with red mottled sections							
378	5	CORE LOSS - 1.29m							5
									From 4.8m to 6.35m, 5mm gravel From 4.85m to 6.35m, Class 18 PVC Screen
377	6				6.0				6
	6.21			C					End Cap
	6.37	COAL - Extremely low strength, extremely weathered black coal			6.4				
	6.4								
	6.55	CARBONACEOUS SILTSTONE - Low strength, moderately weathered, brown carbonaceous siltstone							
	6.76								
376	7	CORE LOSS - 0.150m							7
		CARBONACEOUS SILTSTONE - Low strength, moderately weathered carbonaceous siltstone							
		SANDSTONE - High strength, slightly weathered, grey/brown, fine to medium grained sandstone		C	7.64		PL(A) = 1.54 PL(D) = 1.1		From 6.35m to 8.65m, bentonite
375	8								8
		From 8.29m, moderately weathered							
	8.65				8.55 8.65		PL(A) = 1.73		
		Bore discontinued at 8.65m, limit of investigation							
374	9								9

RIG: Hydropower Scout **DRILLER:** (Total) Sawyer **LOGGED:** Holden **CASING:** HW to 1.25m

TYPE OF BORING: Solid flight auger to 1.6m, HQ3 to 8.65m

WATER OBSERVATIONS: Free groundwater obscured due to drilling fluids. No free groundwater observed whilst auger drilling

REMARKS: From 2.6m, water loss. Top of pipe RL 383.54 AHD. Coordinates in MGA.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Appendix C

Table C1: Summary of Laboratory Test Results
Table C2: Summary of Groundwater Sampling Dates
Table C3: Summary of Surface Water Sampling Dates

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW1	SW1	SW1	SW1	SW1	SW1 (D7)	SW1	SW1	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2012	Mar 2012	May 2012	Jun 2012	Jul 2012	Jul 2012	Aug 2012	Sept 2012			Fresh	Marine	Irrigation Waters
	22/2/2012	8/03/2012	29/05/2012	27/06/2012	22/07/2012	22/07/2012	20/08/2012	19/09/2012					
pH	7.0	6.7	7.5	7.7	7.1	7.1	7.4	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	120	160	270	250	200	210	250	290	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	9.2	26	1.8	4.2	8.3	7.3	3.2	2.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<1	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<1	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	28	38	84	72	62	62	87	81	1/5	NC	NC	NC	NC
Total Alkalinity	28	38	84	72	62	62	87	81	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	18	20	34	33	28	29	34	33	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.02	0.01	<0.005	0.007	0.006	0.008	<0.005	0.007	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.05	0.1	0.02	<0.005	0.03	0.05	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	2	3	6	4	3	3	5	4	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	3.5	4.7	12	11	6.8	6.1	12	13	0.5	NC	NC	NC	NC
Potassium	2.8	3.1	3.2	2.8	2.4	2.4	3.2	3.1	0.5	NC	NC	NC	NC
Sodium	13	14	25	24	19	19	28	28	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	4.1	5.5	11	10	7.5	8.1	12	12	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.15	0.11	0.003	<0.01	0.012	0.007	0.0030	0.0020	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.01	0.013	0.019	0.0160	0.0150	0.0140	0.0210	0.0260	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.003	<0.001	<0.001	<0.001	<0.001	0.001	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.23	0.21	0.023	0.0620	0.0890	0.0870	0.06	0.06	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.013	0.032	0.11	0.1100	0.0890	0.0910	0.120	0.150	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.004	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.008	0.007	0.014	0.013	0.014	0.003	0.005	0.014	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	1.5	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	0.021	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	<0.0001	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	<0.0001	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	0.004	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	0.001	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	0.001	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	1.6	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	0.047	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	<0.00005	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	0.006	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	0.003	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	0.005	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW2	SW2	SW2 (D3)	SW2	SW2	SW2	SW2	SW2	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2012	Mar 2012	Mar 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012			Fresh	Marine	Irrigation Waters
	22/2/2012	8/03/2012	8/03/2012	29/05/2012	26/06/2012	22/07/2012	20/08/2012	19/09/2012					
pH	7.3	7.0	7.0	8.1	8.1	7.7	8.5	7.8	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	260	300	300	890	920	670	830	880	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	11	12	10	1.6	1.4	3.5	2.5	5.5	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<1	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<1	<5	<5	<5	<5	<5	19	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	68	90	99	240	230	210	220	220	1/5	NC	NC	NC	NC
Total Alkalinity	68	90	99	240	230	210	240	220	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	23	37	39	120	120	78	110	110	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.02	0.57	0.02	0.008	<0.005	0.02	0.036	0.006	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.03	0.04	0.03	0.1	0.4	0.2	0.04	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	8	8	8	48	51	24	47	37	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	12	14	14	49	47	34	51	50	0.5	NC	NC	NC	NC
Potassium	6.4	6.4	6.3	8.9	5.2	5.2	5.2	6.9	0.5	NC	NC	NC	NC
Sodium	25	27	27	88	73	60	80	79	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	8.2	12	11	36	34	24	42	39	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.035	0.021	0.034	0.004	0.005	0.005	0.0310	0.0040	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0010	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.019	0.024	0.025	0.051	0.0500	0.0350	0.0560	0.0570	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	0.0001	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.001	NC	NC	0.001	0.05 [4]
Copper	0.004	<0.001	0.003	0.001	0.002	<0.001	<0.001	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.21	0.15	0.17	0.028	<0.01	0.0210	0.22	0.09	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	0.041	0.04	<0.005	<0.005	0.0760	0.100	0.610	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.004	0.005	0.003	0.002	0.002	0.002	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.007	0.017	0.02	0.007	0.012	0.002	0.100	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	0.48	0.55	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	<0.001	<0.001	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	0.028	0.028	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	<0.0001	<0.0001	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	<0.0001	<0.0001	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	0.002	0.002	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	<0.001	<0.001	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	<0.001	<0.001	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	0.75	0.78	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	<0.001	<0.001	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	0.049	0.051	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	<0.00005	<0.00005	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	0.005	0.005	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	<0.001	<0.001	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	0.002	0.002	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	0.002	0.002	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.2	0.1	0.1	<0.05	<0.05	<0.05	<0.05	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW2	SW2	D106 (SW2)	SW2	D110 (SW2)	SW2	SW2	D114 (SW2)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2013	July 2016	July 2016	Sept 2016	Sept 2016	Sept 2016	Oct 2016	Oct 2016			Fresh	Marine	Irrigation Waters
	11/03/2013	25/07/2016	25/07/2016	13/09/2016	13/09/2016	13/09/2016	12/10/2016	12/10/2016					
pH	7.8	7.3	7.3	7.3	7.2	7.3	7.7	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	500	240	240	280	290	280	470	460	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	2.9	16	15	5	6	5	6.8	5.5	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	170	61	61	91	90	91	150	150	1/5	NC	NC	NC	NC
Total Alkalinity	170	61	61	91	90	91	150	150	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	52	27	28	35	33	35	64	65	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.01	0.006	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.2	0.2	<0.005	0.007	<0.005	0.01	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	18	10	10	11	11	11	32	33	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	29	12	11	16	17	16	26	27	0.5	NC	NC	NC	NC
Potassium	6.2	4.7	4.6	4.6	4.7	4.6	5.2	5.2	0.5	NC	NC	NC	NC
Sodium	41	21	22	29	29	29	50	50	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	21	11	10	14	14	14	21	21	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.005	0.044	0.043	0.015	0.012	0.015	0.004	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.029	0.013	0.012	0.016	0.017	0.016	0.031	0.03	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.002	0.002	0.002	0.001	0.002	0.003	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.059	0.2	0.21	0.11	0.11	0.11	0.100	0.110	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.008	<0.005	<0.005	0.013	0.011	0.013	0.050	0.052	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.003	0.002	0.003	0.003	0.003	0.004	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.011	<0.001	0.001	0.003	<0.001	0.003	0.005	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.09	0.08	0.08	0.07	0.09	0.07	0.08	0.09	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2012	Mar 2013	Jan 2016	Feb 2016	July 2016	July 2016	Aug 2016	Nov 2016			Fresh	Marine	Irrigation Waters
	22/10/2012	11/03/2013	28/01/2016	8/02/2016	12/07/2016	25/07/2016	16/08/2016	16/11/2016					
pH	7.7	7.5	7.1	7.5	7.1	7.0	7.1	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	290	180	160	210	210	140	210	180	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	0.6	3	4.9	2.4	4.7	9.8	4.8	6.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	81	54	44	60	43	38	53	49	1/5	NC	NC	NC	NC
Total Alkalinity	81	54	44	60	43	38	53	49	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	35	23	23	27	19	16	25	22	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.03	<0.005	<0.005	0.015	<0.005	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.09	0.3	0.77	0.08	0.2	0.3	0.08	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	5	2	2	3	10	3	4	2	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	12	6.2	3.9	8.4	4.8	4.7	7.5	5.9	0.5	NC	NC	NC	NC
Potassium	3.5	2.6	3.2	4.5	2.3	2.3	2.6	2.8	0.5	NC	NC	NC	NC
Sodium	26	16	16	25	16	13	19	17	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	13	7.3	6.4	9.8	7.3	6.4	9.4	8.1	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.003	0.035	0.029	0.011	0.01	0.034	0.007	0.018	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.023	0.012	0.011	0.017	0.006	0.007	0.013	0.011	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	<0.001	0.007	0.014	0.002	0.003	0.002	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.100	0.210	0.15	0.16	0.029	0.075	0.045	0.087	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.062	0.067	0.022	0.073	<0.005	0.01	0.075	0.041	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	0.00024	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.003	0.004	0.004	0.002	0.002	0.002	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.009	0.003	0.005	0.008	0.002	0.007	0.005	0.014	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW1	SW1	SW1	D127 (SW1)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
							Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2016	Oct 2016	Apr 2017	Apr 2017			Fresh	Marine	Irrigation Waters
	13/09/2016	12/10/2016	5/04/2017	5/04/2017					
pH	6.8	7.1	6.9	6.8	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	130	170	190	180	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	8.8	5.4	5.6	3.7	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity									
Hydroxide (OH^-)	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	37	49	47	47	1/5	NC	NC	NC	NC
Total Alkalinity	37	49	47	47	1/5	NC	NC	NC	NC
Anions									
Chloride (Cl)	17	24	21	21	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.08	0.07	0.03	0.03	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	3	5	5	5	1	500	NC	NC	NC
Cations - Dissolved									
Calcium	4.7	4.8	5.5	5.6	0.5	NC	NC	NC	NC
Potassium	2.5	2.6	3.2	3.2	0.5	NC	NC	NC	NC
Sodium	13	16	17	18	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	6.6	7	7.2	7.3	0.5	NC	NC	NC	NC
Metals - Dissolved									
Aluminium	0.022	0.016	0.01	0.01	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.006	0.009	0.009	0.009	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.002	0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.059	0.052	0.046	0.045	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.016	0.028	0.008	0.007	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	0.002	0.002	0.001	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total									
Aluminium	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW3	SW3 (D1)	SW3	SW3	SW3	SW3	SW3	SW3	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2012	Feb 2012	Mar 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012			Fresh	Marine	Irrigation Waters
	22/2/2012	22/2/2012	8/03/2012	29/05/2012	26/06/2012	22/07/2012	21/08/2012	19/09/2012					
pH	8.1	8.1	7.2	8.3	8.3	8.0	8.6	8.4	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	< 6 (6)(18)
Electrical Conductivity (µS/cm)	940	950	330	1000	1200	990	1200	1200	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	99	99	54	2.3	20	5.3	1.6	2.4	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<1	<1	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<1	<1	<5	13	24	<5	33	19	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	310	320	100	330	370	380	440	420	1/5	NC	NC	NC	NC
Total Alkalinity	310	320	100	340	390	380	470	440	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	47	55	41	130	140	110	120	130	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.055	0.01	<0.005	0.008	0.017	0.013	0.005	0.5 (8)/0.41(12)	0.9	0.91	NC
NO_x ($NO_2^- + NO_3^-$)	15	15	0.09	<0.005	<0.005	0.01	<0.005	0.01	0.005	3(13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	26	31	7	16	16	12	8	6	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	22	21	13	32	33	30	36	35	0.5	NC	NC	NC	NC
Potassium	3.2	3	6.9	6.8	7.5	5.7	6	7.1	0.5	NC	NC	NC	NC
Sodium	180	180	40	150	160	150	180	180	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	20	20	9.9	35	38	32	41	46	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.045	0.039	0.51	0.006	0.007	0.007	0.0110	0.0050	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.064	0.063	0.048	0.065	0.0740	0.0640	0.0800	0.0720	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	0.003	0.001	0.004	0.001	0.002	0.002	0.001	0.001	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	0.032	0.028	0.45	0.012	0.0120	0.017	0.02	0.02	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	<0.005	<0.005	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	0.002	0.001	0.006	0.002	0.002	0.002	0.001	0.002	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.008	0.002	0.01	0.016	0.018	0.013	0.004	0.015	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total													
Aluminium	NT	NT	2.8	NT	NT	NT	NT	NT	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	NT	NT	<0.001	NT	NT	NT	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	NT	0.064	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	0.0002	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	NT	<0.0001	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	NT	0.004	NT	NT	NT	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	NT	0.001	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	NT	0.003	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	NT	2.7	NT	NT	NT	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	NT	<0.001	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	NT	0.023	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	NT	<0.00005	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	NT	0.008	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	NT	<0.001	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	NT	0.005	NT	NT	NT	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	NT	0.004	NT	NT	NT	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	0.1	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW3	SW3	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
					Slightly to Moderately Disturbed Systems		
Date Sampled	July 2016	Apr 2017			Fresh	Marine	Irrigation Waters
	25/07/2016	3/04/2017					
pH	8.1	7.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	710	830	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	2.5	0.8	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity							
Hydroxide (OH^-)	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	230	220	1/5	NC	NC	NC	NC
Total Alkalinity	230	220	1/5	NC	NC	NC	NC
Anions							
Chloride (Cl)	82	89	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.012	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.009	3.7	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	14	69	1	500	NC	NC	NC
Cations - Dissolved							
Calcium	22	39	0.5	NC	NC	NC	NC
Potassium	4.9	12	0.5	NC	NC	NC	NC
Sodium	110	110	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	23	29	0.5	NC	NC	NC	NC
Metals - Dissolved							
Aluminium	0.007	0.002	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	0.051	0.11	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.003	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.028	0.017	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	0.018	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	0.003	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.003	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total							
Aluminium	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	SW4	SW4	SW4	SW4 (D5-270612)	SW4	SW4	SW4	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2012	Mar 2012	May 2012	Jun 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012			Fresh	Marine	Irrigation Waters
	22/2/2012	8/03/2012	29/05/2012	27/06/2012	27/06/2012	22/07/2012	21/08/2012	19/09/2012					
pH	7.9	7.1	7.9	7.8	7.8	7.7	8.0	8.2	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	< 6 (6)(18)
Electrical Conductivity (µS/cm)	660	380	1800	1900	1900	1200	1700	1800	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	6.3	28	2.5	1.8	1.7	3.1	1.8	0.6	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<1	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<1	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	160	110	370	340	350	290	350	340	1/5	NC	NC	NC	NC
Total Alkalinity	160	110	370	340	350	290	350	340	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	79	47	270	260	260	160	230	270	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.02	0.04	0.01	0.02	0.03	0.016	0.028	0.013	0.005	0.5 (8)/0.41(12)	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.03	0.01	0.03	<0.005	0.007	0.08	0.1	0.007	0.005	3(13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	52	19	220	200	200	110	180	210	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	41	19	100	96	98	63	110	120	0.5	NC	NC	NC	NC
Potassium	8.9	6.9	7.6	6.6	7.2	6.4	6.5	7.1	0.5	NC	NC	NC	NC
Sodium	62	33	170	160	200	110	160	170	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	28	15	80	74	78	48	86	92	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.013	0.019	0.011	<0.01	<0.01	0.005	0.0020	0.0020	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.037	0.03	0.085	0.0910	0.091	0.0560	0.0900	0.0910	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0005	<0.0005	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	0.001	0.002	0.003	<0.001	0.002	<0.001	0.002	0.001	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	0.13	0.14	0.027	0.0960	0.092	0.040	0.11	0.03	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	0.01	0.047	0.2	0.2000	0.190	0.1200	0.140	0.013	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	0.003	0.004	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	0.001	<0.001	0.001	0.001	0.001	<0.001	0.0020	0.0030	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.003	0.008	0.015	0.005	0.024	0.009	0.006	0.012	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total													
Aluminium	NT	1.3	NT	NT	NT	NT	NT	NT	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	0.044	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	0.0001	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	<0.0001	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	0.003	NT	NT	NT	NT	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	0.001	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	0.002	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	2	NT	NT	NT	NT	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	0.094	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	<0.00005	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	0.006	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	0.004	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	0.006	NT	NT	NT	NT	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	0.2	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	SW4	SW4 (D16)	SW4	SW4 (D18)	SW4	SW4 (D19)	SW4	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2012	Dec 2012	Dec 2012	Jan 2013	Jan 2013	Feb 2013	Feb 2013	Mar 2013			Fresh	Marine	Irrigation Waters
	22/10/2012	4/12/2012	3/12/2012	15/01/2013	15/01/2013	19/02/2013	19/02/2013	11/03/2013					
pH	8.3	7.6	7.6	7.6	7.6	7.6	7.6	7.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	2100	2200	2200	2200	2200	2200	2100	1300	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	8.8	8	7.8	13	15	4	4.8	1.2	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	6	<5	<5	<5	<5	<5	<5	320	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	380	390	390	410	410	410	410	<5	1/5	NC	NC	NC	NC
Total Alkalinity	390	390	390	410	410	410	410	320	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	290	330	330	360	340	340	340	180	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.028	0.046	0.054	<0.005	<0.005	0.018	0.017	0.009	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.04	0.04	0.02	<0.005	0.008	0.01	0.04	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	240	250	250	310	300	290	290	130	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	120	150	160	120	120	150	130	81	0.5	NC	NC	NC	NC
Potassium	7.3	7.7	7.5	7.1	7.1	7.2	7.1	6.2	0.5	NC	NC	NC	NC
Sodium	210	240	240	230	250	220	210	100	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	110	120	120	96	110	100	100	59	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.008	0.001	0.001	0.003	0.003	0.004	0.007	0.011	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.094	0.094	0.091	0.091	0.087	0.079	0.080	0.073	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	0.0001	0.0001	<0.0001	0.0004	0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.002	0.001	0.001	0.002	0.002	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.003	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.190	0.029	0.024	0.300	0.300	0.017	0.019	0.032	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.580	0.790	0.790	0.560	0.570	0.250	0.250	0.088	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.001	0.001	0.003	0.002	0.001	0.002	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.006	0.004	<0.001	<0.001	0.001	0.005	0.014	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.07	0.06	0.06	0.1	0.1	<0.05	<0.05	0.07	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	SW4 (D24)	SW4	SW4 (D28)	SW4	SW4 (D30)	SW4	SW4	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Apr 2013	Apr 2013	May 2013	May 2013	Jun 2013	Jun 2013	Jul 2013	Aug 2013			Fresh	Marine	Irrigation Waters
	16/04/2013	16/04/2013	13/05/2013	13/05/2013	18/06/2013	18/06/2013	22/07/2013	19/08/2013					
pH	8.1	8.1	8.2	8.2	7.9	8.1	7.9	8.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1900	1900	1800	1800	1800	1900	1800	1800	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	3.7	2.6	3.4	3.3	3.1	2.8	7.2	2.7	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	370	370	360	360	380	370	370	360	1/5	NC	NC	NC	NC
Total Alkalinity	370	370	360	360	380	370	370	360	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	290	290	320	320	290	290	350	240	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.007	<0.005	0.015	0.017	0.019	0.023	0.04	0.01	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	<0.005	<0.005	0.05	0.05	0.03	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	220	210	260	260	240	240	230	190	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	110	110	110	110	100	100	120	100	0.5	NC	NC	NC	NC
Potassium	6.4	6.3	5.9	6.1	7.2	7.4	6	5.3	0.5	NC	NC	NC	NC
Sodium	170	170	170	180	180	180	170	150	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	89	88	84	85	80	84	82	82	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.005	0.008	0.002	<0.0005	0.0006	<0.0005	0.003	0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.099	0.098	0.088	0.085	0.085	0.095	0.092	0.09	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.062	0.078	0.066	0.049	0.075	0.074	0.079	0.048	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.110	0.110	0.120	0.130	0.11	0.12	0.26	0.12	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	<0.001	0.008	0.005	<0.001	0.008	0.001	0.003	0.009	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	0.08	0.10	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014			Fresh	Marine	Irrigation Waters
	17/09/2013	16/10/2013	12/11/2013	16/12/2013	14/01/2014	17/02/2014	19/03/2014	15/04/2014					
pH	8.3	7.8	7.6	7.9	7.6	7.6	6.9	7.7	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	< 6 (6)(18)
Electrical Conductivity (µS/cm)	2200	2000	1900	2000	2300	2000	1900	2100	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	2.4	4.4	21	5.6	3.1	3.1	13	2.2	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	17	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	310	360	300	370	420	390	320	400	1/5	NC	NC	NC	NC
Total Alkalinity	320	360	300	370	420	390	320	400	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	370	320	300	360	350	290	290	290	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.011	0.018	<0.005	<0.005	0.012	0.028	0.053	0.005	0.5 (8)/0.41(12)	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.06	0.02	18	1.9	0.04	<0.005	<0.005	0.03	0.005	3(13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	320	240	250	290	220	240	310	230	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	110	120	120	110	130	120	130	140	0.5	NC	NC	NC	NC
Potassium	14	6.2	5.8	6.2	7.8	8.7	7.9	8.9	0.5	NC	NC	NC	NC
Sodium	230	200	190	220	240	220	230	210	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	98	97	91	99	110	100	99	99	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.009	0.01	0.009	0.005	0.007	0.008	0.002	<0.0005	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.09	0.1	0.14	0.12	0.13	0.087	0.08	0.11	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	0.002	0.002	0.002	0.002	<0.001	<0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	0.13	0.074	0.14	0.017	0.053	0.16	0.25	0.014	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	0.12	0.27	1.4	0.13	0.24	0.5	0.43	0.15	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	0.004	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.01	0.012	0.009	0.011	0.002	0.008	0.002	0.002	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	0.08	0.05	0.3	0.09	<0.05	0.09	0.1	<0.05	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	SW4	SW4	SW4 (D57)	SW4	SW4	SW4	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
										Slightly to Moderately Disturbed Systems		
Date Sampled	May 2014	June 2014	July 2014	July 2014	Aug 2014	Dec 2014	Jan 2015			Fresh	Marine	Irrigation Waters
	20/05/2014	19/06/2014	24/07/2014	24/07/2014	21/08/2014	4/12/2014	14/01/2015					
pH	7.7	8.1	7.9	8.0	7.9	7.8	8.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	2100	1800	1800	1800	1900	1900	1800	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4.6	1.9	6.6	2.9	6.4	11	20	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity												
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	360	360	360	360	350	380	380	1/5	NC	NC	NC	NC
Total Alkalinity	360	360	360	360	350	380	380	1/5	NC	NC	NC	NC
Anions												
Chloride (Cl)	290	310	320	320	300	310	330	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	0.006	0.013	0.009	<0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.1	0.01	0.008	0.01	0.4	0.01	<0.005	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	240	260	270	270	250	230	260	1	500	NC	NC	NC
Cations - Dissolved												
Calcium	130	120	120	120	120	110	110	0.5	NC	NC	NC	NC
Potassium	7.3	7.9	7.7	7.6	8.2	6.9	7.8	0.5	NC	NC	NC	NC
Sodium	190	210	200	200	220	210	210	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	96	93	98	96	97	94	96	0.5	NC	NC	NC	NC
Metals - Dissolved												
Aluminium	<0.005	0.001	<0.0005	0.0006	0.0007	0.001	0.002	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.1	0.079	0.087	0.082	0.087	0.084	0.079	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.027	<0.01	<0.01	<0.01	0.011	0.02	0.013	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.13	0.034	0.091	0.089	0.11	0.24	0.16	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.001	<0.001	<0.001	0.001	<0.001	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	0.002	0.004	<0.001	0.004	0.006	0.006	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total												
Aluminium	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	0.3	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	SW4	SW4	SW4	SW4	SW4	D77 (SW4)	SW4	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2015	March 2015	April 2015	May 2015	June 2015	July 2015	July 2015	Aug 2015			Fresh	Marine	Irrigation Waters
	11/02/2015	11/03/2015	16/04/2015	18/05/2015	22/06/2015	16/07/2015	16/07/2015	13/08/2015					
pH	7.9	7.8	7.8	8.1	7.6	7.7	7.7	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1900	2000	2100	2000	2100	2000	1900	2000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	7.7	7	11	21	5.7	5.3	5.2	6.5	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	400	390	410	390	350	320	320	360	1/5	NC	NC	NC	NC
Total Alkalinity	400	390	410	390	350	320	320	360	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	360	330	320	300	310	320	310	350	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.15	<0.005	0.18	0.03	<0.005	0.006	0.01	0.008	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.007	0.04	0.1	0.01	0.02	0.02	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	290	260	250	250	300	300	300	330	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	120	93	140	120	130	120	120	110	0.5	NC	NC	NC	NC
Potassium	9.8	8.7	10	8.7	7.8	8.2	8.2	7.8	0.5	NC	NC	NC	NC
Sodium	210	230	240	220	200	220	210	210	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	100	77	110	100	100	100	100	91	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.004	0.002	0.004	0.003	0.002	0.002	0.002	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.09	0.095	0.091	0.097	0.083	0.081	0.082	0.076	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	0.001	<0.001	0.001	<0.001	0.002	0.029	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.062	0.057	0.19	0.024	0.13	0.22	0.23	0.075	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.47	0.31	0.36	0.28	0.27	0.29	0.28	0.28	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.002	0.003	0.002	0.002	0.007	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.005	0.005	0.007	0.004	0.014	0.007	0.008	0.094	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.2	0.4	0.2	0.08	0.06	0.05	0.05	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	SW4	D82 (SW4)	SW4	D86 (SW4)	SW4	SW4	D92 (SW4)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2015	Oct 2015	Oct 2015	Nov 2015	Nov 2015	Dec 2015	Jan 2016	Jan 2016			Fresh	Marine	Irrigation Waters
	8/09/2015	12/10/2015	12/10/2015	12/11/2015	12/11/2015	10/12/2015	14/01/2016	14/01/2016					
pH	7.5	7.8	7.8	7.3	7.5	7.9	7.6	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2100	1800	1900	2000	2000	2000	2100	2000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	7.8	4.5	4.5	150	260	4.7	42	24	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	350	380	380	360	340	360	370	380	1/5	NC	NC	NC	NC
Total Alkalinity	350	380	380	360	340	360	370	380	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	330	330	330	370	370	380	340	340	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.018	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	310	260	260	320	300	270	260	260	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	130	110	110	100	130	110	110	110	0.5	NC	NC	NC	NC
Potassium	7.8	14	7.8	7	6.7	11	9.1	9	0.5	NC	NC	NC	NC
Sodium	200	190	180	240	240	230	240	240	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	100	90	91	100	110	110	110	110	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.002	0.004	0.001	0.002	0.002	0.006	0.01	0.007	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	0.002	0.001	<0.001	0.001	0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.081	0.063	0.062	0.096	0.1	0.085	0.093	0.094	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.003	0.001	0.021	0.005	0.008	0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.097	0.028	0.017	0.051	0.16	0.014	0.072	0.071	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.48	0.35	0.34	0.4	0.66	0.350	0.34	0.34	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	0.00062	0.00014	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.001	0.002	0.001	0.002	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.032	0.014	0.009	0.071	0.022	0.011	0.009	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	0.09	0.1	6.3	2	0.5	0.7	0.3	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	SW4	SW4	SW4	D99 (SW4)	SW4	SW4	D103 (SW4)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2016	Feb 2016	Mar 2016	Apr 2016	Apr 2016	May 2016	June 2016	June 2016			Fresh	Marine	Irrigation Waters
	28/01/2016	8/02/2016	16/03/2016	7/04/2016	7/04/2016	12/05/2016	9/06/2016	9/06/2016					
pH	7.3	7.9	7.8	7.8	7.9	7.5	7.6	7.5	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	<6 (6)(18)
Electrical Conductivity (µS/cm)	2100	2300	2200	1900	2000	2100	1900	1900	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	26	4.6	2.9	52	12	99	17	13	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	400	430	390	360	360	380	380	380	1/5	NC	NC	NC	NC
Total Alkalinity	400	430	390	360	360	380	380	380	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	320	360	340	330	330	340	300	300	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.081	<0.005	<0.005	<0.005	0.2	2.9	2.9	0.005	0.5 (8)/0.41(12)	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	<0.005	<0.005	<0.005	0.06	0.08	0.07	0.005	3(13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	270	280	250	290	290	340	290	290	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	130	130	130	120	130	130	130	130	0.5	NC	NC	NC	NC
Potassium	14	12	9.5	7.8	7.8	15	17	18	0.5	NC	NC	NC	NC
Sodium	190	250	240	230	230	240	200	200	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	94	110	110	110	110	110	110	110	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.006	0.004	0.008	0.005	0.003	0.002	0.003	0.003	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.16	0.15	0.073	0.091	0.094	0.096	0.1	0.1	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	0.004	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	<0.001	0.010	0.005	0.002	0.005	0.002	0.001	<0.001	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	1.1	0.039	0.019	0.013	0.012	0.025	0.052	0.051	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	1.5	0.63	0.2	0.21	0.21	0.088	0.33	0.33	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	0.00025	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	0.002	0.002	<0.001	<0.001	0.001	0.001	0.002	0.002	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.018	0.007	0.036	0.007	0.009	0.01	0.002	0.002	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	0.5	0.2	0.1	0.2	0.1	1.8	0.3	0.4	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	D105-ASM (SW4)	SW4	SW4	D108 (SW4)	SW4	SW4	SW4	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	July 2016	July 2016	July 2016	Aug 2016	Aug 2016	Sept 2016	Oct 2016	Nov 2016			Fresh	Marine	Irrigation Waters
	12/07/2016	12/07/2016	25/07/2016	16/08/2016	16/08/2016	13/09/2016	12/10/2016	17/11/2016					
pH	8.1	8.1	7.6	7.5	7.6	7.3	7.8	7.8	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1900	1900	510	2100	2000	510	890	1400	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	7.5	7.9	13	7.6	7.3	6.3	4.2	2.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	340	350	110	350	350	130	220	300	1/5	NC	NC	NC	NC
Total Alkalinity	340	350	110	350	350	130	220	300	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	300	300	58	310	350	68	140	190	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.007	0.031	0.031	0.005	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.01	0.08	0.02	0.02	0.02	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	360	360	45	280	280	46	130	160	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	150	150	31	140	130	35	56	95	0.5	NC	NC	NC	NC
Potassium	13	13	5.4	9.5	9.2	5.9	5.9	6.9	0.5	NC	NC	NC	NC
Sodium	230	230	41	220	220	51	93	140	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	110	120	23	110	110	26	42	72	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.0005	<0.0005	0.015	0.008	0.003	0.007	0.004	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.085	0.069	0.025	0.11	0.1	0.029	0.05	0.08	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	0.001	<0.001	0.003	0.003	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.002	0.003	0.001	<0.001	0.004	0.002	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.045	0.022	0.066	0.11	0.095	0.082	0.059	0.016	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.2	0.18	0.012	0.95	0.93	0.06	0.140	0.26	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00051	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.003	0.002	0.003	0.002	0.003	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	0.002	0.005	0.006	0.007	0.006	0.004	0.011	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.2	0.2	0.08	0.08	0.09	0.06	<0.05	0.07	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	SW4	D120 (SW4)	SW4	SW4	SW4	SW4	D129 (SW4)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Dec 2016	Jan 2017	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	May 2017			Fresh	Marine	Irrigation Waters
	13/12/2016	19/01/2017	19/01/2017	20/02/2017	23/03/2017	6/04/2017	25/05/2017	25/05/2017					
pH	7.5	7.7	7.7	8.2	7.9	7.8	7.4	7.4	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1900	2100	2100	2100	1600	2200	1600	1600	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	12	9.7	8.7	3.3	11	2.8	3.8	13	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	370	400	410	410	310	390	350	340	1/5	NC	NC	NC	NC
Total Alkalinity	370	400	410	410	310	390	350	340	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	330	390	390	400	280	310	240	250	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.01	0.01	<0.005	0.034	0.14	0.029	0.018	0.019	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x ($NO_2^- + NO_3^-$)	<0.005	<0.005	<0.005	<0.005	0.1	0.01	<0.005	0.006	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	300	340	350	370	260	280	230	240	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	120	130	130	140	100	130	110	110	0.5	NC	NC	NC	NC
Potassium	8.2	7.8	8	9	11	7.9	8.6	8.2	0.5	NC	NC	NC	NC
Sodium	200	220	220	240	190	240	190	180	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	93	110	110	120	84	110	86	86	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.006	0.007	0.190	<0.0005	0.001	0.002	0.003	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.1	0.1	0.1	0.083	0.065	0.083	0.072	0.071	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.031	0.71	0.72	0.012	0.026	0.017	0.029	0.028	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.75	0.84	0.82	0.38	0.28	0.27	0.36	0.34	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.013	0.013	0.001	0.002	0.012	0.006	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.07	0.2	0.2	0.1	0.2	0.06	0.07	0.08	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW4	A132 (SW4)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
					Slightly to Moderately Disturbed Systems		
Date Sampled	Jun 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	22/06/2017	22/06/2017					
pH	7.8	7.8	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1900	1800	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	2.4	4.4	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity							
Hydroxide (OH^-)	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	350	350	1/5	NC	NC	NC	NC
Total Alkalinity	350	350	1/5	NC	NC	NC	NC
Anions							
Chloride (Cl)	270	270	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	250	260	1	500	NC	NC	NC
Cations - Dissolved							
Calcium	110	110	0.5	NC	NC	NC	NC
Potassium	7.8	8.2	0.5	NC	NC	NC	NC
Sodium	190	200	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	82	83	0.5	NC	NC	NC	NC
Metals - Dissolved							
Aluminium	0.003	0.003	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	0.072	0.076	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.035	0.034	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.079	0.086	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total							
Aluminium	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.2	0.2	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW6	SW6	SW6	SW6	SW6	SW6	SW6	SW6	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2012	Mar 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012			Fresh	Marine	Irrigation Waters
	22/2/2012	8/03/2012	29/05/2012	26/06/2012	22/07/2012	21/08/2012	19/09/2012	22/10/2012					
pH	8.0	7.1	8.2	8.1	7.8	8.2	8.1	8.5	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	<6 (6)(18)
Electrical Conductivity (µS/cm)	1700	480	1400	2100	1400	2000	2100	2200	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	18	17	15	11	15	19	20	14	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<1	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<1	<5	<5	14	<5	<5	<5	27	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	260	120	400	330	320	380	370	340	1/5	NC	NC	NC	NC
Total Alkalinity	260	120	400	350	320	380	370	360	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	280	64	340	330	220	310	340	360	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.03	0.04	0.007	0.01	0.015	0.029	0.011	0.024	0.005	0.5 (8)/0.41(12)	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.08	0.03	0.07	0.06	0.05	0.09	0.02	<0.005	0.005	3(13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	150	29	230	210	140	200	200	220	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	62	25	110	97	72	100	110	99	0.5	NC	NC	NC	NC
Potassium	11	7.5	9.7	7	6.5	6.5	6.6	6.2	0.5	NC	NC	NC	NC
Sodium	190	43	220	200	140	200	210	240	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	70	19	93	83	57	88	100	110	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.003	0.018	0.009	0.005	0.003	0.0050	0.0040	0.002	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.099	0.039	0.11	0.0970	0.0690	0.1100	0.1100	0.097	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	0.002	0.003	0.005	<0.001	<0.001	0.001	0.002	<0.001	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	0.017	0.1	0.017	0.0110	0.014	0.02	0.01	0.020	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	0.043	0.018	0.017	0.0190	0.0280	0.041	0.030	0.019	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	0.003	0.004	0.002	0.002	0.002	0.001	0.002	0.002	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.003	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.004	0.009	0.017	0.013	0.011	0.004	0.015	0.003	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total													
Aluminium	NT	0.5	NT	NT	NT	NT	NT	NT	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	0.041	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	<0.0001	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	<0.0001	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	0.002	NT	NT	NT	NT	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	0.001	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	0.62	NT	NT	NT	NT	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	0.022	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	<0.00005	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	0.004	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	0.002	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	0.002	NT	NT	NT	NT	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW6 (D14)	SW6	SW6	SW6	SW6	SW6 (D35)	SW6	SW6 (D54)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2012	Dec 2012	Mar 2013	Jul 2013	Sept 2013	Sept 2013	June 2014	June 2014			Fresh	Marine	Irrigation Waters
	22/10/2012	4/12/2012	11/03/2013	24/07/2013	16/09/2013	16/09/2013	19/06/2014	19/06/2014					
pH	8.5	8.5	8.1	8.3	8.4	8.2	8.3	8.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2200	2300	1600	2100	2100	2100	2100	2000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	14	17	18	18	4.5	7.4	0.9	1.8	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	27	23	<5	8	27	<5	11	12	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	340	330	360	390	340	370	380	370	1/5	NC	NC	NC	NC
Total Alkalinity	370	350	360	400	370	370	390	380	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	360	400	260	340	360	390	390	400	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.035	<0.005	0.032	0.012	0.009	0.01	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.02	0.05	0.006	0.05	0.09	0.006	0.007	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	220	210	150	180	240	280	260	260	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	97	100	88	110	100	100	120	120	0.5	NC	NC	NC	NC
Potassium	6.2	9.7	7.8	6.1	7.3	6.9	8.9	8.7	0.5	NC	NC	NC	NC
Sodium	240	300	150	190	220	210	270	270	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	110	130	73	98	96	96	110	110	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.003	0.005	0.011	0.0009	0.001	0.002	0.004	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.098	0.100	0.092	0.110	0.11	0.1	0.1	0.1	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.018	0.010	0.019	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.018	0.005	0.023	0.008	0.008	0.008	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.003	0.004	0.004	0.003	0.003	0.003	0.003	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.005	0.004	0.006	0.005	0.008	0.002	<0.001	0.002	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW6	SW6	SW6 (D60-21/8/14)	SW6	SW6	D93 (SW6)	SW6	SW6	SW6	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	July 2014	Aug 2014	Aug 2014	Sept 2015	Jan 2016	Jan 2016	Feb 2016	July 2016	July 2016			Fresh	Marine	Irrigation Waters
	24/07/2014	21/08/2014	21/08/2014	10/09/2015	28/01/2016	28/01/2016	8/02/2016	12/07/2016	25/07/2016					
pH	8.3	8.3	8.3	8.3	7.7	7.8	8.3	8.1	7.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2000	2100	2200	2200	930	990	2200	2100	890	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	0.9	3.5	4.6	2.5	29	24	30	2.2	13	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	12	14	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	390	360	360	370	250	240	420	410	180	1/5	NC	NC	NC	NC
Total Alkalinity	390	370	370	370	250	240	420	410	180	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	440	370	370	420	150	130	430	360	110	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.011	<0.005	0.012	0.012	0.025	<0.005	0.012	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.008	<0.005	0.01	0.03	<0.005	<0.005	<0.005	<0.005	0.03	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	260	230	240	250	70	67	190	250	80	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	120	110	100	100	53	52	91	120	55	0.5	NC	NC	NC	NC
Potassium	9.4	10	9.7	8.2	9.6	9.5	13	10	7.8	0.5	NC	NC	NC	NC
Sodium	260	280	270	290	100	97	290	290	85	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	120	110	110	110	45	43	100	120	42	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.0008	0.0007	0.009	0.003	0.004	0.004	0.001	0.008	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	0.002	0.002	0.002	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	0.11	0.11	0.11	0.11	0.099	0.099	0.18	0.11	0.054	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	0.002	0.013	0.011	0.012	0.001	0.005	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	0.019	0.056	0.058	<0.01	<0.01	0.057	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	<0.005	<0.005	0.016	0.034	0.036	0.005	0.01	0.008	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00016	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	0.001	0.001	0.001	0.004	0.004	0.004	0.001	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	<0.001	<0.001	<0.001	0.055	0.011	0.011	0.013	0.006	0.008	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	0.1	0.2	0.2	0.1	<0.05	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW6	SW6	SW6	SW6	SW6	SW6	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
									Slightly to Moderately Disturbed Systems		
Date Sampled	Aug 2016	Sept 2016	Oct 2016	Nov 2016	Apr 2017	May 2017			Fresh	Marine	Irrigation Waters
	16/08/2016	13/09/2016	12/10/2016	17/11/2016	6/04/2017	25/05/2017					
pH	8.1	7.2	7.9	8.0	8.2	8.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2300	720	1200	1600	2100	2000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	5.2	17	7.6	1.7	13	160	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity											
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	420	170	290	340	430	430	1/5	NC	NC	NC	NC
Total Alkalinity	420	170	290	340	430	430	1/5	NC	NC	NC	NC
Anions											
Chloride (Cl)	370	110	210	230	320	350	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.1	0.01	0.006	<0.005	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	220	69	170	140	190	240	1	500	NC	NC	NC
Cations - Dissolved											
Calcium	120	49	70	92	110	120	0.5	NC	NC	NC	NC
Potassium	8.1	10	6.1	5.3	9.8	11	0.5	NC	NC	NC	NC
Sodium	280	80	140	170	250	250	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	120	38	58	78	99	110	0.5	NC	NC	NC	NC
Metals - Dissolved											
Aluminium	0.018	0.004	0.001	0.008	0.004	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.12	0.047	0.059	0.085	0.1	0.11	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.005	0.004	0.002	0.002	<0.001	0.005	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.025	0.046	0.028	0.013	0.011	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.01	0.017	0.020	0.019	0.014	0.014	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	0.00023	<0.00005	0.0001	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	0.003	0.003	0.002	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	0.002	0.002	0.002	0.003	0.003	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.039	0.006	0.001	0.004	<0.001	0.006	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total											
Aluminium	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.07	0.06	0.06	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW7	SW7	SW7	SW7 (D12/KMH)	SW7	SW7 (D21)	SW7	SW7	SW7	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2012	Aug 2012	Sept 2012	Sept 2012	Mar 2013	Mar 2013	Sept 2016	Oct 2016	Nov 2016			Fresh	Marine	Irrigation Waters
	8/03/2012	20/08/2012	19/09/2012	19/09/2012	11/03/2013	11/03/2013	13/09/2016	12/10/2016	16/11/2016					
pH	6.9	7.6	6.6	7.2	7.8	7.8	7.0	7.3	7.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	180	360	320	310	230	230	160	190	220	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	36	1.4	1.8	1.8	5.1	3.8	35	6.3	5.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	68	140	61	83	84	84	42	61	66	1/5	NC	NC	NC	NC
Total Alkalinity	68	140	61	83	84	84	42	61	66	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	18	26	27	25	20	19	17	26	23	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.03	<0.005	<0.005	<0.005	0.015	0.015	0.016	0.015	0.015	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.03	0.01	<0.005	<0.005	0.03	0.03	0.09	0.2	0.2	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	3	18	18	16	8	5	3	8	6	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	8.7	17	17	17	12	13	6.7	8.6	11	0.5	NC	NC	NC	NC
Potassium	2.8	3.4	3.1	3.1	3.2	3.1	2.5	2.9	3	0.5	NC	NC	NC	NC
Sodium	13	26	25	25	16	15	12	16	16	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	7.8	13	13	12	11	11	7	8.7	10	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.036	0.0030	0.0070	0.0030	0.007	0.007	0.028	0.015	0.019	0.0005	0.2 [8]	0.0008 [15][L]/0.055 [14][L]	0.0005 [16][L]	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.022	0.0450	0.0450	0.0450	0.027	0.031	0.013	0.018	0.022	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.001	<0.001	0.002	<0.001	<0.001	0.002	<0.001	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.16	0.04	0.06	0.06	0.240	0.270	0.11	0.120	0.16	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.014	0.110	0.120	0.120	0.050	0.053	0.019	0.012	0.017	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.002	0.002	0.0020	0.002	0.003	0.002	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	0.002	0.002	0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.005	0.010	0.028	<0.001	0.003	0.002	0.002	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	1.3	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15][L]/0.055 [14][L]	0.0005 [16][L]	NC
Arsenic	<0.001	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.034	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	<0.0001	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	0.003	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	2	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.048	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.006	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.003	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW7	SW7	SW7	SW7 (D12/KMH)	SW7	SW7 (D21)	SW7	SW7	SW7	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2012	Aug 2012	Sept 2012	Sept 2012	Mar 2013	Mar 2013	Sept 2016	Oct 2016	Nov 2016			Fresh	Marine	Irrigation Waters
	8/03/2012	20/08/2012	19/09/2012	19/09/2012	11/03/2013	11/03/2013	13/09/2016	12/10/2016	16/11/2016					
pH	6.9	7.6	6.6	7.2	7.8	7.8	7.0	7.3	7.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	180	360	320	310	230	230	160	190	220	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	36	1.4	1.8	1.8	5.1	3.8	35	6.3	5.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	68	140	61	83	84	84	42	61	66	1/5	NC	NC	NC	NC
Total Alkalinity	68	140	61	83	84	84	42	61	66	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	18	26	27	25	20	19	17	26	23	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.03	<0.005	<0.005	<0.005	0.015	0.015	0.016	0.015	0.015	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.03	0.01	<0.005	<0.005	0.03	0.03	0.09	0.2	0.2	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	3	18	18	16	8	5	3	8	6	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	8.7	17	17	17	12	13	6.7	8.6	11	0.5	NC	NC	NC	NC
Potassium	2.8	3.4	3.1	3.1	3.2	3.1	2.5	2.9	3	0.5	NC	NC	NC	NC
Sodium	13	26	25	25	16	15	12	16	16	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	7.8	13	13	12	11	11	7	8.7	10	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.036	0.0030	0.0070	0.0030	0.007	0.007	0.028	0.015	0.019	0.0005	0.2 [8]	0.0008 [15][L]/0.055 [14][L]	0.0005 [16][L]	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.022	0.0450	0.0450	0.0450	0.027	0.031	0.013	0.018	0.022	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.001	<0.001	0.002	<0.001	<0.001	0.002	<0.001	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.16	0.04	0.06	0.06	0.240	0.270	0.11	0.120	0.16	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.014	0.110	0.120	0.120	0.050	0.053	0.019	0.012	0.017	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.002	0.002	0.0020	0.002	0.003	0.002	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	0.002	0.002	0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.005	0.010	0.028	<0.001	0.003	0.002	0.002	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	1.3	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15][L]/0.055 [14][L]	0.0005 [16][L]	NC
Arsenic	<0.001	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.034	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	<0.0001	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	0.003	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	2	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.048	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.006	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.003	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW8	SW8	SW8	SW8 (D5-290512)	SW8	SW8	SW8	SW8	SW8	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2012	Mar 2012	May 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012			Fresh	Marine	Irrigation Waters
	22/2/2012	8/03/2012	29/05/2012	29/05/2012	27/06/2012	22/07/2012	21/08/2012	19/09/2012	22/10/2012					
pH	7.3	6.9	7.9	8.0	8.0	7.6	7.8	7.8	8.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	260	250	800	800	760	620	730	880	950	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	5.7	8	2.3	2.1	2.5	2.1	2.6	2.7	1.3	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<1	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<1	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	71	84	250	250	230	220	250	260	300	1/5	NC	NC	NC	NC
Total Alkalinity	71	84	250	250	230	220	250	260	300	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	30	30	100	100	82	74	79	110	120	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.03	0.01	<0.005	<0.005	0.01	0.014	0.021	0.018	0.015	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.04	<0.005	0.02	0.02	0.02	<0.005	0.2	<0.005	0.03	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	6	4	18	18	9	11	11	13	13	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	12	11	42	40	36	29	40	46	52	0.5	NC	NC	NC	NC
Potassium	6.7	5.8	8.1	8.3	4.7	5.3	4.3	5	4.7	0.5	NC	NC	NC	NC
Sodium	25	23	86	88	72	63	71	99	96	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	9	9.6	32	32	29	23	30	38	43	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.042	0.034	0.003	0.001	<0.01	0.006	0.0060	0.0020	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.018	0.02	0.035	0.034	0.0330	0.0270	0.0370	0.0420	0.058	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.003	<0.001	<0.001	<0.001	0.001	0.002	0.002	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.24	0.15	0.035	0.028	0.0560	0.045	0.03	0.03	0.042	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.006	0.006	0.043	0.044	0.0310	0.1300	0.068	0.140	0.470	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.008	0.015	0.015	0.002	0.017	0.014	0.010	0.017	0.018	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	0.53	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	<0.001	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	0.023	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	<0.0001	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	<0.0001	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	0.002	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	<0.001	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	<0.001	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	0.66	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	<0.001	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	0.018	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	<0.00005	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	0.004	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	<0.001	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	0.002	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	0.001	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.2	0.1	0.06	0.06	<0.05	0.09	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW8	SW8	SW8	SW8	SW8	D94 (SW8)	SW8	SW8	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2013	Jul 2013	Sept 2013	Jan 2016	Feb 2016	Feb 2016	July 2016	Aug 2016			Fresh	Marine	Irrigation Waters
	11/03/2013	23/07/2013	17/09/2013	28/01/2016	8/02/2016	8/02/2016	25/07/2016	16/08/2016					
pH	7.9	8.1	8.2	7.3	7.4	7.5	7.2	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	>6 [6][18]
Electrical Conductivity (µS/cm)	590	900	750	360	260	260	240	1000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	0.5	4.6	4.8	2.3	280	370	13	1.7	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	230	310	220	110	75	74	65	250	1/5	NC	NC	NC	NC
Total Alkalinity	230	310	220	110	75	74	65	250	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	59	60	93	41	26	25	29	140	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.008	0.097	0.14	0.082	0.49	0.49	0.007	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.006	<0.005	0.4	0.01	0.83	0.84	0.2	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	9	6	15	12	11	11	9	45	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	33	42	33	19	15	15	11	50	0.5	NC	NC	NC	NC
Potassium	5.5	5.5	5.6	11	7.7	7.9	4.7	6.4	0.5	NC	NC	NC	NC
Sodium	51	96	65	36	22	25	23	120	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	26	33	26	13	8.3	8.4	11	43	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.003	0.004	0.006	0.021	0.007	0.006	0.041	0.04	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.025	0.039	0.025	0.026	0.035	0.035	0.012	0.045	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	<0.001	0.003	0.004	0.004	0.013	0.002	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.063	0.010	0.027	0.12	0.029	0.049	0.2	0.061	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.006	0.054	0.066	0.06	0.087	0.082	0.006	0.12	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.00023	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.003	0.002	0.005	0.005	0.005	0.002	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	<0.001	<0.001	0.001	0.003	0.003	0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.008	0.008	0.023	0.002	0.008	0.002	0.005	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.07	<0.05	0.2	0.3	0.6	0.6	0.06	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW8	SW8	SW8	D115 (SW8)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
							Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2016	Oct 2016	Nov 2016	Nov 2016			Fresh	Marine	Irrigation Waters
	13/09/2016	12/10/2016	15/11/2016	15/11/2016					
pH	7.1	7.5	7.6	7.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	>6 [6][18]
Electrical Conductivity (µS/cm)	270	380	410	410	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	3.8	2.7	3.2	3.5	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity									
Hydroxide (OH^-)	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	90	140	130	130	1/5	NC	NC	NC	NC
Total Alkalinity	90	140	130	130	1/5	NC	NC	NC	NC
Anions									
Chloride (Cl)	33	52	45	45	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	<0.005	<0.005	<0.005	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	8	12	6	6	1	500	NC	NC	NC
Cations - Dissolved									
Calcium	15	21	21	21	0.5	NC	NC	NC	NC
Potassium	4.8	4.7	4.9	5	0.5	NC	NC	NC	NC
Sodium	28	44	44	44	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	13	17	17	17	0.5	NC	NC	NC	NC
Metals - Dissolved									
Aluminium	0.008	0.008	0.005	0.003	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.015	0.02	0.018	0.017	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.002	0.002	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.12	0.120	0.094	0.097	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.033	0.083	0.094	0.092	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.004	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	0.005	0.005	0.005	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total									
Aluminium	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.08	0.09	0.1	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW8	SW8	SW8	SW8 (D5-290512)	SW8	SW8	SW8	SW8	SW8	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2012	Mar 2012	May 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012			Fresh	Marine	Irrigation Waters
	22/2/2012	8/03/2012	29/05/2012	29/05/2012	27/06/2012	22/07/2012	21/08/2012	19/09/2012	22/10/2012					
pH	7.3	6.9	7.9	8.0	8.0	7.6	7.8	7.8	8.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	260	250	800	800	760	620	730	880	950	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	5.7	8	2.3	2.1	2.5	2.1	2.6	2.7	1.3	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<1	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<1	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	71	84	250	250	230	220	250	260	300	1/5	NC	NC	NC	NC
Total Alkalinity	71	84	250	250	230	220	250	260	300	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	30	30	100	100	82	74	79	110	120	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.03	0.01	<0.005	<0.005	0.01	0.014	0.021	0.018	0.015	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.04	<0.005	0.02	0.02	0.02	<0.005	0.2	<0.005	0.03	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	6	4	18	18	9	11	11	13	13	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	12	11	42	40	36	29	40	46	52	0.5	NC	NC	NC	NC
Potassium	6.7	5.8	8.1	8.3	4.7	5.3	4.3	5	4.7	0.5	NC	NC	NC	NC
Sodium	25	23	86	88	72	63	71	99	96	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	9	9.6	32	32	29	23	30	38	43	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.042	0.034	0.003	0.001	<0.01	0.006	0.0060	0.0020	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.018	0.02	0.035	0.034	0.0330	0.0270	0.0370	0.0420	0.058	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.003	<0.001	<0.001	<0.001	0.001	0.002	0.002	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.24	0.15	0.035	0.028	0.0560	0.045	0.03	0.03	0.042	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.006	0.006	0.043	0.044	0.0310	0.1300	0.068	0.140	0.470	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.008	0.015	0.015	0.002	0.017	0.014	0.010	0.017	0.018	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	0.53	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	<0.001	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	0.023	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	<0.0001	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	<0.0001	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	0.002	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	<0.001	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	<0.001	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	0.66	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	<0.001	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	0.018	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	<0.00005	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	0.004	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	<0.001	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	0.002	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	0.001	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.2	0.1	0.06	0.06	<0.05	0.09	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW8	SW8	SW8	SW8	SW8	D94 (SW8)	SW8	SW8	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2013	Jul 2013	Sept 2013	Jan 2016	Feb 2016	Feb 2016	July 2016	Aug 2016			Fresh	Marine	Irrigation Waters
	11/03/2013	23/07/2013	17/09/2013	28/01/2016	8/02/2016	8/02/2016	25/07/2016	16/08/2016					
pH	7.9	8.1	8.2	7.3	7.4	7.5	7.2	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	>6 [6][18]
Electrical Conductivity (µS/cm)	590	900	750	360	260	260	240	1000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	0.5	4.6	4.8	2.3	280	370	13	1.7	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	230	310	220	110	75	74	65	250	1/5	NC	NC	NC	NC
Total Alkalinity	230	310	220	110	75	74	65	250	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	59	60	93	41	26	25	29	140	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.008	0.097	0.14	0.082	0.49	0.49	0.007	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.006	<0.005	0.4	0.01	0.83	0.84	0.2	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	9	6	15	12	11	11	9	45	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	33	42	33	19	15	15	11	50	0.5	NC	NC	NC	NC
Potassium	5.5	5.5	5.6	11	7.7	7.9	4.7	6.4	0.5	NC	NC	NC	NC
Sodium	51	96	65	36	22	25	23	120	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	26	33	26	13	8.3	8.4	11	43	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.003	0.004	0.006	0.021	0.007	0.006	0.041	0.04	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.025	0.039	0.025	0.026	0.035	0.035	0.012	0.045	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	<0.001	0.003	0.004	0.004	0.013	0.002	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.063	0.010	0.027	0.12	0.029	0.049	0.2	0.061	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.006	0.054	0.066	0.06	0.087	0.082	0.006	0.12	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.00023	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.003	0.002	0.005	0.005	0.005	0.002	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	<0.001	<0.001	0.001	0.003	0.003	0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.008	0.008	0.023	0.002	0.008	0.002	0.005	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.07	<0.05	0.2	0.3	0.6	0.6	0.06	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW8	SW8	SW8	D115 (SW8)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
							Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2016	Oct 2016	Nov 2016	Nov 2016			Fresh	Marine	Irrigation Waters
	13/09/2016	12/10/2016	15/11/2016	15/11/2016					
pH	7.1	7.5	7.6	7.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	>6 [6][18]
Electrical Conductivity (µS/cm)	270	380	410	410	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	3.8	2.7	3.2	3.5	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity									
Hydroxide (OH^-)	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	90	140	130	130	1/5	NC	NC	NC	NC
Total Alkalinity	90	140	130	130	1/5	NC	NC	NC	NC
Anions									
Chloride (Cl)	33	52	45	45	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	<0.005	<0.005	<0.005	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	8	12	6	6	1	500	NC	NC	NC
Cations - Dissolved									
Calcium	15	21	21	21	0.5	NC	NC	NC	NC
Potassium	4.8	4.7	4.9	5	0.5	NC	NC	NC	NC
Sodium	28	44	44	44	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	13	17	17	17	0.5	NC	NC	NC	NC
Metals - Dissolved									
Aluminium	0.008	0.008	0.005	0.003	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.015	0.02	0.018	0.017	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.002	0.002	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.12	0.120	0.094	0.097	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.033	0.083	0.094	0.092	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.004	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	0.005	0.005	0.005	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total									
Aluminium	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.08	0.09	0.1	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	SW9	SW9 (D10)	SW9	SW9	SW9	SW9	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
									Slightly to Moderately Disturbed Systems		
Date Sampled	Aug 2012	Aug 2012	Sept 2012	Mar 2013	Sept 2016	Oct 2016			Fresh	Marine	Irrigation Waters
	20/08/2012	20/08/2012	19/09/2012	11/03/2013	13/09/2016	12/10/2016					
pH	7.5	7.5	7.8	7.3	7.0	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	330	330	320	370	160	220	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4	4.7	26	1.5	40	15	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity											
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	110	120	110	150	43	73	1/5	NC	NC	NC	NC
Total Alkalinity	110	120	110	150	43	73	1/5	NC	NC	NC	NC
Anions											
Chloride (Cl)	21	22	21	21	17	27	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.033	0.04	0.03	0.031	0.019	0.067	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.2	0.2	<0.005	0.06	0.07	0.2	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	15	15	12	24	3	13	1	500	NC	NC	NC
Cations - Dissolved											
Calcium	23	22	23	28	7.8	12	0.5	NC	NC	NC	NC
Potassium	4.6	4.5	4.9	7.4	2.8	4.2	0.5	NC	NC	NC	NC
Sodium	24	24	23	19	13	17	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	14	14	14	19	7.4	10	0.5	NC	NC	NC	NC
Metals - Dissolved											
Aluminium	0.0090	0.0050	0.0090	0.011	0.039	0.071	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.0450	0.0440	0.0300	0.058	0.016	0.031	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.002	0.002	0.001	0.003	<0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	<0.001	0.002	<0.001	0.002	0.010	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.29	0.27	0.29	0.300	0.083	0.450	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.480	0.480	0.370	0.380	0.018	0.170	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.0030	0.004	0.008	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	0.002	0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.002	0.017	0.005	0.004	0.100	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total											
Aluminium	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.1	0.06	0.05	0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014			Fresh	Marine	Irrigation Waters
	19/09/2013	16/101/2013	19/11/2013	16/12/2013	14/01/2014	17/02/2014	18/03/2014	13/04/2014					
pH	7.4	8.1	6.3	7.2	7.2	7.2	5.9	7.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2400	2300	2300	2300	2300	2300	2200	2500	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	19	24	9.5	2.7	6.3	3.6	1.5	18	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	450	470	450	440	440	430	440	630	1/5	NC	NC	NC	NC
Total Alkalinity	450	470	450	440	440	430	440	630	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	400	420	390	410	370	340	350	350	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.044	0.017	0.085	0.047	0.048	0.062	0.069	0.11	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.009	0.01	0.01	0.1	0.07	0.2	0.006	0.008	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	240	240	240	270	230	210	210	190	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	110	130	120	120	120	120	120	130	0.5	NC	NC	NC	NC
Potassium	6.8	6.8	7.3	6.3	7.4	7.4	6.9	6.8	0.5	NC	NC	NC	NC
Sodium	240	280	270	270	270	270	300	330	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	89	100	100	100	100	99	99	110	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.012	0.005	0.002	0.007	0.005	0.003	0.006	<0.0005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.002	0.001	0.001	0.001	0.002	0.002	0.001	0.002	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.14	0.15	0.17	0.14	0.14	0.14	0.14	0.17	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	0.001	0.002	<0.001	<0.001	0.001	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	1.3	1.7	2	2.1	1.8	2.1	2.3	6.8	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	1	1.3	1.5	1.2	1.1	1.1	1.3	1.8	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.004	0.009	0.002	0.002	0.007	0.006	0.005	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.014	0.02	0.092	0.015	0.005	0.014	0.063	0.042	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	0.1	0.1	0.06	0.07	0.05	0.07	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A01-S	A01-S	A01-S (D52)	A01-S	A01-S	A01-S	A01-S (D60-2/12/14)	A01-S	A01-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	May 2014	June 2014	June 2014	July 2014	August 2014	Dec 2014	Dec 2014	Jan 2015	Feb 2015			Fresh	Marine	Irrigation Waters
	19/05/2014	17/06/2014	17/06/2014	21/07/2014	21/08/2014	2/12/2014	2/12/2014	12/01/2015	9/02/2015					
pH	7.1	7.1	7.1	6.7	6.8	7.1	7.1	7.1	6.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2200	1900	1900	1900	2100	2000	2000	1900	1900	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	8.5	1.9	3.1	5.5	69	25	22	9.8	8.5	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	440	410	410	410	410	400	400	400	390	1/5	NC	NC	NC	NC
Total Alkalinity	440	410	410	410	410	400	400	400	390	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	320	320	320	320	320	340	340	360	360	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.087	0.087	0.087	0.082	0.093	0.078	0.064	0.085	0.071	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.07	0.02	0.02	0.01	0.01	<0.005	0.005	0.06	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	200	230	230	220	230	230	230	250	260	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	120	120	120	120	110	110	110	100	99	0.5	NC	NC	NC	NC
Potassium	6.5	6.9	6.9	6.7	6.7	5.5	5.8	6.9	6.7	0.5	NC	NC	NC	NC
Sodium	250	270	260	240	280	240	260	260	280	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	99	96	96	93	91	96	96	95	90	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	<0.005	<0.0005	0.004	0.007	0.015	<0.0005	0.001	0.002	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.16	0.13	0.13	0.14	0.14	0.13	0.12	0.13	0.130	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	3.9	2.7	2.7	2.2	2.1	2.2	2.1	2.6	2.400	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	1.5	1.3	1.2	1	1.1	1.1	1.1	1.2	1	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.002	0.002	0.005	0.009	0.003	0.003	0.007	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.023	0.012	0.016	0.028	0.052	0.018	0.018	0.016	0.027	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.08	0.06	0.05	0.09	0.3	0.08	0.08	0.07	0.07	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A01-S	A01-S	D69 (A01-S)	A01-S	D71 (A01-S)	A01-S	A01-S	A01-S	A01-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	March 2015	April 2015	April 2015	May 2015	May 2015	June 2015	July 2015	Aug 2015	Sept 2015			Fresh	Marine	Irrigation Waters
	10/03/2015	14/04/2015	14/04/2015	19/05/2015	19/05/2015	22/06/2015	14/07/2015	10/08/2015	8/09/2015					
pH	7.3	7.3	7.3	7.3	7.3	6.1	6.1	7	7.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2100	1800	1800	1900	1900	2000	2000	2000	2000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	6.9	1.2	1.8	5.5	8.4	4.4	18	28	8	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	390	380	380	390	380	400	470	440	390	1/5	NC	NC	NC	NC
Total Alkalinity	390	380	380	390	380	400	470	440	390	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	340	320	320	290	290	310	320	300	310	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.094	0.07	0.06	0.082	0.081	0.11	0.1	0.079	0.078	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.04	0.02	0.007	0.02	0.02	0.01	0.008	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	240	230	230	210	220	210	230	220	240	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	110	100	100	110	110	110	110	110	110	0.5	NC	NC	NC	NC
Potassium	6.9	6.2	6.3	7.2	7.1	6.3	7.2	6.4	6.8	0.5	NC	NC	NC	NC
Sodium	230	230	240	230	230	220	220	250	220	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	94	88	86	93	93	94	96	94	93	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.001	0.002	0.001	0.004	0.002	0.006	0.003	0.002	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.13	0.13	0.14	0.13	0.13	0.14	0.17	0.18	0.14	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.009	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	2.4	1.9	2	2.5	2.5	2.9	7.1	6.1	4	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	1.1	0.91	1.1	1.1	1	1.4	1.6	1.8	1.3	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.003	0.003	0.008	0.007	0.003	0.007	0.003	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.032	0.037	0.018	0.014	0.099	0.087	0.026	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.07	<0.05	0.05	0.06	0.05	0.07	0.08	<0.05	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Apr 2016	May 2016	June 2016	July 2016			Fresh	Marine	Irrigation Waters
	12/10/2015	9/11/2015	7/12/2015	12/01/2016	8/02/2016	5/04/2016	10/05/2016	7/06/2016	12/07/2016					
pH	7.1	7.5	7.3	7.4	7.6	7.1	7.1	6.3	6.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1800	1800	1900	2000	2100	1900	1800	1800	1900	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	23	36	21	16	8.8	4.5	6.5	12	0.6	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	390	380	390	380	540	360	370	370	340	1/5	NC	NC	NC	NC
Total Alkalinity	390	380	390	380	540	360	370	370	340	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	320	340	360	330	340	320	350	320	310	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.093	0.081	0.076	0.085	0.071	0.093	0.074	0.073	0.086	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.007	0.008	0.02	0.007	0.008	0.01	0.008	0.009	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	260	260	280	250	260	250	290	250	330	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	97	110	120	110	100	110	110	110	130	0.5	NC	NC	NC	NC
Potassium	5.2	6.6	6.8	7.4	6.5	7.1	6.4	6.5	7.4	0.5	NC	NC	NC	NC
Sodium	200	230	240	240	250	240	230	230	240	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	85	96	99	99	90	99	94	96	110	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.009	0.002	0.005	0.001	0.003	0.001	0.022	0.003	0.003	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	0.001	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	0.002	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.13	0.13	0.130	0.15	0.13	0.13	0.14	0.13	0.14	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.009	<0.001	<0.001	0.002	<0.001	<0.001	0.003	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	3.5	3.1	2.700	3.3	2.8	2.9	2.7	2.5	4.1	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	1.2	1.2	1.100	1.2	1	1.1	1.1	1	1.2	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.001	0.001	0.002	0.002	0.001	0.002	0.007	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.031	0.010	0.007	0.010	0.013	0.017	0.016	0.037	0.04	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.06	<0.05	0.06	0.06	0.06	<0.05	0.06	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	A01-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Aug 2016	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017			Fresh	Marine	Irrigation Waters
	15/08/2016	13/09/2016	11/10/2016	14/11/2016	12/12/2016	19/01/2017	20/02/2017	20/03/2017	3/04/2017					
pH	6.9	6.3	7.4	7.1	7.2	7.2	8.1	7.2	7.5	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	>6 (6)(18)
Electrical Conductivity (µS/cm)	2000	1800	1900	2000	2000	2100	2100	1900	2000	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	12	28	5.3	45	13	6.6	4.1	5.3	4.6	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	360	360	380	360	380	410	400	390	380	1/5	NC	NC	NC	NC
Total Alkalinity	360	360	380	360	380	410	400	390	380	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	300	290	280	290	360	400	400	340	340	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.066	0.063	0.068	0.065	0.049	0.061	0.055	0.061	0.063	0.005	0.5 (8)/0.41(12)	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.04	0.5	0.09	<0.005	0.01	<0.005	0.01	0.01	0.01	0.005	3(13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	250	240	230	240	300	350	330	280	280	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	110	120	110	110	120	120	130	110	120	0.5	NC	NC	NC	NC
Potassium	6.3	7.1	7.1	6.9	6.2	7	7	7.5	7	0.5	NC	NC	NC	NC
Sodium	230	200	240	230	220	240	240	210	250	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	99	98	98	100	99	110	110	98	100	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.004	0.006	0.006	0.0008	0.002	0.002	0.0007	0.0007	0.002	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	0.001	0.001	<0.001	<0.001	0.001	<0.001	0.004	<0.001	<0.001	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.14	0.12	0.15	0.11	0.14	0.16	0.14	0.14	0.14	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	3.2	2.5	2.2	1.1	1.8	2.1	1.9	1.8	2	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	1	0.89	0.74	0.87	0.79	0.82	0.91	0.81	0.89	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	0.001	0.002	0.001	0.003	0.003	0.002	0.001	0.009	0.001	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.012	0.060	0.010	0.013	0.010	0.015	0.010	0.008	0.005	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	<0.05	0.06	<0.05	0.1	<0.05	0.05	<0.05	<0.05	0.06	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A01-S	A01-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
					Slightly to Moderately Disturbed Systems		
Date Sampled	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	22/05/2017	19/06/2017					
pH	7.2	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1900	1900	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	5.5	7.6	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity							
Hydroxide (OH^-)	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	360	350	1/5	NC	NC	NC	NC
Total Alkalinity	360	350	1/5	NC	NC	NC	NC
Anions							
Chloride (Cl)	330	260	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.072	0.071	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.009	0.06	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	270	240	1	500	NC	NC	NC
Cations - Dissolved							
Calcium	130	110	0.5	NC	NC	NC	NC
Potassium	7	7.3	0.5	NC	NC	NC	NC
Sodium	240	220	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	110	98	0.5	NC	NC	NC	NC
Metals - Dissolved							
Aluminium	0.001	0.004	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	0.001	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	0.13	0.14	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	2.1	2.1	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.83	1.1	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.007	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.009	0.011	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total							
Aluminium	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.06	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A02-S	A02-S	A02-S	A02-S (D8)	A02-S	A02-S	A02-S (D11/KMH)	A02-S	A02-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	May 2012	Jun 2012	Jul 2012	Jul 2012	Aug 2012	Sept 2012	Sept 2012	Oct 2012	Dec 2012			Fresh	Marine	Irrigation Waters
	30/5/2012	27/06/2012	23/07/2012	23/07/2012	22/08/2012	18/09/2012	18/09/2012	22/10/2012	3/12/2012					
pH	8.0	7.4	7.1	7.1	7.1	7.0	7.0	8.0	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1200	1400	1400	1400	1300	1300	1300	1500	1300	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	180	150	30	42	20	20	14	51	96	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	290	340	380	380	350	330	330	350	340	1/5	NC	NC	NC	NC
Total Alkalinity	290	340	380	380	350	330	330	350	340	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	170	170	160	180	140	160	160	160	160	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.056	0.02	0.007	0.007	<0.005	<0.005	<0.005	0.01	0.038	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	15	16	19	18	14	19	19	20	16	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	61	51	57	65	47	57	57	59	58	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	120	120	110	120	120	120	120	120	120	0.5	NC	NC	NC	NC
Potassium	8.3	8	7.9	7.8	7.2	8	8	7.7	7.9	0.5	NC	NC	NC	NC
Sodium	51	52	57	55	51	59	58	55	56	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	63	63	65	63	66	71	70	76	65	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.004	<0.01	0.006	0.003	0.0030	0.0010	0.0020	0.024	0.004	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.11	0.110	0.092	0.093	0.1000	0.0940	0.0940	0.097	0.088	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	0.0010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	0.002	0.003	0.002	0.010	0.012	0.013	0.013	0.008	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	0.017	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.036	0.062	0.012	0.012	0.028	0.018	0.019	0.025	0.039	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.002	0.004	0.004	0.0030	0.0020	0.0030	0.003	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.015	0.013	0.013	0.013	0.0170	0.0170	0.0170	0.0170	0.012	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	<0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.011	0.018	0.022	0.008	0.014	0.098	0.023	0.015	0.016	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A02-S	A02-S	A02-S	A02-S	A02-S	A02-S	A02-S	A02-S	A02-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013	Jul 2013	Aug 2013	Sept 2013			Fresh	Marine	Irrigation Waters
	16/01/2013	20/02/2013	20/03/2013	17/04/2013	14/05/2013	19/06/2013	24/07/2013	22/08/2013	18/09/2013					
pH	7.0	7.0	7.2	7.9	7.1	7.1	7.1	7.2	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1300	1500	1300	1900	1300	1300	1100	1200	1300	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	110	250	18	160	160	100	33	640	190	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	330	340	360	360	350	350	340	340	340	1/5	NC	NC	NC	NC
Total Alkalinity	330	340	360	360	350	350	340	340	340	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	160	160	160	160	170	160	140	130	180	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	0.009	<0.005	<0.005	<0.005	0.006	<0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	17	17	17	15	15	17	15	14	13	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	65	61	41	65	69	68	52	60	68	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	110	110	120	110	110	120	120	100	110	0.5	NC	NC	NC	NC
Potassium	6.9	9.2	8.6	8.6	8.3	8.3	6.6	5.6	7.5	0.5	NC	NC	NC	NC
Sodium	46	56	55	53	50	50	45	33	48	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	64	68	71	70	66	67	61	56	65	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.008	0.003	0.008	0.001	0.002	0.0008	<0.0005	0.002	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.089	0.090	0.091	0.120	0.100	0.11	0.098	0.086	0.095	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0005	0.0005	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.005	0.007	0.005	0.007	0.006	0.007	0.002	0.003	0.005	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.040	0.120	0.022	0.049	0.023	0.015	0.053	0.024	0.02	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.004	0.002	0.004	0.003	0.003	0.003	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.012	0.009	0.009	0.012	0.010	0.01	0.009	0.008	0.008	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.014	0.012	0.023	0.017	0.016	0.010	0.024	0.012	0.014	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	0.1	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A02-S	A02-S	A02-S	A02-S	A02-S	A02-S	A02-S	A02-S	A02-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014	Nov 2016			Fresh	Marine	Irrigation Waters
	16/101/2013	13/11/2013	12/12/2013	16/01/2014	20/02/2014	19/03/2014	15/04/2014	21/05/2014	16/11/2016					
pH	8.1	7.6	8.0	7.4	7.3	6.9	7.2	7.1	6.8	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1300	1300	1200	1200	1300	1200	1200	1000	1400	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	19	34	170	17	120	620	260	48	160	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	340	360	260	340	370	360	390	260	410	1/5	NC	NC	NC	NC
Total Alkalinity	340	360	260	340	370	360	390	260	410	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	170	160	140	150	120	120	110	110	140	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	0.008	<0.005	0.12	<0.005	<0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	14	12	14	15	14	24	12	1.4	8.1	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	66	73	73	64	59	56	55	95	90	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	120	120	100	120	100	120	120	70	120	0.5	NC	NC	NC	NC
Potassium	7.8	7.9	8.2	8.1	8.2	9.5	9.1	4.3	9.4	0.5	NC	NC	NC	NC
Sodium	56	55	55	54	52	58	56	65	65	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	69	71	61	68	60	67	66	42	84	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.006	0.01	0.002	<0.0005	0.2	0.010	0.003	<0.0005	0.002	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.093	0.11	0.1	0.098	0.11	0.13	0.11	0.13	0.12	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.004	0.006	0.003	0.005	0.007	0.006	<0.001	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	0.057	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.023	0.025	0.26	0.052	0.25	0.65	0.46	0.11	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.005	0.002	0.006	0.010	0.008	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.003	0.014	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	0.001	0.002	0.001	0.001	<0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.033	0.023	0.023	0.009	0.016	0.041	0.005	0.006	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	1	0.2	0.1	<0.05	0.07	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	D116 (A02-S)	A02-S	A02-S	A02-S	D122 (A02-S)	A02-S	A02-S	A02-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Feb 2017	Mar 2017	Apr 2017	May 2017			Fresh	Marine	Irrigation Waters
	16/11/2016	14/12/2016	18/01/2017	22/02/2017	22/02/2017	22/03/2017	5/04/2017	24/05/2017					
pH	7.0	7.1	7.3	7.3	7.4	7.4	7.3	7.0	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	<6 (6)(18)
Electrical Conductivity (µS/cm)	1400	1200	1100	1100	1100	970	1100	1100	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	150	180	510	3.4	24	25	120	320	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	430	410	440	390	400	400	380	400	1/5	NC	NC	NC	NC
Total Alkalinity	430	410	440	390	400	400	380	400	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	150	140	120	110	110	110	110	91	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.011	0.015	0.008	0.007	0.009	0.011	0.018	0.005	0.5 (8)/0.41 (12)	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	8.1	7.1	6.3	5.7	5.7	5	5.8	3.8	0.005	3 (13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	92	97	79	78	77	84	70	69	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	130	110	110	100	100	100	100	110	0.5	NC	NC	NC	NC
Potassium	9.1	9.4	8.5	7.5	7.6	8.3	8.5	9.2	0.5	NC	NC	NC	NC
Sodium	63	67	56	53	54	57	59	56	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	82	74	67	60	58	60	61	65	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.002	0.005	0.001	0.001	0.001	0.002	0.0008	0.007	0.0005	0.2 (8)	0.0008 (15)(L)/0.055 (14)(L)	0.0005 (16)(L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.11	0.12	0.13	0.095	0.094	0.088	0.095	0.1	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	0.004	0.004	0.001	0.001	0.002	0.001	<0.001	0.002	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	0.035	<0.01	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	<0.005	<0.005	0.13	0.045	0.045	0.092	0.084	0.052	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	0.002	0.002	0.003	0.003	0.003	0.003	0.006	0.005	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	0.015	0.010	0.012	0.010	0.010	0.01	0.010	0.007	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.008	0.009	0.012	0.006	0.007	0.012	0.007	0.012	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 (8)	0.0008 (15)(L)/0.055 (14)(L)	0.0005 (16)(L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	0.06	0.1	0.09	<0.05	<0.05	<0.05	<0.05	0.05	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A02-D	A02-D	A02-D	A02-D	A02-D	A02-D	A02-D	A02-D	A02-D	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	June 2014	July 2014	Aug 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	April 2015	May 2015			Fresh	Marine	Irrigation Waters
	18/06/2014	23/07/2014	20/08/2014	4/12/2014	14/01/2015	11/02/2015	11/03/2015	15/04/2015	21/05/2015					
pH	6.8	6.7	6.8	6.1	6.8	7.2	6.1	5.7	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	910	910	990	940	930	910	950	990	890	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	45	29	56	94	76	90	35	110	170	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	270	260	260	260	270	260	260	280	260	1/5	NC	NC	NC	NC
Total Alkalinity	270	260	260	260	270	260	260	280	260	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	110	110	100	100	120	120	120	100	97	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	1.3	1.2	1.2	1.5	1.4	1.5	1.3	2.3	1.8	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	96	100	98	91	100	110	100	79	86	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	76	74	76	75	74	76	60	83	76	0.5	NC	NC	NC	NC
Potassium	4.8	4.9	4.6	4.2	4.8	4.1	4.3	3.7	4.9	0.5	NC	NC	NC	NC
Sodium	74	74	79	71	74	71	74	65	74	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	48	47	46	45	47	47	36	47	47	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	<0.0005	0.005	0.002	0.006	0.001	0.0009	0.003	0.001	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.12	0.13	0.14	0.13	0.13	0.13	0.13	0.14	0.13	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.004	0.005	0.012	0.012	0.007	0.008	0.009	0.03	0.013	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.024	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.091	0.1	0.095	0.066	0.11	0.11	0.12	0.13	0.16	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.006	0.006	0.005	0.004	0.003	0.004	0.01	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.039	0.032	0.023	0.061	0.021	0.015	0.021	0.072	0.03	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A02-D	A02-D	A02-D	A02-D	A02-D	A02-D	A02-D	A02-D	A02-D	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	June 2015	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016			Fresh	Marine	Irrigation Waters
	23/06/2015	16/07/2015	12/08/2015	09/09/2015	14/10/2015	11/11/2015	9/12/2015	13/01/2016	11/02/2016					
pH	7.0	7.1	6.5	7.2	7.1	7.1	7.2	6.8	7.3	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	<6 (6)(18)
Electrical Conductivity (µS/cm)	1000	1000	890	950	940	890	980	990	880	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	200	150	410	170	260	2600	100	68	68	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	260	250	270	260	260	270	270	290	280	1/5	NC	NC	NC	NC
Total Alkalinity	260	250	270	260	260	270	270	290	280	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	110	110	120	110	120	110	120	100	110	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	0.005	0.5 (8)/0.41 (12)	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	1.6	1.5	1.8	1.6	1.5	1.8	1.1	2.4	2	0.005	3 (13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	91	97	100	100	100	94	110	87	92	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	81	76	70	77	70	81	80	82	74	0.5	NC	NC	NC	NC
Potassium	4.7	4.8	4.1	4.6	4.4	3.9	4.2	4.8	4.3	0.5	NC	NC	NC	NC
Sodium	74	75	71	81	77	72	74	76	73	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	50	48	43	48	45	50	49	51	45	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.001	0.001	0.002	0.001	<0.0005	0.001	0.0009	0.002	0.005	0.0005	0.2 (8)	0.0008 (15)(L)/0.055 (14)(L)	0.0005 (16)(L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.14	0.13	0.13	0.13	0.13	0.13	0.130	0.12	0.13	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	<0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	0.008	0.024	0.036	0.019	0.019	0.020	0.012	0.008	0.011	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	0.13	0.12	0.11	0.086	0.097	0.14	0.064	0.083	0.11	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.004	0.002	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	0.003	0.003	0.003	0.003	0.002	0.002	0.003	0.002	0.002	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.008	0.012	0.02	0.022	0.022	0.020	0.020	0.015	0.012	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 (8)	0.0008 (15)(L)/0.055 (14)(L)	0.0005 (16)(L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	<0.05	<0.05	0.2	0.1	<0.05	0.10	<0.05	<0.05	<0.05	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A02-D	A02-D	A02-D	A02-D	A02-D	A02-D	D109 (A02-D)	A02-D	A02-D	A02-D	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2016	Apr 2016	May 2016	June 2016	July 2016	Aug 2016	Aug 2016	Sept 2016	Oct 2016	Jun 2017		Fresh	Marine	Irrigation Waters
	16/03/2016	6/04/2016	11/05/2016	9/06/2016	13/07/2016	17/08/2016	17/08/2016	13/09/2016	11/10/2016	21/06/2017				
pH	6.2	7.1	6.6	6.7	6.9	6.2	6.7	6.9	7.2	7	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	990	930	900	910	960	970	960	830	880	860	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	36	240	280	140	260	140	110	21	21	6.7	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	280	290	280	280	280	180	270	290	310	300	NC	NC	NC	NC
Total Alkalinity	280	290	280	280	280	180	270	290	310	300	NC	NC	NC	NC
Anions														
Chloride (Cl)	130	100	110	120	110	97	100	81	76	80	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.006	0.01	0.008	0.011	<0.005	0.006	0.007	<0.005	0.01	<0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	2	2.4	2.4	2.3	2.7	2.5	2.5	5.1	4.1	1.6	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	71	89	93	69	110	150	84	69	62	98	500	NC	NC	NC
Cations - Dissolved														
Calcium	80	82	78	79	94	81	80	80	81	73	NC	NC	NC	NC
Potassium	5.1	4.4	4.2	4.6	4.9	4	3.4	4.7	4.2	4.1	NC	NC	NC	NC
Sodium	74	77	74	71	76	68	60	66	64	66	180 [8]	NC	NC	Species Dependent
Magnesium	49	50	47	49	56	49	48	49	48	43	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.005	0.001	<0.0005	<0.0005	0.003	0.001	0.002	0.003	0.004	0.001	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.13	0.14	0.14	0.14	0.12	0.12	0.12	0.12	0.13	0.12	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NC	NC	0.001	0.05 [4]
Copper	0.018	0.005	0.007	0.005	0.008	0.008	0.009	0.005	0.007	0.004	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.017	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.13	0.14	0.13	0.11	0.1	0.084	0.086	0.057	0.021	0.054	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.003	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.006	0.02	0.011	0.007	0.2 [4]
Selenium	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.004	0.003	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.045	0.01	0.012	0.012	0.013	0.028	0.029	0.016	0.017	0.019	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Dec 2012	Jan 2013	Feb 2013			Fresh	Marine	Irrigation Waters
	30/5/2012	27/06/2012	24/07/2012	22/08/2012	18/09/2012	21/10/2012	4/12/2012	15/01/2013	19/02/2013					
pH	8.5	7.3	6.8	7.0	6.9	8.0	6.9	7.0	7.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1500	1500	1500	1500	1600	1500	1400	1400	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	17	41	2.1	4.7	1.6	3.4	42	310	71	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	36	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	380	390	460	470	460	460	420	350	370	1/5	NC	NC	NC	NC
Total Alkalinity	410	390	460	470	460	460	420	350	370	1/5				
Anions														
Chloride (Cl)	260	230	250	220	240	220	230	210	190	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.005	0.01	0.007	0.024	<0.005	0.01	0.022	0.009	0.014	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	<0.005	0.02	<0.005	<0.005	0.03	0.08	25	0.08	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	14	12	13	9	11	12	12	16	15	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	79	73	79	83	92	88	92	73	73	0.5	NC	NC	NC	NC
Potassium	3.4	3.7	3.7	3.8	4.1	3.7	3.8	3.8	3.4	0.5	NC	NC	NC	NC
Sodium	120	120	130	130	140	130	150	110	110	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	71	64	73	73	81	80	85	60	63	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	<0.01	0.005	0.0010	0.0210	0.0008	0.002	0.016	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.019	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.08	0.070	0.073	0.0800	0.0760	0.068	0.065	0.060	0.057	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0006	0.0006	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.005	0.003	0.003	0.002	<0.001	<0.001	0.003	0.002	0.005	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.016	0.026	0.020	0.09	0.10	0.042	0.026	0.018	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.05	0.048	0.032	0.084	0.055	0.032	0.025	0.018	0.011	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.003	0.007	0.0040	0.0030	0.003	0.002	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.027	0.027	0.030	0.013	0.017	0.016	0.015	0.014	0.020	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.1	0.09	0.09	0.09	0.08	0.1	0.3	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2013	Apr 2013	May 2013	Jun 2013	Jul 2013	Aug 2013	Sept 2013	Oct 2013	Nov 2013			Fresh	Marine	Irrigation Waters
	20/03/2013	17/04/2013	13/05/2013	20/06/2013	23/07/2013	20/08/2013	17/09/2013	15/10/2013	19/11/2013					
pH	7.2	8.4	7.8	7	7.4	7.2	8.3	6.9	6.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1000	1000	970	1100	980	940	1100	1100	1000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	2.5	6.2	570	25	56	8.4	14	17	19	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	360	330	330	350	350	350	370	370	360	1/5	NC	NC	NC	NC
Total Alkalinity	360	330	330	350	350	350	370	370	360	1/5				
Anions														
Chloride (Cl)	140	120	160	150	41	110	120	140	120	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.016	0.013	<0.005	<0.005	<0.005	<0.005	<0.005	0.014	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.08	0.04	0.09	0.05	0.02	<0.005	0.03	0.01	0.04	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	10	12	14	15	27	12	15	16	13	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	58	51	50	57	48	50	49	56	54	0.5	NC	NC	NC	NC
Potassium	3.2	2.9	2.5	2.8	2.5	2.2	2.5	2.6	3.3	0.5	NC	NC	NC	NC
Sodium	100	91	100	99	100	85	91	100	110	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	49	44	45	47	42	43	42	49	48	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.006	<0.0005	0.003	0.003	0.003	0.001	0.015	<0.0005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.047	0.045	0.044	0.053	0.052	0.041	0.044	0.043	0.052	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.008	0.009	0.002	0.011	0.006	0.004	0.005	0.003	0.005	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.010	<0.010	<0.01	0.016	0.016	0.015	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.006	<0.005	<0.005	0.006	0.005	0.008	0.007	0.007	0.011	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.003	0.001	0.002	0.002	0.001	0.002	0.002	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	0.002	0.003	0.002	0.002	0.002	0.003	0.002	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.009	0.019	0.003	0.023	0.019	0.01	0.019	0.028	0.064	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.09	0.09	0.4	0.07	0.10	0.09	0.09	0.1	0.09	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A06-S (D40)	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Mar 2016	Apr 2016	May 2016	June 2016			Fresh	Marine	Irrigation Waters
	19/11/2013	12/12/2013	15/01/2014	18/02/2014	19/03/2014	16/03/2016	5/04/2016	10/05/2016	7/06/2016					
pH	6.9	8.6	7.2	7.1	7.0	6.8	7.6	6.6	6.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	>6 [6][18]
Electrical Conductivity (µS/cm)	1000	1000	970	970	920	660	660	640	650	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	19	35	24	54	640	6.1	6.1	570	610	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	30	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	370	300	320	310	310	220	230	230	230	1/5	NC	NC	NC	NC
Total Alkalinity	370	330	320	310	310	220	230	230	230	1/5				
Anions														
Chloride (Cl)	120	120	130	110	110	73	73	84	78	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	0.02	0.02	0.04	<0.005	0.03	0.03	0.04	0.1	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	13	14	14	13	13	20	21	28	25	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	54	54	55	50	52	33	35	35	37	0.5	NC	NC	NC	NC
Potassium	2.8	3.2	3.9	4.3	4.7	3.4	3.2	3.1	3.6	0.5	NC	NC	NC	NC
Sodium	100	110	95	100	110	87	85	82	90	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	49	46	44	40	39	27	28	27	29	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	<0.0005	0.003	<0.0005	0.002	0.005	0.002	0.0009	0.94	<0.0005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.059	0.044	0.043	0.044	0.042	0.025	0.026	0.034	0.027	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.004	0.004	0.001	0.002	0.001	0.002	0.002	0.012	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.014	0.011	<0.01	0.015	0.022	<0.01	<0.01	0.65	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.011	0.008	0.009	0.012	0.011	<0.005	<0.005	0.007	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.002	0.001	0.002	0.002	0.001	0.001	0.002	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.004	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.059	0.024	0.006	0.015	0.004	0.02	0.006	0.013	0.002	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.09	0.1	0.10	0.1	0.6	0.1	0.09	0.5	0.6	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	A06-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	July 2016	Aug 2016	Sept 2016	Oct 2016	Feb 2017	Mar 2017	Apr 2017	May 2017			Fresh	Marine	Irrigation Waters
	13/07/2016	15/08/2016	14/09/2016	11/10/2016	21/02/2017	21/03/2017	4/04/2017	23/05/2017					
pH	6.1	6.5	7.1	6.2	8.0	6.8	7.3	6.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	740	750	740	1100	820	800	910	830	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4.1	110	15	53	0.8	1.1	2.6	33	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	220	230	250	320	270	250	260	270	1/5	NC	NC	NC	NC
Total Alkalinity	220	230	250	320	270	250	260	270	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	98	84	88	150	140	130	150	110	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.009	<0.005	0.007	0.011	0.009	0.006	0.007	0.009	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.2	0.1	0.07	0.3	0.91	0.78	0.76	0.3	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	39	26	23	51	180	18	20	22	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	45	40	40	59	43	42	46	51	0.5	NC	NC	NC	NC
Potassium	3.5	2.4	2.6	2.1	3.4	3.7	3.6	3.3	0.5	NC	NC	NC	NC
Sodium	94	94	89	130	100	100	110	100	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	35	33	35	52	36	34	36	40	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.003	0.006	0.004	0.007	<0.0005	0.0005	<0.0005	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.024	0.03	0.027	0.07	0.035	0.033	0.032	0.036	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.005	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.001	0.001	0.002	0.005	0.008	0.008	0.022	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.04	0.024	0.017	0.029	0.004	0.007	0.004	0.054	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.07	0.2	0.1	0.2	0.08	0.06	0.08	0.2	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A06-D	A06-D	A06-D	A06-D	A06-D	A06-D	A06-D	D62 (A06-D)	A06-D	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Apr 2014	May 2014	June 2014	July 2014	Aug 2014	Dec 2014	Jan 2015	Jan 2015	Feb 2015			Fresh	Marine	Irrigation Waters
	14/04/2014	20/05/2014	17/06/2014	22/07/2014	19/08/2014	2/12/2014	13/01/2015	13/01/2015	10/02/2015					
pH	7.5	6.9	6.3	6.8	6.3	6.9	6.6	6.7	5.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	780	800	700	670	650	630	630	640	670	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	65	17	18	94	49	94	29	28	50	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	270	250	240	250	240	220	220	220	220	1/5	NC	NC	NC	NC
Total Alkalinity	270	250	240	250	240	220	220	220	220	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	85	81	81	73	71	76	93	94	95	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.069	0.07	0.069	0.061	0.055	0.064	0.055	0.06	0.056	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.02	0.007	0.008	0.03	0.006	0.007	<0.005	0.006	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	12	13	13	12	12	15	19	20	24	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	43	43	40	39	35	35	36	36	34	0.5	NC	NC	NC	NC
Potassium	4.8	4.8	4.9	4.8	4.5	4	4.8	4.9	4.7	0.5	NC	NC	NC	NC
Sodium	82	73	79	73	72	76	74	75	85	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	33	33	33	32	29	28	30	30	29	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	<0.0005	<0.005	0.001	0.001	0.003	<0.0005	0.001	0.001	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.019	0.021	0.011	0.014	0.011	0.009	0.009	0.01	0.012	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.001	<0.001	0.004	0.002	<0.001	0.001	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.09	0.049	0.059	0.044	0.05	0.027	0.037	0.036	0.084	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.68	0.83	0.7	0.63	0.62	0.66	0.73	0.72	0.66	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.004	0.003	0.004	0.006	0.004	0.003	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.008	0.011	0.023	0.009	0.05	0.019	0.029	0.021	0.05	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A06-D	A06-D	A06-D	A06-D	A06-D	A06-D	A06-D	A06-D (D80)	A06-D	A06-D	D85 (A06-D)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	A Slightly t
Date Sampled	March 2015	April 2015	May 2015	June 2015	July 2015	Aug 2015	Sept 2015	Sept 2015	Oct 2015	Nov 2015	Nov 2015			Fresh
	10/03/2015	15/04/2015	19/05/2015	22/06/2015	14/07/2015	11/08/2015	8/09/2015	8/09/2015	13/10/2015	10/11/2015	10/11/2015			
pH	7.1	7.2	7.4	6.6	7.0	7.0	6.8	6.8	7.1	7.4	7.4	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]
Electrical Conductivity (µS/cm)	720	700	630	690	630	650	650	650	570	590	580	1	NC	NC
Turbidity (NTU)	33	46	210	78	130	160	32	32	120	160	160	0.1	5 [8]	1-50
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC
Bicarbonate (HCO_3^-)	220	240	230	230	220	230	220	220	220	220	220	1/5	NC	NC
Total Alkalinity	220	240	230	230	220	230	220	220	220	220	220	1/5	NC	NC
Anions														
Chloride (Cl)	90	76	66	72	73	65	69	64	65	66	67	1	250 [8]	NC
Ammonia (NH_3) as N	0.057	0.04	0.057	0.072	0.067	0.048	0.064	0.065	0.069	0.056	0.056	0.005	0.5 [8]/0.41 [12]	0.9
NO_x (NO_2^- + NO_3^-)	0.03	<0.005	0.006	<0.005	0.04	0.02	<0.005	<0.005	<0.005	<0.005	0.01	0.005	3 [13]	0.04 [1]
Sulphate (SO_4^{2-})	23	18	16	18	18	15	14	14	14	15	15	1	500	NC
Cations - Dissolved														
Calcium	35	39	35	38	34	33	33	33	30	33	33	0.5	NC	NC
Potassium	4.6	4.4	4.4	4.6	4.9	4.2	4.3	4.4	3.4	4.2	4.2	0.5	NC	NC
Sodium	73	83	67	74	67	75	66	67	57	66	66	0.5	180 [8]	NC
Magnesium	29	31	27	31	28	27	27	27	24	27	27	0.5	NC	NC
Metals - Dissolved														
Aluminium	0.001	0.004	0.003	<0.0005	0.002	0.001	<0.0005	0.002	0.002	0.004	<0.0005	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]
Barium	0.008	0.008	0.011	0.008	0.008	0.008	0.007	0.007	0.007	0.007	0.007	0.001	2	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC
Copper	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.002	0.013	<0.001	<0.001	<0.001	0.001	2	0.0014
Iron (Fe^{2+})	0.031	0.031	0.068	0.035	0.03	0.025	0.027	0.028	0.012	0.028	0.026	0.01	0.3 [8]	NC
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.001	0.01	0.0034
Manganese	0.78	0.73	0.73	0.74	0.65	0.69	0.67	0.67	0.68	0.68	0.68	0.005	0.5	1.9
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]
Nickel	0.002	0.002	0.004	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.02	0.011
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]
Zinc	0.008	0.008	0.039	0.011	0.012	0.008	0.008	0.024	0.007	0.011	0.007	0.001	3 [8]	0.008
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	0.09	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]

See Notes to Table Following

ANZECC (2000) - Trigger Values	
to Moderately Disturbed Systems	
Marine	**Irrigation Waters**
7.0-8.5 (2)	< 6 (6)(18)
NC	1000 - 7500 (3)
0.5-10	NC
NC	NC
NC	NC
NC	NC
NC	NC
NC	Species Dependent
0.91	NC
0.015 (2)	NC
NC	NC
NC	NC
NC	NC
NC	Species Dependent
NC	NC
0.0005(16)(L)	NC
0.0023 (L) (17)	0.1 (4)
NC	NC
NC	0.1 (4)
0.0007	0.01 (4)
0.0044 (7)	0.1 (4)
0.001	0.05 (4)
0.0013	0.2 (4)
NC	0.2 (4)
0.0044	2 (4)
0.08 (L)	0.2 (4)
0.0001 (10)	0.002 (4)
0.007	0.2 (4)
0.003 (L)	0.02 (4)
0.1	0.1 (4)
0.015	2 (4)
0.0005(16)(L)	NC
0.0023 (L) (17)	0.1 (4)
NC	NC
NC	0.1 (4)
0.0007	0.01 (4)
0.0044 (7)	0.1 (4)
0.001	0.05 (4)
0.0013	0.2 (4)
NC	0.2 (4)
0.0044	2 (4)
0.08 (L)	0.2 (4)
0.0001 (10)	0.002 (4)
0.007	0.2 (4)
0.003 (L)	0.02 (4)
0.1	0.1 (4)
0.015	2 (4)
0.03 (2)	0.05 (5)

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A06-D	A06-D	A06-D	A06-D	A06-D	A06-D	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values			Sample Identification
									Slightly to Moderately Disturbed Systems			
Date Sampled	Dec 2015	Jan 2016	Feb 2016	Nov 2016	Dec 2016	Jan 2017			Fresh	Marine	Irrigation Waters	Date Sampled
	8/12/2015	12/01/2016	11/02/2016	15/11/2016	13/12/2016	17/01/2017						
pH	7.3	7.2	6.7	7.2	7.1	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]	**pH**
Electrical Conductivity (µS/cm)	600	590	540	670	630	640	1	NC	NC	NC	1000 - 7500 [3]	**Electrical Conductivity (µS/cm)**
Turbidity (NTU)	31	210	150	19	37	220	0.1	5 [8]	1-50	0.5-10	NC	**Turbidity (NTU)**
Alkalinity												**Alkalinity**
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC	Hydroxide (OH^-)
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC	Carbonate (CO_3^{2-})
Bicarbonate (HCO_3^-)	230	220	220	220	220	250	1/5	NC	NC	NC	NC	Bicarbonate (HCO_3^-)
Total Alkalinity	230	220	220	220	220	250	1/5	NC	NC	NC	NC	Total Alkalinity
Anions												**Anions**
Chloride (Cl)	64	64	66	69	72	68	1	250 [8]	NC	NC	Species Dependent	Chloride (Cl)
Ammonia (NH_3) as N	0.061	0.053	0.048	0.079	0.056	0.06	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC	Ammonia (NH_3) as N
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	0.006	<0.005	0.01	<0.005	0.005	3 [13]	0.04 [1]	0.015 [2]	NC	NO_x (NO_2^- + NO_3^-)
Sulphate (SO_4^{2-})	15	14	18	17	19	16	1	500	NC	NC	NC	Sulphate (SO_4^{2-})
Cations - Dissolved												**Cations - Dissolved**
Calcium	35	34	31	36	35	35	0.5	NC	NC	NC	NC	Calcium
Potassium	4.3	4.8	3.9	4.7	4	4.5	0.5	NC	NC	NC	NC	Potassium
Sodium	69	66	65	70	69	63	0.5	180 [8]	NC	NC	Species Dependent	Sodium
Magnesium	27	29	25	30	29	29	0.5	NC	NC	NC	NC	Magnesium
Metals - Dissolved												**Metals - Dissolved**
Aluminium	0.0009	0.001	0.004	0.002	0.043	0.009	0.0005	0.2 [8]	0.0008 [15][L]/0.055 [14][L]	0.0005 [16][L]	NC	Aluminium
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]	Arsenic
Barium	0.007	0.007	0.007	0.005	0.008	0.007	0.001	2	NC	NC	NC	Barium
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]	Beryllium
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]	Cadmium
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]	Chromium
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]	Cobalt
Copper	0.002	<0.001	<0.001	0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]	Copper
Iron (Fe^{2+})	0.013	0.023	0.045	0.018	0.058	0.056	0.01	0.3 [8]	NC	NC	0.2 [4]	Iron (Fe^{2+})
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]	Lead
Manganese	0.670	0.69	0.76	0.77	0.75	0.730	0.005	0.5	1.9	0.08 [L]	0.2 [4]	Manganese
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]	Mercury
Nickel	0.002	0.002	0.002	0.002	0.003	0.002	0.001	0.02	0.011	0.007	0.2 [4]	Nickel
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]	Selenium
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]	Vanadium
Zinc	0.006	0.009	0.016	0.005	0.010	0.009	0.001	3 [8]	0.008	0.015	2 [4]	Zinc
Metals - Total												**Metals - Total**
Aluminium	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15][L]/0.055 [14][L]	0.0005 [16][L]	NC	Aluminium
Arsenic	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]	Arsenic
Barium	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC	Barium
Beryllium	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]	Beryllium
Cadmium	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]	Cadmium
Chromium	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]	Chromium
Cobalt	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]	Cobalt
Copper	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]	Copper
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]	Iron (Fe^{2+})
Lead	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]	Lead
Manganese	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]	Manganese
Mercury	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]	Mercury
Nickel	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]	Nickel
Selenium	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]	Selenium
Vanadium	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]	Vanadium
Zinc	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]	Zinc
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]	**Total Phosphorus**

See Notes to Table Following

Table C1 - Summary of Laboratory

See Notes to Table Following

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Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

A06-D	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
			Slightly to Moderately Disturbed Systems		
Jun 2017			Fresh	Marine	Irrigation Waters
20/06/2017					
6.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
670	1	NC	NC	NC	1000 - 7500 [3]
35	0.1	5 [8]	1-50	0.5-10	NC
<5	1/5	NC	NC	NC	NC
<5	1/5	NC	NC	NC	NC
230	1/5	NC	NC	NC	NC
230	1/5	NC	NC	NC	NC
67	1	250 [8]	NC	NC	Species Dependent
0.08	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
15	1	500	NC	NC	NC
36	0.5	NC	NC	NC	NC
4.4	0.5	NC	NC	NC	NC
63	0.5	180 [8]	NC	NC	Species Dependent
31	0.5	NC	NC	NC	NC
0.0006	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
0.007	0.001	2	NC	NC	NC
<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
<0.001	0.001	NC	NC	0.001	0.05 [4]
<0.001	0.001	2	0.0014	0.0013	0.2 [4]
0.024	0.01	0.3 [8]	NC	NC	0.2 [4]
<0.001	0.001	0.01	0.0034	0.0044	2 [4]
0.7	0.005	0.5	1.9	0.08 [L]	0.2 [4]
<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
0.004	0.001	0.02	0.011	0.007	0.2 [4]
<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
0.017	0.001	3 [8]	0.008	0.015	2 [4]
NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
NT	0.001	2	NC	NC	NC
NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
NT	0.001	NC	NC	0.001	0.05 [4]
NT	0.001	2	0.0014	0.0013	0.2 [4]
NT	0.01	0.3 [8]	NC	NC	0.2 [4]
NT	0.001	0.01	0.0034	0.0044	2 [4]
NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
NT	0.001	0.02	0.011	0.007	0.2 [4]
NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
NT	0.001	3 [8]	0.008	0.015	2 [4]
<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A09	A09	A09	A09	A09	A09	A09	A09	A09	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013	Jul 2013			Fresh	Marine	Irrigation Waters
	23/10/2012	5/12/2012	16/01/2013	20/02/2013	20/03/2013	16/04/2013	16/05/2013	19/06/2013	22/07/2013					
pH	7.6	7.5	7.2	7.2	7.3	7.8	7.2	7.2	7.4	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1000	1500	2000	1500	680	780	1200	1800	2000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	75	15	41	27	4.1	27	49	7.2	18	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	240	320	420	320	200	210	270	330	400	1/5	NC	NC	NC	NC
Total Alkalinity	240	320	420	320	200	210	270	330	400	1/5				
Anions														
Chloride (Cl)	150	240	330	220	68	97	200	340	390	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.06	0.029	0.033	0.028	<0.005	0.009	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.04	0.930	0.960	0.400	<0.005	<0.005	0.3	1.2	1.8	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	73	110	150	120	37	45	110	190	110	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	46	81	93	72	27	35	51	87	92	0.5	NC	NC	NC	NC
Potassium	6.8	7.7	8.5	8.7	4.9	5.7	6.4	8.4	7.5	0.5	NC	NC	NC	NC
Sodium	94	130	180	170	87	85	120	180	220	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	53	68	84	67	23	30	47	79	85	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.006	0.004	0.007	0.005	0.004	0.011	<0.0005	0.004	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.049	0.065	0.086	0.064	0.022	0.033	0.054	0.095	0.100	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0006	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.004	0.006	0.007	0.007	0.012	0.006	0.009	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.220	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.060	0.083	0.036	0.024	0.010	0.030	0.024	0.054	0.054	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.002	0.003	0.002	0.003	0.002	0.003	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.003	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.014	0.025	0.010	0.022	0.009	0.032	0.012	0.022	0.013	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A09	A09	A09	A09	A09	A09 (D41)	A09	A09	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Dec 2013	Jan 2014	Feb 2014			Fresh	Marine	Irrigation Waters
	20/08/2013	19/09/2013	15/10/2013	13/11/2013	10/12/2013	10/12/2013	14/01/2014	18/02/2014					
pH	7.2	7.5	6.9	6.8	8.3	8.3	7.1	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2200	2200	2300	2000	2400	2400	2400	2100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	35	15	9.4	9.9	11	8.9	5	5.4	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	7	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	430	420	410	390	390	380	430	370	1/5	NC	NC	NC	NC
Total Alkalinity	430	420	410	390	390	380	430	370	1/5				
Anions													
Chloride (Cl)	350	360	380	370	420	420	400	330	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.005	0.007	<0.005	0.017	<0.005	0.013	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x ($NO_2^- + NO_3^-$)	0.3	0.3	0.03	0.007	0.1	0.01	0.02	0.02	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	210	210	190	190	230	230	190	170	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	99	94	100	94	100	100	100	81	0.5	NC	NC	NC	NC
Potassium	8	9.7	10	9.8	12	12	11	10	0.5	NC	NC	NC	NC
Sodium	220	250	280	290	330	340	320	290	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	93	90	95	87	98	98	91	79	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.003	0.012	0.005	0.008	0.001	0.003	0.006	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.11	0.1	0.1	0.1	0.11	0.11	0.11	0.1	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.010	0.004	0.017	0.009	0.008	0.009	0.001	0.003	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.023	<0.01	<0.01	0.017	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.076	0.074	0.091	0.1	0.11	0.11	0.11	0.11	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.003	0.003	0.004	0.003	0.003	0.002	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.001	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.015	0.014	0.043	0.067	0.016	0.028	0.007	0.012	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A09	A09	A09	A09	A09	A09	A09	A09	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2014	Apr 2014	May 2014	June 2014	July 2014	Aug 2014	Dec 2014	Jan 2015			Fresh	Marine	Irrigation Waters
	18/03/2014	14/04/2014	20/05/2014	17/06/2014	22/07/2014	19/08/2014	3/12/2014	13/01/2015					
pH	6.6	7.7	7.0	6.2	7.0	6.5	6.3	6.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2300	2500	2800	2500	2600	2600	2900	2700	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	24	10	15	53	58	5.3	14	7.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	410	440	430	440	470	450	490	480	1/5	NC	NC	NC	NC
Total Alkalinity	410	440	430	440	470	450	490	480	1/5				
Anions													
Chloride (Cl)	400	400	420	440	450	450	500	540	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.017	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.30	1.2	1.8	1.8	1.9	1.7	1.8	1.6	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	210	260	320	360	360	350	400	470	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	110	110	130	140	150	140	150	140	0.5	NC	NC	NC	NC
Potassium	11	11	11	11	11	9.6	9.8	11	0.5	NC	NC	NC	NC
Sodium	370	350	320	340	330	330	350	350	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	97	100	120	140	150	140	160	160	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.002	<0.0005	<0.005	0.001	0.002	0.001	0.002	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.12	0.13	0.15	0.14	0.15	0.15	0.15	0.16	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	0.001	0.004	0.003	0.003	0.005	0.005	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.022	0.022	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.14	0.11	0.14	0.13	0.12	0.1	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.002	0.003	0.004	0.005	0.004	0.004	0.008	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.001	0.004	0.007	0.008	0.009	0.006	0.013	0.012	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.002	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.013	0.006	0.014	0.031	0.027	0.03	0.042	0.059	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	0.06	0.06	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A09	D64 (A09)	A09	A09	A09	A09	A09	A09	A09	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2015	Feb 2015	Mar 2015	April 2015	May 2015	June 2015	July 2015	Aug 2015	Sept 2015			Fresh	Marine	Irrigation Waters
	10/02/2015	10/02/2015	10/03/2015	14/04/2015	19/05/2015	22/06/2015	14/07/2015	10/08/2015	8/09/2015					
pH	6.4	6.4	7.4	7.5	7.6	6.7	6.4	7.5	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2600	2600	2700	2400	2500	2500	2400	2500	2500	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	8.5	12	9.8	7.5	45	34	150	5.5	44	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	490	490	500	500	490	490	460	480	480	1/5	NC	NC	NC	NC
Total Alkalinity	490	490	500	500	490	490	460	480	480	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	500	500	420	370	330	350	370	360	390	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	0.012	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.6	1.5	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	470	470	420	380	340	350	390	370	380	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	130	130	130	120	120	130	120	120	120	0.5	NC	NC	NC	NC
Potassium	10	11	9.5	8.4	8.7	8	8.2	7.2	7.2	0.5	NC	NC	NC	NC
Sodium	360	370	300	300	280	300	280	310	280	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	140	150	150	130	130	150	140	120	140	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.001	0.001	0.003	0.001	0.003	0.002	0.002	0.003	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.150	0.150	0.13	0.12	0.13	0.12	0.12	0.11	0.12	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.005	0.004	0.002	0.002	0.003	0.002	0.002	0.003	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	0.007	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.003	0.001	0.002	0.002	0.001	0.003	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.011	0.01	0.009	0.008	0.008	0.009	0.009	0.008	0.008	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.047	0.044	0.01	0.022	0.042	0.014	0.022	0.009	0.008	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	0.1	<0.05	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A09	A09	A09	A09	A09	A09	A09	D98 (A09)	A09	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	Apr 2016	May 2016			Fresh	Marine	Irrigation Waters
	13/10/2015	10/11/2015	8/12/2015	11/01/2016	9/02/2016	14/03/2016	5/04/2016	5/04/2016	10/05/2016					
pH	7.4	7.7	7.5	7.5	7.9	6.6	7.5	7.6	6.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2500	2500	2600	2600	740	1800	2000	2000	2200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	9.9	13	6.9	56	35	23	4.5	4.5	4	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	480	470	490	490	180	370	400	400	440	1/5	NC	NC	NC	NC
Total Alkalinity	480	470	490	490	180	370	400	400	440	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	440	480	440	380	80	300	320	330	400	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	1.3	1.5	2.7	2.9	0.3	0.86	2.7	2.7	4.1	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	400	440	450	380	75	250	280	280	350	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	130	140	140	130	26	92	100	100	120	0.5	NC	NC	NC	NC
Potassium	6.8	8	8.7	9.1	3.9	7.3	7.8	7.7	7.3	0.5	NC	NC	NC	NC
Sodium	280	330	350	330	99	230	280	270	300	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	130	150	140	140	26	95	110	110	120	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.0008	0.25	0.001	0.002	0.002	0.002	0.0009	0.001	0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.13	0.15	0.130	0.12	0.025	0.091	0.095	0.092	0.11	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	0.004	0.002	0.004	0.009	0.002	0.002	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	0.17	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	0.006	<0.005	<0.005	0.008	0.048	0.036	0.034	0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	0.001	0.001	0.001	0.001	0.003	0.002	0.002	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.007	0.008	0.008	0.007	0.002	0.004	0.006	0.005	0.007	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.009	0.009	0.012	0.008	0.037	0.01	0.011	0.012	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.05	0.06	0.06	0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A09	A09	A09	A09	A09	A09	A09	A09	A09	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	June 2016	July 2016	Aug 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017			Fresh	Marine	Irrigation Waters
	7/06/2016	12/07/2016	16/08/2016	12/12/2016	16/01/2017	21/02/2017	20/03/2017	3/04/2017	23/05/2017					
pH	7.3	6.6	6.2	7.1	7.3	7.8	6.7	6.9	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2300	2400	400	590	1400	1900	1700	1900	2200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	0.8	66	37	3.9	13	0.5	3.4	1.9	3.4	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	480	480	99	160	270	360	320	340	390	1/5	NC	NC	NC	NC
Total Alkalinity	480	480	99	160	270	360	320	340	390	1/5				
Anions														
Chloride (Cl)	380	350	41	79	280	410	300	350	450	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	0.009	0.019	0.024	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	2.3	1.7	0.64	<0.005	<0.005	0.006	0.01	0.08	0.3	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	360	450	28	37	130	240	170	190	240	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	130	150	16	31	84	110	90	98	120	0.5	NC	NC	NC	NC
Potassium	7.8	8	2.1	4.1	8.7	11	10	9	9.9	0.5	NC	NC	NC	NC
Sodium	340	330	47	66	110	200	170	200	280	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	140	150	16	30	86	110	88	97	120	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.0006	0.001	0.003	0.005	0.003	0.001	0.003	0.001	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.12	0.12	0.012	0.021	0.063	0.098	0.085	0.099	0.11	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.006	0.003	0.019	0.003	0.003	0.008	0.040	0.03	0.016	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	0.012	<0.005	0.011	0.037	0.058	0.047	0.044	0.067	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.002	0.002	0.003	0.004	0.003	0.003	0.016	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.006	0.009	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.013	0.032	0.004	0.010	0.007	0.012	0.018	0.018	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.06	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A09	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
				Slightly to Moderately Disturbed Systems		
Date Sampled	Jun 2017			Fresh	Marine	Irrigation Waters
	20/06/2017					
pH	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2500	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	12	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity						
Hydroxide (OH^-)	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	410	1/5	NC	NC	NC	NC
Total Alkalinity	410	1/5				
Anions						
Chloride (Cl)	420	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.3	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	260	1	500	NC	NC	NC
Cations - Dissolved						
Calcium	110	0.5	NC	NC	NC	NC
Potassium	9.9	0.5	NC	NC	NC	NC
Sodium	280	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	120	0.5	NC	NC	NC	NC
Metals - Dissolved						
Aluminium	0.004	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.094	0.001	2	NC	NC	NC
Beryllium	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.012	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.078	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.006	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.002	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.014	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total						
Aluminium	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	0.001	2	NC	NC	NC
Beryllium	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table 1 - Summary of Laboratory Testing Results - February 2012 to June 2014 (Surface Water and Groundwater) - mg/L

Sample Identification	A12	A12	A12	A12	A12	A12	A12	A12	A12	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2012	Dec 2012	Jan 2013	Feb 2013	Apr 2013	May 2013	Jun 2013	Jul 2013	Aug 2013			Fresh	Marine	Irrigation Waters
	23/10/2012	3/12/2012	16/01/2013	20/02/2013	17/04/2013	14/05/2013	19/06/2013	24/07/2013	21/08/2013					
pH	6.8	6.5	6.7	6.9	8.0	6.7	6.8	6.6	6.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	250	280	290	290	250	250	270	280	300	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	270	180	57	1200	40	1200	210	34	580	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	65	66	81	86	78	76	78	82	88	1/5	NC	NC	NC	NC
Total Alkalinity	65	66	81	86	78	76	78	82	88	1/5				
Anions														
Chloride (Cl)	25	28	27	26	22	28	26	23	24	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.077	0.014	0.03	0.018	0.02	0.035	0.021	0.009	0.058	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	0.02	0.02	0.02	<0.005	0.05	0.01	<0.005	0.4	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	14	17	20	18	13	17	18	15	18	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	15	19	17	18	14	13	16	16	16	0.5	NC	NC	NC	NC
Potassium	2.6	2.8	3.2	3.4	2.6	2.7	2.9	2.9	2.6	0.5	NC	NC	NC	NC
Sodium	15	19	20	22	17	18	18	19	17	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	11	14	12	13	9.5	9.3	10	12	11	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.0009	0.0090	0.0030	0.007	0.002	0.004	<0.0005	0.012	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.047	0.046	0.052	0.052	0.045	0.043	0.045	0.052	0.05	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0006	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.002	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	0.001	<0.001	0.003	0.001	0.003	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.360	0.260	0.250	0.210	0.059	0.078	0.19	0.070	0.086	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.120	0.087	0.094	0.110	0.053	0.070	0.075	0.060	0.083	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.003	0.004	0.004	0.004	0.003	0.004	0.005	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.012	0.011	0.022	0.009	0.029	0.005	0.020	0.017	0.012	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	0.07	<0.05	0.2	<0.05	0.4	0.06	<0.05	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table 1 - Summary of Laboratory Testing Results - February 2012 to June 2014 (Surface Water and Groundwater) - mg/L

Sample Identification	A12	A12	A12	A12	A12	A12 (D44)	A12	A12	A12	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Jan 2014	Feb 2014	Mar 2014	Apr 2014			Fresh	Marine	Irrigation Waters
	18/09/2013	16/101/2013	13/11/2013	11/12/2013	15/01/2014	15/01/2014	19/02/2014	19/03/2014	15/04/2014					
pH	6.9	7.6	5.5	8.0	7.0	6.9	5.4	5.2	6.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	310	320	330	320	280	290	330	310	310	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	290	60	32	800	140	140	330	300	88	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	93	92	92	94	99	100	96	86	100	1/5	NC	NC	NC	NC
Total Alkalinity	93	92	92	94	99	100	96	86	100	1/5				
Anions														
Chloride (Cl)	26	26	26	29	30	29	26	25	24	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.016	0.014	0.005	0.008	0.017	0.008	0.041	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.005	0.02	0.06	0.01	0.02	0.72	0.04	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	21	20	21	22	19	18	18	17	17	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	18	19	21	18	20	20	20	21	21	0.5	NC	NC	NC	NC
Potassium	3.3	2.9	2.9	3.5	3.5	3.4	3.2	3.7	3.8	0.5	NC	NC	NC	NC
Sodium	20	21	22	25	22	22	19	24	25	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	13	14	14	13	14	15	13	14	14	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.010	0.006	0.012	0.004	<0.0005	<0.0005	0.006	0.009	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.055	0.055	0.062	0.059	0.057	0.054	0.061	0.065	0.056	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.002	0.017	0.003	<0.001	<0.001	0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.099	0.38	0.21	0.23	0.061	0.066	0.31	0.55	0.099	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.08	0.096	0.086	0.11	0.083	0.086	0.12	0.13	0.082	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.005	0.015	0.005	0.004	0.004	0.014	0.011	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.021	0.031	0.19	0.024	0.010	0.010	0.13	0.038	0.004	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.07	<0.05	<0.05	0.1	0.06	0.05	0.1	0.1	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A12	A12	A12	A12	A12	A12	A12	A12	A12	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	May 2014	June 2014	July 2014	Aug 2014	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017			Fresh	Marine	Irrigation Waters
	21/05/2014	18/06/2014	23/07/2014	20/08/2014	14/12/2016	18/01/2017	22/02/2017	29/03/2017	5/04/2017					
pH	5.4	6.5	6.7	5.3	6.7	6.8	5.7	6.7	6.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	320	280	280	300	220	240	230	200	240	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	74	110	64	150	200	160	41	64	59	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	86	89	96	85	75	81	81	76	75	1/5	NC	NC	NC	NC
Total Alkalinity	86	89	96	85	75	81	81	76	75	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	26	27	27	25	23	24	24	23	22	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.5	0.029	<0.005	0.021	0.006	0.007	0.009	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.03	1.8	0.01	0.05	0.2	0.1	0.08	0.02	0.02	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	19	20	20	18	7	7	8	8	8	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	19	18	20	17	14	13	14	13	13	0.5	NC	NC	NC	NC
Potassium	3.2	3.6	3.5	3.2	3.1	3	2.9	3.2	3.2	0.5	NC	NC	NC	NC
Sodium	19	25	25	23	16	16	15	18	18	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	12	14	14	12	10	10	9.8	9.9	9.8	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.001	0.04	<0.0005	0.003	0.002	0.002	0.003	0.001	0.0008	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.062	0.058	0.063	0.065	0.042	0.045	0.047	0.039	0.04	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.007	0.008	0.006	0.013	0.012	0.006	0.010	0.003	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.18	0.12	0.04	0.13	0.01	<0.01	0.021	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.098	0.083	0.052	0.063	0.009	0.008	0.019	0.018	0.021	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.007	0.006	0.007	0.026	0.004	0.004	0.007	0.004	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.053	0.026	0.009	0.1	0.006	0.008	0.024	0.008	0.012	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	0.1	0.1	<0.05	<0.05	0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13 (D6)	A13	A13	A13	A13	A13	A13 (D15)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	May 2012	Jun 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Dec 2012	Dec 2012			Fresh	Marine	Irrigation Waters
	30/5/2012	27/06/2012	27/06/2012	24/07/2012	22/08/2012	18/09/2012	21/10/2012	3/12/2012	4/12/2012					
pH	8.3	7.3	7.4	6.9	7.1	7.0	8.0	7	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1300	1400	1400	1400	1400	1400	1300	1400	1500	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	55	9.9	14	4.9	4.2	3.8	4.2	11	9.8	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	15	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	260	290	290	320	310	300	310	300	300	1/5	NC	NC	NC	NC
Total Alkalinity	280	290	290	320	310	300	310	300	300	1/5				
Anions														
Chloride (Cl)	200	210	210	220	190	210	190	230	230	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.006	0.006	<0.005	<0.005	0.009	0.017	0.01	0.023	0.087	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.008	0.1	0.3	0.03	0.01	0.02	0.09	0.64	0.69	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	90	81	81	94	69	83	79	88	88	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	69	72	74	76	80	86	83	110	100	0.5	NC	NC	NC	NC
Potassium	6.1	5.5	5.7	6.2	5.7	6.2	5.7	6	5.7	0.5	NC	NC	NC	NC
Sodium	100	110	110	120	110	130	110	130	130	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	55	56	59	60	62	66	66	78	80	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.039	<0.01	<0.01	0.005	0.0040	0.0020	0.002	0.001	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.095	0.099	0.099	0.099	0.1100	0.1000	0.094	0.100	0.095	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0005	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	<0.001	0.001	0.002	0.003	0.002	0.002	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.25	0.120	0.120	0.130	0.11	0.11	0.120	0.046	0.050	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.25	0.250	0.250	0.230	0.240	0.230	0.250	0.290	0.310	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.003	0.0030	0.007	0.0020	0.0030	0.016	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.022	0.010	0.005	0.027	0.015	0.120	0.019	0.014	0.011	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13	A13	A13	A13 (D26)	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	May 2013	Jun 2013	Jul 2013	Aug 2013			Fresh	Marine	Irrigation Waters
	14/01/2013	19/02/2013	19/03/2013	16/04/2013	12/05/2013	12/05/2013	18/06/2013	22/07/2013	19/08/2013					
pH	7	7.1	7.5	7.7	7.6	7.7	7.3	7.3	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1600	1500	1300	1200	1200	1200	1200	1200	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4	89	20	0.7	1.3	1.1	2.3	14	0.5	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	300	310	310	280	280	280	290	280	280	1/5	NC	NC	NC	NC
Total Alkalinity	300	310	310	280	280	280	290	280	280	1/5				
Anions														
Chloride (Cl)	280	240	200	180	210	220	210	240	180	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.006	0.018	0.005	<0.005	0.01	0.007	<0.005	0.009	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	37	0.3	0.3	0.3	0.4	0.4	0.4	0.2	0.2	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	140	120	89	69	81	83	80	65	68	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	91	92	68	70	64	64	67	64	67	0.5	NC	NC	NC	NC
Potassium	5.5	5.7	5.2	5.5	5.1	5	5.7	4.6	4.6	0.5	NC	NC	NC	NC
Sodium	130	120	110	100	100	100	110	100	89	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	71	73	53	55	52	50	53	50	52	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.013	0.006	0.002	0.005	0.002	0.002	0.001	0.002	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.110	0.110	0.092	0.093	0.087	0.086	0.093	0.091	0.084	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0006	0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.004	0.003	0.002	0.002	0.002	0.003	0.002	0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.021	0.016	0.015	0.019	<0.01	0.010	0.018	0.093	0.034	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.280	0.240	0.220	0.220	0.200	0.190	0.19	0.18	0.18	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.003	0.002	0.003	0.002	0.002	0.004	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.020	0.022	0.016	0.009	0.012	0.011	0.013	0.016	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13	A13	A13	A13	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014			Fresh	Marine	Irrigation Waters
	19/09/2013	15/10/2013	11/11/2013	11/12/2013	13/01/2014	18/02/2014	18/03/2014	15/04/2014	20/05/2014					
pH	7.3	7	7.7	8.2	7.1	7.2	6.3	7.2	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1300	1300	1300	1400	1400	1400	1400	1200	1400	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	1.1	0.7	1.9	1.6	4.1	5.4	0.6	1.4	3.7	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	280	280	280	260	310	290	290	300	280	1/5	NC	NC	NC	NC
Total Alkalinity	280	280	280	260	310	290	290	300	280	1/5				
Anions														
Chloride (Cl)	220	230	220	220	230	210	210	200	190	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.014	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.3	0.4	0.4	0.4	0.4	0.3	0.30	0.4	0.3	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	84	94	98	96	90	95	91	85	81	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	76	80	80	79	82	83	89	79	76	0.5	NC	NC	NC	NC
Potassium	5.6	5.5	5.4	6.2	6.5	6.5	6.4	6.4	5.6	0.5	NC	NC	NC	NC
Sodium	99	110	120	130	120	130	130	130	110	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	58	62	62	62	67	68	67	64	61	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	0.003	0.008	0.004	0.006	0.003	0.002	0.0008	<0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.094	0.089	0.097	0.099	0.1	0.1	0.098	0.095	0.097	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.001	0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.002	0.002	0.004	<0.001	0.002	0.002	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.053	0.034	0.021	0.02	0.013	0.014	0.067	0.013	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.2	0.24	0.22	0.23	0.24	0.22	0.34	0.23	0.21	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	0.001	0.001	0.001	0.001	<0.001	0.001	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.025	0.021	0.012	0.024	0.006	0.016	0.020	0.004	0.006	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13 (D55)	A13	A13	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	June 2014	July 2014	July 2014	Aug 2014	Dec 2014	Jan 2015	Feb 2015	March 2015			Fresh	Marine	Irrigation Waters
	17/06/2014	21/07/2014	21/07/2014	19/08/2014	2/12/2014	12/01/2015	9/02/2015	9/03/2015					
pH	6.4	7.0	7.0	7.1	7.2	6.6	6.5	6.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1200	1100	1100	1200	1200	1200	1200	1300	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	1.1	0.7	0.8	0.3	0.3	1.6	7.1	4.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	280	290	280	280	290	280	290	290	1/5	NC	NC	NC	NC
Total Alkalinity	280	290	280	280	290	280	290	290	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	200	190	180	190	210	220	220	200	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.034	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.2	0.2	0.2	0.2	0.2	0.2	0.09	0.2	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	81	77	77	79	92	81	100	93	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	78	73	71	77	80	75	71	71	0.5	NC	NC	NC	NC
Potassium	5.9	5.7	5.9	5.7	5	6.3	5.8	5.8	0.5	NC	NC	NC	NC
Sodium	120	110	110	110	120	120	140	110	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	62	57	58	58	63	60	59	57	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	<0.0005	0.002	0.003	0.001	0.002	0.002	0.006	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.093	0.092	0.093	0.093	0.092	0.098	0.096	0.094	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.001	<0.001	0.001	0.002	0.002	0.003	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.04	<0.01	<0.01	0.014	<0.01	0.011	0.021	0.017	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.23	0.19	0.19	0.2	0.2	0.23	0.21	0.22	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.003	<0.001	0.002	0.002	0.003	0.003	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.020	0.011	0.009	0.01	0.010	0.027	0.033	0.04	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13	A13	D75 (A13)	A13	A13	A13	D83 (A13)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	April 2015	May 2015	June 2015	July 2015	July 2015	Aug 2015	Sept 2015	Oct 2015	Oct 2015			Fresh	Marine	Irrigation Waters
	14/04/2015	18/05/2015	22/06/2015	14/07/2015	14/07/2015	10/08/2015	8/09/2015	13/10/2015	13/10/2015					
pH	7.3	6.5	6.4	6.4	6.4	7.3	7.0	7.2	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1100	1100	1100	1100	1100	1200	1200	1100	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	0.4	79	12	23	22	6.7	11	23	24	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	290	280	280	270	270	270	270	290	290	1/5	NC	NC	NC	NC
Total Alkalinity	290	280	280	270	270	270	270	290	290	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	190	170	180	190	190	170	180	190	190	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.015	<0.005	0.016	0.015	<0.005	<0.005	0.006	0.011	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.1	0.1	0.1	0.08	0.08	0.2	0.2	0.2	0.2	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	81	73	75	79	79	72	76	81	81	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	67	73	73	69	69	63	67	64	64	0.5	NC	NC	NC	NC
Potassium	5.2	6.2	5.8	6.1	6	5.2	5.2	4.1	4.3	0.5	NC	NC	NC	NC
Sodium	120	110	120	100	100	120	110	100	100	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	54	57	61	54	54	51	54	52	53	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	0.005	0.0006	0.002	0.003	0.002	0.004	0.006	0.006	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.089	0.096	0.091	0.088	0.086	0.083	0.081	0.087	0.087	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.002	0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.002	0.002	0.001	0.001	0.024	0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	0.54	0.12	0.29	0.29	0.044	0.028	0.034	0.034	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.17	0.34	0.29	0.32	0.31	0.19	0.19	0.21	0.21	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.005	0.002	0.004	0.003	0.002	0.001	0.001	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.087	0.028	0.035	0.034	0.034	0.010	0.009	0.008	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	0.1	0.05	0.06	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13 (D88)	A13	A13	A13	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Nov 2015	Dec 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	June 2016			Fresh	Marine	Irrigation Waters
	10/11/2015	8/12/2015	8/12/2015	11/01/2016	9/02/2016	14/03/2016	4/04/2016	10/05/2016	7/06/2016					
pH	7.3	7.0	7.1	6.5	7.7	6.5	7.0	6.6	6.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1200	1200	1200	1200	1200	1100	1100	1100	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	31	3.4	2.1	5.9	7	1.1	9.6	8.6	2.7	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	270	290	290	290	290	280	280	280	290	1/5	NC	NC	NC	NC
Total Alkalinity	270	290	290	290	290	280	280	280	290	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	200	210	210	190	190	180	180	190	170	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.005	<0.005	<0.005	0.011	<0.005	0.033	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.2	0.09	0.1	0.1	0.07	0.07	0.06	0.04	0.03	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	100	97	98	83	84	82	82	85	71	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	70	76	76	72	67	65	69	67	68	0.5	NC	NC	NC	NC
Potassium	5.4	5.5	5.6	6.4	5.2	5	5.3	4.8	5.3	0.5	NC	NC	NC	NC
Sodium	120	130	130	120	110	110	110	120	120	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	61	61	60	60	55	52	57	54	56	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	0.002	0.001	0.005	0.001	0.002	0.001	0.003	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.084	0.088	0.084	0.086	0.087	0.084	0.086	0.084	0.08	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	0.001	0.006	0.006	0.008	<0.001	0.002	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.026	<0.01	<0.01	0.01	<0.01	0.028	0.079	0.065	0.095	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.2	0.200	0.170	0.2	0.19	0.2	0.21	0.21	0.21	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.011	0.010	0.008	0.031	0.010	0.031	0.017	0.015	0.012	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	D106-ASM (A13)	A13	A13	A13	A13	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	July 2016	July 2016	Aug 2016	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017			Fresh	Marine	Irrigation Waters
	12/07/2016	12/07/2016	15/08/2016	13/09/2016	11/10/2016	15/11/2016	12/12/2016	16/01/2017	20/02/2017					
pH	6.6	6.7	7.0	6.6	6.9	7.4	7.1	7.3	7.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1100	1100	1100	1000	1100	1100	1100	1300	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	5.1	3.6	5.3	12	2.2	12	7.4	14	4.2	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	280	280	270	280	290	280	290	310	330	1/5	NC	NC	NC	NC
Total Alkalinity	280	280	270	280	290	280	290	310	330	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	170	170	160	150	150	150	190	210	210	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	0.044	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.05	0.04	0.3	0.06	0.06	0.05	0.4	1.8	1.1	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	90	91	67	61	57	58	73	78	97	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	75	76	68	71	66	65	69	78	74	0.5	NC	NC	NC	NC
Potassium	5.7	5.9	5.1	5.4	5.3	5.4	4.9	5.6	5.8	0.5	NC	NC	NC	NC
Sodium	120	120	120	100	110	110	110	110	120	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	59	60	55	55	53	53	56	64	61	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	<0.0005	0.005	0.001	0.001	0.003	0.001	0.002	0.003	<0.0005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.073	0.071	0.078	0.069	0.092	0.071	0.079	0.093	0.09	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	0.001	0.001	0.001	<0.001	<0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.15	0.15	0.042	0.041	<0.01	0.039	<0.01	<0.010	0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.2	0.2	0.18	0.18	0.15	0.17	0.17	0.210	0.19	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.001	0.001	0.001	0.002	0.002	0.004	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.011	0.017	0.006	0.014	0.016	0.004	0.006	0.010	0.011	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	D123 (A13)	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
								Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2017	Mar 2017	Apr 2017	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	20/03/2017	20/03/2017	3/04/2017	23/05/2017	20/06/2017					
pH	7.0	7.1	7.4	6.9	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1200	1100	1200	1100	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4.9	4.9	3.9	11	2.4	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity										
Hydroxide (OH^-)	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	310	320	320	290	300	1/5	NC	NC	NC	NC
Total Alkalinity	310	320	320	290	300	1/5	NC	NC	NC	NC
Anions										
Chloride (Cl)	170	180	190	170	150	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.011	0.005	<0.005	0.009	0.009	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.94	0.92	0.8	0.2	0.1	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	76	79	84	69	64	1	500	NC	NC	NC
Cations - Dissolved										
Calcium	70	70	77	73	69	0.5	NC	NC	NC	NC
Potassium	5.7	5.8	5.6	5.4	5.6	0.5	NC	NC	NC	NC
Sodium	120	120	120	120	110	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	56	57	62	59	53	0.5	NC	NC	NC	NC
Metals - Dissolved										
Aluminium	0.0008	0.002	0.002	0.001	0.001	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.085	0.088	0.088	0.076	0.078	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.026	0.025	0.023	0.037	0.015	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.2	0.2	0.21	0.21	0.17	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.002	0.007	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.008	0.004	0.011	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total										
Aluminium	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13 (D6)	A13	A13	A13	A13	A13	A13 (D15)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	May 2012	Jun 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Dec 2012	Dec 2012			Fresh	Marine	Irrigation Waters
	30/5/2012	27/06/2012	27/06/2012	24/07/2012	22/08/2012	18/09/2012	21/10/2012	3/12/2012	4/12/2012					
pH	8.3	7.3	7.4	6.9	7.1	7.0	8.0	7	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1300	1400	1400	1400	1400	1400	1300	1400	1500	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	55	9.9	14	4.9	4.2	3.8	4.2	11	9.8	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	15	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	260	290	290	320	310	300	310	300	300	1/5	NC	NC	NC	NC
Total Alkalinity	280	290	290	320	310	300	310	300	300	1/5				
Anions														
Chloride (Cl)	200	210	210	220	190	210	190	230	230	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.006	0.006	<0.005	<0.005	0.009	0.017	0.01	0.023	0.087	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.008	0.1	0.3	0.03	0.01	0.02	0.09	0.64	0.69	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	90	81	81	94	69	83	79	88	88	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	69	72	74	76	80	86	83	110	100	0.5	NC	NC	NC	NC
Potassium	6.1	5.5	5.7	6.2	5.7	6.2	5.7	6	5.7	0.5	NC	NC	NC	NC
Sodium	100	110	110	120	110	130	110	130	130	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	55	56	59	60	62	66	66	78	80	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.039	<0.01	<0.01	0.005	0.0040	0.0020	0.002	0.001	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.095	0.099	0.099	0.099	0.1100	0.1000	0.094	0.100	0.095	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0005	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	<0.001	0.001	0.002	0.003	0.002	0.002	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.25	0.120	0.120	0.130	0.11	0.11	0.120	0.046	0.050	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.25	0.250	0.250	0.230	0.240	0.230	0.250	0.290	0.310	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.003	0.0030	0.007	0.0020	0.0030	0.016	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.022	0.010	0.005	0.027	0.015	0.120	0.019	0.014	0.011	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13	A13	A13	A13 (D26)	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	May 2013	Jun 2013	Jul 2013	Aug 2013			Fresh	Marine	Irrigation Waters
	14/01/2013	19/02/2013	19/03/2013	16/04/2013	12/05/2013	12/05/2013	18/06/2013	22/07/2013	19/08/2013					
pH	7	7.1	7.5	7.7	7.6	7.7	7.3	7.3	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1600	1500	1300	1200	1200	1200	1200	1200	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4	89	20	0.7	1.3	1.1	2.3	14	0.5	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	300	310	310	280	280	280	290	280	280	1/5	NC	NC	NC	NC
Total Alkalinity	300	310	310	280	280	280	290	280	280	1/5				
Anions														
Chloride (Cl)	280	240	200	180	210	220	210	240	180	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.006	0.018	0.005	<0.005	0.01	0.007	<0.005	0.009	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	37	0.3	0.3	0.3	0.4	0.4	0.4	0.2	0.2	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	140	120	89	69	81	83	80	65	68	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	91	92	68	70	64	64	67	64	67	0.5	NC	NC	NC	NC
Potassium	5.5	5.7	5.2	5.5	5.1	5	5.7	4.6	4.6	0.5	NC	NC	NC	NC
Sodium	130	120	110	100	100	100	110	100	89	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	71	73	53	55	52	50	53	50	52	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.013	0.006	0.002	0.005	0.002	0.002	0.001	0.002	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.110	0.110	0.092	0.093	0.087	0.086	0.093	0.091	0.084	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0006	0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.004	0.003	0.002	0.002	0.002	0.003	0.002	0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.021	0.016	0.015	0.019	<0.01	0.010	0.018	0.093	0.034	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.280	0.240	0.220	0.220	0.200	0.190	0.19	0.18	0.18	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.003	0.002	0.003	0.002	0.002	0.004	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.020	0.022	0.016	0.009	0.012	0.011	0.013	0.016	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13	A13	A13	A13	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014			Fresh	Marine	Irrigation Waters
	19/09/2013	15/10/2013	11/11/2013	11/12/2013	13/01/2014	18/02/2014	18/03/2014	15/04/2014	20/05/2014					
pH	7.3	7	7.7	8.2	7.1	7.2	6.3	7.2	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1300	1300	1300	1400	1400	1400	1400	1200	1400	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	1.1	0.7	1.9	1.6	4.1	5.4	0.6	1.4	3.7	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	280	280	280	260	310	290	290	300	280	1/5	NC	NC	NC	NC
Total Alkalinity	280	280	280	260	310	290	290	300	280	1/5				
Anions														
Chloride (Cl)	220	230	220	220	230	210	210	200	190	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.014	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.3	0.4	0.4	0.4	0.4	0.3	0.30	0.4	0.3	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	84	94	98	96	90	95	91	85	81	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	76	80	80	79	82	83	89	79	76	0.5	NC	NC	NC	NC
Potassium	5.6	5.5	5.4	6.2	6.5	6.5	6.4	6.4	5.6	0.5	NC	NC	NC	NC
Sodium	99	110	120	130	120	130	130	130	110	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	58	62	62	62	67	68	67	64	61	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	0.003	0.008	0.004	0.006	0.003	0.002	0.0008	<0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.094	0.089	0.097	0.099	0.1	0.1	0.098	0.095	0.097	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.001	0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.002	0.002	0.004	<0.001	0.002	0.002	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.053	0.034	0.021	0.02	0.013	0.014	0.067	0.013	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.2	0.24	0.22	0.23	0.24	0.22	0.34	0.23	0.21	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	0.001	0.001	0.001	0.001	<0.001	0.001	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.025	0.021	0.012	0.024	0.006	0.016	0.020	0.004	0.006	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13 (D55)	A13	A13	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	June 2014	July 2014	July 2014	Aug 2014	Dec 2014	Jan 2015	Feb 2015	March 2015			Fresh	Marine	Irrigation Waters
	17/06/2014	21/07/2014	21/07/2014	19/08/2014	2/12/2014	12/01/2015	9/02/2015	9/03/2015					
pH	6.4	7.0	7.0	7.1	7.2	6.6	6.5	6.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1200	1100	1100	1200	1200	1200	1200	1300	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	1.1	0.7	0.8	0.3	0.3	1.6	7.1	4.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	280	290	280	280	290	280	290	290	1/5	NC	NC	NC	NC
Total Alkalinity	280	290	280	280	290	280	290	290	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	200	190	180	190	210	220	220	200	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.034	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.2	0.2	0.2	0.2	0.2	0.2	0.09	0.2	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	81	77	77	79	92	81	100	93	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	78	73	71	77	80	75	71	71	0.5	NC	NC	NC	NC
Potassium	5.9	5.7	5.9	5.7	5	6.3	5.8	5.8	0.5	NC	NC	NC	NC
Sodium	120	110	110	110	120	120	140	110	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	62	57	58	58	63	60	59	57	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	<0.0005	0.002	0.003	0.001	0.002	0.002	0.006	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.093	0.092	0.093	0.093	0.092	0.098	0.096	0.094	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.001	<0.001	0.001	0.002	0.002	0.003	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.04	<0.01	<0.01	0.014	<0.01	0.011	0.021	0.017	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.23	0.19	0.19	0.2	0.2	0.23	0.21	0.22	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.003	<0.001	0.002	0.002	0.003	0.003	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.020	0.011	0.009	0.01	0.010	0.027	0.033	0.04	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13	A13	D75 (A13)	A13	A13	A13	D83 (A13)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	April 2015	May 2015	June 2015	July 2015	July 2015	Aug 2015	Sept 2015	Oct 2015	Oct 2015			Fresh	Marine	Irrigation Waters
	14/04/2015	18/05/2015	22/06/2015	14/07/2015	14/07/2015	10/08/2015	8/09/2015	13/10/2015	13/10/2015					
pH	7.3	6.5	6.4	6.4	6.4	7.3	7.0	7.2	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1100	1100	1100	1100	1100	1200	1200	1100	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	0.4	79	12	23	22	6.7	11	23	24	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	290	280	280	270	270	270	270	290	290	1/5	NC	NC	NC	NC
Total Alkalinity	290	280	280	270	270	270	270	290	290	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	190	170	180	190	190	170	180	190	190	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.015	<0.005	0.016	0.015	<0.005	<0.005	0.006	0.011	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.1	0.1	0.1	0.08	0.08	0.2	0.2	0.2	0.2	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	81	73	75	79	79	72	76	81	81	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	67	73	73	69	69	63	67	64	64	0.5	NC	NC	NC	NC
Potassium	5.2	6.2	5.8	6.1	6	5.2	5.2	4.1	4.3	0.5	NC	NC	NC	NC
Sodium	120	110	120	100	100	120	110	100	100	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	54	57	61	54	54	51	54	52	53	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	0.005	0.0006	0.002	0.003	0.002	0.004	0.006	0.006	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.089	0.096	0.091	0.088	0.086	0.083	0.081	0.087	0.087	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.002	0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.002	0.002	0.001	0.001	0.024	0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	0.54	0.12	0.29	0.29	0.044	0.028	0.034	0.034	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.17	0.34	0.29	0.32	0.31	0.19	0.19	0.21	0.21	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.005	0.002	0.004	0.003	0.002	0.001	0.001	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.087	0.028	0.035	0.034	0.034	0.010	0.009	0.008	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	0.1	0.05	0.06	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	A13	A13 (D88)	A13	A13	A13	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Nov 2015	Dec 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	June 2016			Fresh	Marine	Irrigation Waters
	10/11/2015	8/12/2015	8/12/2015	11/01/2016	9/02/2016	14/03/2016	4/04/2016	10/05/2016	7/06/2016					
pH	7.3	7.0	7.1	6.5	7.7	6.5	7.0	6.6	6.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1200	1200	1200	1200	1200	1100	1100	1100	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	31	3.4	2.1	5.9	7	1.1	9.6	8.6	2.7	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	270	290	290	290	290	280	280	280	290	1/5	NC	NC	NC	NC
Total Alkalinity	270	290	290	290	290	280	280	280	290	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	200	210	210	190	190	180	180	190	170	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.005	<0.005	<0.005	0.011	<0.005	0.033	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.2	0.09	0.1	0.1	0.07	0.07	0.06	0.04	0.03	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	100	97	98	83	84	82	82	85	71	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	70	76	76	72	67	65	69	67	68	0.5	NC	NC	NC	NC
Potassium	5.4	5.5	5.6	6.4	5.2	5	5.3	4.8	5.3	0.5	NC	NC	NC	NC
Sodium	120	130	130	120	110	110	110	120	120	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	61	61	60	60	55	52	57	54	56	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	0.002	0.001	0.005	0.001	0.002	0.001	0.003	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.084	0.088	0.084	0.086	0.087	0.084	0.086	0.084	0.08	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	0.001	0.006	0.006	0.008	<0.001	0.002	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.026	<0.01	<0.01	0.01	<0.01	0.028	0.079	0.065	0.095	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.2	0.200	0.170	0.2	0.19	0.2	0.21	0.21	0.21	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.011	0.010	0.008	0.031	0.010	0.031	0.017	0.015	0.012	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	D106-ASM (A13)	A13	A13	A13	A13	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	July 2016	July 2016	Aug 2016	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017			Fresh	Marine	Irrigation Waters
	12/07/2016	12/07/2016	15/08/2016	13/09/2016	11/10/2016	15/11/2016	12/12/2016	16/01/2017	20/02/2017					
pH	6.6	6.7	7.0	6.6	6.9	7.4	7.1	7.3	7.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1100	1100	1100	1000	1100	1100	1100	1300	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	5.1	3.6	5.3	12	2.2	12	7.4	14	4.2	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	280	280	270	280	290	280	290	310	330	1/5	NC	NC	NC	NC
Total Alkalinity	280	280	270	280	290	280	290	310	330	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	170	170	160	150	150	150	190	210	210	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	0.044	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.05	0.04	0.3	0.06	0.06	0.05	0.4	1.8	1.1	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	90	91	67	61	57	58	73	78	97	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	75	76	68	71	66	65	69	78	74	0.5	NC	NC	NC	NC
Potassium	5.7	5.9	5.1	5.4	5.3	5.4	4.9	5.6	5.8	0.5	NC	NC	NC	NC
Sodium	120	120	120	100	110	110	110	110	120	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	59	60	55	55	53	53	56	64	61	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	<0.0005	0.005	0.001	0.001	0.003	0.001	0.002	0.003	<0.0005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.073	0.071	0.078	0.069	0.092	0.071	0.079	0.093	0.09	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	0.001	0.001	0.001	<0.001	<0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.15	0.15	0.042	0.041	<0.01	0.039	<0.01	<0.010	0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.2	0.2	0.18	0.18	0.15	0.17	0.17	0.210	0.19	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.001	0.001	0.001	0.002	0.002	0.004	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.011	0.017	0.006	0.014	0.016	0.004	0.006	0.010	0.011	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A13	D123 (A13)	A13	A13	A13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
								Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2017	Mar 2017	Apr 2017	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	20/03/2017	20/03/2017	3/04/2017	23/05/2017	20/06/2017					
pH	7.0	7.1	7.4	6.9	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1200	1100	1200	1100	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4.9	4.9	3.9	11	2.4	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity										
Hydroxide (OH^-)	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	310	320	320	290	300	1/5	NC	NC	NC	NC
Total Alkalinity	310	320	320	290	300	1/5	NC	NC	NC	NC
Anions										
Chloride (Cl)	170	180	190	170	150	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.011	0.005	<0.005	0.009	0.009	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.94	0.92	0.8	0.2	0.1	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	76	79	84	69	64	1	500	NC	NC	NC
Cations - Dissolved										
Calcium	70	70	77	73	69	0.5	NC	NC	NC	NC
Potassium	5.7	5.8	5.6	5.4	5.6	0.5	NC	NC	NC	NC
Sodium	120	120	120	120	110	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	56	57	62	59	53	0.5	NC	NC	NC	NC
Metals - Dissolved										
Aluminium	0.0008	0.002	0.002	0.001	0.001	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.085	0.088	0.088	0.076	0.078	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.026	0.025	0.023	0.037	0.015	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.2	0.2	0.21	0.21	0.17	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.002	0.007	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.008	0.004	0.011	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total										
Aluminium	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A14	A14	A14	A14	A14	A14	A14	A14	A14	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Aug 2012	Sept 2012	Oct 2012	Dec 2012	Jan 2013	Feb 2013	Apr 2013	May 2013	Jun 2013			Fresh	Marine	Irrigation Waters
	21/08/2012	19/09/2012	22/10/2012	4/12/2012	16/01/2013	20/02/2013	16/04/2013	14/05/2013	19/06/2013					
pH	7.2	7.1	8.1	7.2	7.3	7.2	7.9	7.3	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1800	1800	1800	1800	1800	1800	1700	1700	1700	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	180	26	140	49	100	160	620	82	43	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	440	440	470	450	460	460	450	460	460	1/5	NC	NC	NC	NC
Total Alkalinity	440	440	470	450	460	460	450	460	460	1/5				
Anions														
Chloride (Cl)	190	180	190	190	190	180	180	200	180	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.079	0.055	0.016	<0.005	0.021	0.006	0.014	<0.005	0.016	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.64	0.84	1	1.3	1.2	1.2	1.1	1.3	1.3	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	210	210	230	230	250	230	220	270	250	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	120	130	130	150	110	120	110	110	120	0.5	NC	NC	NC	NC
Potassium	5.4	5	5.5	5.1	3.8	5.6	5.3	4.9	5.1	0.5	NC	NC	NC	NC
Sodium	150	150	160	180	120	170	140	150	140	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	87	95	99	110	79	91	84	83	83	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.0050	0.0030	0.003	0.002	0.003	0.004	0.005	0.002	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.0010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.1500	0.1400	0.110	0.099	0.100	0.100	0.100	0.098	0.11	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	0.0006	0.0005	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	0.003	0.002	0.005	0.004	0.004	0.002	0.004	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.44	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.660	0.220	0.063	0.020	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.0040	0.0030	0.002	<0.001	0.001	0.002	<0.001	0.001	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.0030	0.0030	0.003	0.002	0.002	0.002	0.003	0.002	0.003	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.014	0.032	0.010	0.017	0.014	0.016	0.005	0.011	0.015	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	<0.05	0.09	0.07	0.06	0.1	0.2	0.07	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A14	A14	A14	A14	A14 (D37)	A14	A14	A14	A14	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jul 2013	Aug 2013	Sept 2013	Oct 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014			Fresh	Marine	Irrigation Waters
	23/07/2013	20/08/2013	19/09/2013	15/10/2013	15/10/2013	13/11/2013	12/12/2013	14/01/2014	18/02/2014					
pH	7.5	7.4	7.4	7.2	7.2	7.8	8.1	7.3	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1600	1600	1700	1800	1800	1800	1600	1800	1700	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	40	58	110	36	30	27	34	1600	29	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	460	450	450	450	440	460	360	480	460	1/5	NC	NC	NC	NC
Total Alkalinity	460	450	450	450	440	460	360	480	460	1/5				
Anions														
Chloride (Cl)	230	160	200	190	190	180	180	170	170	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	1.2	1.2	1.3	1.5	1.4	1.4	1.5	1.3	1.6	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	55	210	230	230	230	240	240	210	220	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	120	110	110	120	120	120	130	120	120	0.5	NC	NC	NC	NC
Potassium	4.4	3.9	4.9	5	5	4.9	5.5	5.9	5.9	0.5	NC	NC	NC	NC
Sodium	150	120	130	160	160	170	180	170	170	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	78	77	79	92	92	91	94	90	88	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.004	0.003	0.004	0.004	0.012	0.002	0.008	0.003	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.100	0.094	0.1	0.098	0.095	0.11	0.1	0.1	0.1	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.002	0.003	0.004	0.003	0.004	0.006	0.002	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.010	<0.01	<0.01	<0.01	<0.01	0.012	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	0.001	0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.015	0.012	0.016	0.017	0.01	0.033	0.027	0.004	0.005	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.05	0.09	0.05	0.06	<0.05	0.06	1.6	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A14	A14	A14	A14	A14	A14	A14	A14	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2014	Apr 2014	May 2014	June 2014	July 2014	Aug 2014	Dec 2014	April 2015			Fresh	Marine	Irrigation Waters
	18/03/2014	14/04/2014	20/05/2014	17/06/2014	22/07/2014	19/08/2014	15/12/2014	16/04/2015					
pH	7.2	7.8	6.3	6.8	7.3	6.8	7.2	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1600	1700	1800	1600	1500	1600	1600	1600	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	24	120	29	16	13	21	8.4	34	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	460	490	460	450	460	450	450	470	1/5	NC	NC	NC	NC
Total Alkalinity	460	490	460	450	460	450	450	470	1/5				
Anions													
Chloride (Cl)	170	160	160	160	160	170	170	170	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.009	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	1.6	1.7	1.7	1.6	1.7	1.8	1.9	0.67	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	230	210	210	220	220	230	210	210	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	120	120	130	120	120	110	100	120	0.5	NC	NC	NC	NC
Potassium	5.5	5.4	5.2	5.5	5.5	5.3	4.9	5	0.5	NC	NC	NC	NC
Sodium	180	170	150	170	160	170	160	180	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	89	83	86	88	86	83	81	88	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	<0.0005	<0.0005	<0.005	0.004	0.002	0.002	0.002	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.099	0.1	0.11	0.099	0.096	0.1	0.098	0.099	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	<0.001	<0.001	0.003	0.001	0.003	0.002	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	0.003	0.001	0.010	0.009	0.002	0.006	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.002	0.001	0.001	<0.001	0.001	<0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.005	0.033	0.017	0.008	0.031	0.013	0.014	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.09	0.06	<0.05	0.05	<0.05	0.05	0.07	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A14	A14	A14	A14	D78 (A14)	A14	A14	A14	A14	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	May 2015	June 2015	July 2015	Aug 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015	Dec 2015			Fresh	Marine	Irrigation Waters
	19/05/2015	24/06/2015	14/07/2015	11/08/2015	11/08/2015	7/09/2015	13/10/2015	11/11/2015	8/12/2015					
pH	7.6	7.3	7.5	7.4	7.4	7.2	7.3	7.3	7.4	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1600	1600	1500	1600	1600	1600	1500	1500	1600	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	210	48	67	110	98	71	200	13000	NT	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	450	450	430	440	440	450	450	460	470	1/5	NC	NC	NC	NC
Total Alkalinity	450	450	430	440	440	450	450	460	470	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	150	160	170	160	160	170	170	180	190	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	0.007	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	1.8	1.8	1.8	1.8	1.9	2.1	1.8	1.6	1.6	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	200	190	220	210	210	210	210	230	240	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	110	110	110	110	100	110	98	110	110	0.5	NC	NC	NC	NC
Potassium	5.7	5.2	5.8	4.8	5	5.2	4	5.4	5.6	0.5	NC	NC	NC	NC
Sodium	170	160	150	170	180	160	140	170	170	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	80	83	81	79	77	83	74	83	84	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.004	0.001	0.002	0.001	0.005	0.002	0.0007	0.003	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.098	0.093	0.097	0.097	0.095	0.092	0.095	0.098	0.099	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	0.002	0.001	0.007	0.019	<0.001	<0.001	0.004	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.002	0.002	0.002	0.003	0.003	0.003	0.002	0.002	0.003	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.011	0.007	0.011	0.024	0.005	0.004	0.003	0.003	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	0.08	0.07	0.07	0.07	0.2	0.1	3.1	3.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A14	A14	A14	A14	A14	D100 (A14)	A14	A14	A14	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	May 2016	Dec 2016	Jan 2017	Feb 2017			Fresh	Marine	Irrigation Waters
	11/01/2016	11/02/2016	14/03/2016	4/04/2016	10/05/2016	10/05/2016	14/12/2016	19/01/2017	20/02/2017					
pH	7.5	7.5	7.5	7.7	6.9	7.0	7.6	7.6	8.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1700	1500	1500	1600	1500	1500	1500	1600	1600	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	NT	NT	110	97	540	570	>1100	640	130	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	460	480	480	460	460	450	450	480	490	1/5	NC	NC	NC	NC
Total Alkalinity	460	480	480	460	460	450	450	480	490	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	170	180	170	170	180	170	180	180	210	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	0.007	0.011	0.009	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	2	1.8	1.7	1.8	1.8	1.8	2.4	2	1.7	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	220	220	200	210	230	220	220	210	250	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	110	100	100	120	110	110	110	110	120	0.5	NC	NC	NC	NC
Potassium	6.5	5.2	4.9	5.5	4.8	4.5	5.6	5.4	5.5	0.5	NC	NC	NC	NC
Sodium	180	170	170	170	170	170	180	160	170	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	86	77	77	86	80	82	87	82	87	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.004	0.004	0.002	0.001	0.002	0.001	0.005	0.007	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.1	0.098	0.093	0.094	0.1	0.095	0.099	0.12	0.099	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.004	0.005	0.008	0.002	0.002	<0.001	0.003	0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.005	0.005	0.013	0.006	0.015	0.006	0.005	0.020	0.006	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	3.2	2.3	0.08	0.08	0.1	0.1	1.2	1.7	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A14	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
				Slightly to Moderately Disturbed Systems		
Date Sampled	Jun 2017			Fresh	Marine	Irrigation Waters
	20/06/2017					
pH	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1700	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	110	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity						
Hydroxide (OH^-)	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	440	1/5	NC	NC	NC	NC
Total Alkalinity	440	1/5	NC	NC	NC	NC
Anions						
Chloride (Cl)	170	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.022	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	1.5	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	230	1	500	NC	NC	NC
Cations - Dissolved						
Calcium	110	0.5	NC	NC	NC	NC
Potassium	5.4	0.5	NC	NC	NC	NC
Sodium	160	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	85	0.5	NC	NC	NC	NC
Metals - Dissolved						
Aluminium	0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.096	0.001	2	NC	NC	NC
Beryllium	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.003	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.013	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total						
Aluminium	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	0.001	2	NC	NC	NC
Beryllium	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A15	A15	A15	A15	A15	A15	A15	A15	A15	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2012	Dec 2012	Jan 2013	Feb 2013	Apr 2013	May 2013	Jun 2013	Jul 2013	Aug 2013			Fresh	Marine	Irrigation Waters
	23/10/2012	4/12/2012	16/01/2013	20/02/2013	17/04/2013	14/05/2013	19/06/2013	23/07/2013	22/08/2013					
pH	7.0	6.6	6.8	6.7	8.0	6.7	6.7	7.0	7.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	290	280	310	350	260	300	340	320	320	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	400	25	210	86	55	90	40	120	280	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	77	78	97	80	78	97	110	110	100	1/5	NC	NC	NC	NC
Total Alkalinity	77	78	97	80	78	97	110	110	100	1/5				
Anions														
Chloride (Cl)	33	34	35	32	30	41	36	25	38	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.058	0.039	0.038	0.024	0.03	0.02	0.031	0.012	0.017	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	0.01	0.1	0.03	0.03	0.008	0.03	<0.005	0.03	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	5	5	6	5	5	4	7	20	5	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	12	13	12	12	10	11	15	13	13	0.5	NC	NC	NC	NC
Potassium	2.9	2.9	3.1	2.9	2.5	3	3.1	2.8	2.7	0.5	NC	NC	NC	NC
Sodium	24	29	24	27	21	23	26	26	22	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	12	14	12	12	10	13	16	15	13	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.012	0.0008	0.0100	0.0060	0.009	0.001	0.002	0.003	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.025	0.023	0.027	0.022	0.023	0.027	0.032	0.030	0.028	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0006	0.0002	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.003	0.002	0.003	0.001	0.002	0.003	0.004	0.003	0.003	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	<0.001	0.003	<0.001	<0.001	<0.001	0.007	0.001	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.510	0.026	0.038	0.480	0.590	0.250	0.096	0.099	0.078	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.160	0.110	0.120	0.087	0.110	0.160	0.15	0.12	0.12	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.002	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.012	0.008	0.011	0.012	0.017	0.017	0.019	0.013	0.013	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.3	<0.05	0.09	<0.05	<0.05	0.05	<0.05	0.06	0.3	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A15	A15	A15	A15	A15	A15	A15 (D46)	A15	A15	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Feb 2014	Mar 2014	Apr 2014			Fresh	Marine	Irrigation Waters
	18/09/2013	16/101/2013	14/11/2013	11/12/2013	15/01/2014	19/02/2014	19/02/2014	19/03/2014	15/04/2014					
pH	6.9	7.6	6.3	7.9	6.8	6.3	6.5	5.8	6.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	310	300	300	290	280	300	300	280	280	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	340	200	18	11	6.6	4.8	4.9	15	41	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	100	87	84	78	84	85	86	77	82	1/5	NC	NC	NC	NC
Total Alkalinity	100	87	84	78	84	85	86	77	82	1/5				
Anions														
Chloride (Cl)	42	33	34	36	39	34	35	33	32	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.007	<0.005	0.01	0.017	0.017	0.014	0.023	<0.005	0.081	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.02	<0.005	0.03	0.01	0.02	0.05	0.02	0.02	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	6	6	6	6	5	5	5	5	9	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	14	12	13	11	14	12	10	14	13	0.5	NC	NC	NC	NC
Potassium	3.3	3.1	2.8	2.9	3.1	2.8	2.6	3.2	3.1	0.5	NC	NC	NC	NC
Sodium	25	27	28	28	27	26	25	30	28	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	15	12	12	11	12	11	11	12	12	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	<0.005	0.009	0.001	<0.0005	0.007	0.006	0.003	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.031	0.024	0.027	0.025	0.026	0.024	0.022	0.026	0.023	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.004	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.004	0.003	0.008	0.003	<0.001	0.001	0.002	0.002	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.027	0.022	0.024	0.01	0.014	0.017	0.019	0.022	0.014	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.14	0.11	0.096	0.083	0.088	0.093	0.094	0.091	0.083	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.003	0.004	0.002	0.002	0.002	0.002	0.005	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.016	0.023	0.06	0.032	0.005	0.015	0.021	0.023	0.004	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.5	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A15	A15	A15	A15	A15	A15	A15	A15	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	May 2014	June 2014	July 2014	Aug 2014	Dec 2014	Jan 2015	Feb 2015	March 2015			Fresh	Marine	Irrigation Waters
	21/05/2014	18/06/2014	23/07/2014	20/08/2014	3/12/2014	14/01/2015	11/02/2015	11/03/2015					
pH	6.0	6.4	6.6	6.2	6.2	5.8	6.8	5.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	290	260	270	290	310	320	310	330	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	7.9	5	8.1	9.2	11	10	12	1.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	77	79	84	80	88	94	96	94	1/5	NC	NC	NC	NC
Total Alkalinity	77	79	84	80	88	94	96	94	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	35	36	38	37	40	48	49	48	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.014	0.024	0.022	0.013	0.021	0.024	0.007	0.028	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.03	0.02	<0.005	<0.005	0.03	0.1	0.03	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	5	6	6	6	7	8	10	9	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	13	11	14	12	13	14	14	11	0.5	NC	NC	NC	NC
Potassium	2.8	3.1	3.1	3.1	3	3.6	3.1	3.3	0.5	NC	NC	NC	NC
Sodium	25	28	30	32	32	32	32	34	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	11	12	13	13	14	15	15	12	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	<0.0005	0.003	0.001	0.003	0.0009	0.007	0.0009	0.0008	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.027	0.022	0.028	0.025	0.026	0.031	0.028	0.029	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	<0.001	0.003	0.004	0.012	0.001	0.003	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.016	0.019	0.012	0.017	<0.01	0.012	0.014	0.015	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.089	0.086	0.092	0.092	0.092	0.11	0.099	0.1	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.004	0.002	0.009	0.003	0.007	0.002	0.007	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.022	0.020	0.008	0.092	0.027	0.074	0.01	0.038	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A15	A15	A15	A15	A15	A15	A15	A15	A15	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	April 2015	May 2015	June 2015	July 2015	Aug 2015	Jan 2016	Mar 2016	Apr 2016	May 2016			Fresh	Marine	Irrigation Waters
	15/04/2015	20/05/2015	23/06/2015	15/07/2015	11/08/2015	13/01/2016	16/03/2016	6/04/2016	10/05/2016					
pH	5.8	6.6	6.5	6.4	6.8	6.6	5.8	6.0	5.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	350	340	360	340	350	380	230	200	220	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	18	40	79	3800	1300	NT	130	82	53	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	100	97	98	96	99	130	67	64	67	1/5	NC	NC	NC	NC
Total Alkalinity	100	97	98	96	99	130	67	64	67	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	43	38	42	47	45	39	9	25	32	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.02	0.015	0.022	0.04	0.025	<0.005	0.007	0.011	0.008	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.03	0.008	0.02	0.07	1.1	0.02	0.01	0.006	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	10	8	9	10	9	15	8	6	7	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	16	15	16	14	14	17	9	8.2	9.2	0.5	NC	NC	NC	NC
Potassium	3.3	3.7	3.5	3.7	3.3	5.3	3.2	2.6	2.5	0.5	NC	NC	NC	NC
Sodium	35	34	33	31	36	42	25	24	26	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	16	15	17	15	15	18	9.6	8.2	9.3	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.004	0.0020	0.005	0.003	0.005	0.01	0.026	0.006	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.031	0.03	0.03	0.028	0.028	0.034	0.022	0.019	0.021	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.002	0.002	<0.001	0.003	0.002	0.015	0.002	0.009	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.032	0.025	0.031	0.016	0.011	<0.01	0.18	0.32	0.32	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.12	0.1	0.11	0.12	0.11	0.05	0.063	0.047	0.041	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.009	0.005	0.002	0.002	0.002	0.003	0.003	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.049	0.028	0.026	0.003	0.009	0.016	0.037	0.04	0.038	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.05	0.7	0.5	1	0.2	0.06	0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A15	D101 (A15)	A15	A15	A15	A15	A15	A15	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	June 2016	June 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	8/06/2016	8/06/2016	14/12/2016	18/01/2017	22/02/2017	22/03/2017	24/05/2017	21/06/2017					
pH	6.5	6.5	6.7	6.9	7.0	6.5	6.5	6.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	290	250	250	270	270	270	270	280	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	13	10	89	86	64	140	85	34	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	77	77	77	99	100	95	99	99	1/5	NC	NC	NC	NC
Total Alkalinity	77	77	77	99	100	95	99	99	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	35	37	29	27	27	29	23	23	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.01	<0.005	0.031	0.01	0.012	0.045	0.05	0.023	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.007	<0.005	<0.005	0.006	0.007	0.006	0.01	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	8	8	3	5	6	8	5	6	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	11	11	11	11	11	11	12	11	0.5	NC	NC	NC	NC
Potassium	3.2	3.2	2.9	3.3	3.1	3.2	3.3	2.8	0.5	NC	NC	NC	NC
Sodium	32	31	26	28	25	26	29	27	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	11	11	10	12	12	12	13	12	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.0008	0.001	0.015	0.004	0.002	0.008	0.006	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.021	0.021	0.022	0.025	0.021	0.022	0.024	0.024	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	0.002	0.002	<0.001	<0.001	0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	<0.001	<0.001	0.001	0.002	0.003	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.087	0.087	1.4	0.48	0.53	0.45	0.24	0.22	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.042	0.042	0.095	0.11	0.068	0.075	0.11	0.11	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.005	0.003	0.002	0.003	0.004	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.008	0.009	0.007	0.014	0.011	0.012	0.014	0.013	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.1	0.07	0.06	0.1	0.08	0.08	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A18	A18	A18	A18	A18	A18	A18	A18	A18	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2012	Dec 2012	Jan 2013	Feb 2013	Apr 2013	May 2013	Jun 2013	Jul 2013	Aug 2013			Fresh	Marine	Irrigation Waters
	23/10/2012	3/12/2012	16/01/2013	20/02/2013	17/04/2013	14/05/2013	19/06/2013	24/07/2013	22/08/2013					
pH	6.8	6.6	6.7	6.7	8.2	6.6	6.6	6.6	6.8	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	330	380	370	360	370	350	360	350	360	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	3400	270	71	38	230	39	57	140	60	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	130	140	130	120	140	130	130	120	110	1/5	NC	NC	NC	NC
Total Alkalinity	130	140	130	120	140	130	130	120	110	1/5				
Anions														
Chloride (Cl)	22	22	24	26	22	28	23	20	24	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.2	0.053	0.064	0.079	0.097	0.068	0.1	0.082	0.085	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.01	0.02	0.05	0.007	<0.005	0.02	0.007	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	10	11	22	25	10	16	24	20	28	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	21	28	21	21	21	20	21	20	18	0.5	NC	NC	NC	NC
Potassium	5.1	11	10	19	14	14	15	17	15	0.5	NC	NC	NC	NC
Sodium	21	26	17	24	20	20	22	21	18	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	15	19	14	14	14	13	14	13	12	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.008	0.0007	0.0050	0.0030	0.005	<0.0005	0.002	<0.0005	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.084	0.097	0.098	0.100	0.110	0.100	0.1	0.098	0.1	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.006	0.003	0.002	0.001	0.003	0.002	0.002	0.002	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	<0.001	0.001	0.001	0.001	<0.001	0.002	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.670	2.100	1.100	0.400	1.700	0.990	<0.010	0.890	0.39	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.410	0.250	0.100	0.075	0.150	0.100	0.092	0.090	0.073	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.007	0.005	0.005	0.004	0.007	0.006	0.005	0.005	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.008	0.011	0.011	0.029	0.015	0.016	0.023	0.011	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.6	0.2	<0.05	<0.05	0.2	0.06	<0.05	0.20	0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A18	A18	A18	A18	A18	A18	A18	A18 (A48)	A18	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Mar 2014	Apr 2014			Fresh	Marine	Irrigation Waters
	18/09/2013	16/101/2013	14/11/2013	11/12/2013	15/01/2014	20/02/2014	20/03/2014	20/03/2014	15/04/2014					
pH	6.9	7.6	6.4	7.9	6.9	6.8	5.9	5.9	6.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	320	360	370	360	320	360	320	320	320	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	57	70	48	40	71	44	28	30	11	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	110	110	110	110	110	110	100	100	110	1/5	NC	NC	NC	NC
Total Alkalinity	110	110	110	110	110	110	100	100	110	1/5				
Anions														
Chloride (Cl)	25	22	22	23	25	21	21	21	20	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.08	0.1	0.08	0.073	0.071	0.073	0.053	0.062	0.061	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	<0.005	<0.005	0.02	0.03	0.03	0.01	0.007	0.02	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	31	30	31	31	26	24	22	22	20	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	20	19	21	19	21	19	19	21	17	0.5	NC	NC	NC	NC
Potassium	17	25	16	20	16	13	14	15	17	0.5	NC	NC	NC	NC
Sodium	21	23	24	26	23	19	24	25	24	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	13	12	14	12	13	11	12	13	12	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.031	<0.005	0.018	0.002	<0.0005	0.006	0.005	0.005	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.11	0.1	0.1	0.097	0.09	0.082	0.079	0.082	0.075	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.002	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	0.002	0.004	0.005	<0.001	<0.001	0.002	0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.74	0.17	0.72	0.56	0.45	0.6	0.62	0.58	0.15	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.095	0.058	0.095	0.086	0.084	0.095	0.089	0.088	0.058	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.004	0.005	0.005	0.003	0.004	0.007	0.007	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.021	0.015	0.079	0.068	0.008	0.012	0.049	0.031	0.006	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	0.05	0.07	0.05	0.10	<0.05	0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A18	A18	A18	A18	A18 (D58)	A18	A18	A18	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	May 2014	June 2014	July 2014	Aug 2014	Aug 2014	Dec 2014	Jan 2015	Feb 2015			Fresh	Marine	Irrigation Waters
	21/05/2014	18/06/2014	23/07/2014	20/08/2014	21/08/2014	15/12/2014	14/01/2015	11/02/2015					
pH	6.7	6.2	6.7	6.2	6.3	6.3	6.7	6.8	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	330	290	290	310	310	290	280	270	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	45	36	43	29	26	28	35	64	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	100	100	100	100	100	97	97	97	1/5	NC	NC	NC	NC
Total Alkalinity	100	100	100	100	100	97	97	97	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	22	23	22	21	20	21	26	24	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.044	0.066	0.053	0.058	0.056	0.053	0.044	0.043	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.03	0.02	0.005	<0.005	0.06	0.02	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	21	22	22	21	20	17	21	21	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	20	18	20	18	18	16	17	17	0.5	NC	NC	NC	NC
Potassium	12	12	13	12	11	8.1	8.2	7.4	0.5	NC	NC	NC	NC
Sodium	20	24	25	24	25	19	18	19	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	11	13	12	12	12	12	12	12	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.007	0.014	<0.0005	0.004	0.003	0.0008	0.003	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.084	0.078	0.083	0.081	0.082	0.069	0.067	0.067	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	<0.001	0.003	0.002	0.002	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.68	0.73	0.3	0.43	0.44	0.52	0.52	0.6	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.093	0.094	0.069	0.081	0.084	0.08	0.077	0.082	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.005	0.003	0.016	0.013	0.006	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.011	0.035	0.008	0.082	0.057	0.025	0.011	0.009	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	0.05	0.06	0.07	0.06	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A18	A18	A18	A18	A18	A18	A18	A18	A18	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2015	April 2015	May 2015	June 2015	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015			Fresh	Marine	Irrigation Waters
	11/03/2015	15/04/2015	20/05/2015	23/06/2015	16/07/2015	12/08/2015	09/09/2015	14/10/2015	11/11/2015					
pH	6.6	6.6	6.5	6.7	6.7	6.5	6.7	6.7	6.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	300	310	270	310	300	290	280	270	290	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	32	23	90	150	71	140	75	53	100	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	97	100	97	99	97	97	96	95	93	1/5	NC	NC	NC	NC
Total Alkalinity	97	100	97	99	97	97	96	95	93	1/5		NC	NC	NC
Anions														
Chloride (Cl)	23	22	20	21	23	24	24	24	24	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.048	0.8	0.047	0.043	0.03	0.031	0.033	0.033	0.018	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.04	0.04	0.02	0.04	0.02	0.02	0.007	0.009	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	20	20	17	18	19	20	18	19	19	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	13	20	18	19	18	16	17	16	19	0.5	NC	NC	NC	NC
Potassium	8	7.8	7.8	6.7	6.4	5.6	5.8	5.1	4.8	0.5	NC	NC	NC	NC
Sodium	23	25	20	23	20	22	24	19	23	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	9.1	14	12	13	13	11	12	12	14	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.0006	0.004	0.003	0.001	0.003	0.002	0.004	0.001	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.067	0.07	0.065	0.07	0.063	0.063	0.059	0.06	0.061	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.002	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.59	0.62	0.53	0.82	0.35	0.49	0.46	0.37	0.39	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.092	0.089	0.083	0.09	0.084	0.081	0.085	0.08	0.085	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.005	0.005	0.003	0.003	0.003	0.003	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.015	0.016	0.044	0.009	0.018	0.008	0.009	0.008	0.009	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.05	<0.05	0.09	0.09	0.08	0.2	0.2	0.05	0.06	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A18	A18 (D89)	A18	A18	A18 (D95)	A18	A18	A18	A18	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Dec 2015	Dec 2015	Jan 2016	Feb 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	June 2016			Fresh	Marine	Irrigation Waters
	9/12/2015	9/12/2015	13/01/2016	11/02/2016	11/02/2016	17/03/2016	6/04/2016	11/05/2016	15/06/2016					
pH	6.9	6.9	6.5	6.5	6.5	6.7	6.7	6.2	5.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	290	290	290	300	300	320	290	280	280	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	100	93	110	88	50	40	130	79	25	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	97	98	100	99	98	110	100	100	85	1/5	NC	NC	NC	NC
Total Alkalinity	97	98	100	99	98	110	100	100	85	1/5		NC	NC	NC
Anions														
Chloride (Cl)	21	23	23	31	31	28	25	25	21	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.039	0.027	0.029	0.016	<0.005	<0.005	0.008	0.012	0.009	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.03	0.01	0.03	0.1	0.1	<0.005	0.01	<0.005	0.005	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	19	19	18	26	26	22	20	20	17	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	18	18	18	20	20	20	20	18	17	0.5	NC	NC	NC	NC
Potassium	5.1	5.1	5.8	5.2	5.1	6.1	4.9	4.6	4	0.5	NC	NC	NC	NC
Sodium	23	23	19	25	24	25	24	23	20	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	13	13	13	14	15	14	14	13	12	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.001	0.014	0.003	0.003	0.004	0.001	0.009	0.003	0.002	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.063	0.064	0.06	0.07	0.07	0.07	0.072	0.068	0.057	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.002	0.003	0.001	0.010	0.001	0.001	0.003	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.65	0.63	0.57	0.32	0.32	0.34	0.31	0.33	0.24	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.086	0.087	0.087	0.093	0.09	0.096	0.1	0.099	0.088	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.002	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.008	0.009	0.011	0.009	0.013	0.007	0.007	0.098	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	0.1	0.1	0.1	0.1	0.07	0.06	0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A18	A18	A18	A18	A18	A18	A18	A18	A18	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	July 2016	Aug 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	13/07/2016	17/08/2016	16/11/2016	14/12/2016	18/01/2017	22/02/2017	22/03/2017	5/04/2017	21/06/2017					
pH	6.4	5.7	6.5	6.6	6.6	6.5	6.7	6.6	6.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	330	250	250	240	310	330	320	330	320	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	23	17	38	240	81	24	130	130	30	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	84	55	97	83	95	100	100	96	110	1/5	NC	NC	NC	NC
Total Alkalinity	84	55	97	83	95	100	100	96	110	1/5		NC	NC	NC
Anions														
Chloride (Cl)	25	19	15	18	26	28	27	25	21	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.022	0.005	0.009	<0.005	0.009	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	0.96	0.009	0.02	0.5	0.5	0.1	0.07	0.009	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	25	24	7	13	23	28	27	24	23	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	19	15	18	15	19	21	19	19	19	0.5	NC	NC	NC	NC
Potassium	4.6	3.3	2	2.9	4	5.1	6.9	7.5	8	0.5	NC	NC	NC	NC
Sodium	24	15	16	17	18	22	24	25	24	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	13	11	12	11	14	15	14	14	13	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	<0.0005	0.005	0.004	0.003	0.003	0.0008	0.005	0.004	0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.044	0.051	0.048	0.046	0.065	0.071	0.066	0.075	0.072	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	<0.001	<0.001	0.001	0.001	<0.001	0.001	0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	0.003	<0.001	<0.001	<0.001	0.002	0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.14	0.01	0.011	0.052	0.032	<0.01	0.022	0.045	0.082	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.064	0.014	0.082	0.095	0.063	0.061	0.069	0.073	0.068	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.003	0.002	0.003	0.004	0.003	0.003	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.012	0.031	0.041	0.018	0.018	0.013	0.015	0.011	0.021	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.1	0.2	0.1	<0.05	0.1	0.1	0.09	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A20	A20	A20	A20 (D20)	A20	A20	A20	A20	A20	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Dec 2012	Jan 2013	Feb 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013	Aug 2013			Fresh	Marine	Irrigation Waters
	3/12/2012	14/01/2013	19/02/2013	19/02/2013	13/05/2013	17/04/2013	13/05/2013	20/06/2013	20/08/2013					
pH	7.1	7.5	7.5	7.5	7.8	8.4	7.8	7.4	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1200	1300	1000	1100	760	740	760	770	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	220	3500	290	320	97	61	97	180	33	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	340	360	270	270	260	240	260	250	300	1/5	NC	NC	NC	NC
Total Alkalinity	340	360	270	270	260	240	260	250	300	1/5				
Anions														
Chloride (Cl)	160	210	140	140	110	76	110	78	160	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.023	0.02	0.024	0.024	0.027	0.013	0.027	0.065	0.098	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.03	0.02	0.02	0.006	0.01	0.006	0.03	0.009	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	27	50	76	76	41	24	41	40	64	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	71	68	55	53	40	34	40	37	60	0.5	NC	NC	NC	NC
Potassium	6.4	6.1	6	6.1	5.1	4.8	5.1	5.3	5.2	0.5	NC	NC	NC	NC
Sodium	130	130	110	110	89	80	89	84	98	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	58	54	44	43	31	26	31	28	47	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.047	0.007	0.004	0.006	<0.0005	0.007	<0.0005	0.0005	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	0.0010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.047	0.089	0.044	0.043	0.032	0.020	0.032	0.025	0.074	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0006	0.0002	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.002	0.004	0.002	0.002	0.002	0.001	0.002	<0.001	0.003	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	<0.001	<0.001	0.003	0.002	0.003	0.003	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.430	0.011	0.047	0.041	0.044	0.140	0.044	<0.010	0.21	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	1.000	2.100	0.900	0.900	0.700	0.440	0.700	0.39	1.1	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.008	0.005	0.005	0.006	0.005	0.006	0.003	0.005	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	0.002	0.001	0.001	<0.001	<0.001	<0.001	0.002	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.011	0.005	0.006	0.005	0.026	0.028	0.026	0.014	0.009	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.2	0.4	0.1	0.1	0.05	0.1	0.05	0.10	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A20	A20	A20	A20	A20	A20	A20	A20	A20	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014	June 2014			Fresh	Marine	Irrigation Waters
	16/101/2013	19/11/2013	12/12/2013	15/01/2014	18/02/2014	19/03/2014	14/04/2014	22/05/2014	17/06/2014					
pH	8.1	7.3	8.5	7.9	7.4	5.6	7.8	5.8	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1200	1200	1100	980	1000	1100	1100	1300	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	40	32	50	140	45	280	20	27	5.6	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	20	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	300	320	270	340	330	340	350	320	310	1/5	NC	NC	NC	NC
Total Alkalinity	300	320	290	340	330	340	350	320	310	1/5				
Anions														
Chloride (Cl)	180	160	130	160	110	130	130	160	140	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.022	<0.005	0.026	0.022	0.036	0.036	0.07	0.023	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.009	0.007	0.1	0.04	0.01	0.01	0.03	0.02	0.06	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	58	57	40	35	21	31	35	110	100	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	61	59	54	58	53	64	60	64	71	0.5	NC	NC	NC	NC
Potassium	6.3	7	6.6	6.5	6.7	6.3	6.4	6.2	7.1	0.5	NC	NC	NC	NC
Sodium	120	120	130	110	110	120	130	100	120	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	49	48	43	47	43	48	47	50	58	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	<0.005	0.003	0.004	<0.0005	0.001	0.019	<0.0005	0.005	<0.0005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.033	0.029	0.031	0.037	0.028	0.069	0.042	0.068	0.027	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	0.001	0.001	0.002	0.001	0.004	0.002	0.003	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.003	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.059	0.11	0.038	0.049	0.065	0.62	0.24	0.54	0.14	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.42	0.61	0.52	0.89	0.46	1.4	0.81	1.3	0.44	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.004	0.004	0.004	0.004	0.022	0.005	0.009	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.021	0.022	0.038	0.011	0.009	0.049	0.010	0.053	0.012	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.05	<0.05	0.05	0.09	<0.05	0.1	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A20	A20	A20	A20	A20	A20	A20	A20	A20	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	July 2014	Aug 2014	Dec 2014	Jan 2015	Feb 2015	March 2015	April 2015	May 2015	June 2015			Fresh	Marine	Irrigation Waters
	22/07/2014	19/08/2014	2/12/2014	13/01/2015	10/02/2015	10/03/2015	16/04/2015	19/05/2015	22/06/2015					
pH	7.2	5.7	7.3	7.3	6.5	5.9	7.3	6.2	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1000	960	890	920	1000	1100	1000	870	930	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	24	12	11	1.2	96	40	54	55	65	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	310	300	260	270	330	290	310	290	260	1/5	NC	NC	NC	NC
Total Alkalinity	310	300	260	270	330	290	310	290	260	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	120	100	100	140	150	140	120	99	110	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.013	0.029	0.014	0.019	0.04	0.04	0.04	0.061	0.035	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.07	0.09	0.01	0.008	0.009	0.2	0.01	0.03	0.006	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	110	82	84	76	71	66	55	43	50	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	65	53	53	55	59	56	60	51	51	0.5	NC	NC	NC	NC
Potassium	6.8	5.7	5.1	6.6	5.7	6	5.6	5.8	6.1	0.5	NC	NC	NC	NC
Sodium	120	100	100	100	130	100	120	97	100	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	52	41	42	45	47	43	46	38	43	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.001	0.005	<0.0005	0.007	0.001	0.003	0.006	0.003	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.026	0.026	0.021	0.026	0.078	0.045	0.062	0.046	0.035	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	0.001	<0.001	<0.001	0.003	0.002	0.002	0.002	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.003	0.001	0.004	<0.001	<0.001	<0.001	0.001	0.020	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.049	0.055	0.059	0.12	0.620	0.21	0.2	0.27	0.16	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.45	0.53	0.43	0.47	0.79	1	1.1	0.88	0.56	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.004	0.005	0.005	0.005	0.007	0.005	0.005	0.005	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.010	0.033	0.012	0.013	0.028	0.062	0.012	0.05	0.032	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	D74 (A20)	A20	A20	A20	A20	A20	A20	A20	A20	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	June 2015	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Mar 2016			Fresh	Marine	Irrigation Waters
	22/06/2015	14/07/2015	11/08/2015	8/09/2015	13/10/2015	10/11/2015	9/12/2015	13/01/2016	17/03/2016					
pH	7.3	6.6	6.1	7.0	7.2	6.6	7.4	6.9	6.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	930	880	930	900	870	910	950	950	1000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	74	63	100	56	25	29	100	100	17	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	270	250	250	230	230	230	260	270	220	1/5	NC	NC	NC	NC
Total Alkalinity	270	250	250	230	230	230	260	270	220	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	110	110	110	110	110	120	120	110	170	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.033	0.034	0.021	0.02	0.026	0.019	0.027	0.021	0.016	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.06	0.02	0.02	0.04	0.5	0.03	0.08	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	49	66	67	90	96	100	89	65	57	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	50	51	49	48	48	52	54	52	55	0.5	NC	NC	NC	NC
Potassium	5.8	6.3	5.3	5.6	4.7	6	5.5	6.4	7.1	0.5	NC	NC	NC	NC
Sodium	99	95	100	94	89	100	110	110	100	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	42	41	38	39	38	43	43	42	43	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	<0.0005	0.003	0.005	0.003	0.001	0.002	0.0006	0.015	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.035	0.037	0.039	0.024	0.025	0.026	0.036	0.029	0.023	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.001	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.002	0.004	<0.001	0.002	<0.001	<0.001	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.15	0.15	0.14	0.044	0.019	0.019	0.18	0.11	0.041	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.56	0.51	0.64	0.35	0.4	0.41	0.500	0.35	0.3	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.009	0.004	0.002	0.003	0.003	0.003	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	0.002	0.002	0.002	<0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	0.014	0.026	0.011	0.008	0.027	0.006	0.008	0.026	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	0.06	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A20	A20	A20	A20	A20	A20	A20	D121 (A20)	A20	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Apr 2016	May 2016	June 2016	July 2016	Dec 2016	Jan 2017	Feb 2017	Feb 2017	Mar 2017			Fresh	Marine	Irrigation Waters
	5/04/2016	10/05/2016	7/06/2016	13/07/2016	13/12/2016	17/01/2017	21/02/2017	21/02/2017	21/03/2017					
pH	7.3	6.6	6.9	6.2	7.1	7.3	8.0	7.9	6.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1100	1100	1100	1100	980	1000	1200	1200	1000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	24	61	5.1	10	71	85	11	15	10	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	240	260	270	270	240	260	320	320	330	1/5	NC	NC	NC	NC
Total Alkalinity	240	260	270	270	240	260	320	320	330	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	180	200	190	200	160	170	210	210	160	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.028	0.02	0.022	0.014	<0.005	0.006	0.008	0.017	0.014	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.005	0.01	0.01	1.4	0.07	0.007	0.01	0.69	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	66	70	57	74	58	42	72	67	37	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	65	67	68	76	57	56	70	70	59	0.5	NC	NC	NC	NC
Potassium	7.6	6.6	7.8	7.8	5.8	6.5	7.3	7.4	7.7	0.5	NC	NC	NC	NC
Sodium	110	110	130	130	110	100	120	120	120	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	53	53	57	60	45	43	58	57	49	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.0005	0.002	0.0009	0.001	0.002	0.006	0.0008	<0.0005	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.023	0.028	0.024	0.02	0.021	0.025	0.023	0.024	0.02	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	0.009	0.002	0.002	<0.001	<0.001	0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.035	0.072	0.035	0.015	0.017	0.029	0.013	0.013	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.37	0.44	0.38	0.36	0.32	0.450	0.4	0.4	0.33	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.004	0.005	0.005	0.003	0.003	0.004	0.004	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.008	0.032	0.008	0.034	0.010	0.014	0.008	0.007	0.012	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A20	A20	D128 (A20)	A20	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
							Slightly to Moderately Disturbed Systems		
Date Sampled	Apr 2017	May 2017	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	4/04/2017	23/05/2017	23/05/2017	20/06/2017					
pH	7.4	6.9	6.9	7.2	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	<6 (6)(18)
Electrical Conductivity (µS/cm)	1000	970	950	1000	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	4.8	50	28	60	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity									
Hydroxide (OH^-)	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	330	320	320	330	1/5	NC	NC	NC	NC
Total Alkalinity	330	320	320	330	1/5	NC	NC	NC	NC
Anions									
Chloride (Cl)	170	140	140	120	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.018	0.023	0.029	0.012	0.005	0.5 (8)/0.41 (12)	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.007	0.007	0.008	0.01	0.005	3 (13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	31	50	49	35	1	500	NC	NC	NC
Cations - Dissolved									
Calcium	60	66	67	54	0.5	NC	NC	NC	NC
Potassium	6.9	6.9	6.9	6.6	0.5	NC	NC	NC	NC
Sodium	120	120	120	110	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	48	52	52	43	0.5	NC	NC	NC	NC
Metals - Dissolved									
Aluminium	0.002	0.0007	0.0007	0.001	0.0005	0.2 (8)	0.0008 (15)(L)/0.055 (14)(L)	0.0005 (16)(L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.017	0.021	0.021	0.022	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	<0.001	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	<0.001	0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	<0.01	0.012	0.012	0.054	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	0.4	0.42	0.42	0.44	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	0.003	0.005	0.005	0.004	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	0.001	0.001	0.001	0.001	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.006	0.015	0.015	0.016	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total									
Aluminium	NT	NT	NT	NT	0.0005	0.2 (8)	0.0008 (15)(L)/0.055 (14)(L)	0.0005 (16)(L)	NC
Arsenic	NT	NT	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	NT	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	NT	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	NT	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	NT	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	NT	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	NT	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	NT	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	<0.05	0.08	0.09	0.05	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	A19	A19	A19	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
						Slightly to Moderately Disturbed Systems		
Date Sampled	Dec 2012	Jan 2013	Feb 2013			Fresh	Marine	Irrigation Waters
	5/12/2012	15/01/2013	19/02/2013					
pH	7.7	7.4	7.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	2100	2000	2000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	240	6200	130	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity								
Hydroxide (OH^-)	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	340	330	340	1/5	NC	NC	NC	NC
Total Alkalinity	340	330	340	1/5	NC	NC	NC	NC
Anions								
Chloride (Cl)	330	350	330	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.02	0.03	0.028	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.03	0.06	0.71	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	250	280	270	1	500	NC	NC	NC
Cations - Dissolved								
Calcium	120	110	120	0.5	NC	NC	NC	NC
Potassium	8.4	7.9	8	0.5	NC	NC	NC	NC
Sodium	200	200	190	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	89	86	97	0.5	NC	NC	NC	NC
Metals - Dissolved								
Aluminium	0.002	0.003	0.007	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.120	0.140	0.120	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0006	0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.023	0.140	0.051	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.690	0.630	0.560	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.005	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	0.005	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.005	0.007	0.010	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total								
Aluminium	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.2	1.7	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jun 2013	Jul 2013	Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014			Fresh	Marine	Irrigation Waters
	20/06/2013	23/07/2013	20/08/2013	17/09/2013	15/10/2013	19/11/2013	12/12/2013	13/01/2014	18/02/2014					
pH	7.2	7.5	7.4	8.3	7.1	6.9	8.6	7.3	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1300	1200	1200	1300	1300	1200	1300	1300	1300	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	13	21	6.1	3.1	33	2.8	4.3	3.2	5.4	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	17	<5	<5	37	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	590	590	580	570	570	590	520	600	590	1/5	NC	NC	NC	NC
Total Alkalinity	590	590	580	580	570	590	550	600	590	1/5				
Anions														
Chloride (Cl)	88	38	78	93	100	98	91	88	82	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.5	1.5	1.4	1.6	1.5	1.6	1.7	1.6	1.7	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	<0.005	0.2	0.02	0.01	0.007	0.03	0.02	0.02	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	1	<1	<1	<1	<1	1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	35	31	34	34	37	34	34	37	36	0.5	NC	NC	NC	NC
Potassium	14	13	11	14	15	16	16	16	15	0.5	NC	NC	NC	NC
Sodium	220	230	190	220	240	240	280	250	250	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	27	25	26	26	30	29	28	29	29	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.006	0.004	0.006	0.003	0.008	0.002	0.006	0.007	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.002	0.001	0.002	0.003	0.003	<0.001	0.002	0.002	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.15	0.150	0.15	0.15	0.15	0.19	0.16	0.16	0.16	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.003	<0.001	<0.001	<0.001	<0.001	0.004	0.003	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.24	0.170	0.19	0.18	0.18	0.21	0.19	0.17	0.16	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.11	0.092	0.1	0.1	0.11	0.15	0.12	0.11	0.098	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.013	0.002	0.001	0.002	0.002	0.003	0.002	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.140	0.022	0.066	0.14	0.16	0.16	0.083	0.027	0.011	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE08	AGE08	AGE08 (D50)	AGE08	AGE08 (D51)	AGE08	AGE08	AGE08	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2014	Apr 2014	Apr 2014	May 2014	May 2014	June 2014	July 2014	Aug 2014			Fresh	Marine	Irrigation Waters
	18/03/2014	14/04/2014	14/04/2014	19/05/2014	19/05/2014	17/06/2014	22/07/2014	19/08/2014					
pH	5.8	7.7	7.7	5.9	5.9	6.3	6.5	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1200	1300	1300	1300	1300	1300	1100	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	51	4.5	5.2	0.8	0.7	4.1	1.7	2.8	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	580	610	600	570	570	570	590	580	1/5	NC	NC	NC	NC
Total Alkalinity	580	610	600	570	570	570	590	580	1/5				
Anions													
Chloride (Cl)	82	79	79	81	81	84	98	85	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.7	1.6	1.6	1.5	1.6	1.6	1.5	1.7	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.020	0.01	0.03	0.006	0.008	0.01	0.01	0.009	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	39	37	37	36	34	35	33	34	0.5	NC	NC	NC	NC
Potassium	14	15	16	13	13	14	14	14	0.5	NC	NC	NC	NC
Sodium	260	270	280	210	210	250	240	250	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	28	28	28	28	27	29	27	27	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.021	0.002	0.0007	<0.005	<0.005	0.011	0.006	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.16	0.16	0.15	0.16	0.16	0.16	0.16	0.16	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	<0.001	<0.001	0.002	0.003	0.004	0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.18	0.14	0.14	0.19	0.19	0.2	0.25	0.23	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.13	0.11	0.11	0.11	0.12	0.11	0.11	0.11	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.027	0.053	0.053	0.040	0.042	0.016	0.016	0.013	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.160	0.22	0.23	0.23	0.25	0.110	0.041	0.013	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Dec 2014	Jan 2015	Feb 2015	Mar 2015	April 2015	May 2015	June 2015	July 2015	Aug 2015			Fresh	Marine	Irrigation Waters
	3/12/2014	13/01/2015	10/02/2015	10/03/2015	15/04/2015	19/05/2015	23/06/2015	15/07/2015	11/08/2015					
pH	6.2	6.0	7.2	7.1	7.4	7.4	6.4	7.3	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1200	1200	1200	1300	1300	1200	1300	1200	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4.4	20	6.2	6.5	4.1	8.7	16	62	120	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	590	580	580	580	610	580	580	550	570	1/5	NC	NC	NC	NC
Total Alkalinity	590	580	580	580	610	580	580	550	570	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	92	93	100	93	84	75	<1	90	96	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.6	1.6	1.2	1.8	0.94	1.6	1.7	1.8	1.7	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.03	0.006	<0.005	0.02	0.01	<0.005	<0.005	0.007	0.009	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	33	36	33	36	38	34	37	35	34	0.5	NC	NC	NC	NC
Potassium	13	15	16	15	15	15	15	15	14	0.5	NC	NC	NC	NC
Sodium	240	240	290	250	280	260	250	240	270	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	27	28	27	29	30	27	30	27	27	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	0.018	0.003	0.003	0.005	0.005	0.005	0.005	0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.15	0.18	0.160	0.16	0.16	0.16	0.16	0.16	0.16	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.005	0.003	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.22	0.15	0.160	0.15	0.16	0.2	0.16	0.15	0.16	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.1	0.12	0.11	0.12	0.11	0.11	0.11	0.11	0.11	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.02	<0.001	<0.001	<0.001	0.004	0.008	0.002	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.073	0.093	0.01	0.015	0.011	0.016	0.034	0.035	0.026	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	AGE08	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2015	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016			Fresh	Marine	Irrigation Waters
	8/09/2015	13/10/2015	10/11/2015	8/12/2015	12/01/2016	9/02/2016	15/03/2016	5/04/2016	10/05/2016					
pH	7.2	7.3	5.9	7.4	6.3	7.3	7.0	6.7	7.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1300	1200	1200	1200	1300	1300	1100	1200	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	38	33	120	18	51	57	34	30	37	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	570	580	500	590	600	620	600	600	580	1/5	NC	NC	NC	NC
Total Alkalinity	570	580	500	590	600	620	600	600	580	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	88	86	91	100	90	86	94	84	92	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.6	1.8	1.5	1.7	1.6	1.6	1.8	1.7	1.5	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	0.02	<0.005	0.02	<0.005	<0.005	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	56	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	34	32	36	37	37	38	34	38	34	0.5	NC	NC	NC	NC
Potassium	14	13	13	15	16	14	14	14	13	0.5	NC	NC	NC	NC
Sodium	240	230	240	280	250	250	250	260	240	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	27	26	28	29	28	28	26	30	27	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.003	0.008	0.002	0.072	0.019	0.004	0.007	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.15	0.16	0.17	0.170	0.17	0.18	0.16	0.16	0.16	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	0.0001	<0.0001	0.0002	0.0003	0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	0.003	0.001	0.003	0.012	0.002	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.17	0.19	0.22	0.150	0.26	0.72	0.24	0.19	0.18	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.11	0.11	0.12	0.100	0.12	0.14	0.12	0.11	0.11	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	0.002	0.004	0.003	0.003	0.003	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.009	0.009	0.025	0.013	0.027	0.048	0.033	0.048	0.019	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE08	AGE08	AGE08	AGE08	D111 (AGE08)	AGE08	AGE08	AGE08	D117 (AGE08)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	June 2016	July 2016	Aug 2016	Sept 2016	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Dec 2016			Fresh	Marine	Irrigation Waters
	7/06/2016	13/07/2016	15/08/2016	14/09/2016	14/09/2016	11/10/2016	15/11/2016	13/12/2016	13/12/2016					
pH	7.1	7.0	7.2	7.1	7.2	7.4	7.2	7.3	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1200	1200	1200	1100	1100	1200	1300	1200	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	26	25	84	22	34	37	46	8.4	7.2	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	590	580	560	580	580	610	580	590	600	1/5	NC	NC	NC	NC
Total Alkalinity	590	580	560	580	580	610	580	590	600	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	81	92	79	80	83	78	82	90	89	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.5	1.5	1.6	1.6	1.6	1.7	1.6	1.5	1.5	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.009	0.06	0.009	<0.005	0.007	0.01	<0.005	0.006	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	36	40	37	36	36	37	34	34	33	0.5	NC	NC	NC	NC
Potassium	15	15	14	15	15	15	15	13	13	0.5	NC	NC	NC	NC
Sodium	270	280	270	220	230	260	260	260	250	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	29	31	29	29	29	29	29	28	27	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.006	0.009	0.009	0.002	0.002	0.004	0.002	0.002	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.16	0.15	0.17	0.16	0.16	0.2	0.14	0.15	0.15	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	0.002	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.13	0.13	0.15	0.14	0.15	0.068	0.2	0.17	0.17	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.11	0.1	0.11	0.11	0.11	0.096	0.1	0.1	0.1	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.016	0.003	<0.001	<0.001	<0.001	<0.001	0.008	0.006	0.006	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.034	0.031	0.011	0.013	0.012	0.032	0.012	0.006	0.004	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE08	D119 (AGE08)	AGE08	AGE08	AGE08	AGE08	AGE08	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
										Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2017	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	17/01/2017	17/01/2017	21/02/2017	21/03/2017	4/04/2017	23/05/2017	20/06/2017					
pH	6.7	6.7	8.0	7.5	7.7	6.0	6.8	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1200	1200	1200	1100	1300	1200	1300	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4.1	4.2	2.2	1.8	6.6	3.3	5.7	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity												
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	660	650	650	630	620	600	610	1/5	NC	NC	NC	NC
Total Alkalinity	660	650	650	630	620	600	610	1/5	NC	NC	NC	NC
Anions												
Chloride (Cl)	87	88	110	78	88	87	86	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.5	1.5	1	1.5	1.6	1.1	0.85	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	<0.005	0.009	0.009	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	1	<1	<1	2	<1	1	500	NC	NC	NC
Cations - Dissolved												
Calcium	35	34	35	32	34	39	36	0.5	NC	NC	NC	NC
Potassium	15	14	15	15	14	14	15	0.5	NC	NC	NC	NC
Sodium	240	240	260	230	270	260	250	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	28	27	29	27	28	30	30	0.5	NC	NC	NC	NC
Metals - Dissolved												
Aluminium	0.005	0.005	0.001	0.003	0.003	0.008	0.01	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.170	0.180	0.16	0.15	0.15	0.15	0.15	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0002	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.170	0.170	0.16	0.17	0.22	0.22	0.58	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.100	0.100	0.11	0.099	0.1	0.12	0.11	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.007	0.006	0.017	0.009	<0.001	0.057	0.019	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.016	0.028	0.007	0.009	0.009	0.13	0.029	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total												
Aluminium	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE10	AGE10 (D31)	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jul 2013	Jul 2013	Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014			Fresh	Marine	Irrigation Waters
	25/07/2013	25/07/2013	22/08/2013	19/09/2013	16/101/2013	14/11/2013	10/12/2013	15/01/2014	19/02/2014					
pH	6.9	6.9	7.3	7.2	7.7	7.5	8.4	7.2	6.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	2000	2000	1900	1900	2000	2200	2100	2100	2300	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	96	89	69	54	32	98	31	33	61	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	29	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	850	850	660	700	730	810	750	920	960	1/5	NC	NC	NC	NC
Total Alkalinity	850	850	660	700	730	810	780	920	960	1/5				
Anions														
Chloride (Cl)	190	190	210	250	250	210	210	250	210	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.9	3	2.6	3.7	3.7	3.3	3.3	3.4	3.1	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	0.2	<0.005	<0.005	<0.005	0.02	0.02	0.02	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	23	22	33	23	35	28	26	20	18	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	54	55	54	60	58	55	55	58	53	0.5	NC	NC	NC	NC
Potassium	23	22	19	28	27	26	29	23	24	0.5	NC	NC	NC	NC
Sodium	320	330	130	280	330	390	430	390	370	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	58	59	52	65	67	65	65	69	60	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.0010	0.0009	0.009	0.005	0.011	0.027	0.009	<0.0005	0.011	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.009	0.009	0.030	0.008	0.005	0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.410	0.410	0.23	0.26	0.24	0.31	0.31	0.32	0.36	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.650	0.640	0.6	0.89	0.35	0.48	0.54	0.47	0.53	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.120	0.120	0.19	0.15	0.19	0.18	0.16	0.14	0.13	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.003	0.003	0.005	0.016	0.001	0.001	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.670	0.650	6.5	0.26	0.002	0.008	0.007	<0.001	0.004	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2014	Apr 2014	May 2014	June 2014	July 2014	Aug 2014	Dec 2014	Jan 2015	Feb 2015			Fresh	Marine	Irrigation Waters
	19/03/2014	15/04/2014	21/05/2014	18/06/2014	23/07/2014	20/08/2014	3/12/2014	14/01/2015	11/02/2015					
pH	6.7	7.1	7.1	7.6	6.9	7.1	7.1	7.0	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	2200	2200	2300	2100	1900	2200	2100	2100	2000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	31	44	26	34	31	22	19	25	100	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	920	950	910	920	950	930	950	940	930	1/5	NC	NC	NC	NC
Total Alkalinity	920	950	910	920	950	930	950	940	930	1/5				
Anions														
Chloride (Cl)	210	190	210	230	240	210	210	220	250	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.9	2.5	2.6	2.6	2.5	2.4	2.6	2.4	2.5	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.09	<0.005	0.01	<0.005	0.008	0.02	<0.005	0.008	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	15	21	16	17	18	23	15	14	18	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	56	56	49	55	56	52	53	52	54	0.5	NC	NC	NC	NC
Potassium	27	27	24	29	27	27	25	26	25	0.5	NC	NC	NC	NC
Sodium	450	450	360	450	440	460	430	410	420	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	66	66	55	67	67	63	64	63	64	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.005	0.002	0.004	0.002	0.003	0.003	0.005	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.32	0.32	0.34	0.32	0.36	0.35	0.37	0.34	0.35	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.69	0.57	0.61	0.48	0.49	0.33	0.33	0.29	0.34	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.13	0.13	0.11	0.1	0.12	0.097	0.099	0.095	0.086	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.017	0.003	0.003	0.003	0.031	0.002	0.002	0.002	0.005	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.001	0.006	0.002	<0.001	0.004	0.004	0.004	0.012	0.005	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	March 2015	April 2015	May 2015	May 2015	June 2015	July 2015	August 2015	Sept 2015	Oct 2015			Fresh	Marine	Irrigation Waters
	11/03/2015	15/04/2015	20/05/2015	20/05/2015	23/06/2015	15/07/2015	11/08/2015	09/09/2015	14/10/2015					
pH	7.0	7.1	7.4	7.4	6.9	7.2	7.2	7.1	6.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	2100	2200	2000	2000	2200	2100	2200	2100	2100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	42	48	590	590	95	240	260	74	110	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	940	980	950	950	930	890	920	920	930	1/5	NC	NC	NC	NC
Total Alkalinity	940	980	950	950	930	890	920	920	930	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	220	200	200	200	200	240	200	220	230	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.4	1.3	2.6	2.6	2.6	2.6	2.5	2.5	2.4	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.02	0.007	0.007	0.02	0.02	0.006	0.01	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	18	15	15	15	16	15	15	17	17	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	43	59	54	54	53	51	50	49	47	0.5	NC	NC	NC	NC
Potassium	27	27	27	27	27	26	26	27	28	0.5	NC	NC	NC	NC
Sodium	450	480	440	440	440	400	460	470	460	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	51	71	64	64	68	62	61	60	60	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.006	0.074	0.074	0.001	0.009	0.002	0.012	0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	0.004	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.39	0.37	0.34	0.34	0.35	0.39	0.37	0.35	0.38	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.36	0.29	0.68	0.68	0.35	0.39	0.36	0.32	0.36	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.11	0.089	0.095	0.095	0.086	0.089	0.089	0.089	0.092	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.006	0.005	0.006	0.006	0.003	0.001	0.001	0.001	0.013	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.012	0.018	0.018	0.005	0.004	0.003	0.043	0.014	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.2	0.2	<0.05	0.07	0.06	0.2	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	AGE10	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	June 2016	July 2016			Fresh	Marine	Irrigation Waters
	11/11/2015	9/12/2015	13/01/2016	11/02/2016	16/03/2016	5/04/2016	11/05/2016	8/06/2016	14/07/2016					
pH	6.7	7.3	7.2	6.2	6.2	7.2	7.1	7.2	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	2100	2100	2200	2000	2200	2200	2000	2000	2100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	190	120	86	130	44	130	470	59	84	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	940	960	930	960	940	960	950	950	930	1/5	NC	NC	NC	NC
Total Alkalinity	940	960	930	960	940	960	950	950	930	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	230	230	230	240	210	220	230	210	230	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.2	2.5	2.4	2.3	2.4	2.6	2.2	2.3	2.4	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	0.01	0.02	0.005	<0.005	<0.005	0.008	0.007	0.006	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	17	16	14	15	17	17	17	14	18	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	53	57	69	53	56	59	52	57	62	0.5	NC	NC	NC	NC
Potassium	23	26	31	25	26	25	23	27	25	0.5	NC	NC	NC	NC
Sodium	420	440	450	420	430	450	430	470	440	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	63	67	69	59	67	68	61	68	72	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.005	0.003	0.021	0.048	0.008	0.003	0.004	0.001	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	0.002	<0.001	0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.34	0.360	0.32	0.35	0.35	0.36	0.37	0.36	0.360	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	0.0001	0.0004	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.001	<0.001	0.002	<0.001	<0.001	0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.28	0.33	0.17	0.39	0.43	0.24	0.18	0.23	0.39	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.086	0.082	0.26	0.11	0.1	0.091	0.087	0.09	0.092	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.005	0.003	0.004	0.017	0.014	0.002	0.005	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.011	0.005	0.006	0.038	0.068	0.036	0.04	0.024	0.014	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.1	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE10	AGE10	AGE10	AGE10	AGE10	D118 (AGE10)	AGE10	AGE10	AGE10	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Aug 2016	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017			Fresh	Marine	Irrigation Waters
	17/08/2016	14/09/2016	10/10/2016	16/11/2016	14/12/2016	14/12/2016	18/01/2017	22/02/2017	23/03/2017					
pH	7.0	7.1	7.3	7.0	7.2	7.2	7.2	6.4	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	2100	2000	2100	2200	2100	2100	2200	2200	2100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	97	42	16	170	82	87	67	76	44	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	900	940	970	950	920	960	1000	1100	1000	1/5	NC	NC	NC	NC
Total Alkalinity	900	940	970	950	920	960	1000	1100	1000	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	210	200	200	200	230	230	210	210	210	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.4	2.3	2.4	2.6	2.2	2.3	2.2	2.5	2.8	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.03	0.1	0.07	0.2	0.006	0.005	0.1	<0.005	0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	15	14	22	14	17	17	15	16	15	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	58	57	57	56	56	57	55	56	56	0.5	NC	NC	NC	NC
Potassium	20	27	27	23	28	29	25	24	26	0.5	NC	NC	NC	NC
Sodium	380	350	460	390	480	480	420	380	450	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	66	67	65	65	68	69	64	63	65	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.002	0.004	0.005	0.002	0.003	0.003	0.004	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.35	0.38	0.43	0.35	0.36	0.34	0.38	0.37	0.34	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.19	0.23	0.26	0.055	0.12	0.13	0.16	0.59	0.93	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.083	0.083	0.076	0.078	0.093	0.096	0.096	0.088	0.096	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	<0.001	0.001	0.020	0.007	0.008	0.004	0.011	0.022	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.027	0.010	0.015	0.039	0.063	0.066	0.048	0.020	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	0.08	0.05	0.06	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE10	AGE10	AGE10	D130 (AGE10)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
							Slightly to Moderately Disturbed Systems		
Date Sampled	Apr 2017	May 2017	Jun 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	5/04/2017	24/05/2017	21/06/2017	21/06/2017					
pH	7.3	6.7	6.1	6.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	2200	2000	2100	2200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	120	70	15	3.1	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity									
Hydroxide (OH^-)	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	980	960	960	990	1/5	NC	NC	NC	NC
Total Alkalinity	980	960	960	990	1/5	NC	NC	NC	NC
Anions									
Chloride (Cl)	200	190	180	180	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.3	2.5	2.4	2.4	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.007	0.005	<0.005	<0.005	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	14	16	18	15	1	500	NC	NC	NC
Cations - Dissolved									
Calcium	53	57	56	52	0.5	NC	NC	NC	NC
Potassium	26	26	22	22	0.5	NC	NC	NC	NC
Sodium	440	430	370	370	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	62	66	63	57	0.5	NC	NC	NC	NC
Metals - Dissolved									
Aluminium	0.003	0.002	0.006	0.006	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.36	0.33	0.35	0.35	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.6	0.37	0.53	0.52	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.12	0.084	0.093	0.091	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.025	0.010	0.031	0.03	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.013	0.022	0.12	0.13	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total									
Aluminium	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.07	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table 1 - Summary of Laboratory Testing Results - February 2012 to June 2014 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jul 2013	Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014			Fresh	Marine	Irrigation Waters
	24/07/2013	22/08/2013	17/09/2013	17/10/2013	13/11/2013	17/12/2013	16/01/2014	20/02/2014	20/03/2014					
pH	6.8	7.1	8.1	7.6	7.1	7.4	7.3	7.1	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1600	1600	1700	1700	1700	1700	1600	1800	1700	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	30	140	180	3200	49	170	33	35	14	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	660	670	660	840	700	680	710	700	680	1/5	NC	NC	NC	NC
Total Alkalinity	660	670	660	840	700	680	710	700	680	1/5				
Anions														
Chloride (Cl)	130	140	150	170	150	170	170	150	140	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.2	1.1	1.3	1.1	1.3	1.3	1.4	1.3	0.98	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.02	0.07	0.02	0.008	0.06	0.04	0.2	0.009	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	41	49	58	48	59	66	53	52	50	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	71	65	70	75	77	73	75	70	74	0.5	NC	NC	NC	NC
Potassium	18	15	17	20	19	21	20	18	20	0.5	NC	NC	NC	NC
Sodium	180	100	190	220	230	220	210	200	230	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	73	65	71	78	81	74	83	73	81	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.0030	0.005	0.002	0.009	0.019	0.011	<0.0005	0.008	0.012	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.002	0.002	<0.001	0.01	0.001	0.009	0.001	<0.001	0.003	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.098	0.092	0.091	0.1	0.1	0.11	0.092	0.092	0.089	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0002	0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.001	0.002	0.014	0.002	0.011	0.009	0.003	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.007	0.002	0.003	0.005	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.840	0.56	0.085	0.014	0.43	0.011	0.033	0.066	0.58	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.060	0.059	0.064	0.076	0.06	0.11	0.075	0.064	0.058	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.007	0.013	0.002	0.011	0.004	0.002	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.017	0.031	0.075	0.031	0.049	0.04	0.016	0.014	0.110	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	1.1	<0.05	0.06	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table 1 - Summary of Laboratory Testing Results - February 2012 to June 2014 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Apr 2014	May 2014	June 2014	July 2014	Aug 2014	Dec 2014	Jan 2015	Feb 2015			Fresh	Marine	Irrigation Waters
	15/04/2014	21/05/2014	18/06/2014	23/07/2014	20/08/2014	4/12/2014	14/01/2015	11/02/2015					
pH	7.1	7.1	7.5	7.1	7.1	7.1	7.2	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1700	1700	1500	1500	1700	1600	1600	1500	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	28	48	30	25	21	35	87	74	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	720	660	680	690	670	690	690	670	1/5	NC	NC	NC	NC
Total Alkalinity	720	660	680	690	670	690	690	670	1/5				
Anions													
Chloride (Cl)	140	150	150	160	150	140	160	170	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.93	1.1	1.2	1.1	1.2	0.96	0.9	0.89	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.05	0.02	0.03	0.02	0.03	0.04	0.07	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	50	54	56	59	55	54	59	61	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	73	66	72	74	75	70	68	71	0.5	NC	NC	NC	NC
Potassium	20	17	19	21	20	18	19	18	0.5	NC	NC	NC	NC
Sodium	230	190	230	220	250	220	230	210	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	79	70	82	81	79	76	77	77	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.006	0.002	0.006	0.002	0.002	0.005	0.003	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.091	0.096	0.088	0.099	0.099	0.092	0.09	0.09	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.52	0.37	0.33	0.057	0.075	0.033	0.039	0.1	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.056	0.052	0.048	0.052	0.046	0.042	0.043	0.042	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.004	0.005	0.014	0.006	0.005	0.006	0.006	0.004	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Mar 2015	April 2015	May 2015	June 2015	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015			Fresh	Marine	Irrigation Waters
	11/03/2015	15/04/2015	20/05/2015	23/06/2015	15/07/2015	12/08/2015	09/09/2015	14/10/2015	11/11/2015					
pH	7.1	7.1	7.1	7	7.2	6.9	7.2	7.2	7.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1600	1700	1600	1600	1500	1600	1600	1500	1500	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	66	100	650	210	630	150	92	270	190	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	[NT]	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	[NT]	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	690	710	680	680	630	670	660	670	650	1/5	NC	NC	NC	NC
Total Alkalinity	690	710	680	680	630	670	660	670	650	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	160	140	140	140	150	150	150	160	160	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.96	0.04	1	1.3	0.93	1.2	1	1.1	1	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.08	0.1	0.03	0.01	<0.005	<0.005	0.05	<0.05	0.07	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	57	50	50	51	52	57	53	55	58	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	56	75	70	73	67	64	66	64	71	0.5	NC	NC	NC	NC
Potassium	19	19	20	19	19	17	20	19	18	0.5	NC	NC	NC	NC
Sodium	230	240	220	220	210	210	240	230	230	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	61	82	78	81	75	71	75	72	76	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	0.004	0.003	0.006	0.01	0.003	0.005	0.003	0.014	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	0.008	0.004	0.002	0.002	0.002	0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.09	0.092	0.081	0.082	0.083	0.089	0.087	0.07	0.087	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.16	0.11	0.11	2.1	1.3	0.81	1	0.73	0.89	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.046	0.045	0.05	0.055	0.054	0.053	0.058	0.062	0.052	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.005	0.006	0.016	0.013	0.007	0.013	0.021	0.013	0.016	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.1	0.07	0.1	0.1	0.2	0.09	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	June 2016	July 2016	Aug 2016			Fresh	Marine	Irrigation Waters
	9/12/2015	13/01/2016	11/02/2016	17/03/2016	7/04/2016	11/05/2016	9/06/2016	13/07/2016	17/08/2016					
pH	7.3	7.1	7.3	7.2	7.3	7.0	6.9	7.2	7.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1600	1700	1400	1700	1500	1500	1500	1500	1600	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	80	78	36	62	110	61	72	270	270	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	700	690	680	670	680	680	690	660	650	1/5	NC	NC	NC	NC
Total Alkalinity	700	690	680	670	680	680	690	660	650	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	150	150	150	130	140	150	140	150	140	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.95	1.0	0.94	0.96	0.98	0.93	0.99	1	1.2	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.2	0.006	0.02	0.008	0.006	<0.005	0.01	0.02	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	56	54	52	53	54	58	49	69	50	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	75	74	66	71	72	70	71	80	73	0.5	NC	NC	NC	NC
Potassium	19	21	18	19	17	18	18	20	15	0.5	NC	NC	NC	NC
Sodium	230	250	220	230	220	230	220	240	200	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	81	83	71	80	78	76	80	88	79	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.004	0.028	0.007	0.006	0.003	0.005	0.003	0.005	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.096	0.09	0.092	0.092	0.094	0.095	0.089	0.06	0.082	0.001	2	NC	NC	NC
Beryllium	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.003	0.001	0.003	<0.001	0.003	<0.001	0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.77	0.67	1	0.95	0.84	0.69	0.55	0.41	0.61	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.049	0.06	0.058	0.051	0.047	0.047	0.044	0.043	0.049	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.004	0.11	0.006	0.011	0.003	0.015	0.005	0.029	0.003	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	AGE13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017			Fresh	Marine	Irrigation Waters
	13/09/2016	11/10/2016	16/11/2016	14/12/2016	18/01/2017	22/02/2017	22/03/2017	5/04/2017	24/05/2017					
pH	7.1	7.5	7.1	7.2	7.3	6.9	7.2	7.2	7.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1500	1500	1500	1500	1600	1600	1600	1700	1500	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	170	130	2.3	34	52	62	170	240	200	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	650	690	650	690	740	750	740	700	670	1/5	NC	NC	NC	NC
Total Alkalinity	650	690	650	690	740	750	740	700	670	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	140	130	130	150	150	150	150	140	130	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1	1.1	1.1	1	0.98	1.2	1	0.92	0.82	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.005	0.04	0.04	0.005	0.05	0.006	0.01	0.008	0.2	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	47	45	47	59	53	55	57	51	54	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	72	73	73	76	70	72	71	71	74	0.5	NC	NC	NC	NC
Potassium	19	19	18	20	18	18	19	19	20	0.5	NC	NC	NC	NC
Sodium	190	220	210	240	210	200	220	230	220	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	78	80	80	83	77	77	78	78	79	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.002	0.004	0.073	0.004	0.004	0.002	0.004	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.072	0.1	0.087	0.084	0.09	0.1	0.11	0.093	0.089	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	0.008	0.003	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.74	0.39	0.45	0.6	0.37	0.63	0.51	0.46	0.1	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.056	0.045	0.053	0.058	0.051	0.043	0.045	0.045	0.054	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	0.002	<0.001	0.012	0.002	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.011	0.018	0.009	0.015	0.016	0.024	0.039	0.042	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	0.06	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE13	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
				Slightly to Moderately Disturbed Systems		
Date Sampled	June 2017 12/07/2017			Fresh	Marine	Irrigation Waters
pH	7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	1600	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	280	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity						
Hydroxide (OH^-)	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	690	1/5	NC	NC	NC	NC
Total Alkalinity	690	1/5	NC	NC	NC	NC
Anions						
Chloride (Cl)	140	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	55	1	500	NC	NC	NC
Cations - Dissolved						
Calcium	61	0.5	NC	NC	NC	NC
Potassium	20	0.5	NC	NC	NC	NC
Sodium	240	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	65	0.5	NC	NC	NC	NC
Metals - Dissolved						
Aluminium	0.003	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.091	0.001	2	NC	NC	NC
Beryllium	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.34	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.049	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.022	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total						
Aluminium	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	0.001	2	NC	NC	NC
Beryllium	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.1	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE26M	AGE26M	AGE26M	AGE26M	AGE26M	AGE26M	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
									Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	17/01/2017	23/02/2017	23/03/2017	4/04/2017	24/05/2017	21/06/2017					
pH	7.4	7.6	6.3	7.4	7.0	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	810	700	610	620	600	650	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	5.3	3.7	2.3	6	9	11	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity											
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	290	250	220	210	200	210	1/5	NC	NC	NC	NC
Total Alkalinity	290	250	220	210	200	210	1/5	NC	NC	NC	NC
Anions											
Chloride (Cl)	100	80	71	69	67	72	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	0.016	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.3	0.01	0.01	0.02	0.06	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	25	21	18	20	8	20	1	500	NC	NC	NC
Cations - Dissolved											
Calcium	46	38	32	31	34	33	0.5	NC	NC	NC	NC
Potassium	5.9	4.7	4.7	4.1	4.3	4.2	0.5	NC	NC	NC	NC
Sodium	85	76	74	73	68	70	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	35	28	24	23	26	24	0.5	NC	NC	NC	NC
Metals - Dissolved											
Aluminium	0.007	0.002	0.004	0.001	0.002	0.002	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.036	0.027	0.026	0.024	0.025	0.028	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.001	<0.001	<0.001	0.001	0.013	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.010	<0.01	0.022	0.012	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.051	0.04	0.032	0.032	0.037	0.048	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.008	0.001	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.005	0.005	0.015	0.003	0.007	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total											
Aluminium	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	AGE33M	AGE33M	AGE33M	AGE33M	D126 (AGE33M)	AGE33M	D128 (AGE33)	AGE33M	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2017	Feb 2017	Mar 2017	Apr 2017	Apr 2017	May 2017	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	17/01/2017	22/02/2017	21/03/2017	4/04/2017	4/04/2017	23/05/2017	23/05/2017	20/06/2017					
pH	7.0	7.2	7.2	7	7.1	6.7	6.9	7.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	420	410	370	420	420	380	950	410	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	5.3	2.3	8.9	3.3	4.6	6.7	28	4.8	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	160	160	150	150	150	150	320	140	1/5	NC	NC	NC	NC
Total Alkalinity	160	160	150	150	150	150	320	140	1/5	NC	NC	NC	NC
Anions													
Chloride (Cl)	43	42	37	40	40	38	140	38	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.041	0.043	0.038	0.048	0.046	0.048	0.029	0.057	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	0.008	0.006	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	10	11	10	11	11	12	49	12	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	24	24	22	23	24	27	67	24	0.5	NC	NC	NC	NC
Potassium	3.3	3.1	3.3	3	3	3.1	6.9	3.4	0.5	NC	NC	NC	NC
Sodium	33	34	36	35	34	37	120	35	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	20	20	18	19	19	21	52	20	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.0009	0.0006	0.001	0.001	0.0009	<0.0005	0.0007	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.022	0.019	0.02	0.02	0.022	0.022	0.021	0.023	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.001	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.270	0.35	0.25	0.39	0.39	0.28	0.012	0.23	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.180	0.15	0.16	0.16	0.16	0.19	0.42	0.17	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.003	0.003	0.002	0.003	0.005	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.005	0.004	0.006	0.006	0.006	0.005	0.015	0.011	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.06	<0.05	0.05	0.06	0.06	0.07	0.09	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0014CH	BY0014CH	BY0014CH	BY0014CH	BY0014CH	BY0014CH (D9)	BY0014CH	BY0014CH	BY0014CH (D13)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Aug 2012	Sept 2012	Oct 2012	Oct 2012			Fresh	Marine	Irrigation Waters
	23/2/2012	31/5/2012	28/06/2012	22/07/2012	20/08/2012	20/08/2012	17/09/2012	21/10/2012	21/10/2012					
pH	6.7	8.6	7.8	7.5	7.7	7.7	7.5	8.4	8.4	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	990	990	1100	1100	1100	1100	1100	1000	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4.8	26	7	19	3.5	4.4	2.7	9.5	4.1	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<1	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<1	33	<5	<5	<5	<5	<5	23	19	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	420	400	440	500	470	460	460	460	460	1/5	NC	NC	NC	NC
Total Alkalinity	970	430	440	500	470	460	460	480	480	1/5				
Anions														
Chloride (Cl)	75	78	75	81	75	76	82	75	75	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.65	0.72	1.0	1.0	1.1	1.1	1.0	1.1	1.1	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.006	0.2	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	1	1	<1	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	31	32	31	31	34	34	34	37	37	0.5	NC	NC	NC	NC
Potassium	10	11	11	11	12	12	11	10	11	0.5	NC	NC	NC	NC
Sodium	190	170	190	210	180	180	210	190	200	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	17	18	18	17	19	20	19	21	20	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.025	0.007	<0.01	0.009	0.0080	0.0060	0.0040	0.005	0.006	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	0.004	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.2	0.21	0.210	0.210	0.2300	0.2300	0.2100	0.220	0.220	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.59	0.11	0.220	0.160	0.20	0.20	0.18	0.130	0.130	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.079	0.03	0.029	0.027	0.026	0.025	0.023	0.025	0.026	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.012	0.005	0.005	0.009	0.0020	0.0020	0.0010	0.003	0.003	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.088	0.01	0.005	0.012	0.015	0.002	0.006	0.006	0.008	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0014CH	BY0014CH	BY0014CH	BY0014CH	BY0014CH	BY0014CH	BY0014CH	BY0014CH	BY0014CH	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013	Jul 2013	Aug 2013			Fresh	Marine	Irrigation Waters
	3/12/2012	14/01/2013	18/02/2013	19/03/2013	15/04/2013	12/05/2013	18/06/2013	22/07/2013	19/08/2013					
pH	7.8	7.8	7.6	7.9	8.0	8.1	7.6	7.8	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1100	1100	1000	1100	1000	980	1000	1000	1000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	2.6	14	12	11	5.1	3.8	5.4	34	58	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	470	470	470	480	460	450	470	480	470	1/5	NC	NC	NC	NC
Total Alkalinity	470	470	470	480	460	450	470	480	470	1/5				
Anions														
Chloride (Cl)	76	80	78	86	80	87	79	87	71	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.9	1.0	1.2	1.0	1.0	1.0	1	0.97	0.99	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.009	0.03	<0.005	0.006	0.006	<0.005	<0.005	<0.005	0.03	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	39	32	35	31	34	32	32	31	32	0.5	NC	NC	NC	NC
Potassium	12	9.8	9.4	10	11	10	11	9.7	8.8	0.5	NC	NC	NC	NC
Sodium	230	200	170	190	180	190	200	190	160	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	22	18	19	17	18	18	17	17	18	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.004	0.002	0.008	0.004	0.012	0.006	0.018	0.003	0.006	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.190	0.210	0.200	0.220	0.210	0.210	0.21	0.200	0.22	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0002	0.0003	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.033	0.140	0.180	0.290	0.200	0.170	0.22	0.190	0.23	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.021	0.024	0.029	0.037	0.030	0.025	0.024	0.02	0.022	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.002	0.008	0.002	0.003	0.001	0.002	0.001	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.006	0.003	0.008	0.002	0.011	0.006	0.010	0.006	0.009	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0014CH	BY0014CH (D34)	BY0014CH	BY0014CH	BY0014CH	BY0014CH	BY0014CH	BY0014CH	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014			Fresh	Marine	Irrigation Waters
	19/09/2013	19/09/2013	14/10/2013	13/11/2013	16/12/2013	13/01/2014	19/02/2014	17/03/2014					
pH	7.9	7.7	7.4	8.1	7.6	7.6	7.7	7.5	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	<6 (6)(18)
Electrical Conductivity (µS/cm)	1000	1000	1100	1000	1000	1100	1100	930	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	3.7	3	4.6	5.2	17	2.6	2.7	2.8	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	470	470	450	480	470	500	480	470	1/5	NC	NC	NC	NC
Total Alkalinity	470	470	450	480	470	500	480	470	1/5				
Anions													
Chloride (Cl)	86	99	93	86	88	83	77	78	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.95	1.1	1	1	1.1	1.0	1.2	1.0	0.005	0.5 (8)/0.41(12)	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	<0.005	0.006	0.01	0.05	0.02	0.07	<0.005	0.005	3(13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	33	30	35	37	34	37	34	38	0.5	NC	NC	NC	NC
Potassium	11	11	11	11	11	12	10	12	0.5	NC	NC	NC	NC
Sodium	180	170	200	220	210	210	190	240	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	19	18	20	20	19	21	19	21	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.003	0.003	0.011	0.011	0.011	0.008	0.012	0.005	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.22	0.23	0.21	0.21	0.21	0.21	0.2	0.22	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	<0.001	<0.001	<0.001	0.002	0.003	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	0.2	0.21	0.13	0.16	0.062	0.12	0.2	0.24	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	0.02	0.021	0.022	0.023	0.025	0.022	0.024	0.025	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	<0.001	<0.001	0.003	0.002	0.002	<0.001	<0.001	0.006	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.008	0.003	0.013	0.015	0.019	0.002	0.002	0.003	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0014CH	BY0014CH	BY0014CH	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Apr 2014	May 2014	June 2014	July 2014	Aug 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015			Fresh	Marine	Irrigation Waters
	13/04/2014	20/05/2014	16/06/2014	21/07/2014	18/08/2014	2/12/2014	13/01/2015	9/02/2015	9/03/2015					
pH	8.0	7.7	7.6	7.4	7.7	7.7	7.7	7.5	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1100	1100	1100	980	990	990	940	980	1000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	19	3.9	2.2	14	9.9	6	2.6	2.9	1.4	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	490	460	460	470	470	470	460	460	460	1/5	NC	NC	NC	NC
Total Alkalinity	490	460	460	470	470	470	460	460	460	1/5				
Anions														
Chloride (Cl)	73	75	77	90	77	86	85	81	88	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.1	1.0	1	1	1.1	1.1	0.92	0.78	0.97	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.02	0.009	<0.005	<0.005	0.02	0.005	0.04	0.01	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	37	37	35	33	36	35	34	32	34	0.5	NC	NC	NC	NC
Potassium	11	11	12	11	12	10	12	12	11	0.5	NC	NC	NC	NC
Sodium	220	190	220	200	220	210	210	240	200	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	20	20	21	19	20	20	20	19	19	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.0008	<0.005	0.11	0.006	0.004	0.005	0.006	0.006	0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.21	0.22	0.21	0.21	0.22	0.21	0.22	0.220	0.22	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.023	<0.001	<0.001	<0.001	<0.001	0.001	0.005	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.054	0.28	0.27	0.28	0.23	0.1	0.25	0.220	0.25	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.023	0.024	0.025	0.023	0.024	0.022	0.025	0.023	0.024	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.001	0.001	<0.001	0.003	0.002	0.002	0.001	0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.002	0.005	0.008	0.009	0.007	0.008	0.011	0.012	0.01	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	April 2015	May 2015	June 2015	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015	Dec 2015			Fresh	Marine	Irrigation Waters
	13/04/2015	19/05/2015	15/06/2015	16/07/2015	12/08/2015	7/09/2015	12/10/2015	9/11/2015	7/12/2015					
pH	8.0	7.9	7.4	7.8	7.5	7.5	7.6	7.9	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	960	1000	1000	970	1000	1000	950	990	1000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	2	2.7	1.1	22	29	73	21	42	7.2	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	470	460	470	440	470	460	460	460	470	1/5	NC	NC	NC	NC
Total Alkalinity	470	460	470	440	470	460	460	460	470	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	80	68	82	79	85	82	80	85	89	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.1	1	1.1	0.9	0.92	1.3	1.1	1	1.1	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.05	0.005	<0.005	0.007	<0.005	<0.005	<0.005	<0.005	0.98	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	33	33	33	34	31	33	31	34	37	0.5	NC	NC	NC	NC
Potassium	11	11	11	11	10	11	9.4	11	11	0.5	NC	NC	NC	NC
Sodium	210	210	210	220	210	200	180	210	220	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	18	19	19	20	18	19	18	20	20	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.006	0.006	0.003	0.007	0.005	0.006	0.003	0.006	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.22	0.22	0.22	0.21	0.21	0.2	0.22	0.25	0.220	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	<0.001	<0.001	<0.001	0.02	0.022	<0.001	<0.001	0.003	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.19	0.3	0.3	0.13	0.21	0.19	0.21	0.14	0.180	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.022	0.024	0.024	0.031	0.028	0.033	0.028	0.025	0.025	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.001	<0.001	0.003	0.005	0.003	0.002	0.002	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.014	0.008	0.009	0.019	0.039	0.061	0.015	0.012	0.016	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	0.08	0.1	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0014	D91 (BY0014)	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2016	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	June 2016	July 2016	Aug 2016			Fresh	Marine	Irrigation Waters
	12/01/2016	12/01/2016	9/02/2016	15/03/2016	4/04/2016	12/05/2016	8/06/2016	12/07/2016	15/08/2016					
pH	7.8	7.8	8.1	7.5	8.0	7.5	7.6	7.5	7.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	>6 [6][18]
Electrical Conductivity (µS/cm)	1100	1100	1100	930	960	1000	940	1000	1000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	7.4	6.9	6.5	17	6.5	6	5.9	4.7	39	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	470	480	480	470	470	470	480	460	450	1/5	NC	NC	NC	NC
Total Alkalinity	470	480	480	470	470	470	480	460	450	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	84	84	78	83	72	87	81	73	70	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.0	1.0	0.99	1	1	1	0.95	1.1	1.2	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	0.007	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	35	36	35	32	37	34	35	40	34	0.5	NC	NC	NC	NC
Potassium	12	12	11	10	12	12	12	12	11	0.5	NC	NC	NC	NC
Sodium	220	220	190	210	230	210	230	230	220	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	20	20	20	18	22	19	20	22	19	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.003	0.014	0.008	0.005	0.006	0.005	0.002	0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.21	0.22	0.23	0.22	0.21	0.22	0.22	0.2	0.23	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	0.010	<0.001	0.002	0.001	0.002	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.23	0.24	0.24	0.23	0.26	0.27	0.18	0.24	0.15	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.024	0.025	0.025	0.025	0.025	0.025	0.026	0.022	0.026	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.003	0.003	0.003	0.002	0.002	0.001	0.007	0.007	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.013	0.015	0.019	0.047	0.05	0.026	0.037	0.024	0.031	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	BY0014	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017			Fresh	Marine	Irrigation Waters
	15/09/2016	10/10/2016	14/11/2016	12/12/2016	18/01/2017	20/02/2017	20/03/2017	3/04/2017	22/05/2017					
pH	7.5	7.7	7.6	7.6	7.9	8.3	7.8	7.9	7.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	>6 [6][18]
Electrical Conductivity (µS/cm)	880	970	1000	980	1000	990	1000	1000	990	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	5.9	1.1	0.6	3.7	1.3	0.5	1.2	0.9	1.5	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	14	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	470	490	460	470	510	500	490	490	480	1/5	NC	NC	NC	NC
Total Alkalinity	470	490	460	470	510	510	490	490	480	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	68	70	72	84	77	92	68	78	83	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.98	1.2	1.1	1	0.98	0.77	0.97	0.97	1.3	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.4	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	6	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	40	36	44	36	34	34	31	34	38	0.5	NC	NC	NC	NC
Potassium	12	12	13	11	11	12	11	11	11	0.5	NC	NC	NC	NC
Sodium	200	220	220	220	200	220	200	230	220	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	22	21	27	20	19	19	18	19	21	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.005	0.006	0.001	0.005	0.004	0.003	0.003	0.005	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.21	0.24	0.11	0.2	0.24	0.21	0.2	0.22	0.21	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.17	0.2	0.19	0.24	0.23	0.2	0.19	0.26	0.33	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.025	0.023	0.041	0.024	0.024	0.024	0.021	0.021	0.024	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	<0.001	0.009	0.003	0.009	0.007	0.01	0.009	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.063	0.060	<0.001	0.021	0.005	0.005	0.013	0.01	0.021	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0014	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
				Slightly to Moderately Disturbed Systems		
Date Sampled	Jun 2017			Fresh	Marine	Irrigation Waters
	19/06/2017					
pH	7.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	0.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity						
Hydroxide (OH^-)	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	500	1/5	NC	NC	NC	NC
Total Alkalinity	500	1/5	NC	NC	NC	NC
Anions						
Chloride (Cl)	66	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	1	500	NC	NC	NC
Cations - Dissolved						
Calcium	33	0.5	NC	NC	NC	NC
Potassium	11	0.5	NC	NC	NC	NC
Sodium	210	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	19	0.5	NC	NC	NC	NC
Metals - Dissolved						
Aluminium	0.003	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.21	0.001	2	NC	NC	NC
Beryllium	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.31	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.025	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.036	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total						
Aluminium	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	0.001	2	NC	NC	NC
Beryllium	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0015CH	BY0015CH (D2)	BY0015CH	BY0015CH (D4)	BY0015CH	BY0015CH	BY0015CH	BY0015CH	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2012	Feb 2012	May 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012			Fresh	Marine	Irrigation Waters
	23/2/2012	23/2/2012	29/05/2012	29/05/2012	27/06/2012	24/07/2012	22/08/2012	17/09/2012					
pH	7.2	7.3	7.5	7.5	7.5	6.8	7.3	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1200	1200	1200	1200	1200	1200	1200	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	1.8	1.8	0.2	0.3	3.2	1.5	2.5	2.6	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<1	<1	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<1	<1	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	410	420	460	450	410	510	440	420	1/5	NC	NC	NC	NC
Total Alkalinity	410	420	460	450	410	510	440	420	1/5				
Anions													
Chloride (Cl)	110	110	120	120	110	460	110	110	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.1	1.1	1.0	1.0	1.1	0.96	0.92	1.0	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.009	<0.005	<0.005	<0.005	<0.005	0.03	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	33	32	34	34	28	310	24	31	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	44	41	43	41	39	41	40	45	0.5	NC	NC	NC	NC
Potassium	13	13	13	13	12	14	12	14	0.5	NC	NC	NC	NC
Sodium	200	200	210	200	190	200	190	230	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	26	25	26	24	23	24	24	26	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.003	0.002	0.004	0.008	<0.01	0.003	0.0009	0.0020	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.093	0.094	0.098	0.092	0.095	0.092	0.0990	0.0930	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.19	0.19	0.21	0.2	0.180	0.160	0.17	0.12	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.044	0.045	0.046	0.043	0.045	0.042	0.044	0.042	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.008	<0.001	0.001	0.007	0.011	0.006	0.002	0.100	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0015CH	BY0015CH	BY0015CH	BY0015CH	BY0015CH	BY0015CH	BY0015CH	BY0015CH	BY0015CH (D29)	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Oct 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013	Jun 2013			Fresh	Marine	Irrigation Waters
	21/10/2012	5/12/2012	14/01/2013	18/02/2013	19/03/2013	16/04/2013	12/05/2013	18/06/2013	18/06/2013					
pH	8.2	7.6	7.4	7.2	7.7	7.8	7.8	7.3	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1200	1200	1200	1200	1100	1200	1100	1200	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	3.2	4.3	3.7	4.5	3.7	3.3	4.9	3.9	3.4	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	450	430	430	430	450	420	420	430	430	1/5	NC	NC	NC	NC
Total Alkalinity	450	430	430	430	450	420	420	430	430	1/5				
Anions														
Chloride (Cl)	120	120	110	120	120	110	130	120	120	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.1	1.0	1.1	1.3	1.2	1.0	1.1	1	1.1	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	0.01	0.009	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	32	31	33	33	34	31	38	36	36	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	47	44	43	42	38	42	40	39	40	0.5	NC	NC	NC	NC
Potassium	12	12	12	12	12	13	12	13	13	0.5	NC	NC	NC	NC
Sodium	200	200	210	190	190	180	190	200	200	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	28	24	25	25	22	25	24	23	24	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.002	0.005	0.009	0.008	0.014	<0.0005	0.001	<0.0005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.098	0.090	0.092	0.091	0.092	0.095	0.093	0.094	0.1	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0003	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.260	0.320	0.240	0.280	0.270	0.280	0.300	0.29	0.29	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.044	0.045	0.042	0.042	0.046	0.047	0.047	0.047	0.046	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	0.001	0.007	0.003	0.006	0.007	<0.001	0.001	<0.001	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0015CH	BY0015CH	BY0015CH	BY0015CH	BY0015CH	BY0015CH	BY0015CH	BY0015CH	BY0015CH	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jul 2013	Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014			Fresh	Marine	Irrigation Waters
	22/07/2013	19/08/2013	19/09/2013	16/10/2013	19/11/2013	16/12/2013	14/01/2014	17/02/2014	18/03/2014					
pH	7.5	7.3	7.6	7.6 (field)	7.4	7.3	7.3	7.4	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1100	1200	1200	1070 (field)	1200	1200	1200	1200	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4.3	3.8	3.9	1 (field)	4	4.1	4.6	4.3	4.5	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	430	420	420	420	430	430	440	420	430	1/5	NC	NC	NC	NC
Total Alkalinity	430	420	420	420	430	430	440	420	430	1/5				
Anions														
Chloride (Cl)	120	110	120	110	120	140	120	110	110	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1	0.95	0.97	1.1	1.1	1.2	0.95	1.1	0.98	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	34	32	39	35	39	81	32	34	34	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	39	41	42	42	43	42	45	45	47	0.5	NC	NC	NC	NC
Potassium	11	10	13	13	14	13	13	14	14	0.5	NC	NC	NC	NC
Sodium	190	160	190	230	200	210	210	210	240	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	23	24	25	26	27	25	27	26	27	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.005	0.005	0.014	0.003	0.008	0.007	0.003	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.095	0.092	0.095	0.1	0.12	0.094	0.1	0.1	0.10	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.270	0.3	0.3	0.34	0.37	0.34	0.28	0.28	0.27	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.042	0.045	0.045	0.051	0.06	0.05	0.047	0.044	0.05	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.005	0.007	0.005	0.005	0.007	0.003	<0.001	0.001	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0015CH	BY0015CH	BY0015CH	BY0015	BY0015	BY0015	BY0015	BY0015	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Apr 2014	May 2014	June 2014	July 2014	Aug 2014	Dec 2014	Jan 2015	Feb 2015			Fresh	Marine	Irrigation Waters
	13/04/2014	19/05/2014	17/06/2014	21/07/2014	21/08/2014	2/12/2014	12/01/2015	9/02/2015					
pH	7.8	7.3	7.4	7.3	7.6	7.4	7.5	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1200	1200	1100	1100	1200	1100	1100	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	3.5	3.8	2.9	3.4	11	3.9	4	3.6	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	440	410	420	430	420	420	420	420	1/5	NC	NC	NC	NC
Total Alkalinity	440	410	420	430	420	420	420	420	1/5				
Anions													
Chloride (Cl)	110	110	110	110	110	120	130	140	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.1	1.0	1	1.1	1.1	1.1	1	0.91	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.09	<0.005	<0.005	0.04	<0.005	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	33	33	35	34	36	37	32	48	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	46	48	44	46	46	47	42	39	0.5	NC	NC	NC	NC
Potassium	13	13	13	13	13	12	14	14	0.5	NC	NC	NC	NC
Sodium	230	200	230	210	240	210	220	250	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	25	27	27	27	27	27	26	25	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.002	<0.005	<0.0005	0.002	0.001	<0.0005	0.002	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.099	0.1	0.094	0.098	0.11	0.1	0.1	0.100	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.25	0.28	0.27	0.24	0.21	0.27	0.27	0.280	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.043	0.049	0.046	0.045	0.046	0.048	0.046	0.046	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	<0.001	0.001	0.003	<0.001	0.001	0.002	0.002	0.001	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0015	BY0015	BY0015	BY0015	BY0015	BY0015	BY0015	BY0015	BY0015	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	March 2015	April 2015	June 2015	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015	Dec 2015			Fresh	Marine	Irrigation Waters
	10/03/2015	14/04/2015	22/06/2015	14/07/2015	10/08/2015	8/09/2015	12/10/2015	9/11/2015	7/12/2015					
pH	7.4	7.8	7.4	7.5	7.5	7.3	7.4	7.7	7.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1200	990	1200	1100	1200	1200	1100	1100	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	3.2	3.6	2.6	3.4	4.8	3.9	2	2.1	1.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	420	430	430	400	420	420	420	420	430	1/5	NC	NC	NC	NC
Total Alkalinity	420	430	430	400	420	420	420	420	430	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	130	110	110	120	130	120	120	130	130	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.1	1.2	1	1	1.3	1	1.2	0.99	1	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	0.009	0.01	<0.005	0.007	<0.005	<0.005	0.02	0.006	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	38	38	34	37	39	36	36	37	41	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	43	41	44	42	40	42	39	43	46	0.5	NC	NC	NC	NC
Potassium	13	12	13	13	12	13	11	13	13	0.5	NC	NC	NC	NC
Sodium	210	210	210	200	230	210	180	220	230	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	26	25	27	25	24	25	23	26	26	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.001	0.002	0.004	0.003	0.003	0.002	0.001	0.002	0.001	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.098	0.098	0.1	0.099	0.097	0.097	0.096	0.093	0.098	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.28	0.19	0.25	0.23	0.23	0.27	0.19	0.21	0.200	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.048	0.045	0.046	0.045	0.048	0.048	0.044	0.042	0.044	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	0.003	0.003	0.003	0.006	0.002	0.001	0.003	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0015	BY0015	BY0015	D96 (BY0015)	BY0015	BY0015	BY0015	BY0015	BY0015	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2016	Feb 2016	Mar 2016	Mar 2016	Apr 2016	May 2016	June 2016	July 2016	Aug 2016			Fresh	Marine	Irrigation Waters
	12/01/2016	8/02/2016	15/03/2016	15/03/2016	5/04/2016	10/05/2016	7/06/2016	12/07/2016	15/08/2016					
pH	7.5	7.7	7.3	7.4	7.9	7.0	7.3	7.4	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1200	1200	1000	1000	1100	1100	1100	1100	1200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	4.1	1.5	0.3	0.6	3.3	2.8	2.5	2.7	3	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	430	430	430	430	430	430	430	420	410	1/5	NC	NC	NC	NC
Total Alkalinity	430	430	430	430	430	430	430	420	410	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	120	120	120	110	110	72	110	120	110	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.0	0.99	1	0.92	1.1	0.96	1.1	1	1	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	0.01	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	35	37	35	34	37	47	33	43	35	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	45	43	40	40	42	42	44	49	45	0.5	NC	NC	NC	NC
Potassium	14	13	12	12	13	12	13	14	12	0.5	NC	NC	NC	NC
Sodium	220	230	210	210	230	220	240	240	230	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	28	25	24	25	25	25	27	29	27	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	0.005	0.002	0.001	0.001	0.002	0.002	0.0008	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.095	0.1	0.096	0.095	0.098	0.1	0.097	0.091	0.095	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.007	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.27	0.25	0.23	0.23	0.22	0.25	0.23	0.23	0.2	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.064	0.046	0.045	0.045	0.043	0.047	0.046	0.045	0.044	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.005	0.007	0.005	<0.001	<0.001	0.002	0.002	0.001	0.001	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0015	BY0015	D113 (BY0015)	BY0015	BY0015	BY0015	BY0015	BY0015	BY0015	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2016	Oct 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017			Fresh	Marine	Irrigation Waters
	13/09/2016	11/10/2016	11/10/2016	14/11/2016	12/12/2016	19/01/2017	20/02/2017	20/03/2017	3/04/2017					
pH	7.3	7.6	7.6	7.4	7.4	7.7	8.2	7.6	7.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1000	1100	1100	1200	1100	1200	1100	1100	1100	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	3.3	2.5	2.7	1.8	3.1	2.3	2	2.5	2.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	420	440	440	410	430	470	480	450	450	1/5	NC	NC	NC	NC
Total Alkalinity	420	440	440	410	430	470	480	450	450	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	110	110	110	110	120	130	140	100	120	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.99	1.1	1.1	1.1	1	1	0.82	1	1	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	32	31	31	35	42	39	46	33	36	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	44	44	43	44	43	43	43	39	43	0.5	NC	NC	NC	NC
Potassium	13	14	13	13	12	13	13	14	13	0.5	NC	NC	NC	NC
Sodium	190	230	210	220	210	210	220	200	230	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	27	27	27	27	26	27	26	24	26	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.001	0.006	0.007	<0.0005	0.003	0.003	<0.0005	0.001	0.0008	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.1	0.11	0.12	0.083	0.093	0.1	0.097	0.09	0.09	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.24	0.22	0.23	<0.01	0.23	0.24	0.23	0.2	0.23	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.045	0.041	0.042	0.042	0.049	0.05	0.046	0.041	0.042	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.001	0.002	0.006	<0.001	0.004	0.006	<0.001	0.001	0.001	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0015	BY0015	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
					Slightly to Moderately Disturbed Systems		
Date Sampled	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	22/05/2017	19/06/2017					
pH	7.3	7.4	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	1100	990	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	3.3	1.9	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity							
Hydroxide (OH^-)	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	440	430	1/5	NC	NC	NC	NC
Total Alkalinity	440	430	1/5	NC	NC	NC	NC
Anions							
Chloride (Cl)	100	110	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.0	1	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	35	38	1	500	NC	NC	NC
Cations - Dissolved							
Calcium	49	44	0.5	NC	NC	NC	NC
Potassium	13	14	0.5	NC	NC	NC	NC
Sodium	230	220	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	30	28	0.5	NC	NC	NC	NC
Metals - Dissolved							
Aluminium	0.009	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	0.093	0.089	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.22	0.22	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.07	0.058	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.009	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total							
Aluminium	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0016CH	BY0016CH	BY0016CH	BY0016CH	BY0016CH	BY0016CH	BY0016CH	BY0016CH	BY0016CH	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Dec 2012	Jan 2013			Fresh	Marine	Irrigation Waters
	23/2/2012	30/5/2012	28/06/2012	23/07/2012	19/08/2012	17/09/2012	21/10/2012	3/12/2012	14/01/2013					
pH	7.1	8.8	7.3	7.1	7.2	7.0	8.3	7.2	7.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2900	2700	3900	3000	3400	3100	2900	2800	2700	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	0.6	540	0.9	55	47	37	37	19	170	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<1	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<1	110	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	970	900	890	1100	1000	1000	1100	1000	1000	1/5	NC	NC	NC	NC
Total Alkalinity	420	1000	890	1100	1000	1000	1100	1000	1000	1/5				
Anions														
Chloride (Cl)	350	340	630	420	470	380	330	300	280	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.9	1.9	1.9	2.0	2.1	2.0	2.1	1.8	1.9	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	<0.005	1.8	0.5	0.007	0.008	0.009	0.07	0.06	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	59	47	130	78	91	67	50	38	35	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	49	40	71	47	54	49	47	48	36	0.5	NC	NC	NC	NC
Potassium	21	19	26	22	24	21	19	20	16	0.5	NC	NC	NC	NC
Sodium	620	590	740	740	640	740	620	690	670	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	43	32	88	37	51	40	35	35	28	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.018	0.008	<0.01	0.014	0.0090	0.0040	0.006	0.002	0.007	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.025	0.002	0.008	0.029	0.0290	0.0420	<0.001	0.034	0.029	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.31	0.31	<0.001	0.340	0.4400	0.3500	0.290	0.280	0.390	0.001	2	NC	NC	NC
Beryllium	0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	0.0001	0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	0.005	0.003	0.007	0.002	0.002	<0.001	0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	0.002	0.008	0.002	0.001	0.002	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.78	0.32	<0.01	0.190	0.04	0.26	0.220	0.430	0.083	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.058	0.054	0.043	0.063	0.075	0.057	0.049	0.038	0.043	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.013	0.041	0.093	0.0490	0.010	0.014	0.006	0.009	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.011	0.026	0.015	0.084	0.035	0.088	0.050	0.020	0.017	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0016CH	BY0016CH	BY0016CH (D22)	BY0016CH	BY0016CH (D23)	BY0016CH	BY0016CH	BY0016CH	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2013	Mar 2013	Mar 2013	Apr 2013	Apr 2013	May 2013	June 2013	Jul 2013			Fresh	Marine	Irrigation Waters
	19/02/2013	18/03/2013	18/03/2013	15/04/2013	15/04/2013	12/05/2013	18/06/2013	22/07/2013					
pH	7.2	7.5	7.5	7.7	7.8	7.8	7.2	7.4	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2500	2500	2600	2500	2500	2400	2500	2400	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	1.6	13	13	28	29	4	190	54	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	1100	1100	1100	1000	1100	1100	1100	1100	1/5	NC	NC	NC	NC
Total Alkalinity	1100	1100	1100	1000	1100	1100	1100	1100	1/5				
Anions													
Chloride (Cl)	230	250	250	220	250	240	230	220	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.2	1.9	2.1	2.1	2.1	2.1	2	1.9	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.007	0.007	<0.005	0.52	0.05	<0.005	0.02	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	22	26	26	21	21	18	19	16	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	35	32	35	35	34	31	32	30	0.5	NC	NC	NC	NC
Potassium	18	18	19	19	19	17	18	15	0.5	NC	NC	NC	NC
Sodium	570	560	630	550	520	560	600	540	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	24	23	25	25	24	20	23	20	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.006	0.003	0.004	0.012	0.013	0.003	0.002	0.003	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.037	0.036	0.038	0.036	0.036	0.038	0.083	0.034	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.290	0.300	0.320	0.290	0.290	0.300	0.39	0.350	0.001	2	NC	NC	NC
Beryllium	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	0.0003	<0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	0.002	0.001	0.007	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.170	0.51	0.54	0.31	0.300	0.032	0.87	0.610	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.029	0.037	0.041	0.035	0.036	0.031	0.041	0.03	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.003	0.004	0.008	0.008	0.007	0.011	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.017	0.007	0.019	0.050	0.042	0.039	0.024	0.031	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0016CH	BY0016CH (D33)	BY0016CH	BY0016CH	BY0016CH	BY0016CH	BY0016CH	BY0016CH	BY0016CH	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Aug 2013	Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014			Fresh	Marine	Irrigation Waters
	19/08/2013	19/08/2013	17/09/2013	15/10/2013	11/11/2013	16/12/2013	13/01/2014	19/02/2014	17/03/2014					
pH	7.3	7.4	8.4	7	7.8	7.2	7.2	7.3	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2400	2400	2500	2500	2400	2400	2500	2600	2400	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	3.8	5.2	5	5.7	7.8	4.9	3.9	6.4	5.8	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	32	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	1100	1100	1000	1100	1100	1100	1100	1100	1100	1/5	NC	NC	NC	NC
Total Alkalinity	1100	1100	1100	1100	1100	1100	1100	1100	1100	1/5				
Anions														
Chloride (Cl)	200	200	240	230	220	200	200	180	180	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.8	0.98	2	1.9	2.1	2	2.0	2.2	1.9	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	<0.005	0.008	<0.005	<0.005	<0.005	0.07	0.02	0.03	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	21	15	17	15	14	10	10	8	7	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	30	31	31	33	31	27	31	30	34	0.5	NC	NC	NC	NC
Potassium	15	15	17	18	16	17	19	16	19	0.5	NC	NC	NC	NC
Sodium	490	500	570	630	600	610	630	560	720	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	21	21	20	23	20	17	21	18	21	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.009	0.007	0.006	0.007	0.012	0.008	0.006	0.01	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.032	0.034	0.038	0.036	0.037	0.031	0.031	0.028	0.026	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.31	0.33	0.32	0.33	0.33	0.33	0.34	0.34	0.34	0.001	2	NC	NC	NC
Beryllium	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	<0.001	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.55	0.59	0.48	0.44	0.49	0.23	0.4	0.43	0.51	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.031	0.033	0.031	0.028	0.033	0.028	0.027	0.031	0.032	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.005	0.005	0.007	0.004	0.003	0.002	<0.001	<0.001	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.034	0.028	0.029	0.031	0.028	0.048	0.010	0.010	0.010	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0016CH	BY0016CH	BY0016CH	BY0016	BY0016	BY0016	BY0016	BY0016	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Apr 2014	May 2014	June 2014	July 2014	August 2014	Dec 2014	Jan 2015	Feb 2015			Fresh	Marine	Irrigation Waters
	13/04/2014	19/05/2014	16/06/2014	21/07/2014	18/08/2014	1/12/2014	12/01/2015	9/02/2015					
pH	7.0	7.1	6.2	7.1	7.2	7.3	7.3	7.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2400	2400	2400	2300	2300	2300	2200	2200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	11	16	1.6	8.3	7.1	59	38	15	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	1100	1100	1100	1100	1100	1100	1100	1100	1/5	NC	NC	NC	NC
Total Alkalinity	1100	1100	1100	1100	1100	1100	1100	1100	1/5				
Anions													
Chloride (Cl)	170	180	170	170	170	180	190	190	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.1	2.0	2	2	2.1	2.2	2.1	2.2	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.01	0.008	0.009	0.005	0.007	0.02	0.06	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	6	5	4	4	4	2	1	2	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	32	33	32	31	29	30	30	29	0.5	NC	NC	NC	NC
Potassium	18	17	17	18	18	15	19	18	0.5	NC	NC	NC	NC
Sodium	680	600	630	630	660	640	660	710	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	21	20	20	19	19	19	20	19	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.005	<0.005	0.031	0.003	0.007	0.007	0.005	0.010	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.024	0.020	0.02	0.014	0.013	0.006	0.005	0.004	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.35	0.37	0.37	0.37	0.38	0.37	0.4	0.390	0.001	2	NC	NC	NC
Beryllium	0.0001	0.0001	0.0003	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.5	0.53	0.58	0.47	0.49	0.36	0.43	0.470	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.027	0.027	0.039	0.025	0.027	0.031	0.031	0.022	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.003	0.008	0.007	0.01	0.058	0.007	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.027	0.005	0.082	0.002	0.006	0.065	0.004	0.003	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0016	D67 (BY0016)	BY0016	BY0016	BY0016	BY0016	BY0016	BY0016	BY0016	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	March 2015	March 2015	April 2015	May 2015	June 2015	July 2015	August 2015	Sept 2015	Oct 2015			Fresh	Marine	Irrigation Waters
	9/03/2015	9/03/2015	13/04/2015	18/05/2015	15/06/2015	14/07/2015	10/08/2015	7/09/2015	12/10/2015					
pH	6.9	7.1	7.7	7.9	7.2	7.4	6.9	6.3	7.2	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2400	2400	2200	2100	2300	2200	2200	2400	2000	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	5	6.6	7	810	3.7	65	12	33	8.3	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	1100	1100	1100	1100	1100	1000	1100	1100	1100	1/5	NC	NC	NC	NC
Total Alkalinity	1100	1100	1100	1100	1100	1000	1100	1100	1100	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	190	190	180	160	190	180	200	180	190	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.2	2.3	2.1	2.2	2.2	2.1	2	2.2	2.1	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.01	0.01	0.02	0.009	<0.005	0.01	<0.005	0.01	<0.005	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	2	2	1	3	2	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	31	28	28	31	29	29	28	29	26	0.5	NC	NC	NC	NC
Potassium	18	18	16	18	18	19	16	16	14	0.5	NC	NC	NC	NC
Sodium	620	600	610	640	640	600	640	560	550	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	19	17	17	19	19	18	18	18	17	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.006	0.006	0.003	0.021	0.004	0.004	0.008	0.011	0.007	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.4	0.39	0.37	0.41	0.38	0.41	0.39	0.37	0.41	0.001	2	NC	NC	NC
Beryllium	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002	0.0002	0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.36	0.38	0.34	0.85	0.48	0.36	0.35	0.46	0.4	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.025	0.023	0.021	0.028	0.026	0.025	0.027	0.029	0.025	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.001	0.003	0.001	0.001	<0.001	0.007	0.005	<0.001	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.003	0.002	0.004	0.005	0.004	0.005	0.011	0.094	0.008	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	0.1	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0016	BY0016	BY0016	BY0016	BY0016	BY0016	BY0016	BY0016	BY0016	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	June 2016	July 2016			Fresh	Marine	Irrigation Waters
	9/11/2015	7/12/2015	12/01/2016	9/02/2016	15/03/2016	4/04/2016	10/05/2016	7/06/2016	12/07/2016					
pH	6.8	6.5	7.3	7.7	7.0	7.4	7.3	6.8	6.5	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2200	2200	2400	2400	2100	2200	2200	2100	2200	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	11	11	10	4.8	5.6	2.9	3.1	2.3	1.7	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	1100	1100	1100	1100	1100	1100	1100	1100	1100	1/5	NC	NC	NC	NC
Total Alkalinity	1100	1100	1100	1100	1100	1100	1100	1100	1100	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	190	220	190	180	190	160	190	180	190	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.1	2	2.0	2	2	2.1	1.9	1.9	1.9	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.03	0.007	0.006	0.01	<0.005	<0.005	<0.005	0.005	0.01	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	29	32	30	28	27	30	29	31	33	0.5	NC	NC	NC	NC
Potassium	16	17	20	17	15	18	16	17	18	0.5	NC	NC	NC	NC
Sodium	600	660	680	630	590	670	630	670	680	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	19	19	19	18	17	19	19	19	20	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.009	0.012	0.003	0.006	0.004	0.005	0.003	0.007	0.006	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.004	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.004	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.42	0.430	0.42	0.39	0.41	0.37	0.38	0.38	0.34	0.001	2	NC	NC	NC
Beryllium	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	0.002	0.002	0.006	<0.001	<0.001	<0.001	0.001	0.005	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.43	0.420	0.41	0.45	0.4	0.4	0.42	0.39	0.37	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.026	0.025	0.023	0.024	0.025	0.023	0.024	0.027	0.024	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.001	0.002	0.002	0.002	0.003	<0.001	<0.001	0.017	0.007	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.027	0.040	0.007	0.010	0.025	0.005	0.003	0.027	0.083	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0016	BY0016	BY0016	BY0016	BY0016	BY0016	BY0016	BY0016	BY0016	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Aug 2016	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017			Fresh	Marine	Irrigation Waters
	15/08/2016	15/09/2016	10/10/2016	14/11/2016	12/12/2016	16/01/2017	20/02/2017	21/03/2017	3/04/2017					
pH	7.2	7.1	6.5	6.3	7.1	6.5	7.9	6.4	7.6	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	<6 [6][18]
Electrical Conductivity (µS/cm)	2200	2000	2300	2300	2300	2300	2200	2100	2300	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	13	1.9	3.6	7.8	19	3.7	1.3	7.4	3.4	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	1100	1100	1100	1100	1100	1200	1200	1200	1200	1/5	NC	NC	NC	NC
Total Alkalinity	1100	1100	1100	1100	1100	1200	1200	1200	1200	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	160	170	170	170	180	180	210	150	180	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	1.9	1.9	2.2	2	2	1.6	2	2	1.9	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.006	0.2	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	0.006	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	30	34	33	33	31	30	30	26	30	0.5	NC	NC	NC	NC
Potassium	17	18	18	17	16	17	18	18	17	0.5	NC	NC	NC	NC
Sodium	650	700	630	600	620	610	630	610	680	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	19	22	20	21	20	19	20	17	18	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.004	0.011	0.042	0.035	0.004	0.017	0.004	0.006	0.004	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.003	0.003	0.003	0.007	0.003	0.003	0.003	0.003	0.003	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.38	0.37	0.31	0.32	0.37	0.410	0.38	0.35	0.41	0.001	2	NC	NC	NC
Beryllium	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.44	0.52	0.74	0.58	0.47	0.590	0.54	0.4	0.48	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.025	0.026	0.025	0.028	0.029	0.031	0.028	0.024	0.025	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	<0.001	<0.001	<0.001	0.017	0.003	0.017	0.005	0.023	0.004	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.01	0.012	0.040	0.023	0.005	0.038	0.007	0.016	0.009	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	BY0016	BY0016	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
					Slightly to Moderately Disturbed Systems		
Date Sampled	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	22/05/2017	19/06/2017					
pH	7.4	7.2	0.1 pH unit	6.5-8.5 (8)	6.5-8.0 (1)	7.0-8.5 (2)	<6 (6)(18)
Electrical Conductivity (µS/cm)	2000	2300	1	NC	NC	NC	1000 - 7500 (3)
Turbidity (NTU)	5.5	6.8	0.1	5 (8)	1-50	0.5-10	NC
Alkalinity							
Hydroxide (OH^-)	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	1100	1100	1/5	NC	NC	NC	NC
Total Alkalinity	1100	1100	1/5	NC	NC	NC	NC
Anions							
Chloride (Cl)	180	170	1	250 (8)	NC	NC	Species Dependent
Ammonia (NH_3) as N	2.1	2.3	0.005	0.5 (8)/0.41(12)	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.005	0.006	0.005	3(13)	0.04 (1)	0.015 (2)	NC
Sulphate (SO_4^{2-})	2	<1	1	500	NC	NC	NC
Cations - Dissolved							
Calcium	32	29	0.5	NC	NC	NC	NC
Potassium	18	18	0.5	NC	NC	NC	NC
Sodium	670	650	0.5	180 (8)	NC	NC	Species Dependent
Magnesium	20	19	0.5	NC	NC	NC	NC
Metals - Dissolved							
Aluminium	0.004	0.002	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	0.003	0.003	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	0.37	0.38	0.001	2	NC	NC	NC
Beryllium	0.0002	0.0001	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	<0.001	<0.001	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	<0.001	<0.001	0.001	NC	NC	0.001	0.05 (4)
Copper	<0.001	<0.001	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	0.47	0.45	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	0.025	0.027	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	<0.00005	<0.00005	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	0.038	0.004	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	<0.001	<0.001	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	<0.001	<0.001	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	0.008	0.009	0.001	3 (8)	0.008	0.015	2 (4)
Metals - Total							
Aluminium	NT	NT	0.0005	0.2(8)	0.0008(15)(L)/0.055(14)(L)	0.0005(16)(L)	NC
Arsenic	NT	NT	0.001	0.01	0.013 (9)	0.0023 (L) (17)	0.1 (4)
Barium	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	0.0001	0.06	0.00013 (16)	NC	0.1 (4)
Cadmium	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 (4)
Chromium	NT	NT	0.001	0.05 (7)	0.001 (7)	0.0044 (7)	0.1 (4)
Cobalt	NT	NT	0.001	NC	NC	0.001	0.05 (4)
Copper	NT	NT	0.001	2	0.0014	0.0013	0.2 (4)
Iron (Fe^{2+})	NT	NT	0.01	0.3 (8)	NC	NC	0.2 (4)
Lead	NT	NT	0.001	0.01	0.0034	0.0044	2 (4)
Manganese	NT	NT	0.005	0.5	1.9	0.08 (L)	0.2 (4)
Mercury	NT	NT	0.00005	0.001	0.00006 (10)	0.0001 (10)	0.002 (4)
Nickel	NT	NT	0.001	0.02	0.011	0.007	0.2 (4)
Selenium	NT	NT	0.001	0.01	0.005	0.003 (L)	0.02 (4)
Vanadium	NT	NT	0.001	NC	0.006 (L)	0.1	0.1 (4)
Zinc	NT	NT	0.001	3 (8)	0.008	0.015	2 (4)
Total Phosphorus	<0.05	<0.05	0.05	NC	0.05 (1)	0.03 (2)	0.05 (5)

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014	June 2014	July 2014	Aug 2014			Fresh	Marine	Irrigation Waters
	15/01/2014	19/02/2014	19/03/2014	15/04/2014	21/05/2014	18/06/2014	23/07/2014	20/08/2014					
pH	6.9	6.5	6.4	6.6	5.0	5.4	5.0	5.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	290	280	230	240	200	190	210	250	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	26000	100	21	31	130	1300	90	45000	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	100	80	70	79	34	41	51	57	1/5	NC	NC	NC	NC
Total Alkalinity	100	80	70	79	34	41	51	57	1/5				
Anions													
Chloride (Cl)	39	32	31	29	23	25	27	27	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	<0.005	<0.005	0.005	<0.005	0.011	0.021	0.022	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.08	0.02	<0.005	0.05	1.2	0.85	0.81	0.4	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	13	6	9	8	8	9	11	10	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	12	7.7	7.2	7.9	4.3	3.5	7.2	5.4	0.5	NC	NC	NC	NC
Potassium	5.1	4.4	4.7	4.6	5.1	5.7	6.1	6.3	0.5	NC	NC	NC	NC
Sodium	38	35	39	38	17	22	25	30	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	10	8.5	9	8.7	5.4	6.4	8.8	9.1	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.005	0.013	0.006	0.009	0.004	0.010	0.005	0.012	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	0.039	0.053	0.05	0.049	0.057	0.049	0.087	0.095	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.005	0.009	0.008	0.008	<0.001	<0.001	0.002	0.014	0.001	NC	NC	0.001	0.05 [4]
Copper	0.001	<0.001	<0.001	<0.001	0.005	0.006	0.12	0.25	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.011	2.7	1.6	0.73	0.015	0.019	0.026	0.45	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.38	0.67	0.65	0.56	0.008	0.02	0.12	0.51	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.004	0.007	0.006	0.006	0.009	0.010	0.032	0.033	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.020	0.012	0.013	0.012	0.063	0.037	0.2	0.14	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 (L) [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.30	<0.05	<0.05	<0.05	<0.05	0.09	0.2	0.3	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2015	April 2015	May 2015	June 2015	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015			Fresh	Marine	Irrigation Waters
	11/02/2015	15/04/2015	21/05/2015	24/06/2015	15/07/2015	11/08/2015	09/09/2015	14/10/2015	11/11/2015					
pH	NT	6.0	NT	6.0	6.0	6.2	6.0	6.2	5.7	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	NT	230	NT	220	210	220	220	220	260	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	NT	5200	NT	1500	3700	4900	1200	900	3500	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	NT	<5	NT	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	NT	<5	NT	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	NT	43	NT	41	39	41	43	45	54	1/5	NC	NC	NC	NC
Total Alkalinity	NT	43	NT	41	39	41	43	45	54	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	NT	33	NT	30	33	31	34	35	38	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	NT	<0.005	<0.025	0.005	0.016	0.006	<0.005	0.005	0.007	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	NT	0.07	0.02	0.93	0.93	0.82	0.75	0.61	0.3	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	NT	9	NT	11	12	11	14	15	15	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	NT	3.6	NT	4.1	4.1	3.3	3.5	3.4	4.7	0.5	NC	NC	NC	NC
Potassium	NT	3.5	NT	6.1	6.5	6	6.5	6	6.3	0.5	NC	NC	NC	NC
Sodium	NT	36	NT	26	26	29	32	31	37	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	NT	5.8	NT	7	6.5	6.4	6.9	6.9	8.1	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.008	0.024	NT	0.006	0.004	0.058	0.002	0.008	0.005	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	NT	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.073	0.03	NT	0.043	0.042	0.048	0.054	0.054	0.066	0.001	2	NC	NC	NC
Beryllium	0.0002	<0.0001	NT	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	NT	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	NT	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.019	0.009	NT	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.001	NC	NC	0.001	0.05 [4]
Copper	0.72	0.017	NT	0.003	0.001	0.042	0.002	0.008	0.67	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	1.4	1.8	NT	0.012	<0.01	0.011	0.026	0.055	0.37	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	NT	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.68	0.4	NT	0.007	<0.005	0.01	0.007	0.015	0.15	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	NT	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.034	0.01	NT	0.002	0.002	0.003	0.003	0.003	0.006	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	NT	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	NT	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.25	0.027	NT	0.019	0.02	0.042	0.012	0.019	0.060	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	1.1	NT	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	0.062	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	0.0003	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	<0.0001	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	0.012	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	0.008	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	0.38	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	4.1	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	0.003	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	0.34	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	<0.00005	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	0.015	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	<0.001	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	0.005	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	0.041	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	NT	0.2	NT	0.06	0.09	0.07	0.1	<0.05	0.08	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	June 2016	July 2016	Aug 2016			Fresh	Marine	Irrigation Waters
	9/12/2015	13/01/2016	11/02/2016	16/03/2016	6/04/2016	10/05/2016	8/06/2016	12/07/2016	16/08/2016					
pH	6.7	6.1	6.3	6.2	6.2	5.7	6.1	5.4	6.1	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	300	210	170	170	150	150	160	170	170	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	1800	1100	21	190	490	700	710	360	460	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	76	40	46	42	39	39	40	39	35	1/5	NC	NC	NC	NC
Total Alkalinity	76	40	46	42	39	39	40	39	35	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	40	25	22	23	20	22	21	23	21	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.032	<0.005	<0.005	<0.005	<0.005	0.011	<0.005	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.4	2.5	2.1	0.5	0.4	0.3	0.3	0.3	0.2	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	16	17	10	12	9	10	9	12	9	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	6.5	4	3.8	2.9	2.9	2.7	2.9	3.4	3.2	0.5	NC	NC	NC	NC
Potassium	6.6	6.6	5.7	5.9	5.3	4.7	5.7	5.8	5.3	0.5	NC	NC	NC	NC
Sodium	43	28	26	21	22	17	23	21	19	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	8.6	6.5	5.9	5.7	5.6	5.3	5.7	6.3	6.1	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.003	0.006	0.008	0.006	0.002	0.087	0.003	0.006	0.002	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.061	0.04	0.037	0.039	0.04	0.039	0.039	0.034	0.043	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.410	0.003	0.036	0.013	0.005	0.017	0.004	0.012	0.022	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.015	<0.01	<0.01	<0.01	<0.01	0.029	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.130	0.017	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.007	0.003	0.004	0.002	0.002	0.003	0.002	0.003	0.002	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.036	0.019	0.1	0.023	0.014	0.038	0.015	0.036	0.014	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.3	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	B3-S	D124 (B3-S)	B3-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
												Slightly to Moderately Disturbed Systems		
Date Sampled	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Mar 2017	Apr 2017			Fresh	Marine	Irrigation Waters
	13/09/2016	12/10/2016	16/11/2016	14/12/2016	18/01/2017	22/02/2017	22/03/2017	22/03/2017	5/04/2017					
pH	6.0	5.9	6.1	6.3	6.4	6.4	6.3	6.3	6.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	160	170	150	150	160	160	160	170	170	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	31	310	110	75	73	110	320	290	520	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity														
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	34	43	33	33	34	38	34	34	32	1/5	NC	NC	NC	NC
Total Alkalinity	34	43	33	33	34	38	34	34	32	1/5	NC	NC	NC	NC
Anions														
Chloride (Cl)	24	25	19	22	22	23	25	25	24	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	<0.005	0.01	<0.005	<0.005	0.006	0.023	0.01	<0.005	<0.005	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.2	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	8	13	7	9	8	8	8	9	8	1	500	NC	NC	NC
Cations - Dissolved														
Calcium	3.1	3.1	2.6	2.6	2.6	2.7	2.7	2.8	2.6	0.5	NC	NC	NC	NC
Potassium	5.9	6.1	4.6	5.2	5.2	5.1	5.5	5.4	5.6	0.5	NC	NC	NC	NC
Sodium	18	23	16	17	16	16	17	17	17	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	6.1	6.1	4.9	5.1	5	5.1	5.4	5.3	5.1	0.5	NC	NC	NC	NC
Metals - Dissolved														
Aluminium	0.002	0.005	0.006	0.004	0.005	0.003	0.004	0.005	0.005	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.037	0.044	0.034	0.034	0.039	0.032	0.034	0.035	0.035	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.009	0.017	0.039	0.009	0.010	0.006	0.01	0.01	0.002	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.002	0.002	0.010	0.003	0.002	0.003	0.006	0.005	0.006	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.017	0.026	0.009	0.005	0.006	0.005	0.007	0.007	0.007	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total														
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	B3-S	B3-S	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
					Slightly to Moderately Disturbed Systems		
Date Sampled	May 2017	Jun 2017			Fresh	Marine	Irrigation Waters
	24/05/2017	21/06/2017					
pH	5.6	5.3	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	170	190	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	630	980	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity							
Hydroxide (OH^-)	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	32	41	1/5	NC	NC	NC	NC
Total Alkalinity	32	41	1/5	NC	NC	NC	NC
Anions							
Chloride (Cl)	25	24	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.017	0.005	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.1	0.2	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	8	8	1	500	NC	NC	NC
Cations - Dissolved							
Calcium	3.1	3.3	0.5	NC	NC	NC	NC
Potassium	5.8	5.1	0.5	NC	NC	NC	NC
Sodium	18	16	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	5.7	5.9	0.5	NC	NC	NC	NC
Metals - Dissolved							
Aluminium	0.005	0.004	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	<0.001	<0.001	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	0.034	0.05	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	<0.001	<0.001	0.001	NC	NC	0.001	0.05 [4]
Copper	0.018	0.016	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.03	0.017	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.016	0.011	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.009	0.016	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	<0.001	<0.001	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.046	0.041	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total							
Aluminium	NT	NT	0.0005	0.2 [8]	0.0008 [15](L)/0.055 [14](L)	0.0005 [16](L)	NC
Arsenic	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L][17]	0.1 [4]
Barium	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	<0.05	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table 1 - Summary of Laboratory Testing Results - February 2012 to June 2014 (Surface Water and Groundwater) - mg/L

Sample Identification	B3-D	B3-D	B3-D	B3-D	B3-D	B3-D	B3-D	B3-D	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
											Slightly to Moderately Disturbed Systems		
Date Sampled	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014	June 2014	July 2014	Aug 2014			Fresh	Marine	Irrigation Waters
	15/01/2014	19/02/2014	19/03/2014	15/04/2014	21/05/2014	18/06/2014	23/07/2014	20/08/2014					
pH	8.0	5.7	5.9	6.9	6.1	6.1	5.8	5.9	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	880	970	840	840	680	610	730	970	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	80	53	25	22	10	31	29	24	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity													
Hydroxide (OH^-)	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	390	340	380	450	320	350	430	550	1/5	NC	NC	NC	NC
Total Alkalinity	390	340	380	450	320	350	430	550	1/5				
Anions													
Chloride (Cl)	92	69	58	48	43	48	42	35	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	5.3	4.7	2.9	2.2	2.4	1.4	1	1.4	0.005	0.5 [8]/0.41[12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.08	0.3	0.01	2	0.03	0.08	0.05	0.05	0.005	3[13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	70	47	18	120	1	2	2	3	1	500	NC	NC	NC
Cations - Dissolved													
Calcium	33	30	34	47	23	37	48	54	0.5	NC	NC	NC	NC
Potassium	9.3	6.2	5.3	6.2	7.7	7.7	7.7	4.7	0.5	NC	NC	NC	NC
Sodium	130	110	91	90	100	92	85	55	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	29	21	27	35	20	30	39	40	0.5	NC	NC	NC	NC
Metals - Dissolved													
Aluminium	0.034	0.055	1.0	0.22	0.066	0.083	0.2	0.19	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	0.005	0.003	0.002	0.003	0.001	0.001	0.002	0.002	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.15	0.14	0.21	0.34	0.2	0.27	0.41	0.42	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	<0.001	<0.001	0.002	0.003	0.003	0.003	0.006	0.004	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.006	0.005	0.007	0.018	0.010	0.009	0.014	0.016	0.001	NC	NC	0.001	0.05 [4]
Copper	0.005	0.003	0.015	0.001	0.005	<0.001	0.002	<0.001	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	0.31	0.89	5.7	19	7.6	16	33	42	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	<0.001	<0.001	0.005	<0.001	0.003	<0.001	0.003	<0.001	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	0.52	0.9	1.8	3.5	3.2	3.2	3.9	3.2	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.015	0.014	0.020	0.020	0.029	0.013	0.019	0.019	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.009	0.004	0.005	0.003	0.001	0.001	0.002	0.003	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.007	0.094	0.082	0.042	0.16	0.068	0.14	0.077	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total													
Aluminium	NT	NT	NT	NT	NT	NT	NT	NT	0.0005	0.2[8]	0.0008[15](L)/0.055[14](L)	0.0005[16](L)	NC
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.30	0.1	0.08	0.05	<0.05	<0.05	0.06	0.06	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Table C1 - Summary of Laboratory Testing Results - Feb 2012 to June 2017 (Surface Water and Groundwater) - mg/L

Sample Identification	B3-D	B3-D	B3-D	B3-D	B3-D	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values		
								Slightly to Moderately Disturbed Systems		
Date Sampled	Feb 2015	Mar 2015	April 2015	May 2015	June 2015			Fresh	Marine	Irrigation Waters
	11/02/2015	11/03/2015	15/04/2015	21/05/2015	24/06/2015					
pH	5.9	5.7	5.7	5.9	6.0	0.1 pH unit	6.5-8.5 [8]	6.5-8.0 [1]	7.0-8.5 [2]	< 6 [6][18]
Electrical Conductivity (µS/cm)	670	840	840	780	720	1	NC	NC	NC	1000 - 7500 [3]
Turbidity (NTU)	29	69	60	71	28	0.1	5 [8]	1-50	0.5-10	NC
Alkalinity										
Hydroxide (OH^-)	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Carbonate (CO_3^{2-})	<5	<5	<5	<5	<5	1/5	NC	NC	NC	NC
Bicarbonate (HCO_3^-)	420	560	570	530	450	1/5	NC	NC	NC	NC
Total Alkalinity	420	560	570	530	450	1/5	NC	NC	NC	NC
Anions										
Chloride (Cl)	37	33	30	26	29	1	250 [8]	NC	NC	Species Dependent
Ammonia (NH_3) as N	0.87	0.97	0.76	1	1.1	0.005	0.5 [8]/0.41 [12]	0.9	0.91	NC
NO_x (NO_2^- + NO_3^-)	0.2	0.2	0.1	0.1	0.06	0.005	3 [13]	0.04 [1]	0.015 [2]	NC
Sulphate (SO_4^{2-})	<1	2	<1	1	<1	1	500	NC	NC	NC
Cations - Dissolved										
Calcium	49	41	55	63	38	0.5	NC	NC	NC	NC
Potassium	7.2	8.5	7.6	6.5	7.8	0.5	NC	NC	NC	NC
Sodium	87	130	130	94	130	0.5	180 [8]	NC	NC	Species Dependent
Magnesium	41	36	48	47	33	0.5	NC	NC	NC	NC
Metals - Dissolved										
Aluminium	0.26	0.26	0.25	0.33	0.18	0.0005	0.2 [8]	0.0008 [15][L]/0.055 [14][L]	0.0005 [16][L]	NC
Arsenic	0.001	0.002	0.002	0.002	0.001	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	0.43	0.55	0.61	0.65	0.37	0.001	2	NC	NC	NC
Beryllium	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	0.011	0.012	0.012	0.002	0.011	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	0.019	0.038	0.034	0.033	0.018	0.001	NC	NC	0.001	0.05 [4]
Copper	0.002	0.005	0.008	0.003	0.004	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	53	50	46	59	41	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	0.001	0.004	0.012	0.002	0.005	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	9.8	9.8	12	10	7.1	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	<0.00005	0.00025	<0.00005	<0.00005	<0.00005	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	0.012	0.038	0.031	0.029	0.022	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	0.002	0.003	0.004	0.006	0.002	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	0.1	0.36	0.26	0.25	0.066	0.001	3 [8]	0.008	0.015	2 [4]
Metals - Total										
Aluminium	NT	NT	NT	NT	NT	0.0005	0.2 [8]	0.0008 [15][L]/0.055 [14][L]	0.0005 [16][L]	NC
Arsenic	NT	NT	NT	NT	NT	0.001	0.01	0.013 [9]	0.0023 [L] [17]	0.1 [4]
Barium	NT	NT	NT	NT	NT	0.001	2	NC	NC	NC
Beryllium	NT	NT	NT	NT	NT	0.0001	0.06	0.00013 [16]	NC	0.1 [4]
Cadmium	NT	NT	NT	NT	NT	0.0001	0.002	0.0002	0.0007	0.01 [4]
Chromium	NT	NT	NT	NT	NT	0.001	0.05 [7]	0.001 [7]	0.0044 [7]	0.1 [4]
Cobalt	NT	NT	NT	NT	NT	0.001	NC	NC	0.001	0.05 [4]
Copper	NT	NT	NT	NT	NT	0.001	2	0.0014	0.0013	0.2 [4]
Iron (Fe^{2+})	NT	NT	NT	NT	NT	0.01	0.3 [8]	NC	NC	0.2 [4]
Lead	NT	NT	NT	NT	NT	0.001	0.01	0.0034	0.0044	2 [4]
Manganese	NT	NT	NT	NT	NT	0.005	0.5	1.9	0.08 [L]	0.2 [4]
Mercury	NT	NT	NT	NT	NT	0.00005	0.001	0.00006 [10]	0.0001 [10]	0.002 [4]
Nickel	NT	NT	NT	NT	NT	0.001	0.02	0.011	0.007	0.2 [4]
Selenium	NT	NT	NT	NT	NT	0.001	0.01	0.005	0.003 [L]	0.02 [4]
Vanadium	NT	NT	NT	NT	NT	0.001	NC	0.006 [L]	0.1	0.1 [4]
Zinc	NT	NT	NT	NT	NT	0.001	3 [8]	0.008	0.015	2 [4]
Total Phosphorus	0.07	0.1	<0.05	0.1	<0.05	0.05	NC	0.05 [1]	0.03 [2]	0.05 [5]

See Notes to Table Following

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Notes to Table C1:

Results expressed in mg/L unless otherwise stated
NC - No Criteria
PQL - Practical Quantitation Limits
(1) - Trigger Values for physical and chemical stressors for south-east Australia for Slightly Disturbed Ecosystems -Lowland Rivers
(2) - Trigger Values for physical and chemical stressors for south-east Australia for Slightly Disturbed Ecosystems -Estuaries
(3) - Tolerance value of Clover (Conservative Value for Pastures)
(4) - Long Term Trigger Values (up to 100 yrs)
(5) - To minimise bioclogging of irrigation equipment
(6) - Trigger Values for assessing corrosiveness of water
(7) - Chromium (VI)
(8) - Aesthetic Guideline Value
(9) - Arsenic (V) (conservative)
(10) - Mercury (Inorganic)
(11) - Trigger Value for Phenol not Total Phenols (Conservative)
(12) - Drinking Water Criteria re-calculated for N
(13) - Health Based Criteria of Nitrite (Conservative)
(14) - Trigger Values for Fresh Water pH>6.5
(15) - Trigger Values for Fresh Water pH<6.5
(16) - Trigger Values for Marine Water pH<6.5
(17) - Environmental Concern Level (ECL) - indicative interim working level only
(18) pH less than 6 has corrosive potential
(L) - 95% Low Reliability Trigger Values (99% protection level applied where recommended)
Sample Naming Convention:
- "A" and "B" prefix denotes piezometers screened in Alluvium
- "S" and "D" suffix denotes "shallow" and "deep" paired piezometers screened in Alluvium
- "SW" prefix denotes surface water sample
- "AGE" and "BY" prefix denotes piezometers screened in coal measures
- "D" suffix indicates replicate sample for Quality Assurance / Quality Control Testing

Replicate Samples for Quality Assurance / Quality Control Testing:
- Sample D1 - replicate sample of SW3 (22/2/2012)
- Sample D2 - replicate sample of BY0015CH (23/2/2012)
- Sample D3 - replicate sample of SW2 (8/3/2012)
- Sample D4 - replicate sample of BY0015CH (29/5/2012)
- Sample D5-290512 - replicate sample of SW8 (29/5/2012)
- Sample D5-270612 - replicate sample of SW4 (27/6/2012)
- Sample D6 - replicate sample of A13 (27/6/2012)
- Sample D7 - replicate sample of SW1 (22/7/2012)
- Sample D8 - replicate sample of A02-S (23/7/2012)
- Sample D9 - replicate sample of BY0014CH (20/8/2012)
- Sample D10 - replicate sample of SW9 (20/8/2012)
- Sample D11/KMH - replicate sample of A02-S (18/9/2012)
- Sample D12/KMH replicate sample of SW7 (19/9/2012)
- Sample D13 replicate sample of BY0014CH (21/10/2012)
- Sample D14 replicate sample of SW6 (22/10/2012)
- Sample D15 replicate sample of A13 (4/12/2012)
- Sample D16 replicate sample of SW4 (3/12/2012)
- Sample D17 replicate sample of A01-S (14/1/2013)
- Sample D18 replicate sample of SW4 (15/1/2013)
- Sample D19 replicate sample of SW4 (19/2/2013)
- Sample D20 replicate sample of A20 (19/2/2013)
- Sample D21 replicate sample of SW7 (11/3/2013)
- Sample D22 replicate sample of BY0016CH (18/3/2013)
- Sample D23 replicate sample of BY0016CH (15/4/2013)
- Sample D24 replicate sample of SW4 (16/4/2013)
- Sample D26 replicate sample of A13 (12/5/2013)
- Sample D28 replicate sample of SW4 (13/5/2013)
- Sample D29 replicate sample of BY0015
- Sample D30 replicate sample of SW4
- Sample D31 replicate sample of AGE10 (25/7/2013)
- Sample D33 replicate sample of BY0016CH (19/8/2013)
- Sample D34 replicate sample of BY0014CH (19/9/2013)
- Sample D35 replicate sample of SW6 (16/9/2013)
- Sample D37 replicate sample of A14 (15/10/2013)
- Sample D40 replicate sample of A06-S (19/11/2013)
- Sample D41 replicate sample of A09 (10/12/2013)
- Sample D44 replicate sample of A12 (15/1/2014)
- Sample D46 replicate sample of A15 (19/2/2014)
- Sample D48 replicate sample of A18 (20/3/2014)
- Sample D50 replicate sample of AGE08 (14/4/2014)
- Sample D51 replicate sample of AGE08 (19/5/2014)
- Sample D52 replicate sample of A01-S (17/6/2014)
- Sample D54 replicate sample of SW6 (19/6/2014)
- Sample D55 replicate sample of A13 (21/7/2014)
- Sample D57 replicate sample of SW4 (24/7/2014)
- Sample D58 replicate sample of A18 (21/8/2014)
- Sample D60-21/8/14 replicate sample of SW6 (21/8/2014)
- Sample D60-2/12/14 replicate sample of A01-S (2/12/2014)
- Sample D52 replicate sample of A01-S (17/6/2014)
- Sample D54 replicate sample of SW6 (19/6/2014)
- Sample D62 replicate sample of A06-D (13/01/2015)
- Sample D64 replicate sample of A09 (10/02/2015)
- Sample D67 replicate sample of BY0016 (9/03/2015)
- Sample D69 replicate sample of A01-S (14/04/2015)
- Sample D71 replicate sample of A01-S (19/05/2015)
- Sample D74 replicate sample of A20 (22/06/2015)
- Sample D75 replicate sample of A13 (14/07/2015)
- Sample D77 replicate sample of SW4 (16/07/2015)
- Sample D78 replicate sample of A14 (11/08/2015)
- Sample D80 replicate sample of A06-D (8/09/2015)
- Sample D82 replicate sample of SW4 (12/10/2015)
- Sample D83 replicate sample of A13 (13/10/2015)
- Sample D85 replicate sample of A06-D (10/11/2015)
- Sample D86 replicate sample of SW4 (12/11/2015)
- Sample D88 replicate sample of A13 (8/12/2015)
- Sample D89 replicate sample of A18 (9/12/2015)
- Sample D91 replicate sample of BY0014 (12/01/2016)
- Sample D92 replicate sample of SW4 (14/01/2016)
- Sample D91 replicate sample of BY0014 (12/01/2016)
- Sample D92 replicate sample of SW4 (14/01/2016)
- Sample D93 replicate sample of SW6 (28/01/2016)
- Sample D93 replicate sample of SW6 (28/01/2016)
- Sample D94 replicate sample of SW8 (8/2/2016)
- Sample D95 replicate sample of A18 (10/2/2016)
- Sample D96 replicate sample of BY0015 (15/3/2016)
- Sample D98 replicate sample of A09 (5/4/2016)
- Sample D99 replicate sample of SW4 (7/4/2016)
- Sample D100 replicate sample of A14 (10/5/2016)
- Sample D101 replicate sample of A15 (8/6/2016)
- Sample D103 replicate sample of SW4 (9/6/2016)
- Sample D105-ASM replicate sample of SW4 (12/7/2016)
- Sample D106-ASM replicate sample of A13 (12/7/2016)
- Sample D106 replicate sample of SW2 (25/7/2016)
- Sample D108 replicate sample of SW4 (16/8/2016)
- Sample D109 replicate sample of A02-D (17/8/2016)
- Sample D110 replicate sample of SW2 (13/9/2016)
- Sample D111 replicate sample of AGE08 (14/9/2016)
- Sample D113 replicate sample of BY0015 (11/10/2016)
- Sample D114 replicate sample of SW2 (12/10/2016)
- Sample D115 replicate sample of SW8 (15/11/2016)
- Sample D116 replicate sample of A02-S (16/11/2016)
- Sample D117 replicate sample of AGE08 (13/12/2016)
- Sample D118 replicate sample of AGE10 (14/12/2016)
- Sample D119 replicate sample of AGE08 (17/1/2017)
- Sample D120 replicate sample of SW4 (19/1/2017)
- Sample D121 replicate sample of A20 (21/2/2017)
- Sample D122 replicate sample of A02-S (22/2/2017)
- Sample D123 replicate sample of A13 (20/3/2017)
- Sample D126 replicate sample of AGE33M (4/4/2017)
- Sample D127 replicate sample of SW1 (5/4/2017)
- Sample D128 replicate sample of A20 (23/5/2017)
- Sample D129 replicate sample of SW4 (25/5/2017)
- Sample D130 replicate sample of AGE10 (21/6/2017)
- Sample D132 replicate sample of SW4 (22/6/2017)

Assessment of Results:
Exceeds ANZECC 2000 Guidelines - Fresh Waters
Exceeds Australian Drinking Water Guidelines

Table C2: Summary of Groundwater Sampling Dates

Period: 23 February 2012 to 30 June 2017 **Project Number: 49761.04**

Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date
A01-S	23/02/2012	A02-S	30/05/2012	A06-S	30/05/2012	A09	23/10/2012
	31/05/2012		27/06/2012		27/06/2012		5/12/2012
	27/06/2012		23/07/2012		24/07/2012		16/01/2013
	24/07/2012		22/08/2012		22/08/2012		20/02/2013
	22/08/2012		18/09/2012		18/09/2012		20/03/2013
	17/09/2012		22/10/2012		21/10/2012		16/04/2013
	21/10/2012		3/12/2012		4/12/2012		16/05/2013
	5/12/2012		16/01/2013		15/01/2013		19/06/2013
	14/01/2013		20/02/2013		19/02/2013		22/07/2013
	18/02/2013		20/03/2013		20/03/2013		20/08/2013
	19/03/2013		17/04/2013		17/04/2013		19/09/2013
	16/04/2013		14/05/2013		13/05/2013		15/10/2013
	12/05/2013		19/06/2013		20/06/2013		13/11/2013
	18/06/2013		24/07/2013		23/07/2013		10/12/2013
	22/07/2013		22/08/2013		20/08/2013		14/01/2014
	19/08/2013		18/09/2013		17/09/2013		18/02/2014
	19/09/2013		16/10/2013		15/10/2013		18/03/2014
	16/10/2013		13/11/2013		19/11/2013		14/04/2014
	19/11/2013		12/12/2013		12/12/2013		20/05/2014
	16/12/2013		16/01/2014		15/01/2014		17/06/2014
	14/01/2014		20/02/2014		18/02/2014		22/07/2014
	17/02/2014		19/03/2014		19/03/2014		19/08/2014
	18/03/2014		15/04/2014		16/03/2016		3/12/2014
	13/04/2014		21/05/2014		5/04/2016		13/01/2015
	19/05/2014		16/11/2016		10/05/2016		10/02/2015
	17/06/2014		14/12/2016		7/06/2016		10/03/2015
	21/07/2014		18/01/2017		13/07/2016		14/04/2015
	21/08/2014		22/02/2017		15/08/2016		19/05/2015
	2/12/2014		22/03/2017		14/09/2016		22/06/2015
	12/01/2015		5/04/2017		11/10/2016		14/07/2015
	9/02/2015		24/05/2017		21/02/2017		10/08/2015
	10/03/2015				21/03/2017		8/09/2015
	14/04/2015				4/04/2017		13/10/2015
	19/05/2015				23/05/2017		10/11/2015
	22/06/2015						8/12/2015
	14/07/2015						11/01/2016
	10/08/2015						9/02/2016
	8/09/2015						14/03/2016
	12/10/2015						5/04/2016
	9/11/2015						10/05/2016
	7/12/2015						7/06/2016
	12/01/2016						12/07/2016
	8/02/2016						16/08/2016
	15/03/2016						12/12/2016
	5/04/2016						16/01/2017
	10/05/2016						21/02/2017
	7/06/2016						20/03/2017
	12/07/2016						3/04/2017
	15/08/2016						23/05/2017
	13/09/2016						20/06/2017
	11/10/2016						
	14/11/2016						
	12/12/2016						
	19/01/2017						
	20/02/2017						
	20/03/2017						
	3/04/2017						
	22/05/2017						
	19/06/2017						

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Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date
A12	23/10/2012	A13	30/05/2012	A14	21/08/2012	A15	23/10/2012
	3/12/2012		27/06/2012		19/09/2012		4/12/2012
	16/01/2013		24/07/2012		22/10/2012		16/01/2013
	20/02/2013		22/08/2012		4/12/2012		20/02/2013
	17/04/2013		18/09/2012		16/01/2013		17/04/2013
	14/05/2013		21/10/2012		20/02/2013		14/05/2013
	19/06/2013		3/12/2012		16/04/2013		19/06/2013
	24/07/2013		14/01/2013		14/05/2013		23/07/2013
	21/08/2013		19/02/2013		19/06/2013		22/08/2013
	18/09/2013		19/03/2013		23/07/2013		18/09/2013
	16/10/2013		16/04/2013		20/08/2013		16/10/2013
	13/11/2013		12/05/2013		19/09/2013		14/11/2013
	11/12/2013		18/06/2013		15/10/2013		11/12/2013
	15/01/2014		22/07/2013		13/11/2013		15/01/2014
	19/02/2014		19/08/2013		12/12/2013		19/02/2014
	19/03/2014		19/09/2013		14/01/2014		19/03/2014
	15/04/2014		15/10/2013		18/02/2014		15/04/2014
	21/05/2014		11/11/2013		18/03/2014		21/05/2014
	18/06/2014		11/12/2013		14/04/2014		18/06/2014
	23/07/2014		13/01/2014		20/05/2014		23/07/2014
	20/08/2014		18/02/2014		17/06/2014		20/08/2014
	14/12/2016		18/03/2014		22/07/2014		3/12/2014
	18/01/2017		15/04/2014		19/08/2014		14/01/2015
	22/02/2017		20/05/2014		15/12/2014		11/02/2015
	29/03/2017		17/06/2014		16/04/2015		11/03/2015
	5/04/2017		21/07/2014		19/05/2015		15/04/2015
			19/08/2014		24/06/2015		20/05/2015
			2/12/2014		14/07/2015		23/06/2015
			12/01/2015		11/08/2015		15/07/2015
			9/02/2015		7/09/2015		11/08/2015
			9/03/2015		13/10/2015		13/01/2016
			14/04/2015		11/11/2015		16/03/2016
			18/05/2015		8/12/2015		6/04/2016
			22/06/2015		11/01/2016		10/05/2016
			14/07/2015		11/02/2016		8/06/2016
			10/08/2015		14/03/2016		14/12/2016
			8/09/2015		4/04/2016		18/01/2017
			13/10/2015		10/05/2016		22/02/2017
			10/11/2015		14/12/2016		22/03/2017
			8/12/2015		19/01/2017		24/05/2017
			11/01/2016		20/02/2017		21/06/2017
			9/02/2016		20/06/2017		
			14/03/2016				
			4/04/2016				
			10/05/2016				
			7/06/2016				
			12/07/2016				
			15/08/2016				
			13/09/2016				
			11/10/2016				
			15/11/2016				
			12/12/2016				
			16/01/2017				
			20/02/2017				
			20/03/2017				
			3/04/2017				
			23/05/2017				
			20/06/2017				

Table C2: Summary of Groundwater Sampling Dates

Period: 23 February 2012 to 30 June 2017 **Project Number: 49761.04**

Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date
A18	23/10/2012	A19	5/12/2012	A20	3/12/2012	BY0014CH	23/02/2012
	3/12/2012		15/01/2013		14/01/2013		31/05/2012
	16/01/2013		19/02/2013		19/02/2013		28/06/2012
	20/02/2013				17/04/2013		22/07/2012
	17/04/2013				13/05/2013		20/08/2012
	14/05/2013				20/06/2013		17/09/2012
	19/06/2013				20/08/2013		21/10/2012
	24/07/2013				16/10/2013		3/12/2012
	22/08/2013				19/11/2013		14/01/2013
	18/09/2013				12/12/2013		18/02/2013
	16/10/2013				15/01/2014		19/03/2013
	14/11/2013				18/02/2014		15/04/2013
	11/12/2013				19/03/2014		12/05/2013
	15/01/2014				14/04/2014		18/06/2013
	20/02/2014				22/05/2014		22/07/2013
	20/03/2014				17/06/2014		19/08/2013
	15/04/2014				22/07/2014		19/09/2013
	21/05/2014				19/08/2014		14/10/2013
	18/06/2014				2/12/2014		13/11/2013
	23/07/2014				13/01/2015		16/12/2013
	20/08/2014				10/02/2015		13/01/2014
	15/12/2014				10/03/2015		19/02/2014
	14/01/2015				16/04/2015		17/03/2014
	11/02/2015				19/05/2015		13/04/2014
	11/03/2015				22/06/2015		20/05/2014
	15/04/2015				14/07/2015		16/06/2014
	20/05/2015				11/08/2015		21/07/2014
	23/06/2015				8/09/2015		18/08/2014
	16/07/2015				13/10/2015		2/12/2014
	12/08/2015				10/11/2015		13/01/2015
	9/09/2015				9/12/2015		9/02/2015
	14/10/2015				13/01/2016		9/03/2015
	11/11/2015				17/03/2016		13/04/2015
	9/12/2015				5/04/2016		19/05/2015
	13/01/2016				10/05/2016		15/06/2015
	11/02/2016				7/06/2016		16/07/2015
	17/03/2016				13/07/2016		12/08/2015
	6/04/2016				13/12/2016		7/09/2015
	11/05/2016				17/01/2017		12/10/2015
	15/06/2016				21/02/2017		9/11/2015
	13/07/2016				21/03/2017		7/12/2015
	17/08/2016				4/04/2017		12/01/2016
	16/11/2016				23/05/2017		9/02/2016
	14/12/2016				20/06/2017		15/03/2016
	18/01/2017				20/06/2017		4/04/2016
	22/02/2017						12/05/2016
	22/03/2017						8/06/2016
	5/04/2017						12/07/2016
	21/06/2017						15/08/2016
							15/09/2016
							10/10/2016
							14/11/2016
							12/12/2016
							18/01/2017
							20/02/2017
							20/03/2017
							3/04/2017
							22/05/2017
							19/06/2017

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Period: 23 February 2012 to 30 June 2017 **Project Number: 49761.04**

Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date
BY0015CH	23/02/2012	BY0016CH	23/02/2012	AGE08	20/06/2013	AGE10	25/07/2013
	29/05/2012		30/05/2012		23/07/2013		22/08/2013
	27/06/2012		28/06/2012		20/08/2013		19/09/2013
	24/07/2012		23/07/2012		17/09/2013		16/10/2013
	22/08/2012		19/08/2012		15/10/2013		14/11/2013
	17/09/2012		17/09/2012		19/11/2013		10/12/2013
	21/10/2012		21/10/2012		12/12/2013		15/01/2014
	5/12/2012		3/12/2012		13/01/2014		19/02/2014
	14/01/2013		14/01/2013		18/02/2014		19/03/2014
	18/02/2013		19/02/2013		18/03/2014		15/04/2014
	19/03/2013		18/03/2013		14/04/2014		21/05/2014
	16/04/2013		15/04/2013		19/05/2014		18/06/2014
	12/05/2013		12/05/2013		17/06/2014		23/07/2014
	18/06/2013		18/06/2013		22/07/2014		20/08/2014
	22/07/2013		22/07/2013		19/08/2014		3/12/2014
	19/08/2013		19/08/2013		3/12/2014		14/01/2015
	19/09/2013		17/09/2013		13/01/2015		11/02/2015
	16/10/2013		15/10/2013		10/02/2015		11/03/2015
	19/11/2013		11/11/2013		10/03/2015		15/04/2015
	16/12/2013		16/12/2013		15/04/2015		20/05/2015
	14/01/2014		13/01/2014		19/05/2015		23/06/2015
	17/02/2014		19/02/2014		23/06/2015		15/07/2015
	18/03/2014		17/03/2014		15/07/2015		11/08/2015
	13/04/2014		13/04/2014		11/08/2015		9/09/2015
	19/05/2014		19/05/2014		8/09/2015		14/10/2015
	17/06/2014		16/06/2014		13/10/2015		11/11/2015
	21/07/2014		21/07/2014		10/11/2015		9/12/2015
	21/08/2014		18/08/2014		8/12/2015		13/01/2016
	2/12/2014		1/12/2014		12/01/2016		11/02/2016
	12/01/2015		12/01/2015		9/02/2016		16/03/2016
	9/02/2015		9/02/2015		15/03/2016		5/04/2016
	10/03/2015		9/03/2015		5/04/2016		11/05/2016
	14/04/2015		13/04/2015		10/05/2016		8/06/2016
	22/06/2015		18/05/2015		7/06/2016		14/07/2016
	14/07/2015		15/06/2015		13/07/2016		17/08/2016
	10/08/2015		14/07/2015		15/08/2016		14/09/2016
	8/09/2015		10/08/2015		14/09/2016		10/10/2016
	12/10/2015		7/09/2015		11/10/2016		16/11/2016
	9/11/2015		12/10/2015		15/11/2016		14/12/2016
	7/12/2015		9/11/2015		13/12/2016		18/01/2017
	12/01/2016		7/12/2015		17/01/2017		22/02/2017
	8/02/2016		12/01/2016		21/02/2017		23/03/2017
	15/03/2016		9/02/2016		21/03/2017		5/04/2017
	5/04/2016		15/03/2016		4/04/2017		24/05/2017
	10/05/2016		4/04/2016		23/05/2017		21/06/2017
	7/06/2016		10/05/2016		20/06/2017		
	12/07/2016		7/06/2016				
	15/08/2016		12/07/2016				
	13/09/2016		15/08/2016				
	11/10/2016		15/09/2016				
	14/11/2016		10/10/2016				
	12/12/2016		14/11/2016				
	19/01/2017		12/12/2016				
	20/02/2017		16/01/2017				
	20/03/2017		20/02/2017				
	3/04/2017		21/03/2017				
	22/05/2017		3/04/2017				
	19/06/2017		22/05/2017				
			19/06/2017				

Table C2: Summary of Groundwater Sampling Dates

Period: 23 February 2012 to 30 June 2017 **Project Number: 49761.04**

Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date
AGE13	24/07/2013	B3-S	15/01/2014	B3-D	15/01/2014	A06-D	14/04/2014
	22/08/2013		19/02/2014		19/02/2014		20/05/2014
	17/09/2013		19/03/2014		19/03/2014		17/06/2014
	17/10/2013		15/04/2014		15/04/2014		22/07/2014
	13/11/2013		21/05/2014		21/05/2014		19/08/2014
	17/12/2013		18/06/2014		18/06/2014		2/12/2014
	16/01/2014		23/07/2014		23/07/2014		13/01/2015
	20/02/2014		20/08/2014		20/08/2014		10/02/2015
	20/03/2014		11/02/2015		11/02/2015		10/03/2015
	15/04/2014		15/04/2015		11/03/2015		15/04/2015
	21/05/2014		21/05/2015		15/04/2015		19/05/2015
	18/06/2014		24/06/2015		21/05/2015		22/06/2015
	23/07/2014		15/07/2015		24/06/2015		14/07/2015
	20/08/2014		11/08/2015				11/08/2015
	4/12/2014		9/09/2015				8/09/2015
	14/01/2015		14/10/2015				13/10/2015
	11/02/2015		11/11/2015				10/11/2015
	11/03/2015		9/12/2015				8/12/2015
	15/04/2015		13/01/2016				12/01/2016
	0/01/1900		11/02/2016				11/02/2016
	23/06/2015		16/03/2016				15/11/2016
	15/07/2015		6/04/2016				13/12/2016
	12/08/2015		10/05/2016				17/01/2017
	9/09/2015		8/06/2016				20/06/2017
	14/10/2015		12/07/2016				
	11/11/2015		16/08/2016				
	9/12/2015		13/09/2016				
	13/01/2016		12/10/2016				
	11/02/2016		16/11/2016				
	17/03/2016		14/12/2016				
	7/04/2016		18/01/2017				
	11/05/2016		22/02/2017				
	9/06/2016		22/03/2017				
	13/07/2016		5/04/2017				
	17/08/2016		24/05/2017				
	13/09/2016		21/06/2017				
	11/10/2016						
	16/11/2016						
	14/12/2016						
	18/01/2017						
	22/02/2017						
	22/03/2017						
	5/04/2017						
	24/05/2017						

Table C2: Summary of Groundwater Sampling Dates

Period: 23 February 2012 to 30 June 2017 **Project Number: 49761.04**

Well ID	Sampling Date	Well ID	Sampling Date	Well ID	Sampling Date
A02-D	18/06/2014	AGE26M	17/01/2017	AGE33M	17/01/2017
	23/07/2014		23/02/2017		22/02/2017
	20/08/2014		23/03/2017		21/03/2017
	4/12/2014		4/04/2017		4/04/2017
	14/01/2015		24/05/2017		23/05/2017
	11/02/2015		21/06/2017		20/06/2017
	11/03/2015				
	15/04/2015				
	21/05/2015				
	23/06/2015				
	16/07/2015				
	12/08/2015				
	9/09/2015				
	14/10/2015				
	11/11/2015				
	9/12/2015				
	13/01/2016				
	11/02/2016				
	16/03/2016				
	6/04/2016				
	11/05/2016				
	9/06/2016				
	13/07/2016				
	17/08/2016				
	13/09/2016				
	11/10/2016				
	21/06/2017				

Table C3: Summary of Surface Water Sampling Dates

Period: 22 February 2012 to 30 June 2017 **Project Number: 49761.04**

Location	Sampling Date	Location	Sampling Date	Location	Sampling Date	Location	Sampling Date
SW1	22-Feb-12	SW2	22/02/2012	SW3	22/02/2012	SW4	22-Feb-12
	08-Mar-12		8/03/2012		8/03/2012		08-Mar-12
	29-May-12		29/05/2012		29/05/2012		29-May-12
	27-Jun-12		26/06/2012		26/06/2012		27-Jun-12
	22-Jul-12		22/07/2012		22/07/2012		22-Jul-12
	20-Aug-12		20/08/2012		21/08/2012		21-Aug-12
	19-Sep-12		19/09/2012		19/09/2012		19-Sep-12
	22-Oct-12		11/03/2013		25/07/2016		22-Oct-12
	11-Mar-13		25/07/2016		3/04/2017		04-Dec-12
	28-Jan-16		13/09/2016				15-Jan-13
	08-Feb-16		12/10/2016				19-Feb-13
	12-Jul-16		15/11/2016				11-Mar-13
	25-Jul-16						16-Apr-13
	16-Aug-16						13-May-13
	13-Sep-16						18-Jun-13
	12-Oct-16						22-Jul-13
	16-Nov-16						19-Aug-13
	05-Apr-17						17-Sep-13
							16-Oct-13
							12-Nov-13
							16-Dec-13
							14-Jan-14
							17-Feb-14
							19-Mar-14
							15-Apr-14
							20-May-14
							19-Jun-14
							24-Jul-14
							21-Aug-14
							04-Dec-14
							14-Jan-15
							11-Feb-15
							11-Mar-15
							16-Apr-15
							18-May-15
							22-Jun-15
							16-Jul-15
							13-Aug-15
							08-Sep-15
							12-Oct-15
							12-Nov-15
							10-Dec-15
							14-Jan-16
							28-Jan-16
							08-Feb-16
							16-Mar-16
							07-Apr-16
							12-May-16
							09-Jun-16
							12-Jul-16
							25-Jul-16
							16-Aug-16
							13-Sep-16
							12-Oct-16
							17-Nov-16
							13-Dec-16
							19-Jan-17
							20-Feb-17
							23-Mar-17

Table C3: Summary of Surface Water Sampling Dates

Period: 22 February 2012 to 30 June 2017 **Project Number: 49761.04**

Location	Sampling Date	Location	Sampling Date	Location	Sampling Date	Location	Sampling Date
SW4 (cont)	06-Apr-17	SW5	-	SW6	22/02/2012	SW7	8/03/2012
	25-May-17				8/03/2012		20/08/2012
	22-Jun-17				29/05/2012		19/09/2012
					26/06/2012		11/03/2013
					22/07/2012		13/09/2016
					21/08/2012		12/10/2016
					19/09/2012		16/11/2016
					22/10/2012		
					4/12/2012		
					11/03/2013		
					24/07/2013		
					16/09/2013		
					19/06/2014		
					24/07/2014		
					21/08/2014		
					10/09/2015		
					28/01/2016		
					8/02/2016		
					12/07/2016		
					25/07/2016		
					16/08/2016		
					13/09/2016		
					12/10/2016		
					17/11/2016		
					6/04/2017		
					25/05/2017		

Table C3: Summary of Surface Water Sampling Dates

Period: 22 February 2012 to 30 June 2017 **Project Number: 49761.04**

Location	Sampling Date	Location	Sampling Date
SW8	22/02/2012	SW9	20-Aug-12
	8/03/2012		19-Sep-12
	29/05/2012		11-Mar-13
	27/06/2012		13-Sep-16
	22/07/2012		12-Oct-16
	21/08/2012		
	19/09/2012		
	22/10/2012		
	11/03/2013		
	23/07/2013		
	17/09/2013		
	28/01/2016		
	8/02/2016		
	25/07/2016		
	16/08/2016		
	13/09/2016		
	12/10/2016		
	15/11/2016		

Appendix D

Summary of Standard Operating Procedures:
Groundwater and Surface Water Sampling

Summary of Standard Operating Procedures
Summary Report on Hydrogeological Investigation and Monitoring
November 2011 to June 2017
Bylong Coal Project, Bylong, NSW

D1 - Standard Operating Procedure: Groundwater Sampling

Prior to purging, the water level in each piezometer was measured within each well using a Solinst dip meter for the assessment of trends in groundwater level / piezometric head (refer Section 4).

The piezometers were purged using a MP10 MicroPurge low-flow water sampler until steady pH, EC, turbidity and temperature readings were achieved. The low volume sampling method provides greater confidence in the quality of the obtained sample versus traditional bailing methods and avoids the requirement to purge high volumes from each piezometer. The pump utilises disposable small diameter tubing to minimise the risk of sample cross contamination.

The purged water was collected within a flow cell and field pH, electrical conductivity (EC), oxidation-reduction potential (ORP), dissolved oxygen (DO), turbidity and temperature were measured using a hand-held calibrated multi-parameter meter until steady readings were achieved.

Piezometer AGE13 was periodically bailed using new Clearview disposable single-check bailers due to high turbidity which precluded low-flow sampling. Other wells were also periodically sampled with bailers due to minimal free water within the wells which precluded MicroPurge sampling.

Groundwater sampling was undertaken by an Environmental Engineer from DP under strict QA/QC protocols. All sampling data was recorded on DP chain of custody sheets, and the general sampling procedure comprised:

- The use of new disposable gloves for each sampling location;
- Transfer of samples into laboratory-prepared bottles, and capping immediately;
- Collection of replicate samples for QA/QC purposes;
- Labelling of sample bottles with individual and unique identification, including project number, sample location and sampling date;
- Placement of the sample bottles into a cooled, insulated and sealed container for transport to the laboratory within recommended holdings times for analysis;
- Use of chain of custody (C-O-C) documentation ensuring that sample tracking and custody could be cross-checked at any point in the transfer of samples from the field to the laboratory.

Samples for metals analysis were filtered on-site using 45 µm disposable filters to allow reporting of dissolved metal concentrations in groundwater.

D2 - Standard Operating Procedure: Surface Water Sampling

Surface water samples were collected using a long-handled 'swing sampler', which allowed the use of a new laboratory prepared sampling bottle for each sampling event. Sampling was undertaken to minimise the disturbance of surface water sediments.

In-situ measurements of pH, EC, ORP, DO, turbidity and temperature were taken using a hand-held calibrated multi-parameter meter following collection of each surface water sample.

Surface water sampling was undertaken by an Environmental Engineer from DP under strict QA/QC protocols. All sampling data was recorded on DP chain of custody sheets, and the general sampling procedure comprised:

- The use of new disposable gloves for each sampling location;
- Transfer of samples into laboratory-prepared bottles, and capping immediately;
- Collection of replicate samples for QA/QC purposes;
- Labelling of sample bottles with individual and unique identification, including project number, sample location and sampling date;
- Placement of the sample bottles into a cooled, insulated and sealed container for transport to the laboratory within recommended holdings times for analysis;
- Use of chain of custody (C-O-C) documentation ensuring that sample tracking and custody could be cross-checked at any point in the transfer of samples from the field to the laboratory.

Samples for metals analysis were filtered on-site using 45 µm disposable filters to allow reporting of dissolved metal concentrations in surface water for comparison against dissolved groundwater concentrations.

Appendix E
Summary of Monitoring Data

Appendix E1
Plots of Groundwater Quality Monitoring
(February 2012 to June 2017) – pH, EC and Dissolved Metals
Plots of Surface Water Quality Monitoring
(February 2012 to June 2017) – pH, EC, and Dissolved Metals

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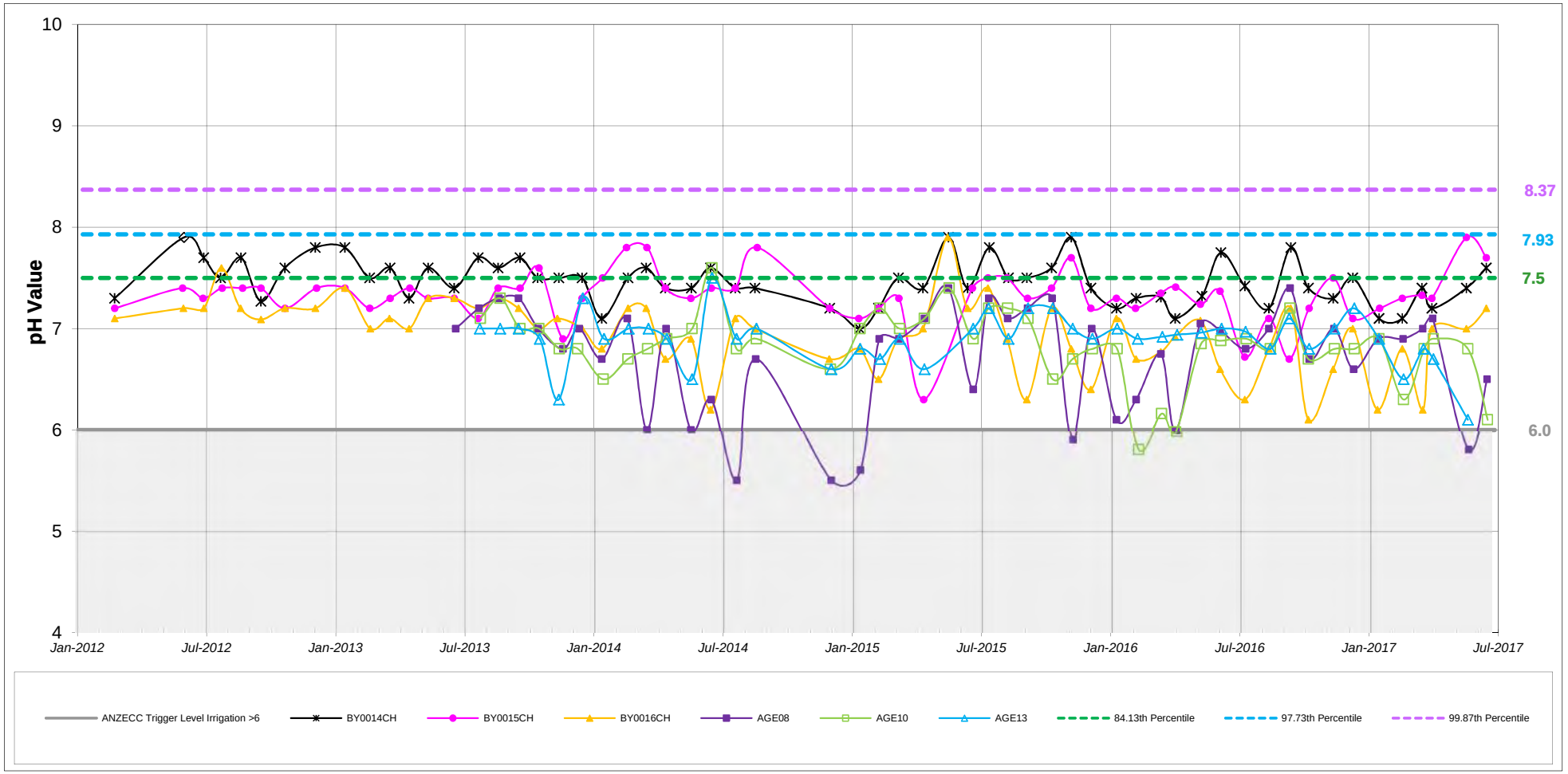
WATER QUALITY MONITORING & STATISTICAL ANALYSIS PLOTS

Bylong Coal Project, Bylong NSW

Period: February 2012 to June 2017
Client: WorleyParsons Services Pty Ltd

Project No: 49761.04
Document No: R.014.Rev0

PARAMETER: pH (field)
GROUPING: COAL MEASURES



Statistical Analyses:		
	84.13th Percentile	7.5
	97.73th Percentile	7.93
	99.87th Percentile	8.37

ANZECC Trigger Level for Irrigation Waters: >6
(i.e. exceedance where pH <6)

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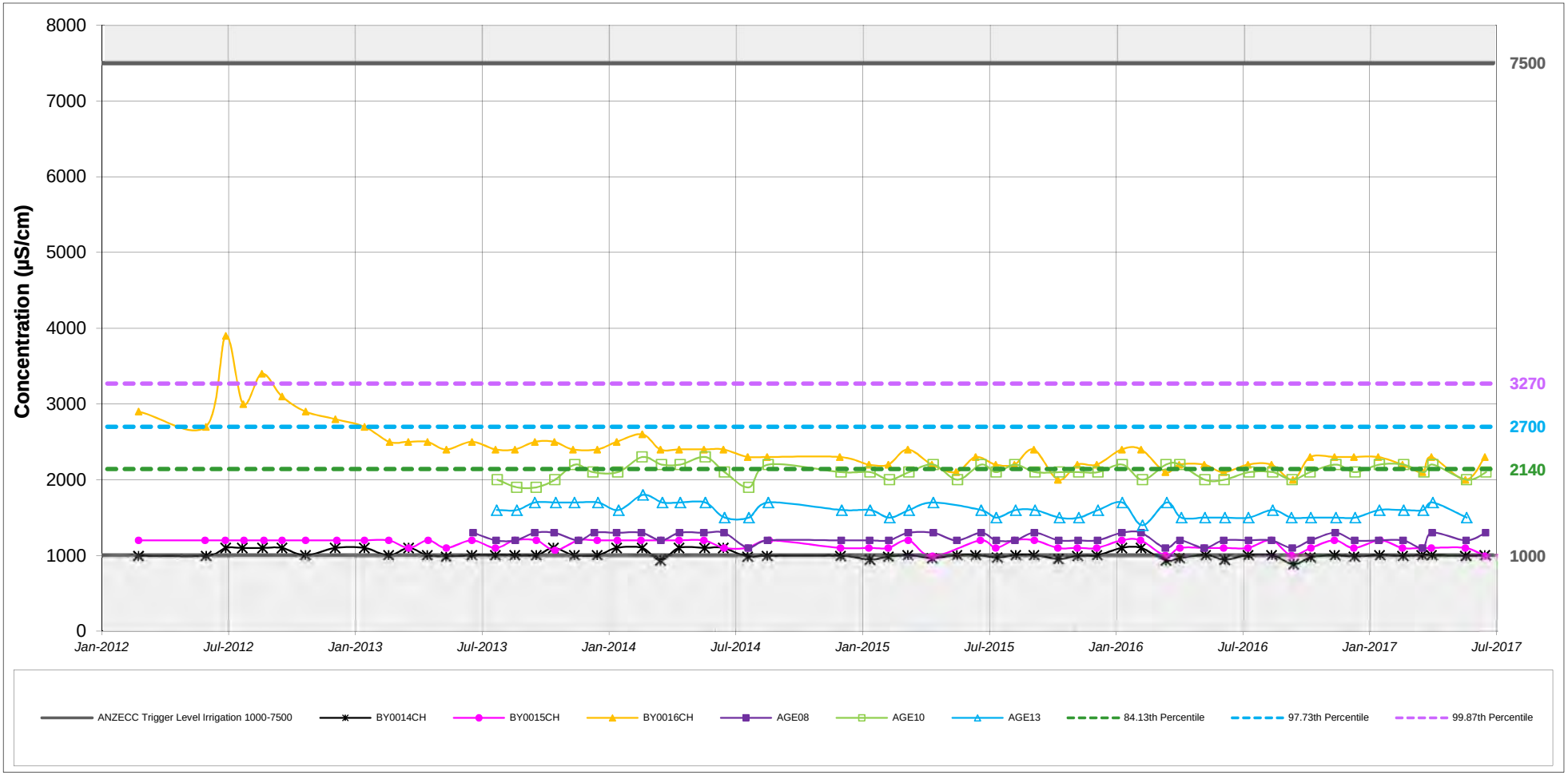
WATER QUALITY MONITORING & STATISTICAL ANALYSIS PLOTS

Bylong Coal Project, Bylong NSW

Period: February 2012 to June 2017
Client: WorleyParsons Services Pty Ltd

Project No: 49761.04
Document No: R.014.Rev0

PARAMETER: ELECTRICAL CONDUCTIVITY
GROUPING: COAL MEASURES



Statistical Analyses:	**84.13th Percentile**	**2140**	**ANZECC Trigger Level for Irrigation Waters:** 1000-7500
	97.73th Percentile	**2700**	**(i.e. exceedance where <1000 or >7500)**
	99.87th Percentile	**3270**	

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WATER QUALITY MONITORING - DISSOLVED METALS PLOTS

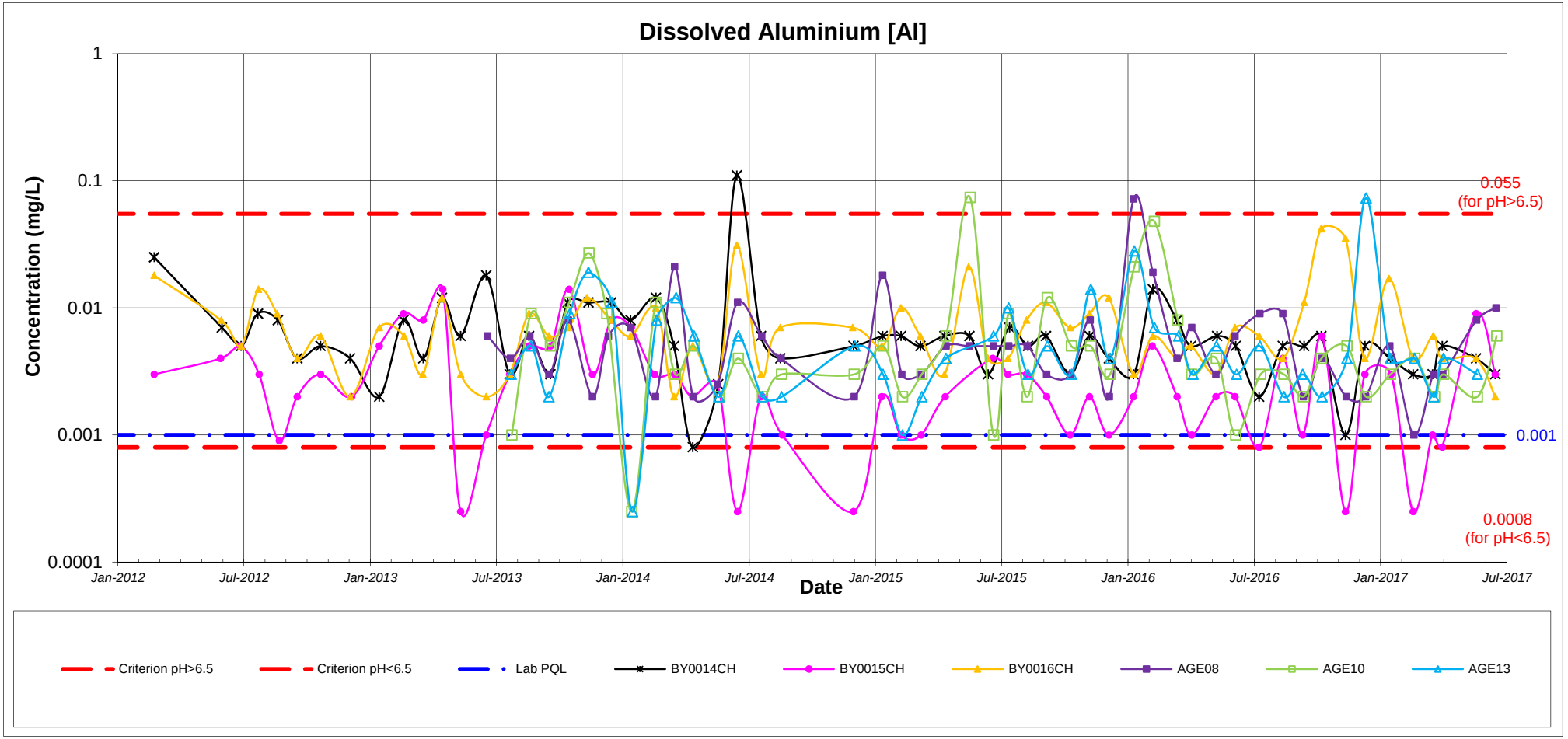
Bylong Coal Project, Bylong NSW

Period: February 2012 to June 2017
Client: WorleyParsons Services Pty Ltd

Project No: 49761.04
Document No: R.014.Rev0

PARAMETER: Dissolved Metals

GROUPING: COAL



Notes:
1. Values reported below PQL are plotted as half of PQL.
2. ANZECC (2000) Fresh Criteria adopted; Marine Water criteria adopted if no Fresh value.
3. If a Criterion line is not plotted, there are No Criteria for the parameter.

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WATER QUALITY MONITORING - DISSOLVED METALS PLOTS

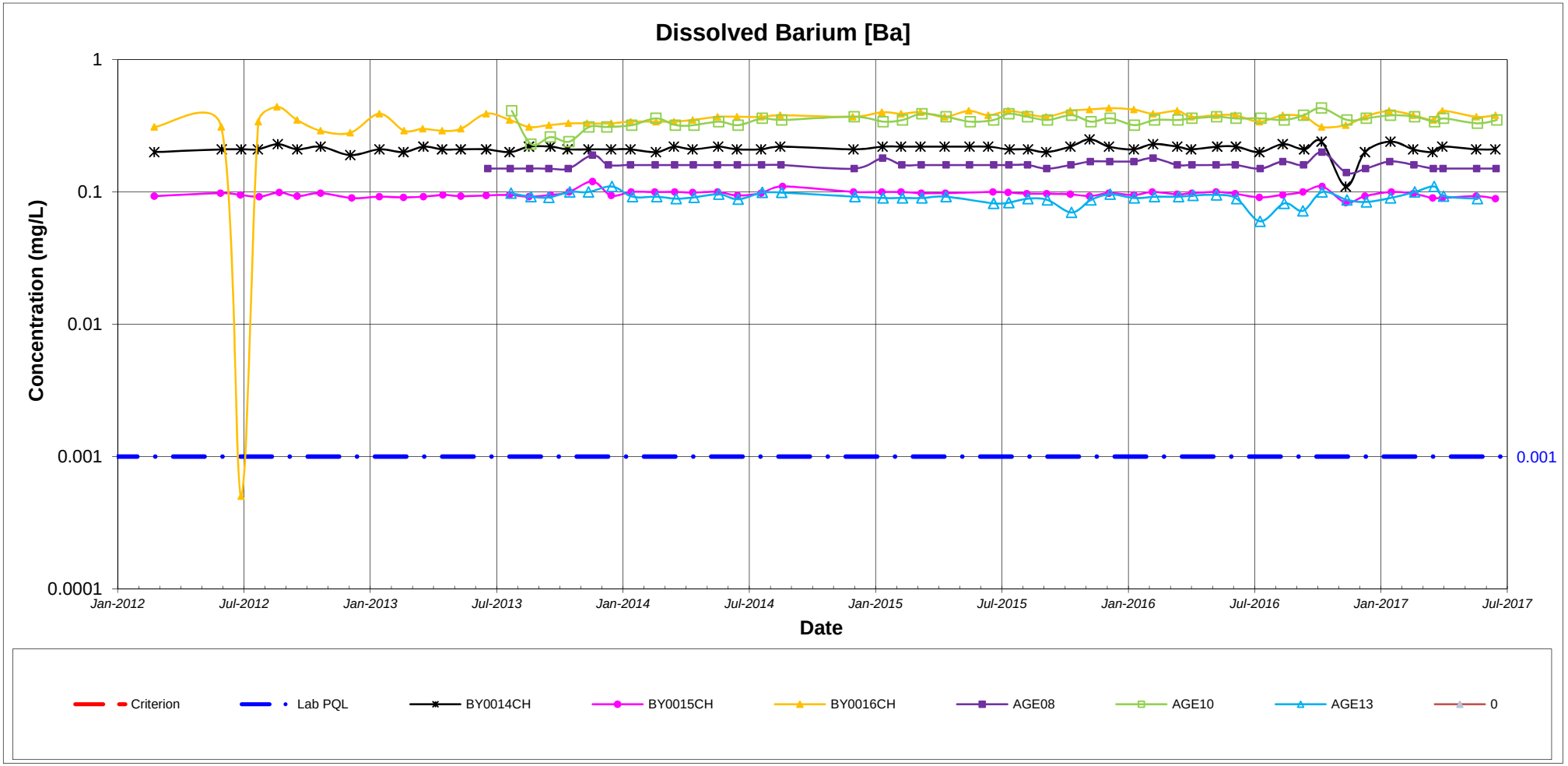
Bylong Coal Project, Bylong NSW

Period: February 2012 to June 2017
Client: WorleyParsons Services Pty Ltd

Project No: 49761.04
Document No: R.014.Rev0

PARAMETER: Dissolved Metals

GROUPING: COAL



Notes:
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2. ANZECC (2000) Fresh Criteria adopted; Marine Water criteria adopted if no Fresh value.
3. If a Criterion line is not plotted, there are No Criteria for the parameter.

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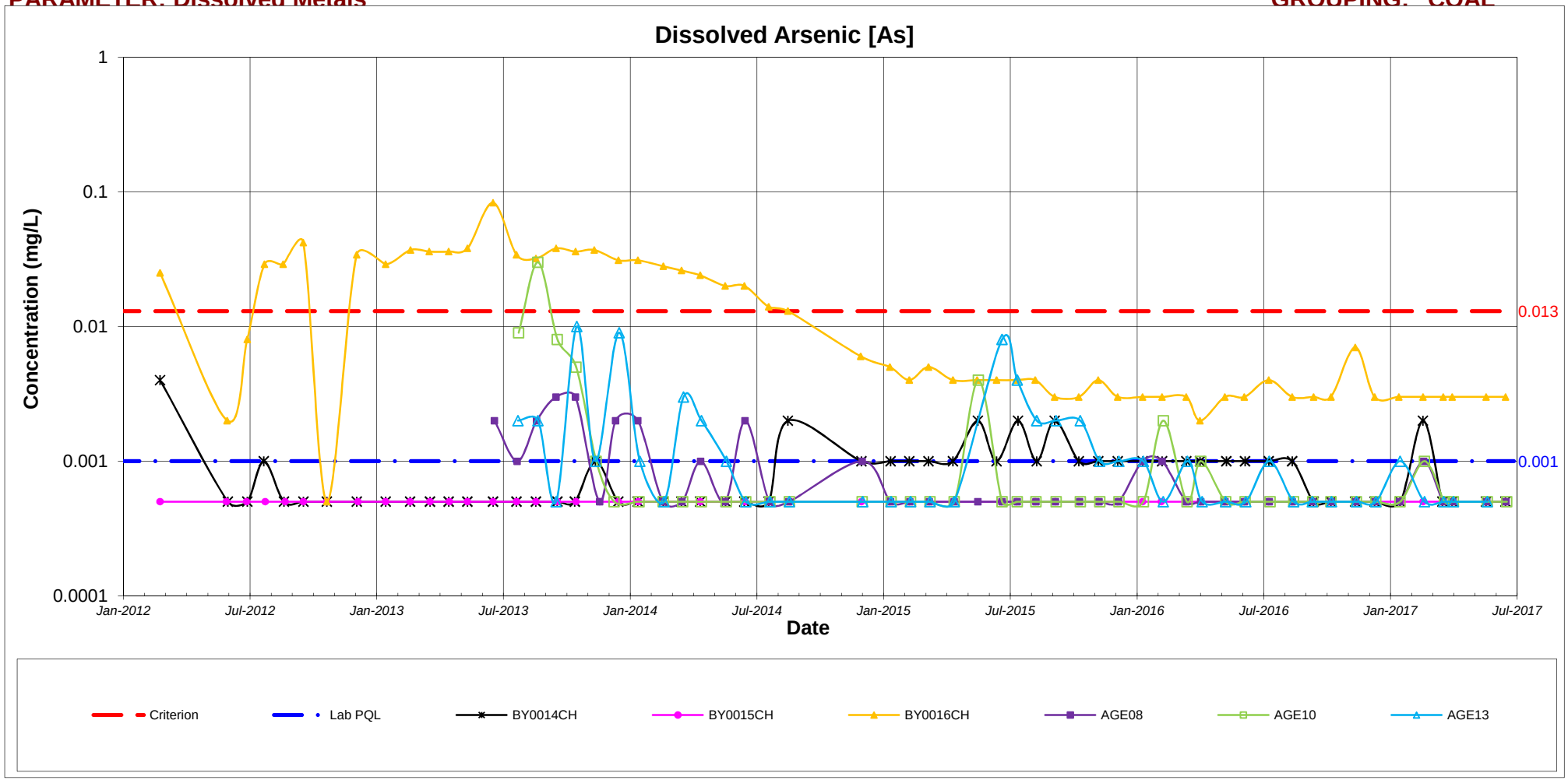
WATER QUALITY MONITORING - DISSOLVED METALS PLOTS

Bylong Coal Project, Bylong NSW

Period: February 2012 to June 2017
Client: WorleyParsons Services Pty Ltd

Project No: 49761.04
Document No: R.014.Rev0

PARAMETER: Dissolved Metals **GROUPING: COAL**



Notes:
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3. If a Criterion line is not plotted, there are No Criteria for the parameter.

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WATER QUALITY MONITORING - DISSOLVED METALS PLOTS

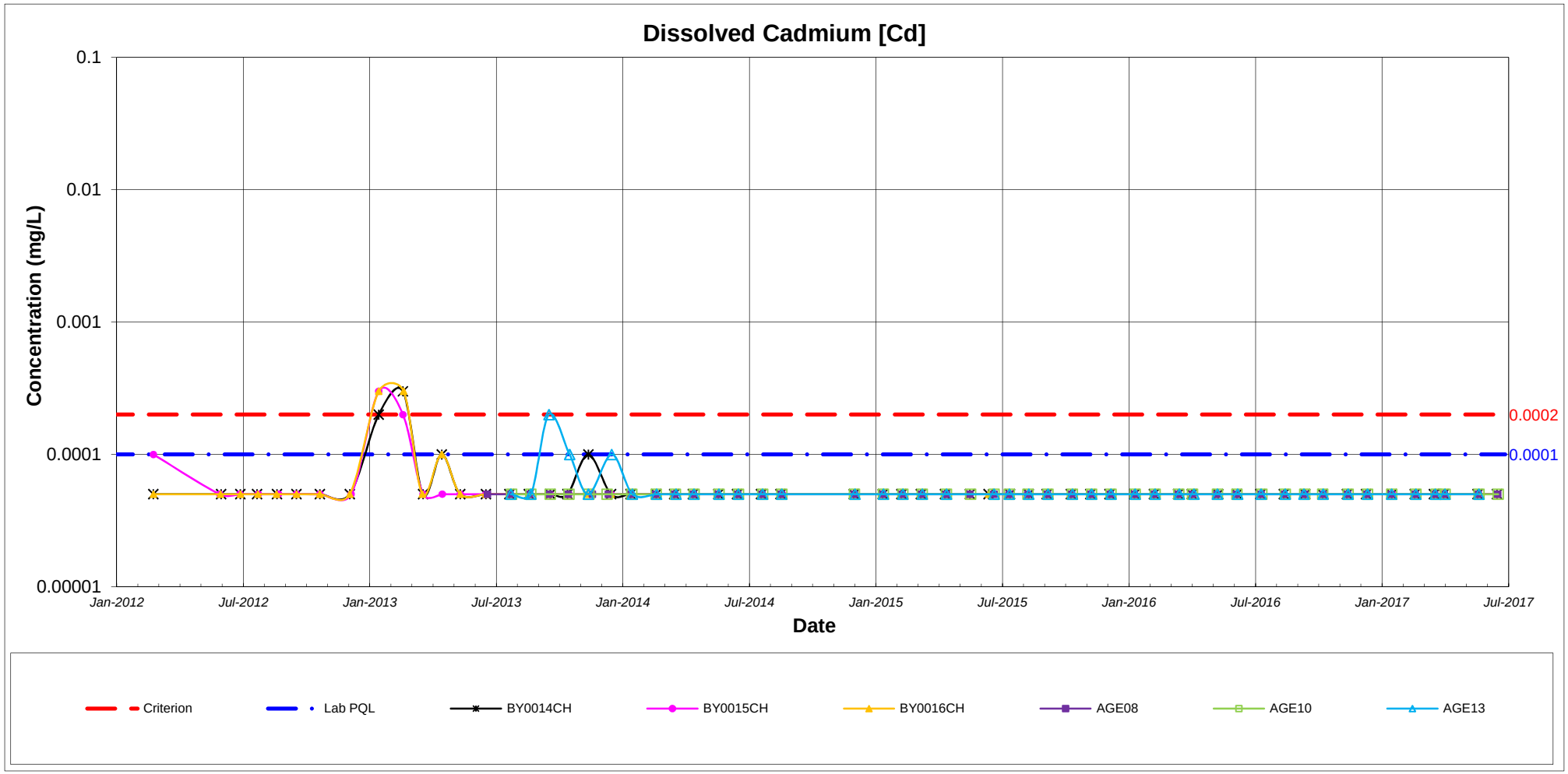
Bylong Coal Project, Bylong NSW

Period: February 2012 to June 2017
Client: WorleyParsons Services Pty Ltd

Project No: 49761.04
Document No: R.014.Rev0

PARAMETER: Dissolved Metals

GROUPING: COAL



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3. If a Criterion line is not plotted, there are No Criteria for the parameter.

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WATER QUALITY MONITORING - DISSOLVED METALS PLOTS

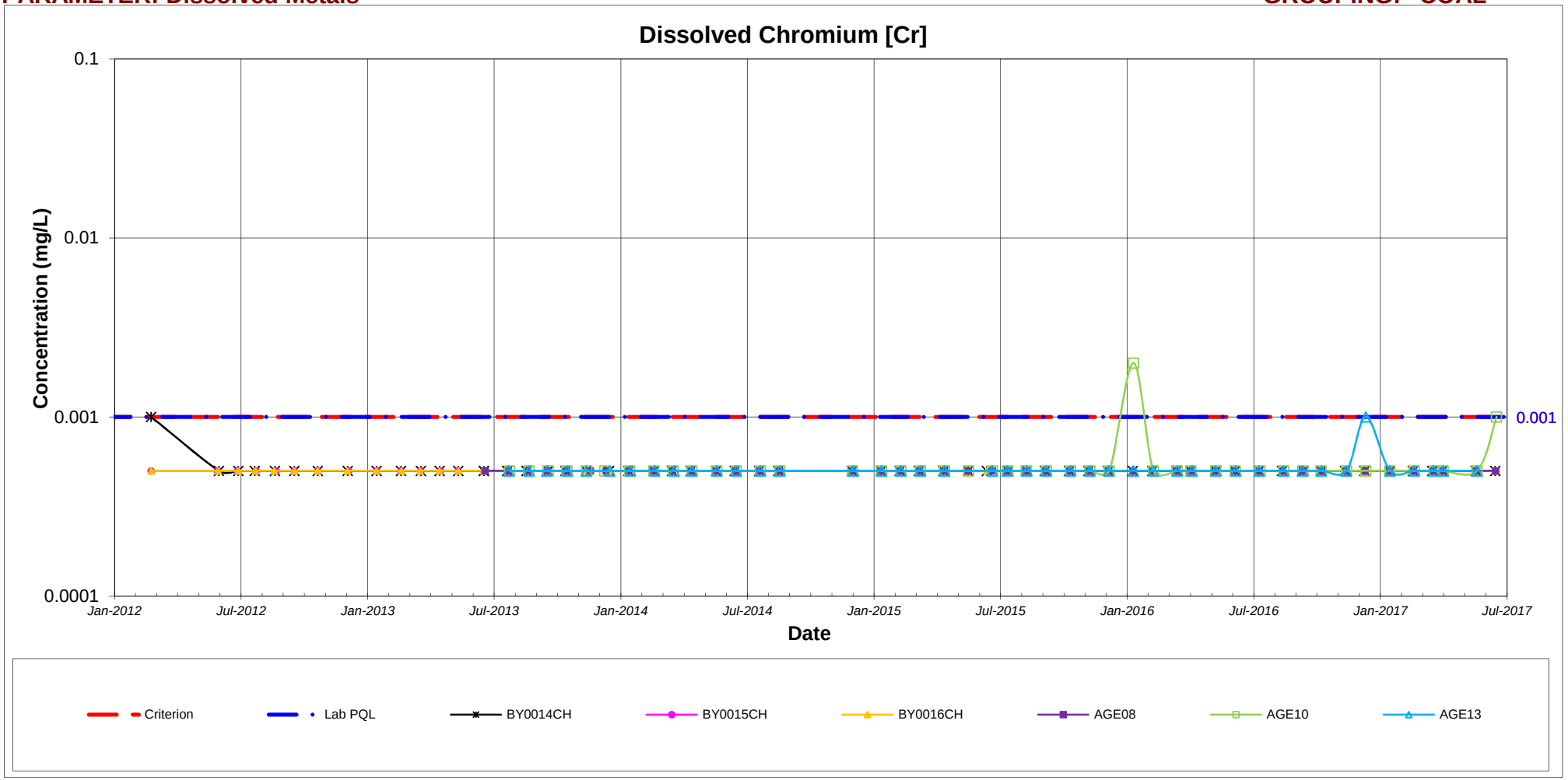
Bylong Coal Project, Bylong NSW

Period: February 2012 to June 2017
Client: WorleyParsons Services Pty Ltd

Project No: 49761.04
Document No: R.014.Rev0

PARAMETER: Dissolved Metals

GROUPING: COAL



Notes:
1. Values reported below PQL are plotted as half of PQL.
2. ANZECC (2000) Fresh Criteria adopted; Marine Water criteria adopted if no Fresh value.
3. If a Criterion line is not plotted, there are No Criteria for the parameter.

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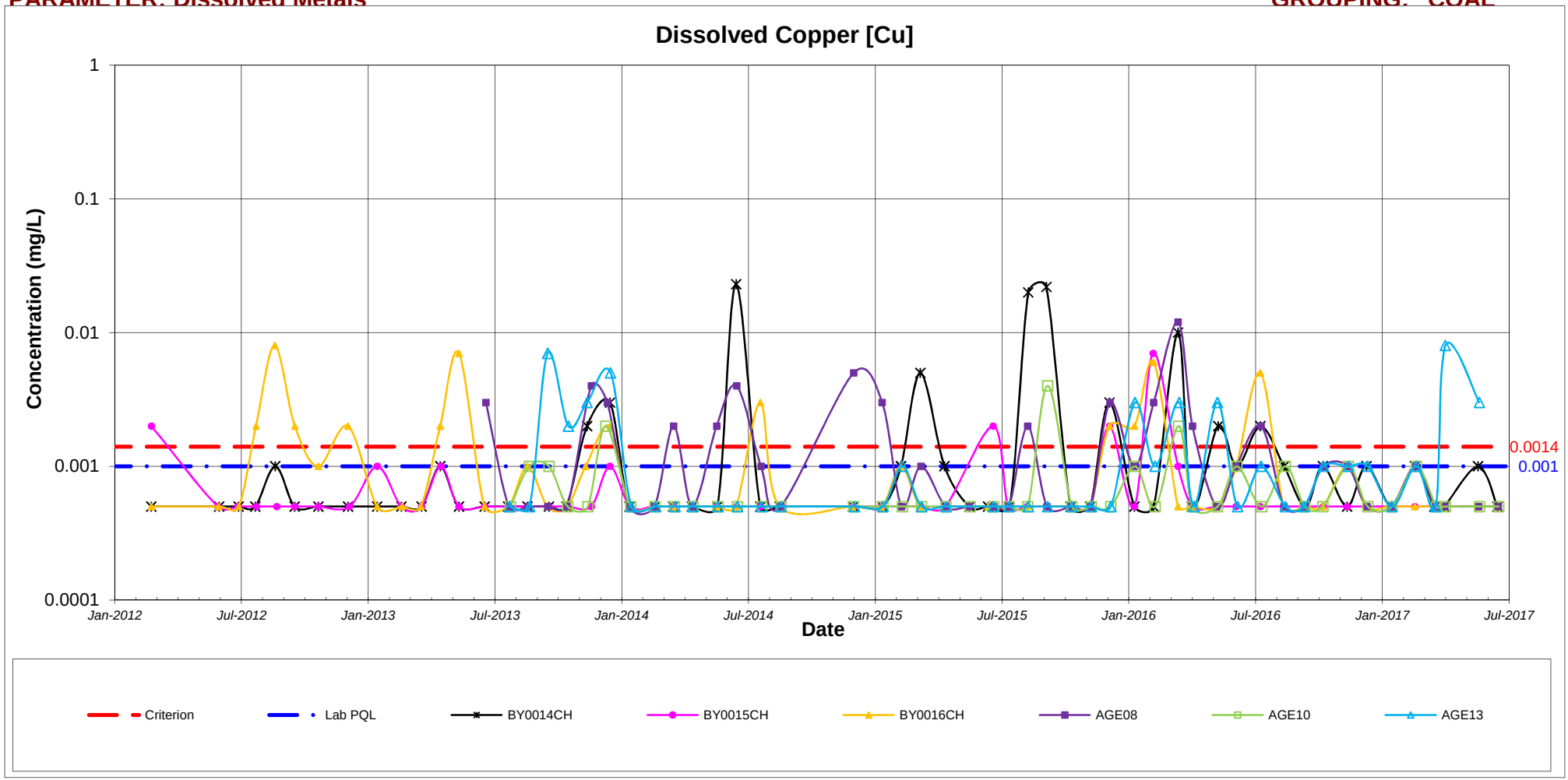
WATER QUALITY MONITORING - DISSOLVED METALS PLOTS

Bylong Coal Project, Bylong NSW

Period: February 2012 to June 2017
Client: WorleyParsons Services Pty Ltd

Project No: 49761.04
Document No: R.014.Rev0

PARAMETER: Dissolved Metals **GROUPING: COAL**



Notes:
1. Values reported below PQL are plotted as half of PQL.
2. ANZECC (2000) Fresh Criteria adopted; Marine Water criteria adopted if no Fresh value.
3. If a Criterion line is not plotted, there are No Criteria for the parameter.

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WATER QUALITY MONITORING - DISSOLVED METALS PLOTS

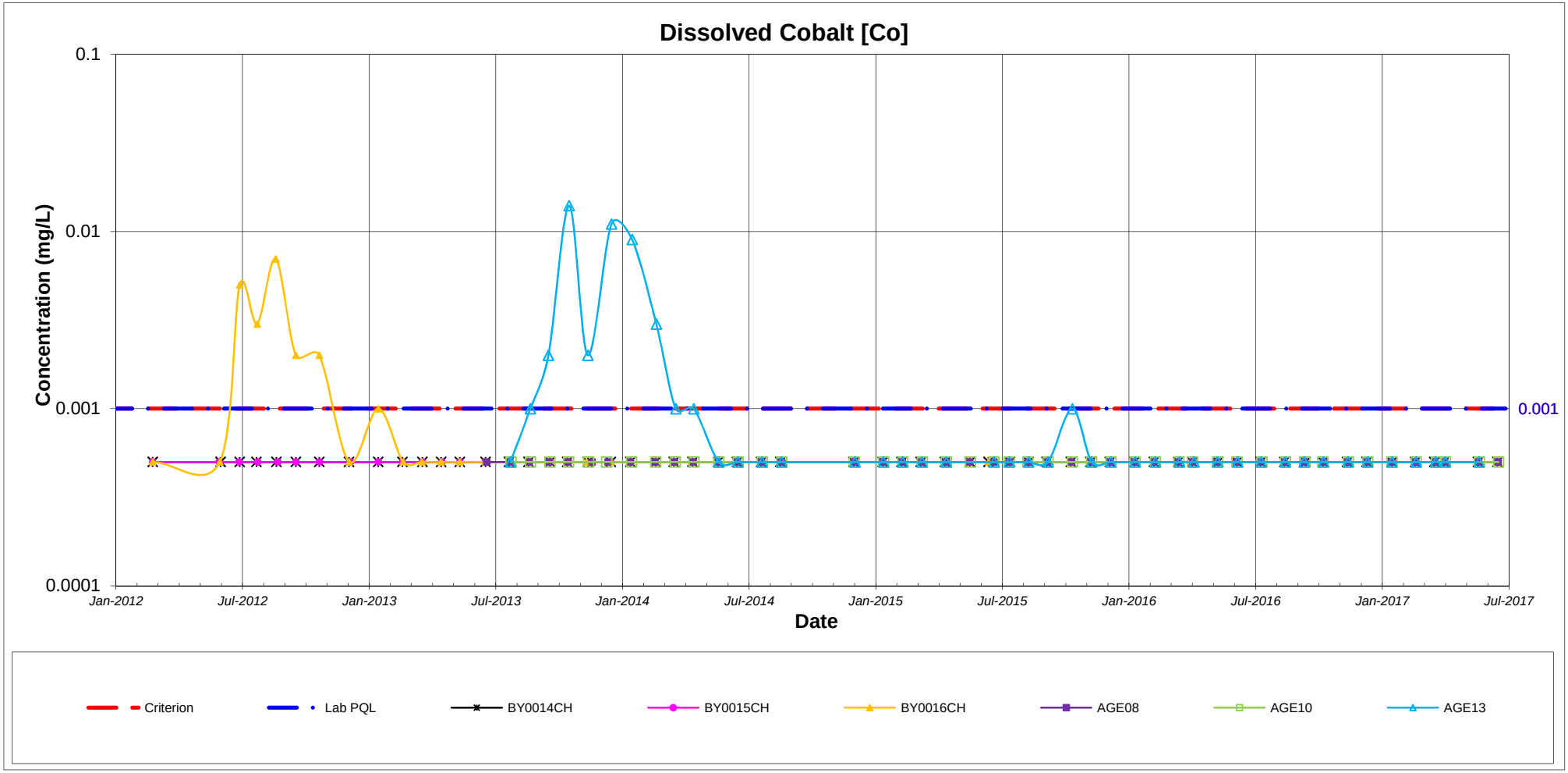
Bylong Coal Project, Bylong NSW

Period: February 2012 to June 2017
Client: WorleyParsons Services Pty Ltd

Project No: 49761.04
Document No: R.014.Rev0

PARAMETER: Dissolved Metals

GROUPING: COAL



Notes:
1. Values reported below PQL are plotted as half of PQL.
2. ANZECC (2000) Fresh Criteria adopted; Marine Water criteria adopted if no Fresh value.
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WATER QUALITY MONITORING - DISSOLVED METALS PLOTS

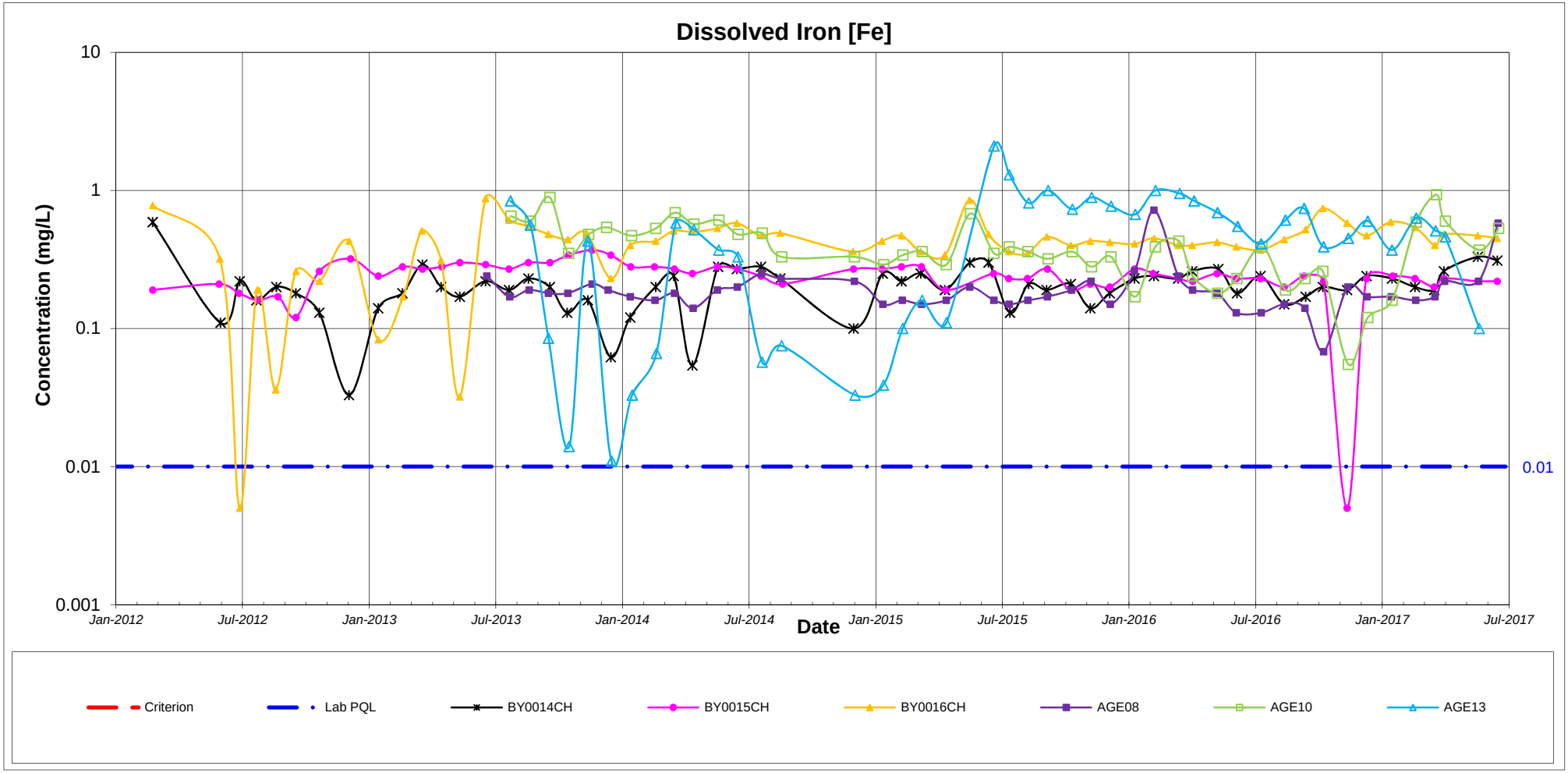
Bylong Coal Project, Bylong NSW

Period: February 2012 to June 2017
Client: WorleyParsons Services Pty Ltd

Project No: 49761.04
Document No: R.014.Rev0

PARAMETER: Dissolved Metals

GROUPING: COAL



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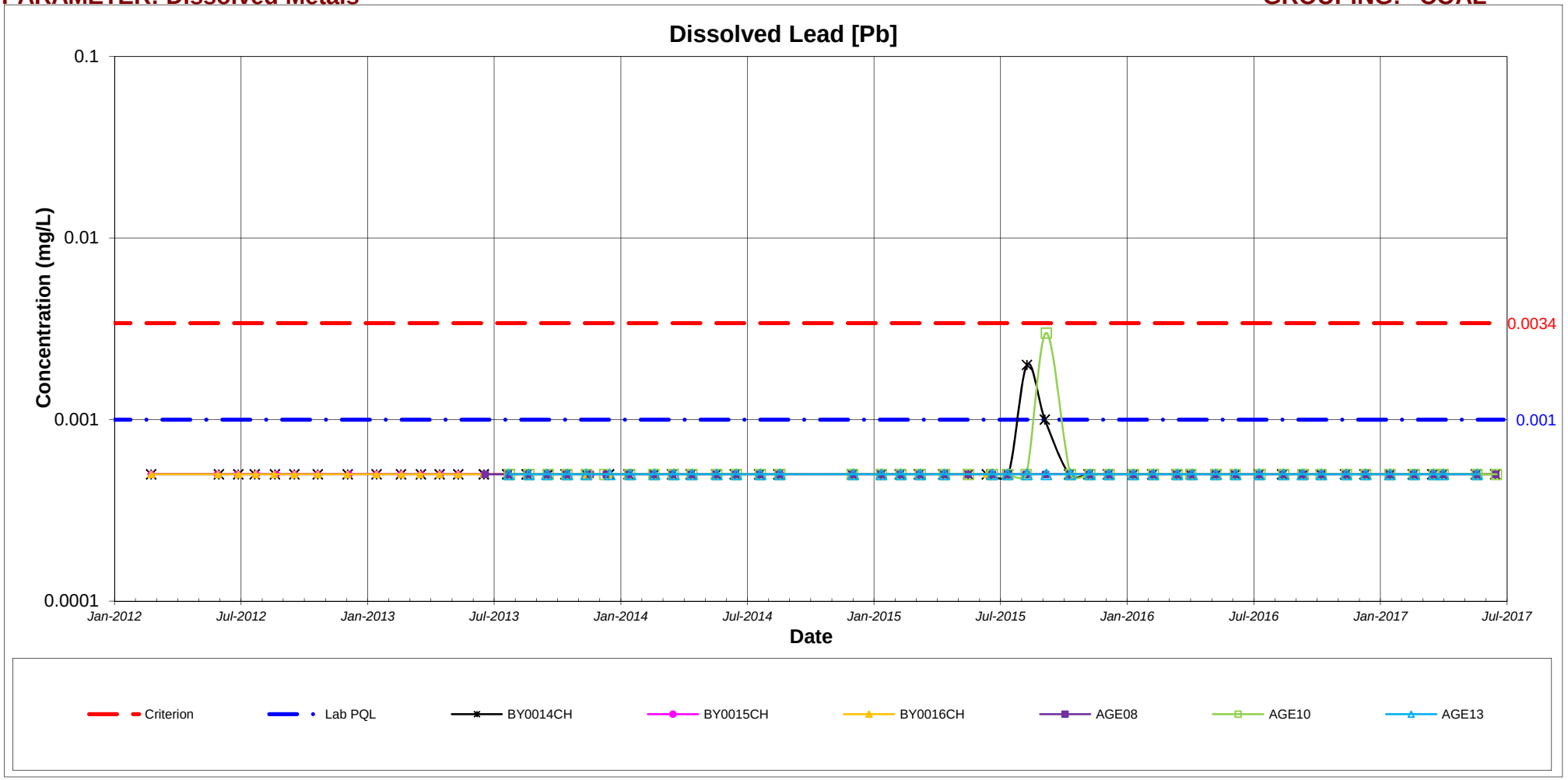

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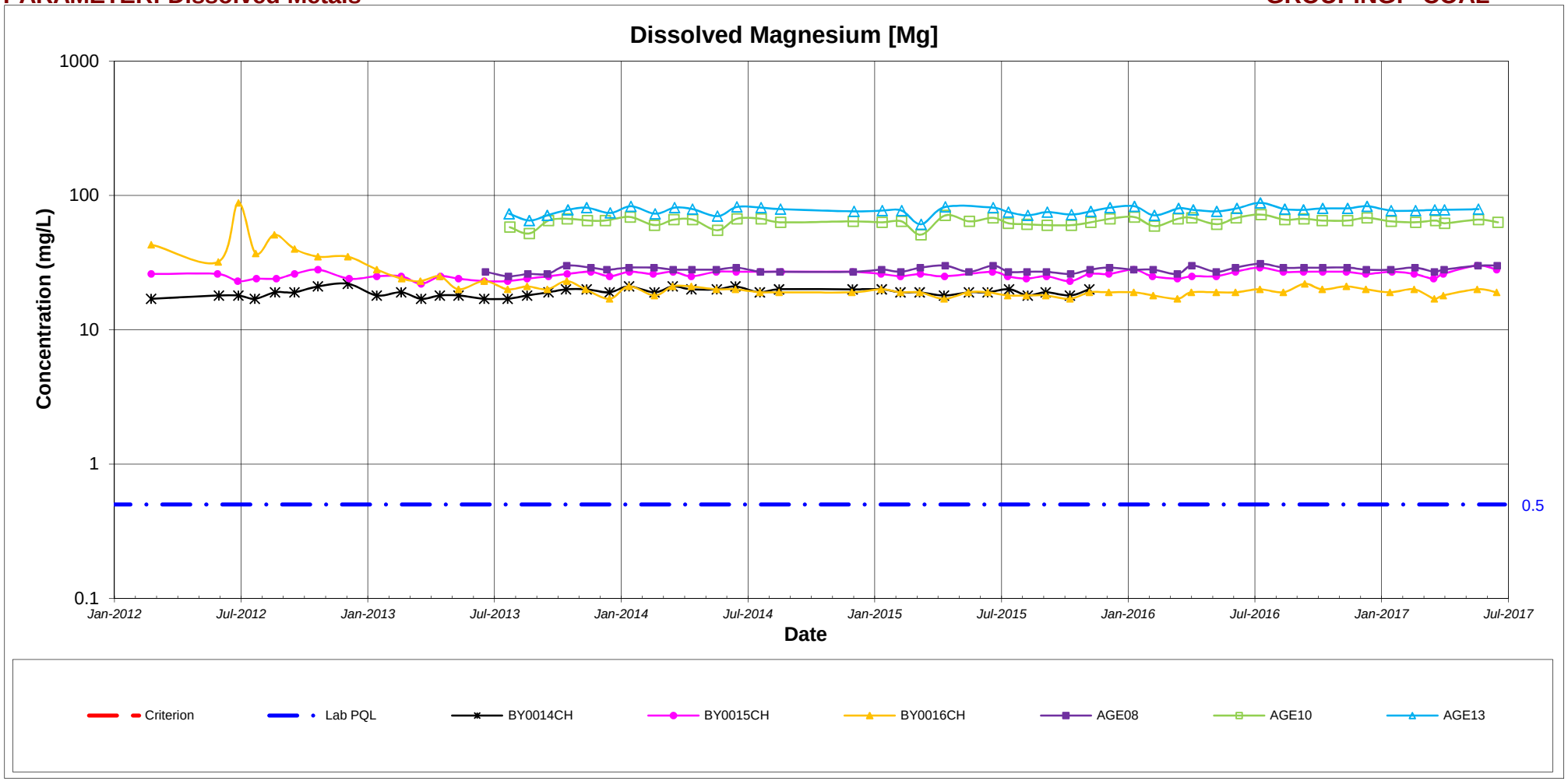

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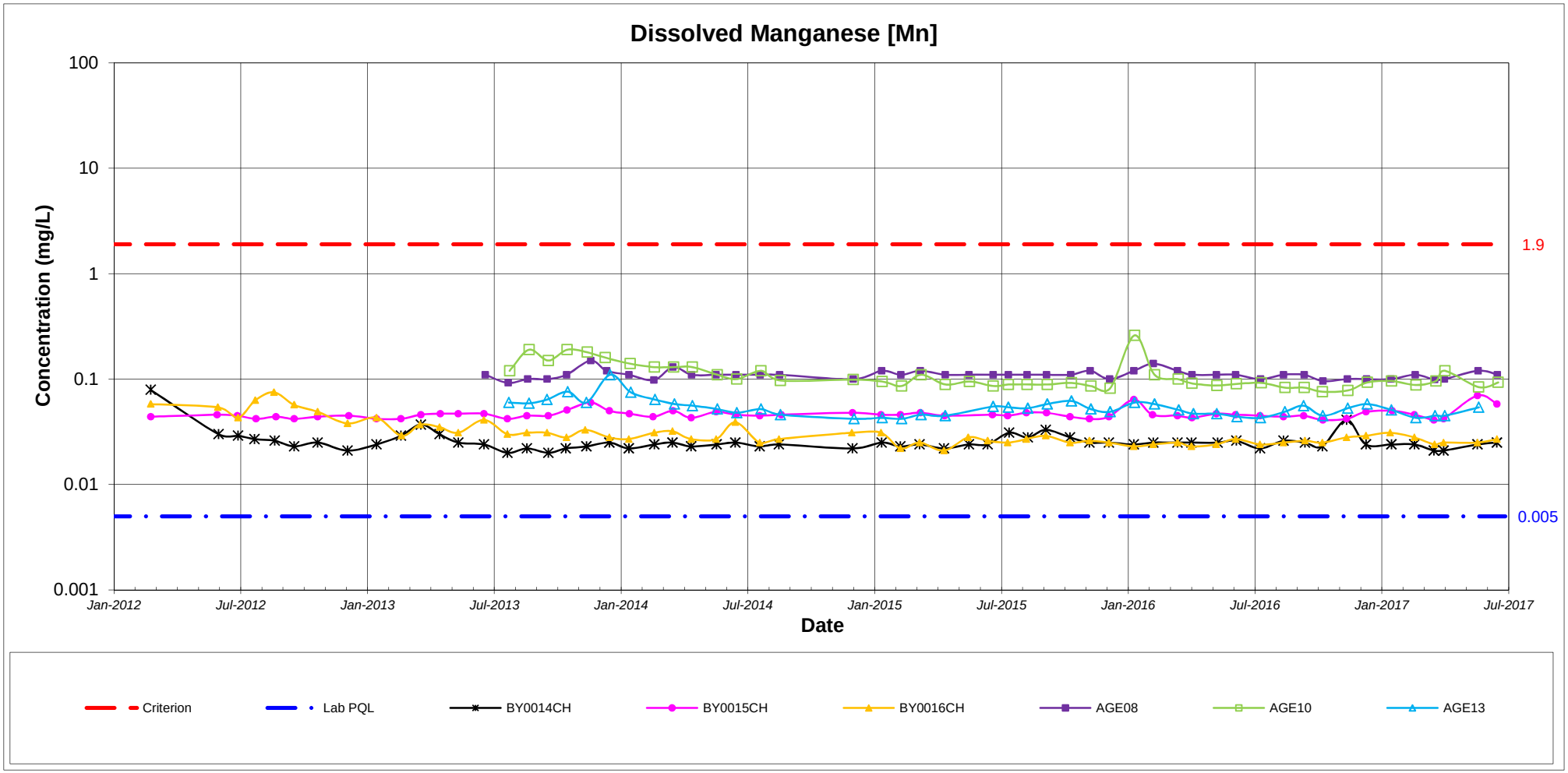

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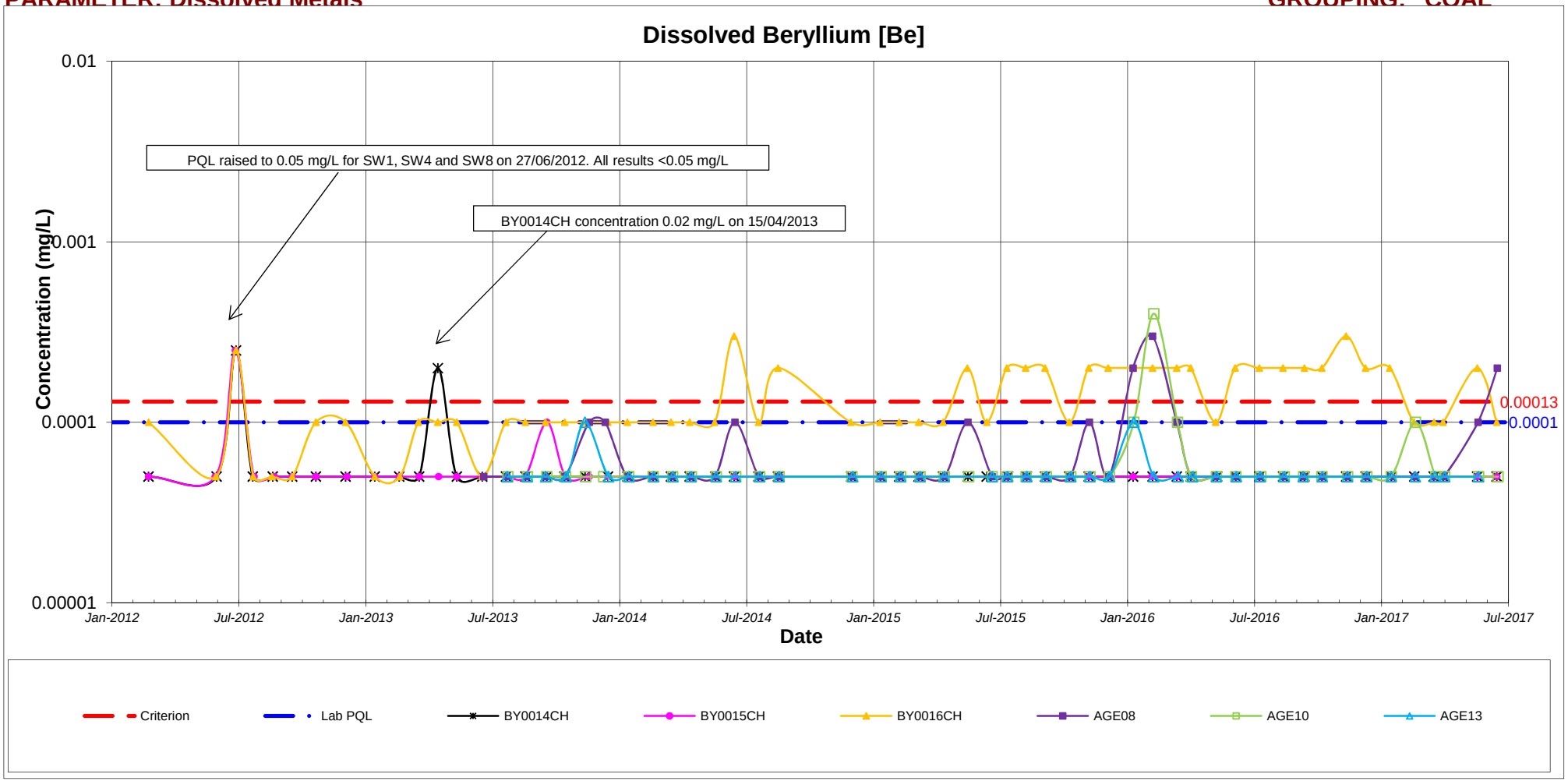

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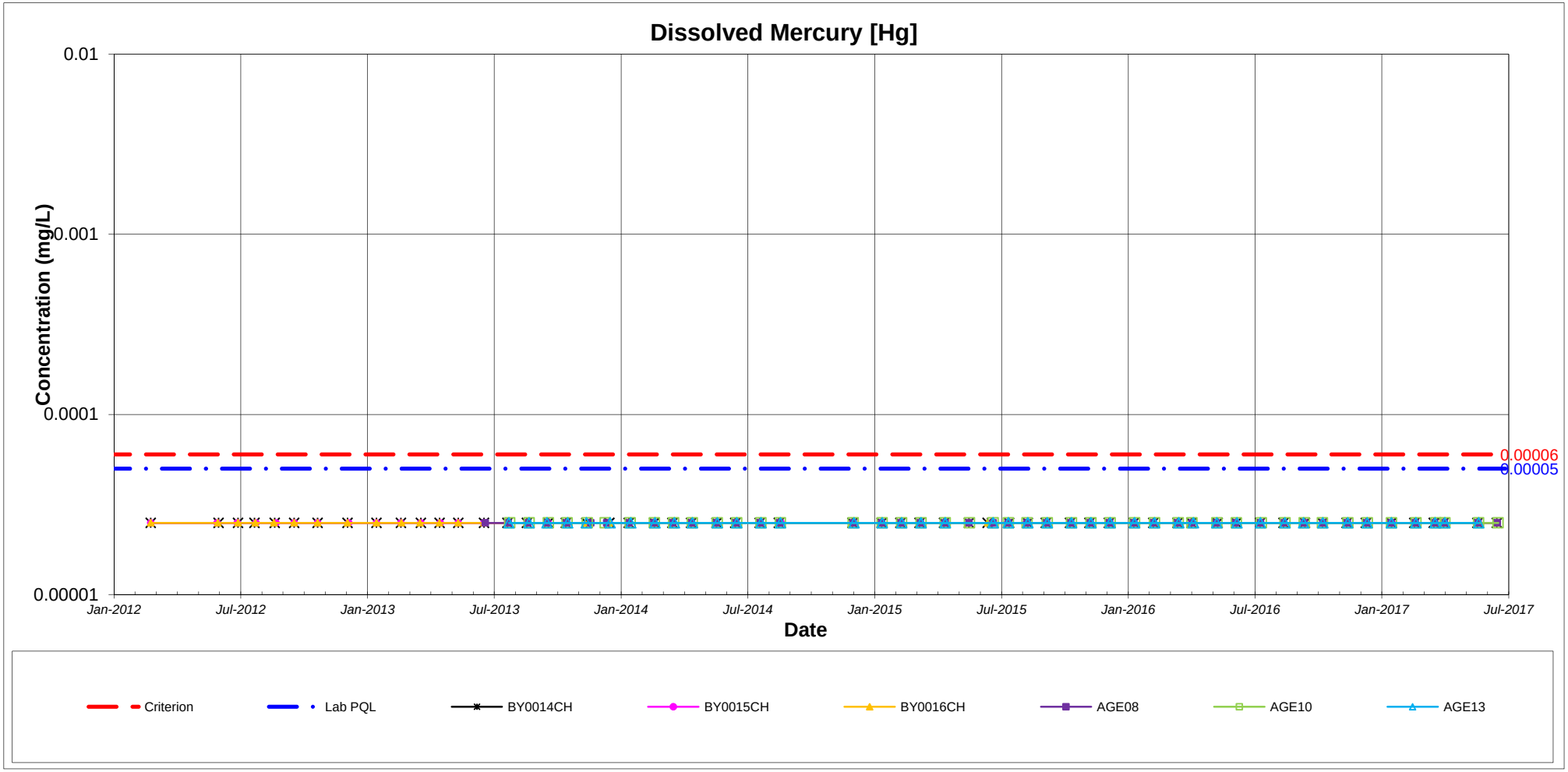

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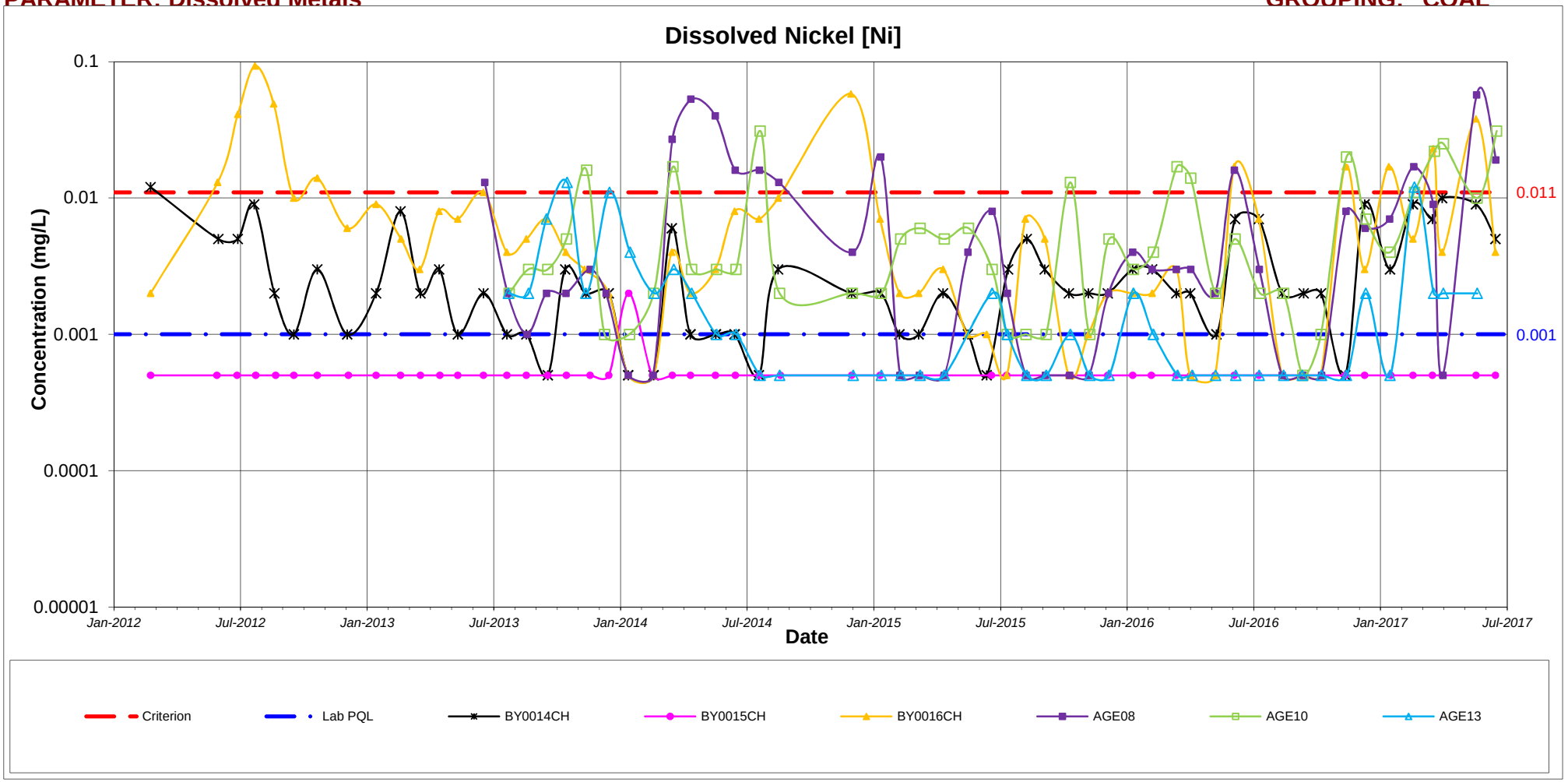

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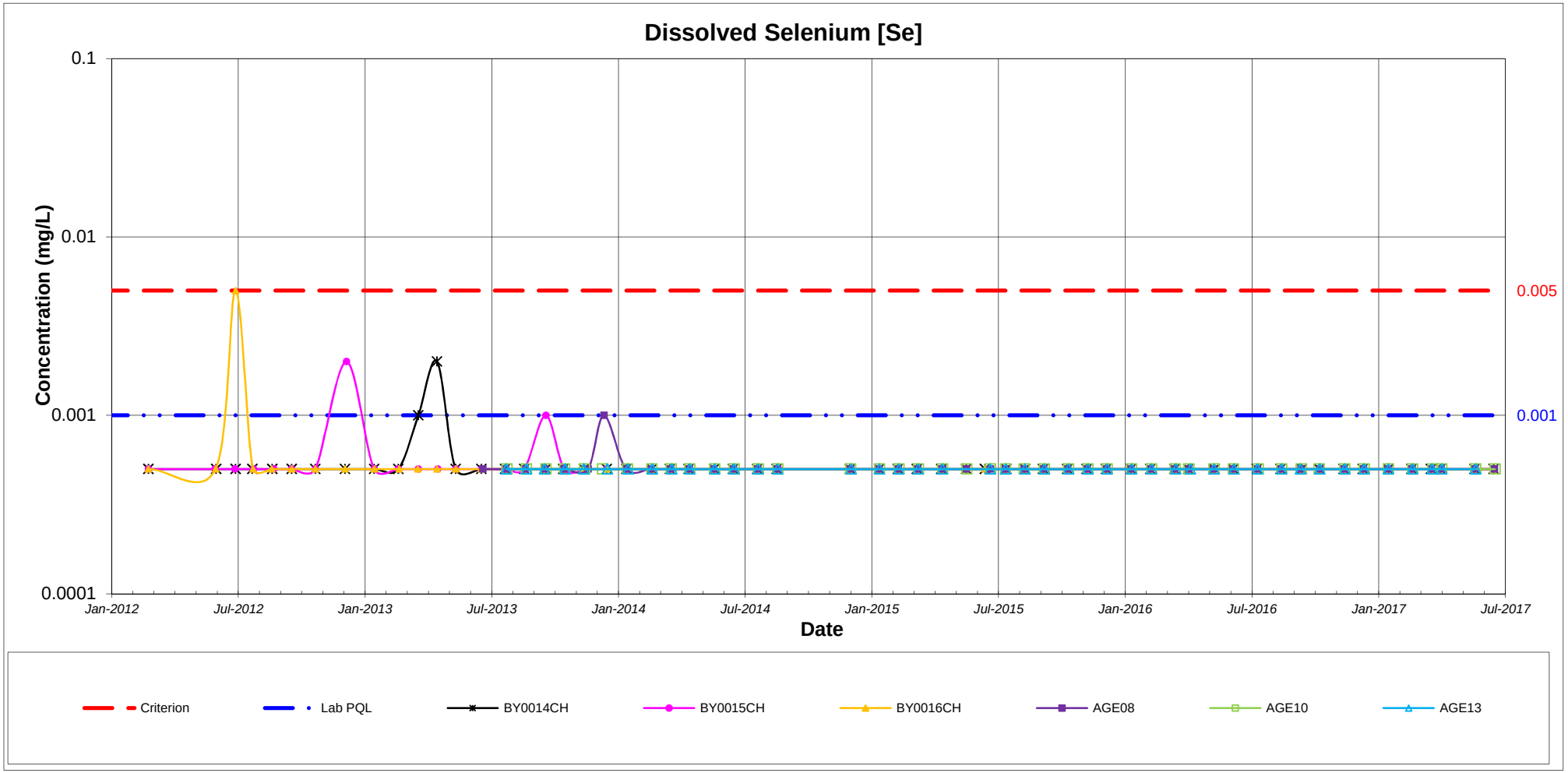

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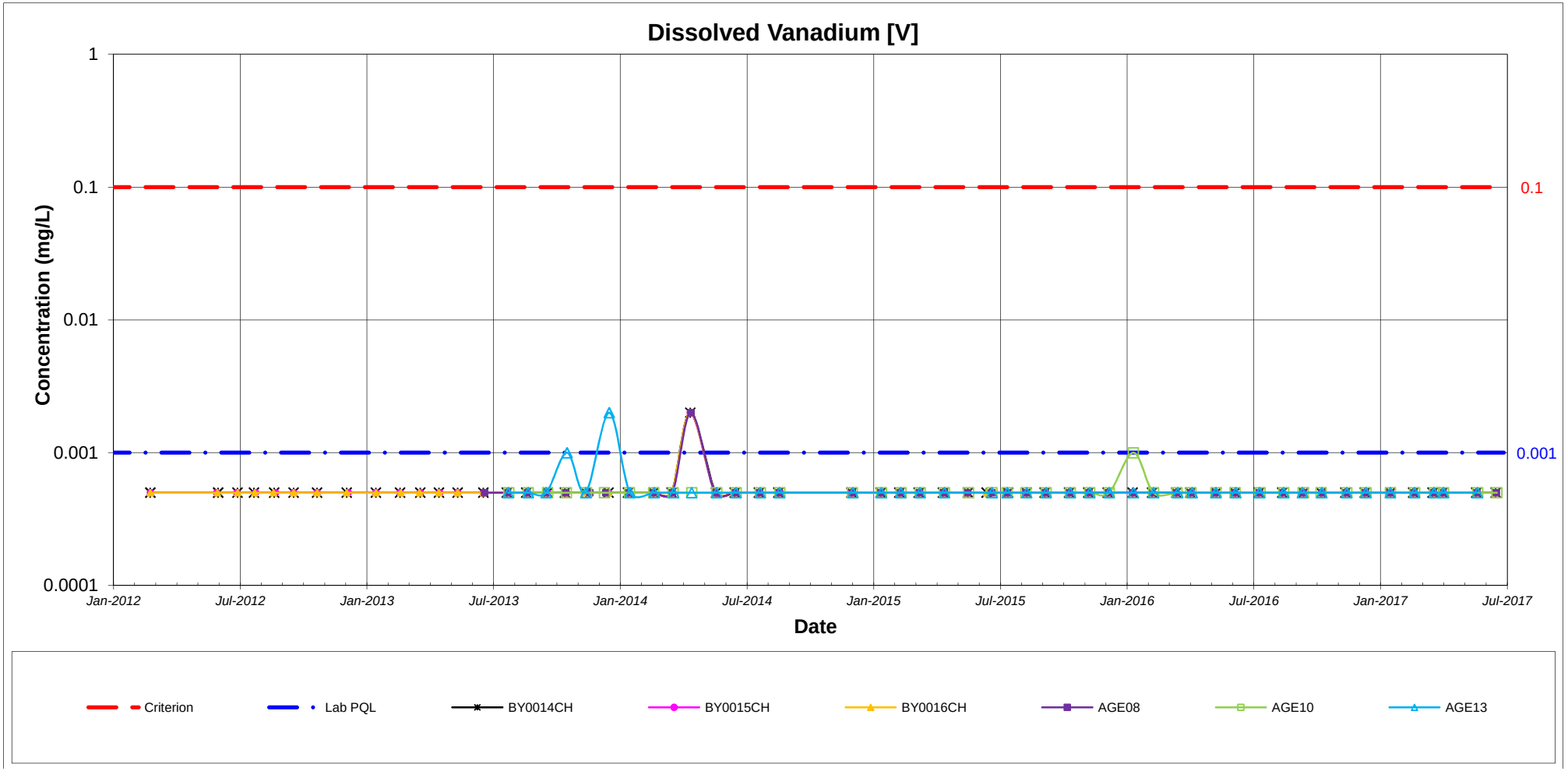

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Client: WorleyParsons Services Pty Ltd — **Document No: R.014.Rev0**

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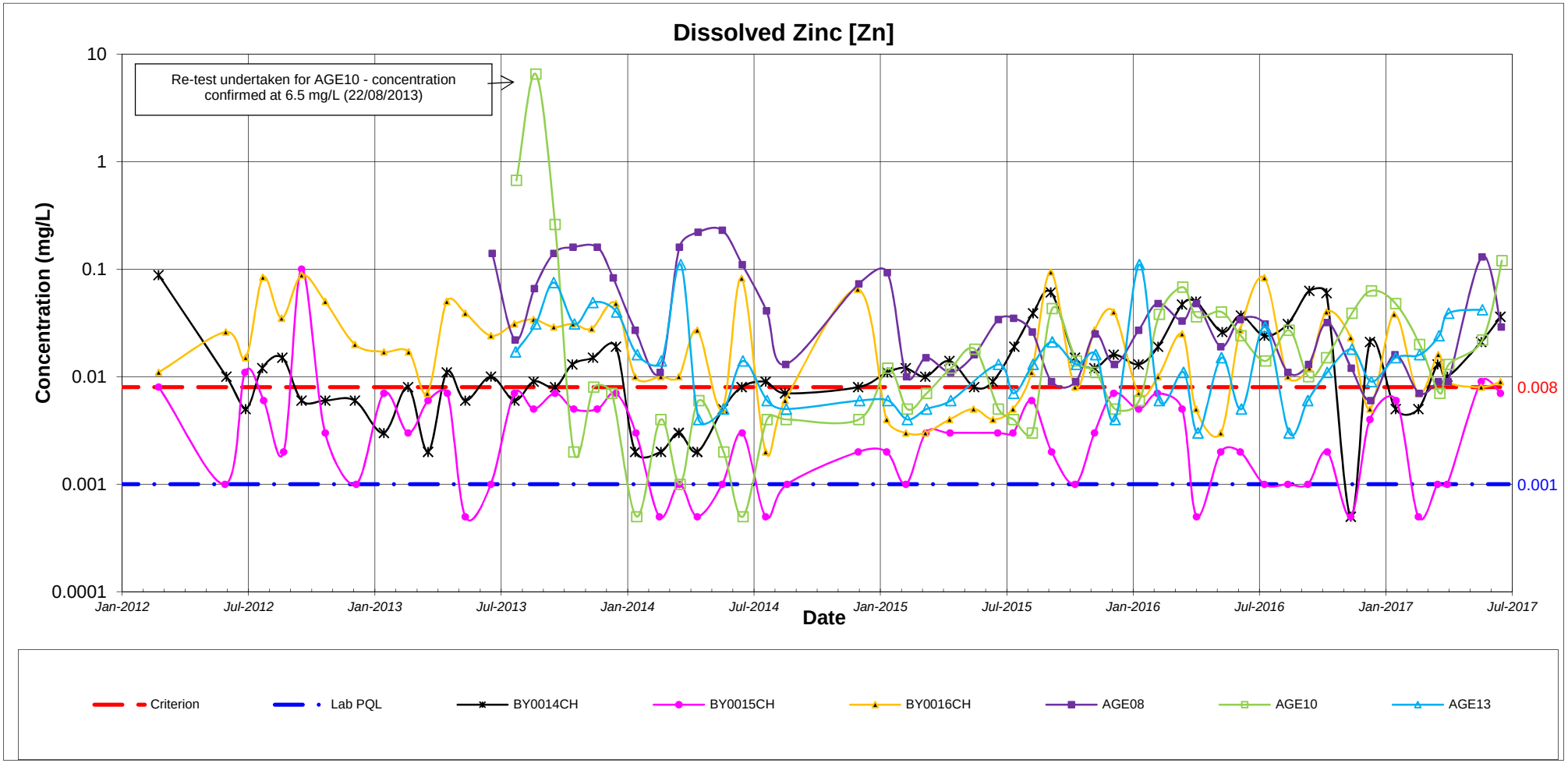

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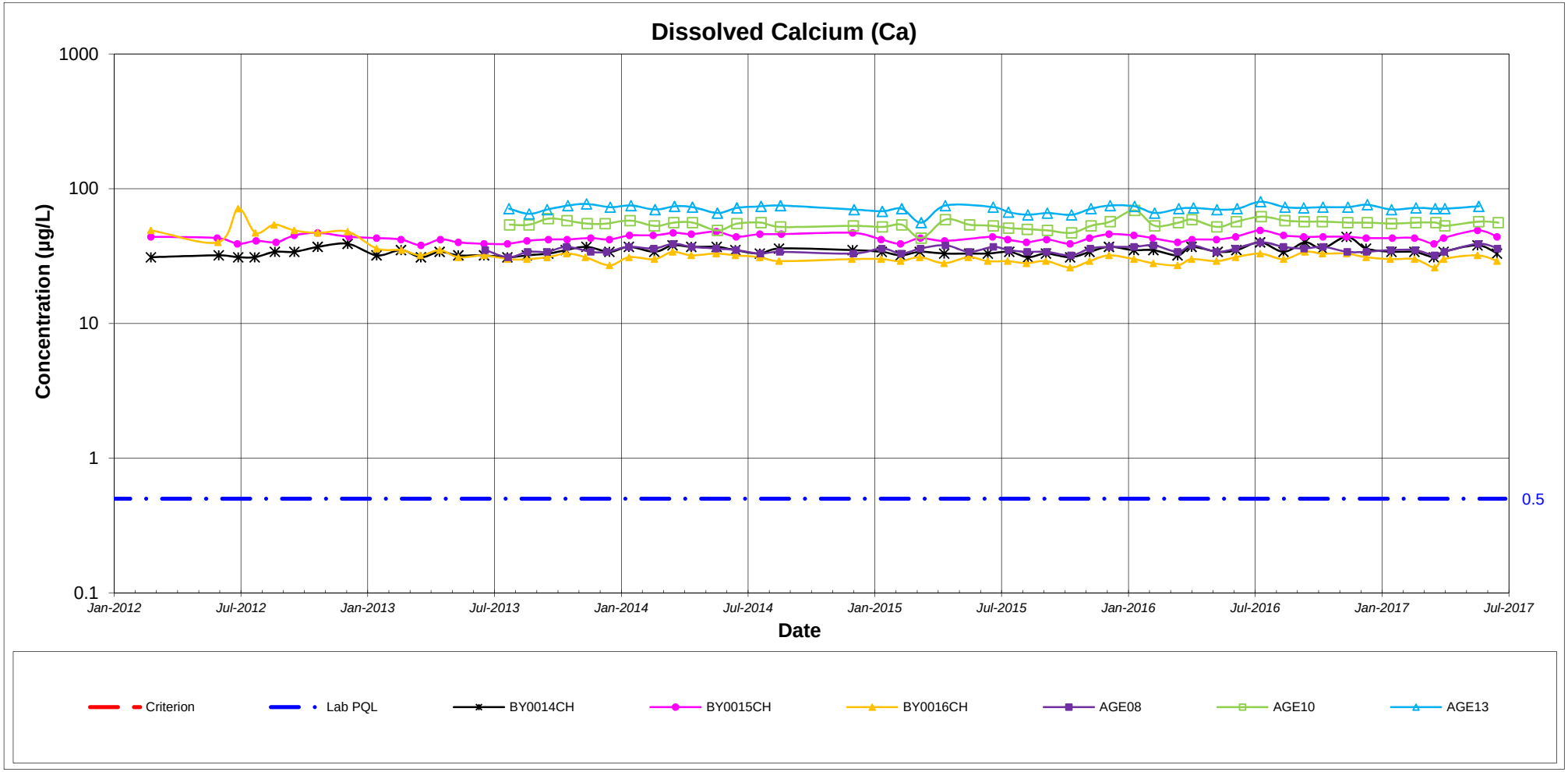

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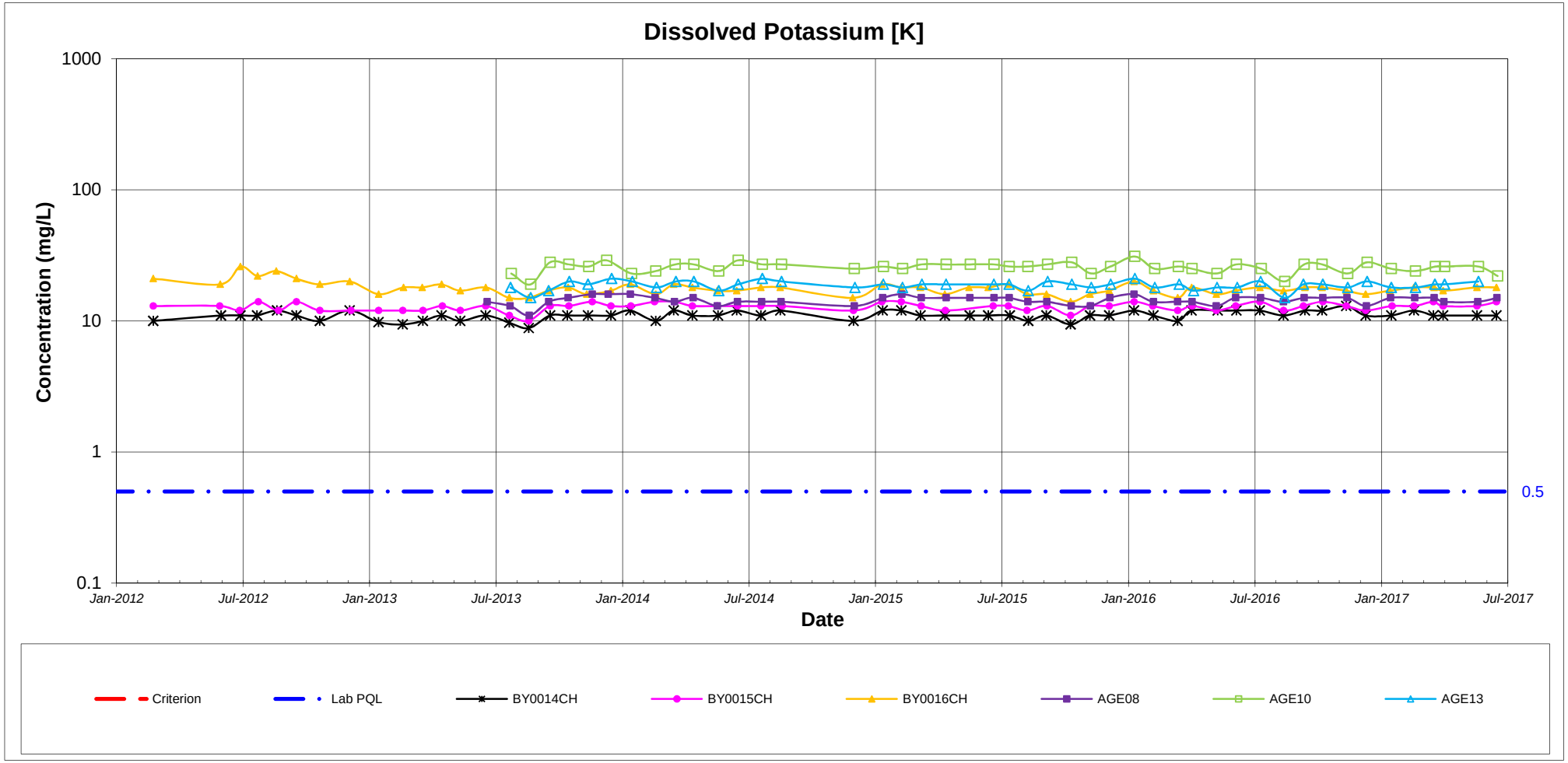

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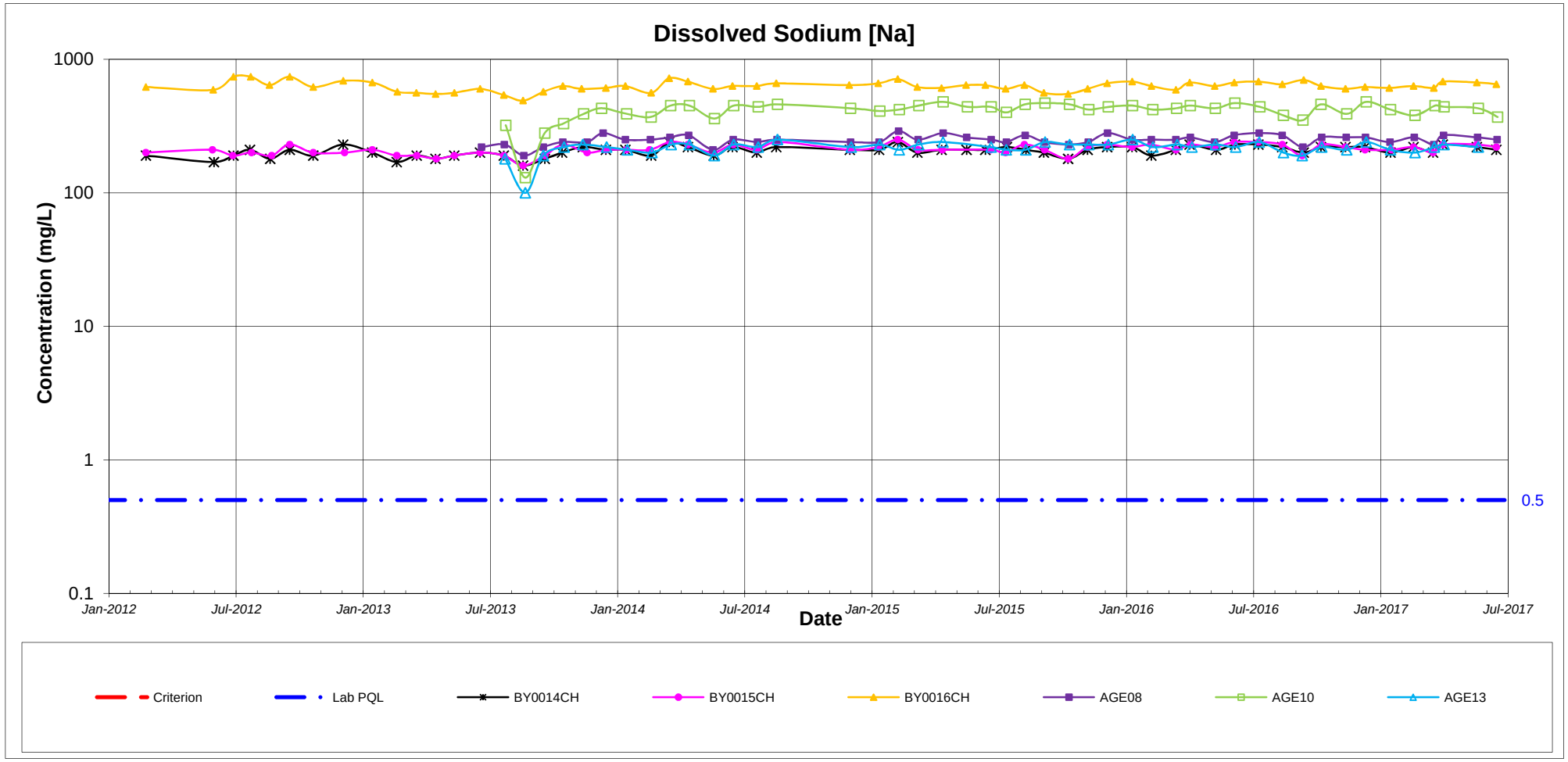

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