BRUKUNGA REMEDIATION PROGRAM: WATER MONITORING REPORT

2009

Brukunga Mine site, Watts Road, Brukunga

EPA Licence: 10577

Mine Completion Program
Mining Regulation & Rehabilitation
Minerals and Energy Resources Division
Department of Primary Industries and Resources (PIRSA)

GPO Box 1671
Adelaide SA 5001

Final Report • May 2010

Table of Contents

List of Figures

List of Tables

1. Acknowledgments

The Brukunga Mine Water Monitoring Report is a combined effort, drafted and finalised by the following individuals:

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Staff and companies that have provided valuable services / and or assistance with the collection, collation, interpretation and presentation of data include:

Peter Grindley (PIRSA)

Mark Seifert (PIRSA)

Matthew Skewes (PIRSA)

Australian Water Quality Centre (AWQC)

Water Data Services (WDS)

2. Monitoring Report for Environment Protection Authority

2.1 Report Identification

Authorisation Number: 10577

Name of Licensed site: Brukunga Water Treatment Plant and Mine

Address of Licensed site: Watts Rd Brukunga SA 5252

Report Name and Date: Brukunga Remediation Program: Water Monitoring Report May 2010

Reporting Period: January – December 2009

Report Contact: Michael McLeary (Program Manager – Mine Completion)

3. Executive Summary

The Brukunga Mine operated between1955 to 1972, quarrying iron sulphide (pyrite and pyrrhotite) from the site of two steep hills in an open pit. The concentrated ore was converted to sulphuric acid, and subsequently used in the manufacture of superphosphate fertiliser. The pyrite and pyrrhotite minerals that remain on site naturally oxidise in air to form acid and the resultant acid and metalliferous drainage (AMD) dissolves other minerals causing heavy metal contamination of the local watercourse.

The land is freehold title held by the Minister for Mineral Resources Development on behalf of the Crown and has been managed by the Department of Primary Industries and Resources - Minerals and Energy Resources Division since 1998.

The key work undertaken on site is the interception and treatment of acid seepage with lime to prevent acid and metals from entering and polluting the local watercourse. The AMD is neutralised in a plant to remove the soluble heavy metals before the cleaned water is released back to Dawesley Creek. The water monitoring program, undertaken in accordance with conditions of the Environment Protection Authority site licence No.10577, provides a measure of the success of the interception and treatment program.

In 2003 a major improvement in water quality in the creek downstream of the mine site was achieved primarily due to the construction of a 1.7 km creek diversion drain. In 2005 upgrading of the lime treatment plant was completed, effectively doubling its capacity to treat AMD from the site. These two initiatives have resulted in a marked improvement in downstream water quality, compared to levels measured prior to 2003.

With respect to results obtained from the 2009 water quality monitoring program the following highlights are considered relevant:

- Rainfall measured in 2009 returned to a figure closer to the long-term average following three dry years, resulting in a marked increase in the volume of water treated.

- In terms of water quality the 2009 results appear reasonably consistent when compared to other recent years (post 2003). It should also be noted that these are markedly improved over pre-diversion results.

- Water quality downstream of the mine generally improves (relative to anayltes measured against ANZECC guidelines) with distance (from the mine) in terms of livestock standards. Exceeded trigger values generally relate to sulphate, aluminium and cadmium.

- Although the catchment and pump system were operating at peak capacity for much of the winter in 2009 there were 5 occasions where the site catchment system (including treatment plant) was unable to contain all contaminated run-off on site.

Given PIRSA's current remediation planning for the Brukunga site it is likely that the monitoring program will be amended in the near future in order to better reflect any future changes to management and/or remediation of the minesite.

4. Background

The Brukunga Mine lies adjacent to the township of Brukunga in the Adelaide Hills. The site is located 4 km north of Nairne and 40 km east of Adelaide in the Mount Lofty Ranges of South Australia. The site operated between 1955 and 1972, quarrying iron sulphide (pyrite and pyrrhotite) from the side of two steep hills, in an open pit. The Mine was sited within a thickening of the geological formation hosting the pyrite. This formation continues to the north and south of Brukunga, extending some 40km in total. Mining activities did not remove all pyrite and pyrrhotite from the site.

The Mine supplied feedstock for sulphuric acid manufacture for use by the fertiliser industry in the production of superphosphate fertilisers. The development of the Mine was encouraged and sponsored by the State and Federal Governments to provide employment and ensure self-sufficiency in local agriculture. This was in-keeping with Government policy at the time, for the nation to become self-sufficient, increase the population and develop the country. In fact, the Federal Government paid a bounty for the mining of pyrite for sulphuric acid manufacture, under the *Sulphuric Acid Bounty Act 1954* and the *Pyrites Bounty Act 1960*. In the late 1960s cheaper sources of sulphur became available and the Government withdrew the subsidy for pyrite. The Mine closed when the subsidy ended on 31 May 1972.

The Mine produced 5.5Mt of iron sulphide during its 17 years of operation. Approximately 8Mt of waste rock and 3.5Mt of tailings were produced during the operation of the Mine. Three waste rock dumps and a tailings storage facility (TSF) were constructed on the site. Two of the waste rock dumps (the north and south) remain, however the third (east) was largely removed to the tailings storage facility.

The major environmental concern associated with the Brukunga Mine site is the natural oxidation of iron sulphides in air and water, which results in acid and metalliferous drainage (AMD). AMD is widely recognised in the mining industry as the greatest environmental legacy of mining and minerals processing. *'AMD is generally characterised as water of low pH containing dissolved metals, as is the case at Brukunga'* (TAG, 2008). The impacts of AMD from the site could be detected while the site was operational, downstream in the Mount Barker Creek, Bremer River and Lake Alexandrina and the water has not been suitable for stock consumption, irrigation, domestic or potable use.

During mining, some of the AMD water was controlled by onsite management including using it in the metallurgical plant. Following closure of the Mine in 1972, two caretakers were employed to collect and pump the AMD to a large evaporation lake on the TSF.

The State Government accepted responsibility for management and remediation of the site in 1977. In 1980, the Government commissioned the

acid neutralisation plant to treat acid water from the lake on the TSF. The Department of Engineering and Water Supply (which then became SA Water) was responsible for management of the plant and site from 1980 to 1997. In 1998 responsibility for the site was transferred to the Mineral Resources Division of the Department of Primary Industries and Resources (PIRSA). Within PIRSA the Mine Completion Program is tasked with management of the Brukunga site. Site based activities are largely focused on operation of the treatment plant and land management activities, such as fencing, pest control, fire management etc.

The Brukunga Mine site is listed as a prescribed activity of environmental significance under Schedule 1 of the *Environment Protection Act 1993* (the EP Act).

> *'4(1) Brukunga Mine Site – the management of the abandoned Brukunga Mine site and associated acid neutralisation plant situated adjacent to Dawesley Creek in the Mount Lofty Ranges.'*

Section 36 of the Act requires that *a 'person must not undertake a prescribed activity of environmental significance except as authorised by an environmental authorisation in the form of a licence'.*

The Minister for Mineral Resources Development holds an environmental licence (EPA10577) for the site.

In March 1999 the Ministerially appointed Brukunga Mine Site Remediation Board (BMSRB) took on the role of managing stakeholder engagement in developing remediation solutions for the site. The BMSRB comprises representatives from the Dawesley Creek Catchment Landcare Group; District Council of Mount Barker; the community and PIRSA; and provides advice to the Minister, Mineral Resources Development on strategies for environmental improvement.

In June 2001, a 10 year rehabilitation programme comprising three stages was recommended and accepted by State Cabinet. The approved strategy has been progressively implemented, with the present state of progress as follows:

- *Stage 1: Diversion of Dawesley Creek* to reduce acid loads – completed in June 2003.
- *Stage 2: Increase Water Treatment Plant Capacity* to upgrade and improve efficiency of acid treatment and reduction of sludge – completed in May 2005.
- *Stage 3: Relocation and Rehabilitation of Waste Rock Dumps* designed to reduce a source of acidity and metals – not yet commenced.

Prior to the installation of the diversion in 2003, approximately 50% of AMD from the site was captured, however following the installation of the diversion the amount of AMD captured and treated increased to over 90% of AMD produced by the site. Thus the second stage was implemented that being to increase the peak capacity of the acid neutralisation plant (to ensure that the majority of AMD emanating from the site is collected and treated prior to being released back into Dawesley Creek); this was completed in 2005. The third stage was to relocate the waste rock dumps back into the mine void area (not undertaken).

4.1 Forward Program

A review of the current mine management strategy was undertaken in 2007, resulting in the development of the Brukunga Mine 'Forward Program'. The 'Forward Program' was designed to be implemented prior to the commitment of capital funding for Stage 3, to ensure that leading practise options would be considered and implemented thereby maximising benefits to the public and the environment.

The Forward Program comprises four key strategies:

- Reconsideration of the strategic goals for rehabilitation of Brukunga;
- Experimental trials of various treatments on Brukunga waste rock samples;
- Use of international experts as a Technical Advisory Group (TAG) to develop solutions; and
- Continued community engagement.

The Forward Program also comprises six operational Phases.

Phase 1 Remediation Option Development – included the establishment of the TAG. The TAG was tasked with recommending (to Government) the most effective technical remediation option(s) for the Brukunga Mine site, with the goal of developing a final remediation option for the site. A final remediation option and mine completion would allow the return of the land to a use(s) suitable for release from government ownership, requiring no further intervention by, ongoing responsibility for or cost to government and / or the community (in terms of the impacts of AMD). Completed November 2008. Also during this phase the second strategy (Experimental trials of various treatments on Brukunga waste rock samples) was designed, implemented and monitored.

Phase 2 Feasibility / Remediation Option Definition – involved undertaking various studies to determine the feasibility of the preferred option (from Phase

1). It involved determining its likelihood of success, potential cost and future risk. Completed October 2009

Phase 3 Detailed Planning and Design – will involve further detailed studies. The largest component of the Phase will be Stakeholder Engagement, including with the community, Government Agencies, non-government organisations and other interest groups. A decision on whether to proceed to this Phase is expected in mid 2010. This phase of works is anticipated to take 18 – 24 months to complete.

Phase 4 Implementation – Upon a final decision resulting from the conclusion of phase 3 the 4th Phase may involve actual on-ground works, including extensive earthworks, land-forming and revegetation. The timeframe for this Phase will depend largely on community expectations of works scheduling and the availability of funds to undertake works.

Phase 5 Post-closure Monitoring – A Mining and Rehabilitation Program (MARP) will be developed to provide detail on control measures, development of measurable criteria to demonstrate achievement of the outcomes. A Post-Closure Monitoring Plan will be developed to monitor and demonstrate achievement of the closure outcomes stated in the MARP, as well as expectations of the Environment Protection Authority (EPA). The post-closure monitoring period will be agreed with EPA.

Phase 6 Validation – this Phase relates to the completion of the agreed post-closure monitoring and demonstration that the closure outcomes have been achieved. This will provide validation of the Forward Program, the remediation option and positive environmental outcomes for the South Australian community.

4.2 Hydrology

Dawesley Creek, located in the Lower Murray River catchment, can be described as an intermittent stream with small constant flows from autumn to spring, when rainfall predominantly occurs. Average annual rainfall is 575 mm. Periods of no flow occur mostly during the months of January and February.

Upstream of Brukunga, the Dawesley Creek catchment consists of over 2,000 ha of sparsely vegetated open pasture extending northwards roughly 5.5 km.

The Bird in Hand Wastewater Treatment Plant (WWTP) is located near the top of the catchment and discharges treated effluent to a tributary of Dawesley Creek. Historically, the Bird In Hand WWTP released treated effluent year round; however since 2007 effluent is no longer released during summer.

Dawesley Creek flows from north to south through the Brukunga Mine site. The original creek alignment was partially covered by the South Waste Rock Dump during mining, causing it to be diverted to the east. Dawesley Creek followed this alignment, flowing immediately adjacent to the North and South Waste Rock Dumps. The Dawesley Creek diversion was commissioned in June 2003, isolating the old creek alignment through the Mine site with 1.7 km of bypass drain and open channel. The design capacity was for an annual average recurrence interval flood, with the un-diverted volume of larger floods passed over a gabion basket spillway into the old creek alignment. Sections of the old creek alignment adjacent to the Mine are used for AMD collection. In the event that the diversion overflows and the natural creek bed floods and overtops the downstream weir untreated AMD escapes the site, however it should be noted that this release would be greatly diluted given peak capacity must be reached within the diversion channel to cause the flooding.

Three small creeks (Days Creek, Shepherd's North Creek and Shepherd's South Creek) flow into the Mine site from the west, resulting in their flows becoming contaminated by the Mine. The combined "clean" catchment area for these creeks upstream of the Mine site is 152 ha. These creeks probably account for more than 60% of mine site runoff.

The reach of Dawesley Creek that traverses through Brukunga is thought to be a losing reach in which a proportion of surface water is lost to groundwater via the fractured rock. The exact area and extent of this is not currently known.

Taylor's Creek joins Dawesley Creek immediately downstream of the Mine. This stream has a catchment area of approximately 500 ha.

Figure 1 shows the drainage system of the Brukunga Mine and surrounds.

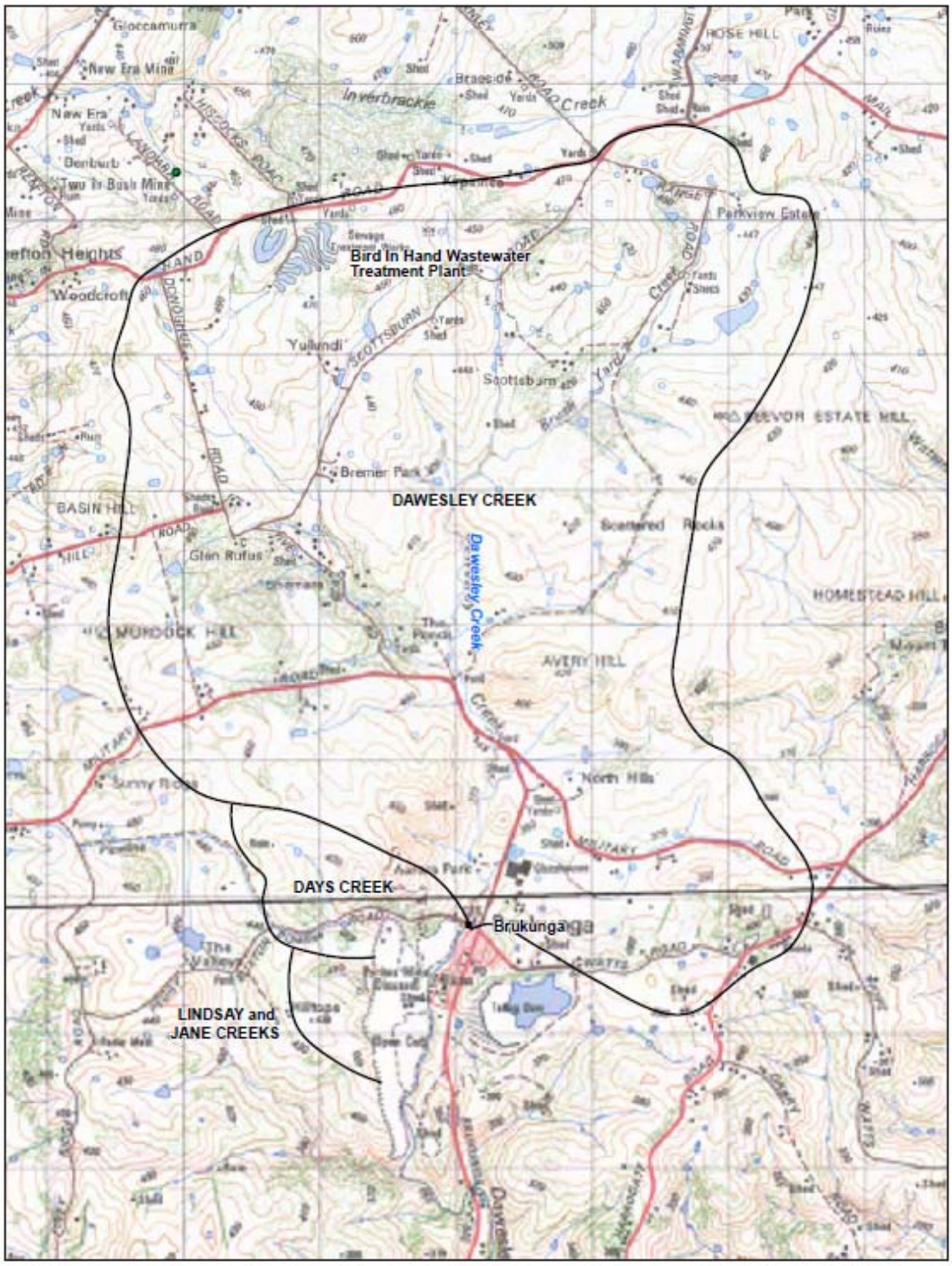


Figure 1 Dawesley Creek Catchment (SKM 2009)

As a result of mining and disturbance of sulphidic materials on site, the Mine became a source of AMD that impacted a range of environmental values (including aquatic ecosystems, stock watering, irrigation, human consumption) downstream to Lake Alexandrina, some 70 km. Whilst substantial improvements were forthcoming with the implementation of the water treatment plant and construction of the diversion channel the effects of AMD are still readily measurable up to 22 km downstream. Contaminants of concern specifically associated with AMD from Brukunga are sulphate, aluminium, iron, manganese, cadmium, zinc and nickel.

5. Monitoring Objective

The impacts of AMD on downstream water quality triggered the inclusion of the Brukunga Mine site and acid neutralisation plant in the EP Act and the requirement to hold a licence under that Act and undertake an extensive surface water quality monitoring program to assess the impacts of the site. The program has been in place since 1996.

The water quality monitoring program was established to:

- Determine annual and seasonal loads of heavy metals entering the Dawesley Creek from the site, by measuring stream flow and metal concentration upstream and downstream of the Mine (composite sampling);

- Determine the extent of impact of the Mine (i.e. the zone of impact) on Dawesley Creek and the Bremer River by undertaking biological (macroinvertebrate) monitoring on a quarterly basis; and

- Determine the temporal and spatial variations of pH and heavy metals concentrations within the zone of impact by undertaking a monthly sampling program (grab sampling).

6. Monitoring Plan

The Monitoring Plan for the Brukunga Remediation Program was developed as part of an Environment Improvement Program established by negotiation between EPA and SA Water (which previously managed the site) in August 1996 and approved by EPA in the same year.

Figure 2 shows the monitoring locations and Table 1 lists the type of monitoring undertaken at the various sites.

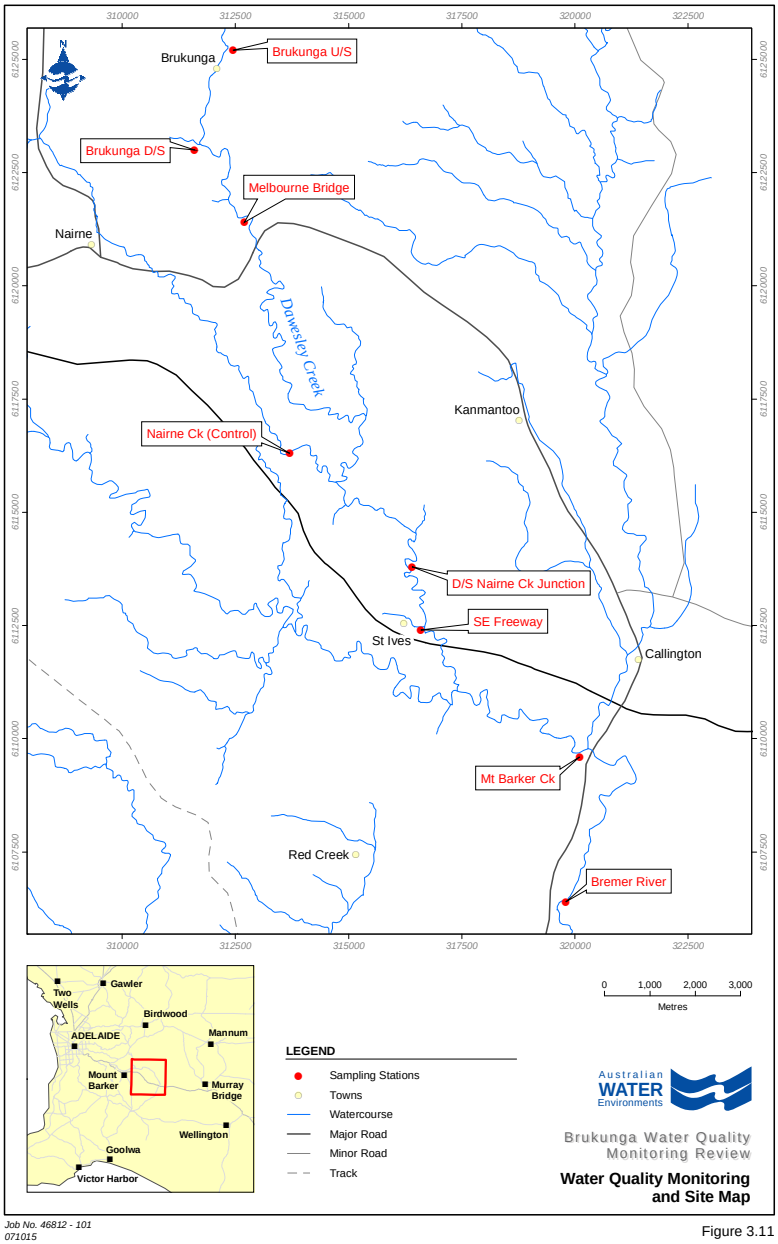


Figure 2 Monitoring Point Locations (PIRSA 2009)

Table 1 Sampling Type and Location

	Monitoring Undertaken		
Site	**Grab Sampling**	**Composite Sampling**	**Macroinvertebrate Sampling**
Brukunga upstream (Peggy Buxton Road) (ref. 4728)	✓	✓	✓
Brukunga downstream (ref. 3158)	✓	✓	✓
Melbourne Bridge (ref. 1951)	✓		✓
Nairne Creek (control) (ref. 1953	✓		✓
Downstream Nairne Creek Junction (ref. 1822)	✓		✓
South East Freeway (ref. 1952)	✓		✓
Mount Barker Creek (ref. 1807)	✓		
Bremer River (ref. 1824)	✓		

6.1 Flow Monitoring and Composite Sampling

Two hydrometric stations were established directly upstream and downstream of Brukunga by the Department of Engineering and Water Supply (E&WS) in 1993. They form part of a system of automatic logging stations that record creek flows in the Adelaide Hills. The volume of flow in the Dawesley Creek is determined as it passes over concrete v-notch weirs.

Automatic water sampling facilities were installed at the Brukunga stations in 1998 and chemical analysis commenced on 3 February 1998. These facilities are presently supplied and maintained by Water Data Services Pty Ltd (WDS).

The annual and seasonal contaminant loads are determined for an agreed suite of contaminants as Dawesley Creek leaves the Mine site. Composite sampling and analysis allows for the conversion of a measured concentration of an analyte into a load of the pollutant for a given period of time, using the corresponding flow data.

Flow and assay data is supplied to the Department of Water, Land and Biodiversity Conservation by WDS, for storage in the Department's water data archive.

6.2 Biological Monitoring

Biological monitoring, involving the collection and identification of macroinvertebrate species, is conducted quarterly (March, June, September, December) by biologists from the Australian Water Quality Centre (AWQC).

Biological monitoring commenced at six monitoring sites in the Dawesley – Bremer River system in September 1996. Monitoring of riffle sites was introduced in 2006 at the recommendation of AWQC. Sampling and analysis is undertaken in accordance with the Australian Rivers Assessment System (AusRivAS) guidelines.

6.3 Grab Sampling

Monthly grab sampling is undertaken at eight sites (refer to Figure 2) by either PIRSA or AWQC (during macroinvertebrate monitoring periods) staff. Unfiltered samples are analysed by AWQC.

The agreed suite of analytes is the same as for the composite samples, with the addition of analysis for acidity as calcium carbonate (to pH 9.5) for four locations, which was initiated in August 2003. The purpose of which was to provide additional information on these sites.

7. Monitoring Results and Interpretation

7.1. Biological Monitoring

The results and interpretation of the biological monitoring program and report prepared by AWQC can be found in Appendix 4.

7.2 Flow Monitoring and Composite Sampling

7.2.1 Annual Flow Volumes

Monthly recorded flow volumes measured at the upstream (U/S) and downstream (D/S) monitoring locations are presented in Table 2.

Table 2 Monthly Recorded Flow Volumes (2009)

	Total flow U/S (ML)	Total flow D/S (ML)
Jan	0.252	0.446
Feb	0	0
Mar	0	0
Apr	0.599	1.481
May	0.843	4.742
Jun	29.114	52.432
Jul	205.977	229.508
Aug	258.838	323.632
Sep	289.325	365.364
Oct	117.367	149.251
Nov	33.634	33.036
Dec	5.921	6.618
Total	**941.87**	**1166.51**

Annual total flows for both sites are presented in Figure 3. It should be noted that the Bird in Hand Wastewater Treatment Plant (WWTP), located upstream of Brukunga, previously released treated effluent to the Dawesley Creek on a year-round basis. Since the summer of 2007, SA Water no longer release treated effluent to the Creek during the summer months, when there is a demand for the effluent for irrigation. This has resulted in a marked difference in the flow regime experienced by the Dawesley Creek particularly during the drier months.

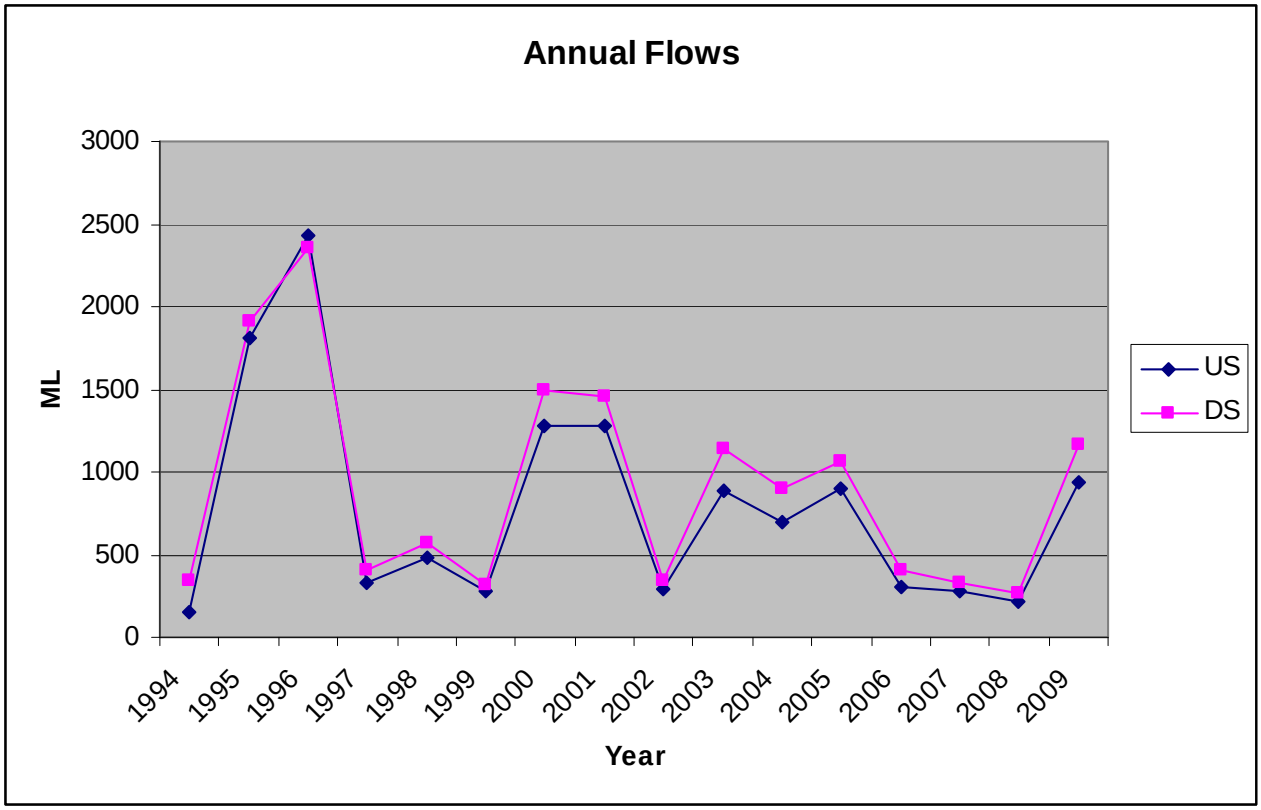


Figure 3 Total Annual Flow Volumes Upstream and Downstream of Brukunga Mine

7.2.2 Annual Pollutant Loads

Tables 3 and 4 detail concentrations of contaminants measured at the upstream and downstream sites during 2009. Measured values are compared with the trigger values for the various analytes listed in the ANZECC guidelines.

Table 3 Contaminant Concentrations Measured at Upstream Hydrometric Station (Peggy Buxton Rd) in 2009

Date and time	EC at 25C us/cm	pH pH Units	TDS mg/l	Sulphate Total mg/l	Aluminium Total mg/l	Cadmium Total mg/l	Chromium Total mg/l	Copper Total mg/l	Iron Total mg/l	Lead Total mg/l	Manganese Total mg/l	Nickel Total mg/l	Zinc Total mg/l
12/01/2009	No Flow												
26/01/2009	No Flow												
**/02/2009	No Flow												
**/02/2009	No Flow												
**/03/2009	No Flow												
**/03/2009	No Flow												
**/4/2009	No Flow												
**4/2009	No Flow												
4/05/2009	No Flow												
18/05/2009	2080	7.5	1100	149	0.213	<0.0005	<0.003	0.0074	1.5	0.0008	0.0379	0.0101	0.0270
3/06/2009	2190	7.3	1200	184	1.89	<0.0005	<0.003	0.0108	3.62	0.0025	0.1416	0.0139	0.0540
16/06/2009	1540	7.6	850	9.3	0.093	<0.0005	<0.003	0.0059	0.283	0.0008	0.0421	0.0106	0.0260
30/06/2009	1740	7.5	960	117	0.184	<0.0005	<0.003	0.005	1.109	<0.0005	0.0149	0.0082	0.0300
13/07/2009	1190	7.2	660	53.7	1.79	<0.0005	0.004	0.006	3.117	0.0014	0.0462	0.0086	0.0450
28/07/2009	866	6.9	480	42.3	0.142	<0.0005	<0.003	<0.0010	0.2034	<0.0005	0.0033	0.0009	0.0030
11/08/2009	1620	7.7	890	96.9	1.873	<0.0005	0.004	0.0076	4.128	0.0013	0.096	0.0124	0.0570
24/08/2009	1710	7.8	940	106	0.559	0.0001	0.0011	0.003	1.763	0.0004	0.0385	0.0084	0.0351
8/09/2009	926	7	510	47.1	0.94	0.0001	0.002	0.005	1.771	0.0008	0.03	0.0045	0.0317
22/09/2009	1300	7.6	720	65.1	2.757 / 2.6	0.0002	0.0047	0.007	4.233	0.0013	0.1373	0.0116	0.0690
6/10/2009	1010	7.2	560	43.2	0.591	0.0001	0.0016	0.0051	2.032	0.0009	0.0179	0.004	0.0310
19/10/2009	1450	7.3	800	60.3	0.394	0.0001	0.0011	0.0049	1.597	0.0006	0.0166	0.0047	0.0246
2/11/2009	1780	7.9	980	119	0.423	0.0001	0.0013	0.0039	1.209	0.0004	0.0735	0.0059	0.0242
16/11/2009	1840	7.7	1000	119	0.213	0.0004	0.0008	0.0136	0.7122	0.001	0.0914	0.0144	0.0332
1/12/2009	1570	7.9	870	65.4	0.211	0.0001	0.001	0.0025	0.8308	0.0003	0.0585	0.008	0.0106
15/12/2009	1910	8.1	1100	102	0.203	0.0003	0.0011	0.0011	1.267	0.0007	0.1127	0.0098	0.0352
29/12/2009	2460	8.1	1400	128	0.231	0.0004	0.001	0.0024	2.167	0.0007	0.271	0.0109	0.0195
For Aquatic Ecosystems		<6.5/>9.0			0.08	0.0004 0.00228		0.0018 0.00936		0.006 0.06608	2.5	0.013 0.0676	0.015 0.078
Irrigation		<6/>8.5			5	0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock		no value	2,500	1,000	5	0.01	1.00	0.4		0.1		1	20.000

Table 4 Contaminant Concentrations Measured at Downstream Hydrometric Station in 2009

Date and time	EC at 25C us/cm	pH pH Units	TDS mg/L	Sulphate mg/l	Aluminium Total mg/L	Cadmium Total mg/L	Chromium Total mg/L	Copper Total mg/L	Iron Total mg/L	Lead Total mg/l	Manganese Total mg/L	Nickel Total mg/l	Zinc Total mg/L
13/01/2009	3860	7.5	2100	2050	1.3	0.0015	<0.003	0.0041	1.77	<0.0005	0.9906	0.0243	0.1110
26/01/2009													
**/02/2009													
**/02/2009													
**/03/2009													
**/03/2009													
**/4/2009													
**4/2009													
5/05/2009	4400	4.5	2500	2810	21.2	0.0212	<0.003	0.0309	0.467	<0.0005	19.22	0.1404	3.7000
19/05/2009	4230	4.6	2400	2487	18.3	0.0232	<0.003	0.0258	2.11	0.0006	14.2	0.0725	3.0300
3/06/2009	3260	4.8	1800	1720	8.23	0.0154	<0.003	0.019	2.02	0.0058	6.421	0.0572	1.9000
16/06/2009	2460	5	1400	96.6	0.358	0.0085	<0.003	0.0089	0.013	<0.0005	2.29	0.0535	1.5900
30/06/2009	2550	7.1	1400	891	1.778	0.0031	<0.003	0.0069	1.099	<0.0005	2.245	0.0225	0.1850
13/07/2009	1900	4.7	1000	690	30.4	0.0179	0.009	0.0374	13.49	0.003	2.805	0.1218	2.4000
28/07/2009	1590	3.9	880	618	42.55	0.0231	<0.003	0.0706	0.9131	<0.0005	2.839	0.0773	3.9990
11/08/2009	2210	5.9	1200	630	15.05	0.0048	0.004	0.0249	9.853	0.002	1.035	0.0365	0.7393
24/08/2009	2290	6.8	1300	657	7.832	0.0038	0.0007	0.0087	2.774	0.0004	0.8908	0.0254	0.3952
8/09/2009	1270	6.1	700	293	1.196	<0.005	0.0003	0.0061	0.432	<0.01	0.667	0.0370	0.5470
21/09/2009	1870	6.1	1000	450	2.605	0.0068	0.0011	0.0118	1.999	0.0007	1.263	0.0676	0.8331
6/10/2009	1230	6.5	680	235	2.145	0.0049	0.0006	0.0078	1.157	0.0003	0.7458	0.0336	0.5193
19/10/2009	1800	6.5	990	363	0.914	0.0048	0.0004	0.0084	0.4839	0.0003	0.7927	0.0356	0.4734
3/11/2009	2040	6.7	1100	474	4.623	0.0022	0.0018	0.0131	3.35	0.001	0.3254	0.0147	0.1753
16/11/2009	1870	7.1	1000	295	3.626	0.002	0.0012	0.0103	3.261	0.0006	0.2706	0.0208	0.1136
1/12/2009	1950	7.3	1100	432	4.17	0.0027	0.0047	0.0134	5.828	0.001	0.2289	0.0137	0.1560
15/12/2009	2260	7.1	1200	561	7.194	0.0024	0.003	0.0155	8.143	0.001	0.2863	0.0262	0.1805
29/12/2009	3200	6.5	1800	1090	11.45	0.0041	0.0057	0.0194	18.04	0.0013	1.99	0.0366	0.3825
For Aquatic Ecosystems		<6.5/>9.0			0.08	0.0004 0.00228		0.0018 0.00936		0.006 0.06608	2.5	0.013 0.0676	0.015 0.078
Irrigation		<6/>8.5			5	0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock		no value	2,500	1,000	5	0.01	1.00	0.4		0.1		1	20.000

The results show that for metal levels measured upstream of the Mine site ANZECC (2000) guideline trigger values for aquatic ecosystems were consistently exceeded for aluminium, and occaisionally for copper. Exceedences of irrigation trigger values for iron and occasionally manganese were also observed upstream. Water quality measured downstream of the Mine site exceeded aquatic trigger values for pH, aluminium, cadmium, copper, manganese, nickel and zinc for the majority of the time. With respect to irrigation guideline triggers, these were exceeded for pH, aluminium, cadmium, iron, manganese and zinc. Trigger values for livestock are noted for TDS, sulphate, aluminium and cadmium. Spikes in contaminant levels can generally be observed following extended periods of no or low flow.

The results indicate that Dawesley Creek water prior to any influence of the Mine exceeds some of the trigger values in order to achieve a 90% level of protection suitable for supporting aquatic ecosystems under the ANZECC (2000) guidelines. The results also indicate that Dawesley Creek water measured downstream of the Mine site consistently exceeds (on a number of analytes) trigger values suitable for supporting aquatic ecosystems. The same results also indicate unacceptable levels of some analytes for the purposes of irrigation use all of the time and stock drinking much of the time.

It should be noted that, while water in Dawesley Creek appears to be suitable for livestock use downstream of the Mine site some of the time, analytes measured by PIRSA only relate to contaminants potentially contributed by the Mine.

Flow volumes and measured concentrations of contaminants were used to calculate the total pollutant load passing each hydrometric station. These annual contaminant loads are detailed in Table 5.

Table 5 Total Annual Contaminant Loads for 2009

	Load										
	TDS (t)	Sulphate (t)	Aluminium (kg)	Cadmium (kg)	Chromium (kg)	Copper (kg)	Iron (kg)	Lead (kg)	Manganese (kg)	Nickel (kg)	Zinc (kg)
U/S Station	596	52	867.7	0.2	2.2	4.7	1879.6	0.8	35.0	5.4	30.7
D/S Station	1009	473	10,134.9	9.1	2.4	19.1	3,285.2	4.2	1474.5	57.1	1185.3
Average Annual Contribution	413	421	9267.2	8.9	0.2	14.4	1405.6	3.4	1439.5	51.7	1154.6
Average Annual Contribution %	40.9	89.0	91.4	97.9	8.3	75.4	42.8	80.9	97.7	90.5	97.4

While the treatment plant is effective in removing a large proportion of the contaminants in the AMD, the Mine site still continues to contribute a significant contaminant load (particularly as a percentage of contaminants) to the Dawesley Creek catchment, predominantly sulphate, aluminium, cadmium, copper, iron, lead, manganese, nickel and zinc.

Composite sampling over the entire monitoring program has presented a trend where the first flush of the season causes a slug of water with high levels of sulphates and metals and low pH to be measured at the downstream location. This is likely a result of the concentration of sulphates and metals in residual surface and near surface (alluvial and colluvial) waters during the summer months, when there are no flows or reduced flows in Dawesley Creek.

The installation of the Dawesley Creek diversion drain caused a significant and immediate reduction in the load of contaminants contributed by the Mine to Dawesley Creek. However it is considered unlikely that continuing operations as they currently are will have any further marked reduction on the concentration or load of contaminants released to the Creek.

7.2.3 Analytical Methods and Limits of Reporting

Table 6 sets out the analytical methods and level of reporting (LOR) for the various analytes. It should be noted that dependent on the actual equipment used (by AWQC) there may be some degree of variability with respect to LOR. These are applicable to both composite and grab samples.

Table 6. Analytical Methods and Limits of Reporting

Analyte	Analytical Method	Limit of Reporting
Aluminium	Elemental Analysis – ICP Mass Spectrometry	0.001 mg/L
Arsenic	Elemental Analysis – ICP Mass Spectrometry	0.0003 mg/L
Cadmium	Elemental Analysis – ICP Mass Spectrometry	0.0001 mg/L
Chromium	Elemental Analysis – ICP Mass Spectrometry	0.0001 mg/L
Copper	Determination of Metals – ICP Spectrometry by ICP2	0.005 mg/L
Iron	Determination of Metals – ICP Spectrometry by ICP2	0.005 mg/L

Lead	Elemental Analysis – ICP Mass Spectrometry	0.0001 mg/L
Manganese	Determination of Metals – ICP Spectrometry by ICP2	0.001 mg/L
Nickel	Elemental Analysis – ICP Mass Spectrometry	0.0001 mg/L
Sulphur	Determination of Metals – ICP Spectrometry by ICP2	1.5 mg/L
Zinc	Elemental Analysis – ICP Mass Spectrometry	0.0003 mg/L

7.3 Grab Sampling

Figure 4 shows the zone of influence for pH within Dawesley Creek catchment. It demonstrates the impact of the installation of the diversion drain on pH levels measured along the Creek. The graph indicates that the zone of impact, i.e. the downstream extent of impacts, of pH has not changed with time and the installation of the diversion. Impacts on pH can still be measured as far downstream as the South-east Freeway. The magnitude / scale of the impact has, however, decreased following the installation of the diversion. pHs range from 6 – 7 at monitoring locations downstream of the Mine to the South-east Freeway, compared with measured ranges of 3.5 – 5.5 over the same distance prior to the installation of the Dawesley Creek diversion, (but inclusive of the water treatment plant).

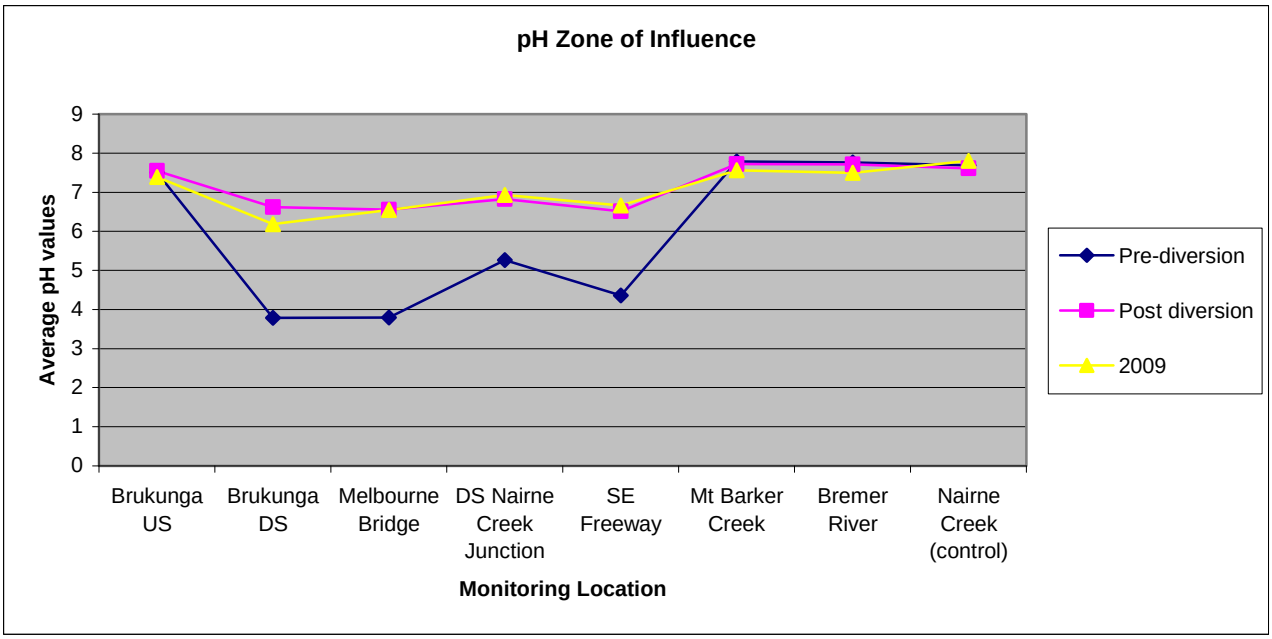


Figure 4 Zone of Influence - pH

Figure 5 displays the zone of influence of cadmium within the Dawesley Creek catchment. Cadmium is similar to pH and other metals in that the zone of impact, i.e. the downstream extent of impacts, of cadmium has not changed with time and the installation of the diversion. Impacts on cadmium concentration can still be measured as far downstream as the South-east Freeway. The magnitude / scale of the impact has, however, decreased following the installation of the diversion.

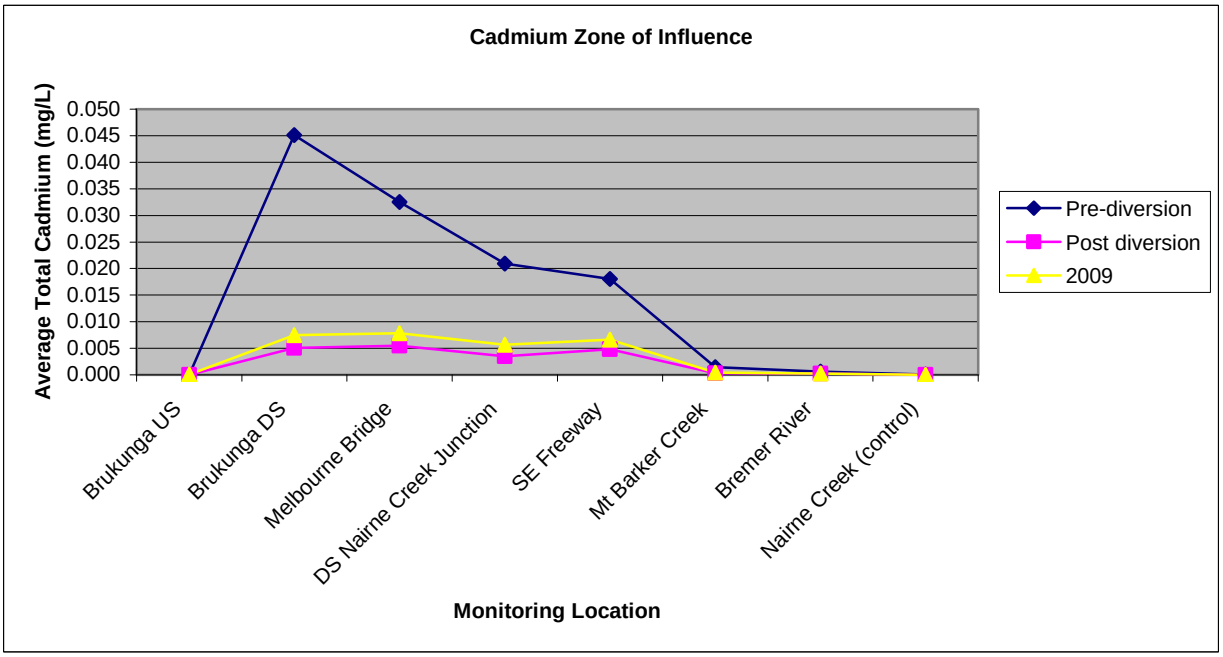


Figure 5 Zone of Influence - Cadmium

As with results obtained from composite sampling, the installation of the Dawesley Creek diversion drain has caused a significant and immediate reduction in the concentration of contaminants measured as part of the grab sampling program.

Further details of grab sampling results are available in Appendix 1.

7.4 Additional Monitoring

7.4.1 Water Treatment

The environmental approval and associated water quality monitoring program focuses on the water quality upstream and downstream of the Mine site, however this does not include the quality of AMD contaminated water treated at the acid neutralisation plant, or the quality of treated water produced by the plant.

Appendix 2 provides tables detailing water quality measured at the seepage collection ponds (pre – treatment) and at the second clarifying pond (post treatment). Please note that monitoring of the clarifying pond only commenced in 2009.

When considering pH and sulphate levels there are marked differences between pre and post treated water as observed in figure 6. Of note is that for both pH and sulphate ANZECC 2000 livestock trigger values are exceeded both pre and post treatment. Aluminium and Cadmium results are also presented in figure 7, aluminium still remains unsuitable when measured against livestock values, but cadmium is reduced often below detection limit.

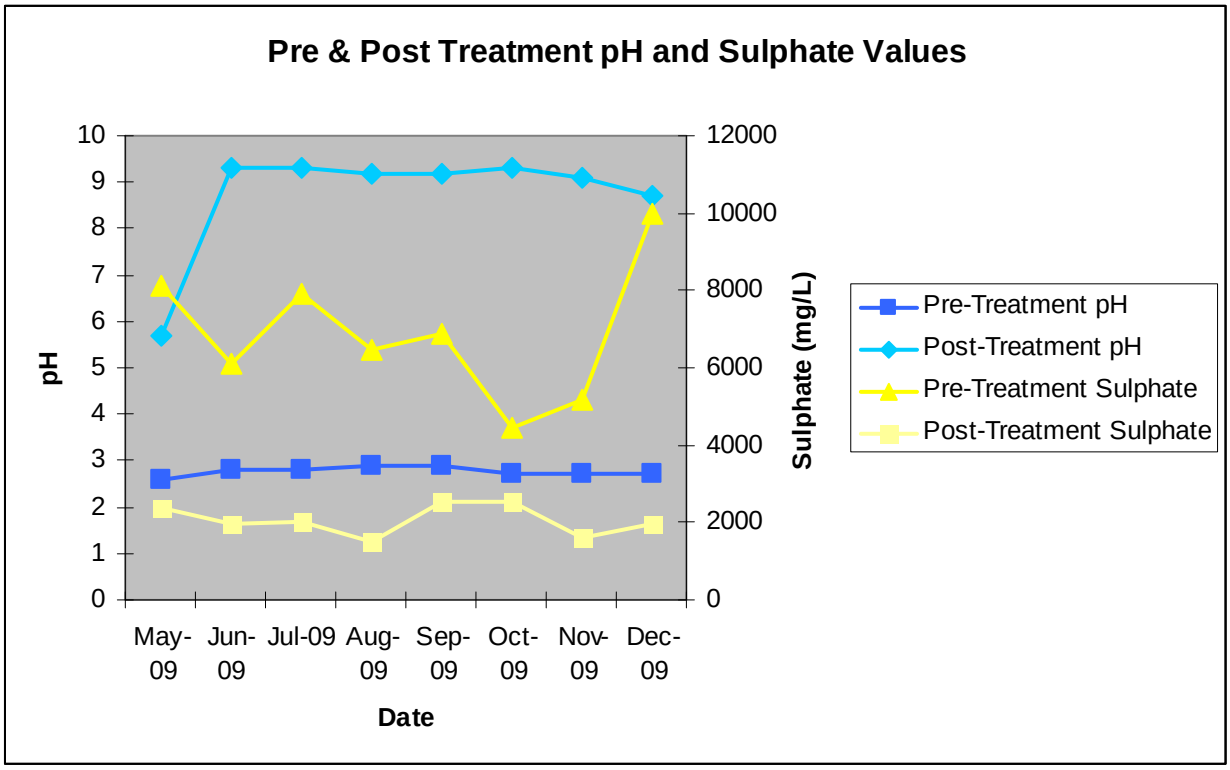


Figure 6 Pre & Post Treatment pH and Sulphate Values

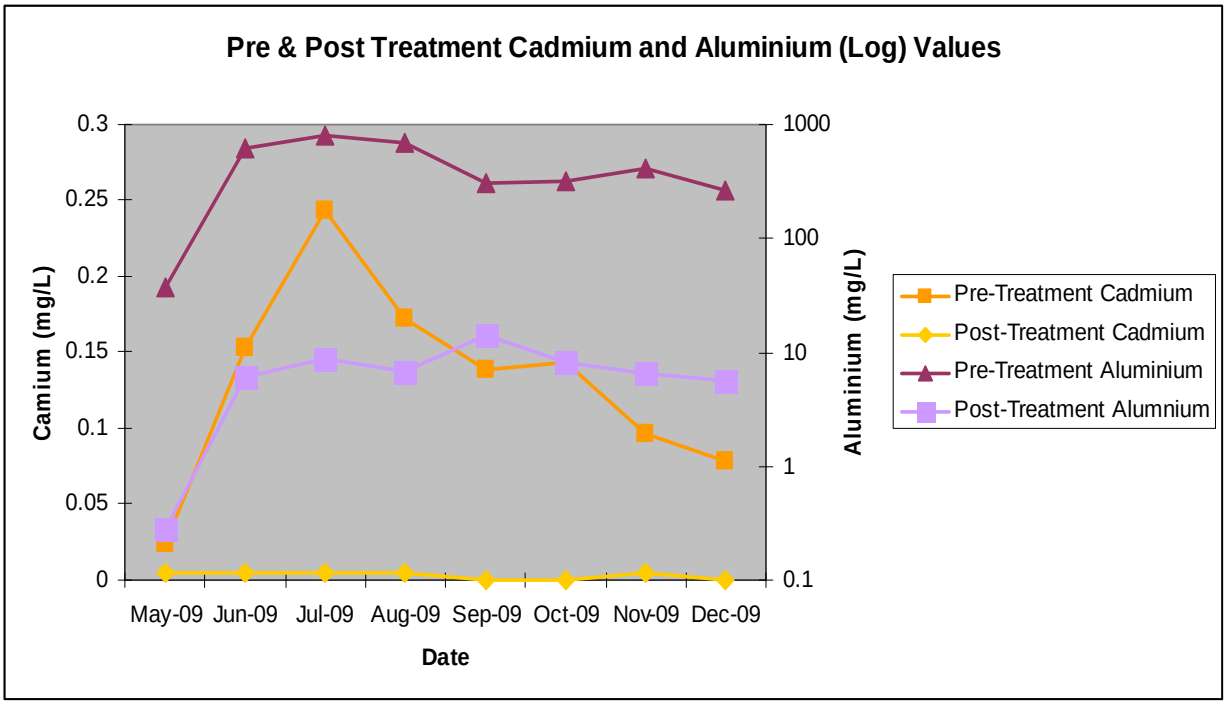


Figure 7 Pre & Post Treatment Cadmium and Aluminium Values

7.4.2 Site Rainfall

Average annual rainfall at Brukunga Mine is 575 mm, most of which falls between April and October, inclusive. Figure 8 compares the monthly rainfall for 2009 with the average annual rainfall for the site.

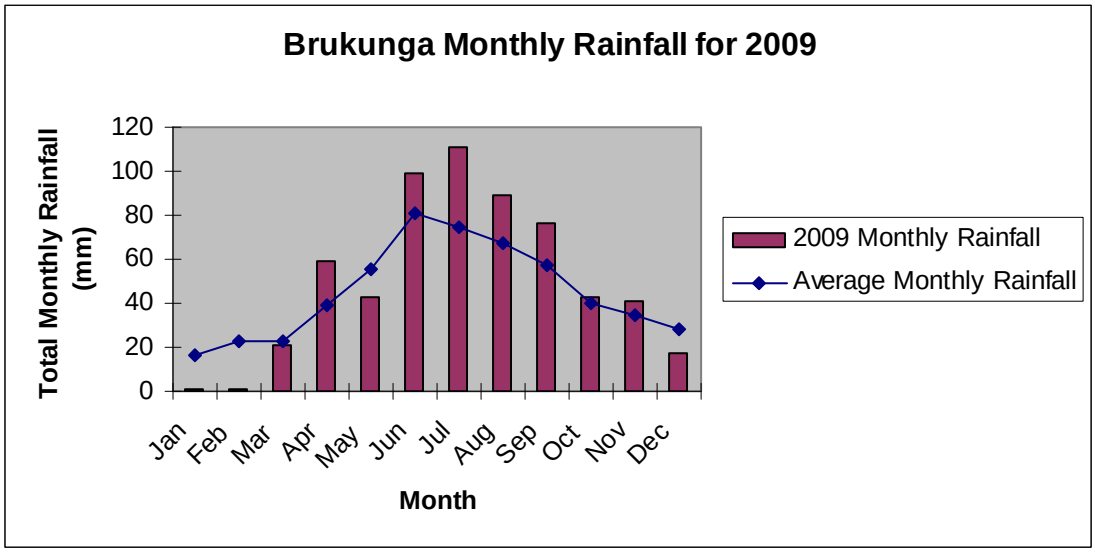


Figure 8 Monthly Rainfall

Annual rainfall has a significant impact on the volume of AMD produced at the Mine site. This subsequently impacts plant operations with increased use of reagent and resultant sludge production. The timing of rainfall events determines the concentration of contaminants reporting to the treatment plant, with a first flush of highly concentrated salts, acid and metals after dry periods normally occurring each year.

Brukunga experienced 600.8mm of rain in 2009. Therefore 2009 rainfall was normal to slightly above average.

7.4.3 Tailings Storage Facility

Concentration of ore following mining produced 3.5 Mt of waste in the form of finely ground sand tailings, which were deposited in a shallow farm valley. The tailings storage facility (TSF) has been progressively capped and revegetated since 1980. The vegetated cover provides erosion protection and reduces infiltration of rainfall. It also provides habitat for wildlife, however a recent preliminary survey suggests that this vegetation will not be sustainable in the long term, with evidence that the vegetation is significantly poorer than similar species within the Mine site.

Deep drainage through the TSF is monitored via:

- A network of 19 pore water monitoring bores, which have been monitored monthly since 2000, to assess the trend in pore water levels within the TSF;

- A v-notch weir, which measures the flow of seepage from the toe of the wall of the TSF.

Figure 9 demonstrates that, since the capping and revegetation of the TSF, there has been a steady decline in the level of pore water within the TSF. Bore KAN040 is located within the front, centre (western) portion of the TSF and therefore provides a good indication of the overall level of pore water within the TSF as well as trends in levels and fluctuations. This bore has demonstrated an average annual drop in pore water level of 142.965 mm / year.

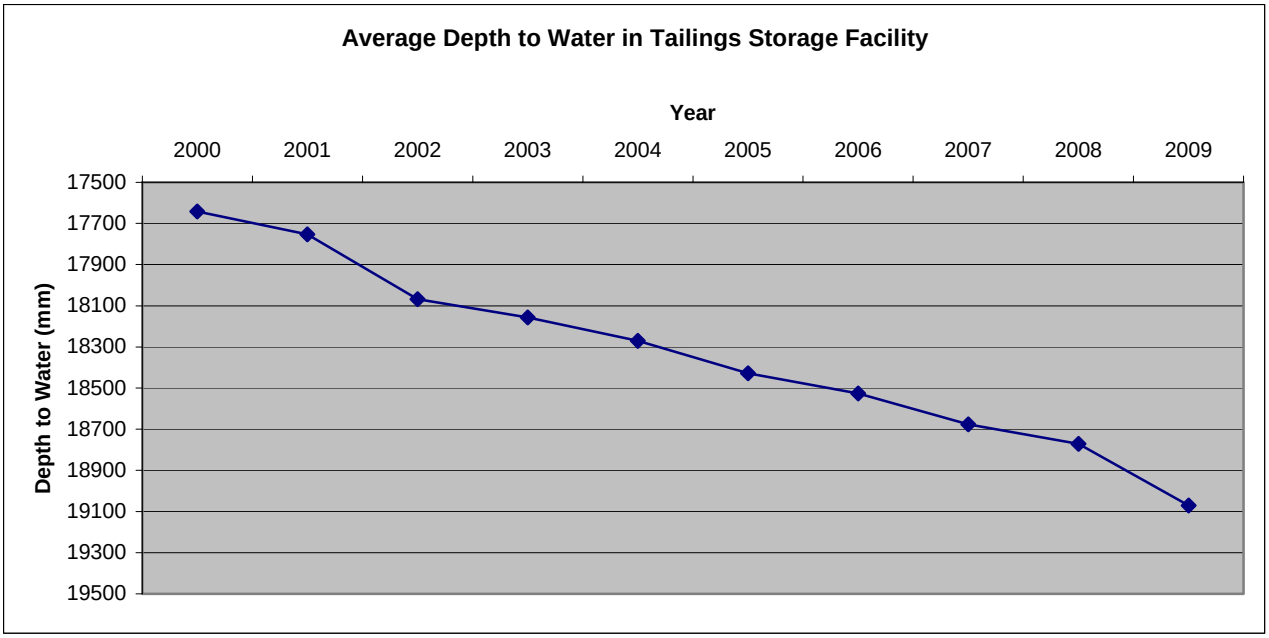


Figure 9 Average Depth to Water Table in the TSF (KAN040)

The volume of seepage reporting to the seepage ponds has reduced over time, as demonstrated by Figure 10. This indicates that the vegetation cover has been successful, at least in part, in minimising the infiltration of rainfall into the TSF. Anecdotal evidence indicates that there is a small fresh water spring located within the TSF, therefore it would be impossible for the pore water to drain down completely. It is possible, however that the rate of seepage from the toe of the TSF is approaching steady state. The same graph also shows some relationship to corresponding rainfalls particularly since 2006.

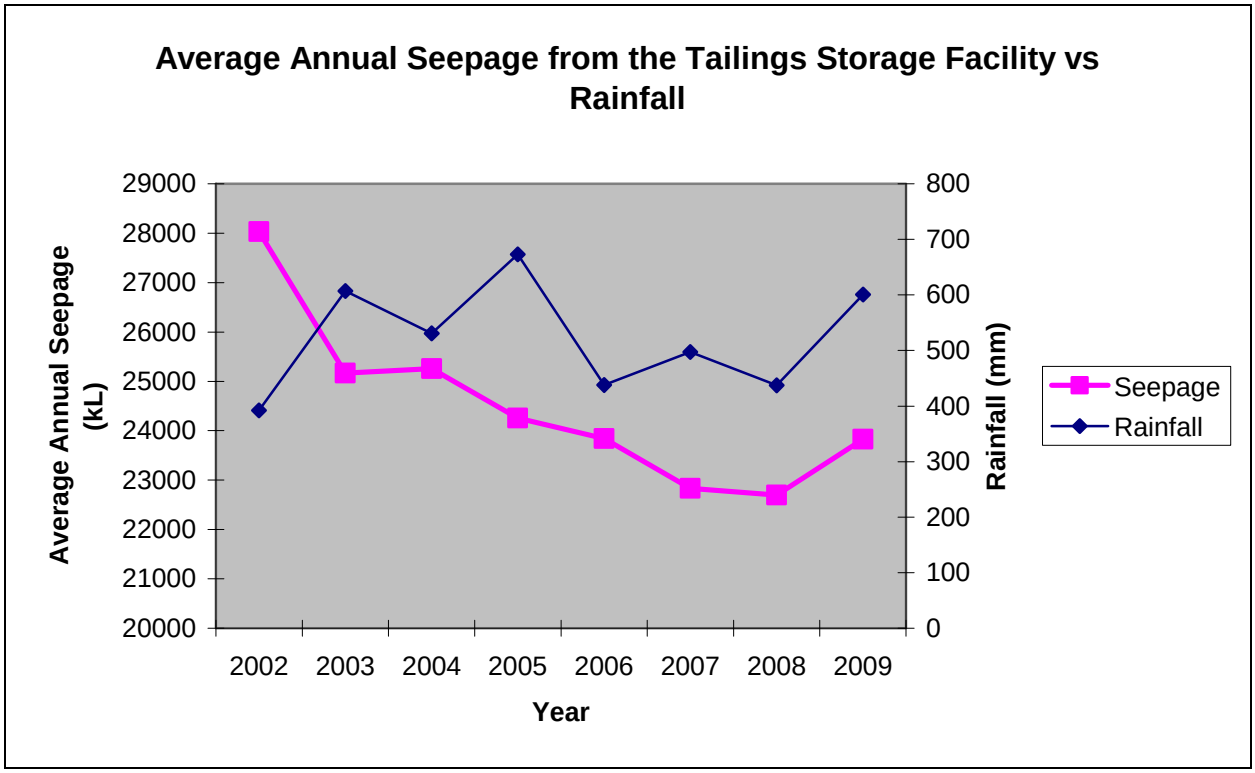


Figure 10 Annual Seepage from TSF vs Rainfall

There has been no significant change in the concentration of contaminants reporting to the seepage ponds (and then the treatment plant) from the TSF over time, as shown in Table 7.

Table 7 Quality of Seepage from the Tailings Storage Facility

DATE	pH	TDS by EC	TSS	NDUCTIVI	SULPHATE	ALUMINIUM	ARSENIC	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	ANGANES	NICKEL	ZINC
		total mg/l	total mg/l	uS/cm	total mg/l	total mg/l	total mg/L	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l
13/Mar/2001	2.6	5,400		9,460	8,550	48		<0.0050	<0.030	0.02	2,740	0.0057	119.00	0.049	3.93
13/Jun/2001	2.5	3,500		6,310	6,430	118		0.0238	0.145	0.035	1,840	0.0023	75.40	0.0523	8.74
12/Sep/2001	2.6	5,000		8,870	8,130	150		0.0297	0.186	0.183	2,363	0.0016	101.00	0.417	13.10
05/Dec/2001	2.5	4,900		8,600	8,650	69.5		0.0064	5.81	0.02	2,490	0.001	96.60	0.139	7.97
10/Mar/2003	2.9	5,100		9,020	7,710	26.1		0.0008	<0.003	0.003	2,730	0.0008	111.00	0.0257	6.64
12/Jun/2003	2.7	4,600		8,210	8,467	52		0.0098	0.003	0.015	2460	0.0012	95.90	0.0475	5.56
10/Sep/2003	2.7	5,000		8,830	8,797	101		0.0202	0.006	0.024	2460	0.0012	89.90	0.3132	8.48
10/Dec/2003	2.6	5,200		9,200	8,730	96.8		0.0055	0.01	0.02	3490	0.0009	143.00	0.1065	10.80
22/Mar/2005	2.8	5,000		8,800	7,540	60.1		0.0020	<0.003	0.0250	2,430	<0.0005	106.00	0.0775	4.20
15/Jun/2005	2.5	4,300		7,550	7,030	129		0.0076	0.020	0.0360	1600	0.0015	93.00	0.0874	10.30
05/Sep/2005	2.8	5,100		9,060	7,990	114		0.0073	0.006	0.0190	4.45	0.0007	0.18	0.0829	7.51
15/Dec/2005	3.0	5,170		9,100	7,200	83.8		0.0047	0.149	0.0103	2570	0.0008	107.70	0.1264	6.01
13/Mar/2007	2.8	5,300		9,270	7,560	29.7		0.0038	0.01	0.0130	2480	0.0008	102.00	0.0756	3.03
27/Apr/2007	2.5	4,800		8,400	7,020	117		0.0056	0.041	0.0645	2130	0.0013	94.63	0.1617	6.79
15/May/2007	2.7	4,800		8,450	7,500	75.1		0.0049	0.004	0.0213	2490	<0.0005	133.60	0.1493	3.95
13/Jun/2007	2.8	4,610		8,140	7,650	59.7		0.0028	<0.003	0.0020	2390	<0.0005	85.09	0.0825	5.40
23/Jul/2007	2.8	4,900		8,650	8,160	119		0.0106	0.017	0.0318	2560	<0.0005	102.00	0.1638	9.04
20/Aug/2007	2.8	4,900		8,620	7,620	81.3		0.0085	0.016	0.0210	2310	<0.0005	91.50	0.1601	6.60
13/Sep/2007	2.8	5,100		8,940	8,460	61.7		0.0039	<0.003	0.0081	2830	0.0011	105.00	0.0645	2.63
15/Oct/2007	3	4,900		8,580	7,920	53.5		0.0025	0.018	0.0036	2650	<0.005	104.00	0.0606	3.09
19/Now/2007	2.8	4,800		8,440	8,280	45.8		0.0350	0.018	0.0090	2630	0.111	108.00	0.098	4.38
12/Dec/2007	3	5,300		9,410	8,430	42.8		0.0340	0.011	0.0070	2750	0.121	109.80	0.043	3.40
19/Jan/2009	2.8	5,100	17	9,070	8,280	27.07	0.003	0.0280	0.013	<0.005	2,673	0.168	98.4	0.0570	2.34
16/Feb/2009	2.8	5,100	26	8,930	7,890	27.47	0.004	0.0260	0.013	<0.005	2,546	0.133	103	0.0550	2.32
01/Mar/2009	Not Collected														
01/Apr/2009	Not Collected														
18/May/2009	2.6	4,100	13	7,300	8,730	608.5	0.010	0.1580	0.106	0.3480	1,302	0.031	62.9	1.1300	26.00
10/Jun/2009	2.7	4,600	15	8,160	7,500	55.18	0.004	0.0280	0.019	0.0390	2,380	0.096	77.5	0.1300	3.78
20/Jul/2009	2.6	4,600	20	8,120	8,250	203.9	0.004	0.0430	0.045	0.1680	2,362	0.056	94.1	0.4210	11.30
17/Aug/2009	2.6	4,600	19	8,090	7,200	138.5	0.005	0.0300	0.026	0.0520	1,970	0.069	83.9	0.2850	8.57
15/Sep/2009	2.6	5,100	25	8,930	6,750	110.2	0.005	0.0095	0.0144	0.0250	2,740	0.0006	81.8	0.1938	5.58
19/Oct/2009	2.5	4,800	13	8,450	7,860	89	0.002	0.0094	0.0126	0.0120	2,505	0.0004	87.7	0.2396	8.09
16/Now/2009	2.6	5,000	6	8,790	7,140	60.22	0.003	0.0320	0.013	<0.005	2,645	0.162	89	0.1340	4.35
14/Dec/2009	2.7	5,100	47	8,960	7,890	30.78	0.003	0.0031	0.0044	<0.005	2,702	0.0015	106	0.0855	2.76
For Aquatic	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
Ecosystems	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,500			1,000	5		0.01	1.00	0.4		0.1		1	20.000

7.4.4 Plant Efficiency

Since May 2007, monthly grab samples have been taken of water from the acid seepage ponds at the base of the TSF (plant feed) and from January 2009 the clarifying ponds (treated water prior to release into diversion). Prior to that, quarterly samples were taken from the seepage ponds.

Figure 11 displays the volume of contaminated water treated daily during 2009.

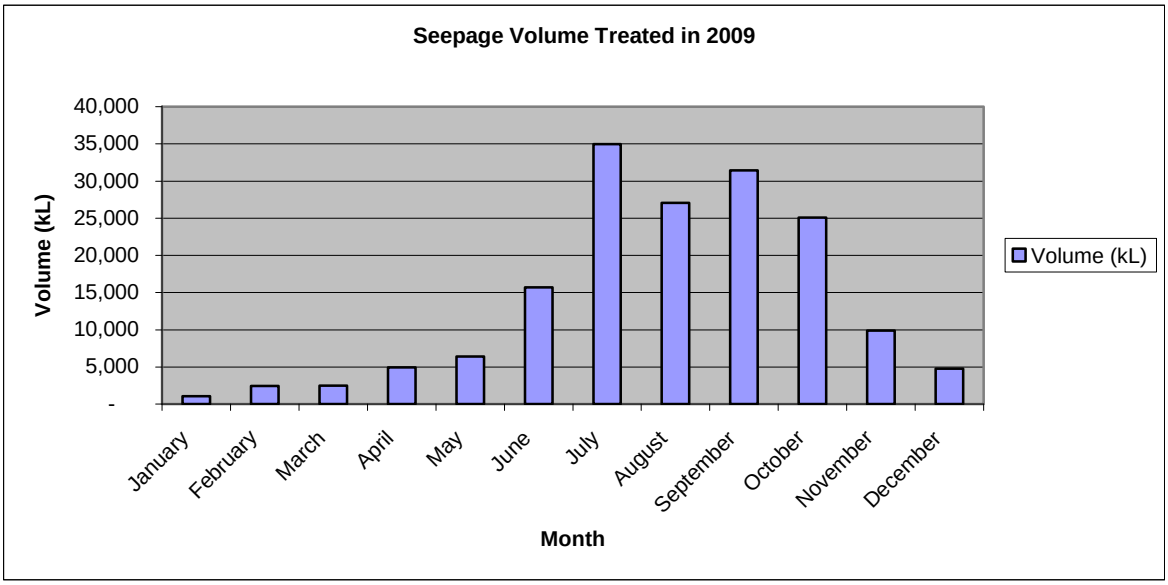


Figure 11 Volume of Water Treated

The acid treatment plant is designed to manage the largest possible volume of contaminated water; therefore it operates at partial capacity for much of the year. Plant utilisation is highest during the winter months, this correlates with high rainfall and increased seepage and contaminated run-off during these periods. During these periods of high demand the plant operates at 100 % capacity, running 24 hours per day, 7 days per week. Table 8 details the monthly percentage utilisation of the plant, i.e. the percentage of the total capacity of plant operation.

Table 8 Monthly Percentage Plant Utilisation

Month	Plant Operation (% of total capacity)
January	10
February	14
March	22
April	33

May	58
June	100
July	98
August	100
September	100
October	99
November	74
December	42

7.4.5 Notified Events

During 2009 there were 5 occasions where the site catchment system (including treatment plant) was unable to contain all contaminated run-off on site. In each instance overflow events occured following large rainfall events, when the Dawesley Creek diversion and site catchment system are at capacity and the pump back system is unable to cope with such continual high flows. It should be noted that when any contaminants are released they are greatly diluted by clean flows through the site and capacity flows within Dawesley Creek.

- Overflow commenced 1 July 2009 control regained 2 July 2009
- Overflow commenced 14 July 2009 control regained 19 July 2009
- Overflow commenced 24 August 2009 control regained 25 August 2009
- Overflow commenced 30 August 2009 control regained 31 August 2009
- Overflow commenced 25 September 2009 control regained 26 September 2009

Overflows are managed in accordance with the approved Contingency Plan for the site. PH values are measured at downstream locations and reported to the Environment Protection Authority.

Ongoing low pH values experienced (at the downstream monitoring point) at the start of the season during May and June were also reported to the EPA in June 2009.

Note: During 2007 and 2008 no events were recorded prompting notification to EPA. Prior to 2007 it is understand that it was not customary practice that overflow events be recorded and/or notified.

8. Evaluation of Quality Assurance / Quality Control

During 2009, all monitoring was carried out in accordance with EPA licence 10577 and the associated Water Quality Monitoring Plan.

The analysis of grab, composite and macroinvertebrate samples was undertaken by the Australian Water Quality Centre (AWQC), with NATA corporate accreditation number 1115 for chemical and biological testing.

Flow monitoring, data logging and continuous water sample collection was undertaken by Water Data Services Pty Ltd (WDS), with NATA certification number 7642-2.

The data was found to be complete for the monitoring period, with the analytical results supplied by the laboratory satisfying the quality control requirements specified by the EPA.

9. Conclusion and Proposed Actions

The results of the water quality monitoring program for 2009 demonstrate the following:

- There is consistency with 2009 results as compared to other years (post diversion) which are markedly improved over pre-diversion values.

- Rainfall measured in 2009 returned to a figure closer to the long-term average following three dry years. This resulted in a marked increase in the volume of water treated during 2009.

- Flushes of low pH and high metals are observed downstream of the mine following the drier summer months, but can also be observed to varying degrees sporadically in the wetter months.

- Water quality downstream of the mine generally improves (relative to anayltes measured against ANZECC guidelines) with distance (from the mine) in terms of livestock standards. Exceeded trigger values generally relate to sulphate, aluminium and cadmium.

- 5 events were notified to EPA (largely resulting from overflows during or subsequent to periods of heavy rain)

In addition to normal hydrological and biological monitoring it is also planned in 2010 to:

- Install telemetry at both the upstream and downstream weirs

- Install a velocity meter within the diversion pipe in order to effectively gauge the upstream station. This information will also be used to back calculate data (post installation of the diversion) in order to verify calculated values.

Given PIRSA's current remediation planning for the Brukunga site it is likely that the monitoring program will be amended in the near future in order to better reflect any future changes to management and/or remediation of the minesite.

References

(ANZECC) Australian and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Environment Australia Publications.

Environment Protection Authority (2007) EPA Guidelines. Regulatory Monitoring and Testing. Reporting Requirements. August 2007

Appendix 1 - Grab Sampling

Metal Concentration

Table 1-1 Dawesley Creek upstream of the Mine site (Peggy Buxton Road)

DATE	pH	TDS by EC	TSS	INDUCTIV	SULPHATE	ALUMINIUM	ARSENIC	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	MANGANES	NICKEL	ZINC
	units	total mg/l	mg/L	uS/cm	total mg/l	total mg/l	total mg/L	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l
12-Jan-2001	7.7	1,100		1960	52.9	0.433		<0.0005	<0.003	0.013	0.578	0.0077	0.0459	0.0064	0.016
5-Feb-2001	7.7	1,500		2750	80.6	0.281		<0.0005	<0.003	0.002	0.439	0.001	0.0266	0.0051	0.004
13-Mar-2001	7.7	1,300		2270	79.9	0.799		<0.0005	<0.003	0.016	2.16	0.0023	0.0527	0.0066	0.011
6-Apr-2001	7.7	1,000		1830	91.2	0.562		<0.0005	<0.003	0.102	0.976	0.0015	0.0218	0.0115	0.022
7-May-2001	7.8	1,900		3440	191	0.332		<0.0005	<0.003	0.017	0.267	0.0033	0.03	0.0047	0.012
13-Jun-2001	7.4	850		1530	109	0.880		<0.0005	<0.003	0.020	1.42	0.0014	0.0377	0.0034	0.025
2-Jul-2001	7.3	780		1420	68.6	0.461		<0.0005	<0.003	0.011	0.827	0.0012	0.0387	0.0044	0.014
8-Aug-2001	7.3	720		1310	51.7	0.590		<0.0005	<0.003	0.020	0.93	0.0022	0.0532	0.0034	0.018
12-Sep-2001	6.6	520		939	38.8	0.821		0.0006	<0.003	0.008	1.13	0.0012	0.134	0.0067	0.097
9-Oct-2001	7.4	1,000		1840	61	0.548		<0.0005	<0.003	0.004	1.25	0.0006	0.0399	0.0025	0.009
14-Nov-2001	7.3	940		1700	94.6	0.543		<0.0005	<0.003	0.003	1.5	0.0008	0.059	0.0045	0.010
5-Dec-2001	7.3	930		1680	81	0.846		<0.0005	<0.003	0.008	0.926	0.0018	0.0691	0.006	0.031
14-Jan-2003	7.7	1,200		2240	42.0	1.180		<0.0005	<0.003	0.003	1.04	0.0012	0.1048	0.0049	0.011
03-Feb-2003	No Flow														
10-Mar-2003	7.8	1,600		2850	255.0	0.272		<0.0005	0.004	0.004	1.67	0.0007	0.4504	0.0129	0.018
01-Apr-2003	7.5	1,400		2500	74.5	0.339		<0.0005	<0.003	0.001	1.01	0.0005	0.0459	0.0084	0.004
05-May-2003	No Flow														
12-Jun-2003	7.6	870		1570	85.9	1.160		<0.0005	0.004	0.003	1.55	0.0009	0.0362	0.0088	0.012
22-Jul-2003	7.9	730		1330	99.4	0.169		<0.0005	<0.003	0.003	0.531	<0.0005	0.021	0.0056	0.023
19-Aug-2003	7	910		1650	93.6	0.209		<0.0005	<0.003	0.003	<0.030	<0.0005	0.1001	0.0051	0.037
10-Sep-2003	7.5	1,000		1840	95.6	0.748		<0.0005	<0.003	0.002	1.93	0.0008	0.1915	0.0063	0.069
21-Oct-2003	7.5	1,200		2180	124.0	0.355		<0.0005	0.004	0.005	0.758	0.0007	0.0479	0.006	0.019
11-Nov-2003	7.5	1,100		1970	98.2	0.609		<0.0005	<0.003	0.003	1.05	0.0007	0.0678	0.0054	0.007
10-Dec-2003	7.2	870		1580	90.7	1.09		<0.0005	<0.003	0.003	2.22	0.001	0.0601	0.0053	0.038
12-Jan-2005	No Flow														
11-Feb-2005	7.5	930		1680	114.0	0.336		<0.0005	<0.003	0.004	1.77	0.0012	0.1829	0.0067	0.015
22-Mar-2005	7.6	910		1650	111.0	0.307		<0.0005	<0.003	0.003	2.11	0.0009	1.342	0.009	0.011
14-Apr-2005	7.6	950		1720	116.0	0.532		<0.0005	<0.003	0.004	1.65	0.0009	0.663	0.0036	0.012
02-May-2005	8.6	970		1760	140.0	0.187		<0.0005	0.004	0.002	0.484	<0.0005	0.1953	0.0030	0.007
15-Jun-2005	7.6	860		1550	99.9	2.720		<0.0005	0.01	0.007	3.42	0.0022	0.2992	0.003	0.015
13-Jul-2005	7.4	820		1490	62.6	0.460		<0.0005	<0.003	0.003	0.77	<0.0005	0.1406	0.0021	0.008
23-Aug-2005	7.3	880		1600	73.9	0.556		<0.0005	0.003	0.006	0.937	0.0007	0.1063	0.0142	0.028
05-Sep-2005	7.4	900		1640	82.5	0.353		<0.0005	0.005	0.003	1.04	<0.0005	0.2021	0.001	0.009
18-Oct-2005	7.5	1,000		1810	89.4	0.373		<0.0005	<0.003	0.003	1.10	0.0007	0.2176	0.0049	0.009
21-Nov-2005	7.5	1,020		1850	71.7	0.455		<0.0005	0.004	0.0048	1.01	0.0006	0.1076	0.004	0.014
15-Dec-2005	7.7	1,510		832	45.3	0.455		<0.0005	<0.003	0.0016	1.13	0.0007	0.0645	0.0069	0.027
16-Jan-2007	No Flow														
13-Feb-2007	No Flow														
13-Mar-2007	No Flow														
16-Apr-2007	No Flow														
15-May-2007	7.4	880		1600	70.5	0.059		<0.0005	<0.003	0.0031	1.04	<0.0005	0.078	0.0093	0.027
13-Jun-2007	7.4	840		1520	77.1	0.084		<0.0005	<0.003	0.0025	1.12	<0.0005	0.2694	0.0062	0.018
23-Jul-2007	7	990		1800	127	0.283		<0.0005	<0.003	<0.0010	1.35	<0.0005	0.4113	0.0068	0.044
20-Aug-2007	7.4	830		1510	93	0.358		<0.0005	<0.003	0.002	0.954	<0.0005	0.0375	0.0071	0.026
13-Sep-2007	7.7	870		1570	58.2	0.362		<0.0005	<0.003	0.0019	1.12	<0.0005	0.0297	0.0067	0.033
15-Oct-2007	7.5	980		1780	52.2	0.203		<0.0005	0.003	0.0016	0.671	<0.0005	0.0359	0.0052	0.014
19-Nov-2007	7.6	990		1800	49.2	0.175		<0.0005	<0.003	0.0021	0.466	<0.0005	0.0655	0.0065	0.011
12-Dec-2007	7.8	1,200		2140	41.4	0.252		<0.005	0.001	<0.005	1.71	<0.01	0.37	0.008	0.013
19-Jan-2009	No Flow														
16-Feb-2009	No Flow														
**/03/2009	No Flow														
**/04/2009	No Flow														
18/05/2009	7.3	1,100	10	1970	140	0.288	0.0100	<0.005	0.002	0.009	1.585	<0.01	0.028	0.011	0.041
10/06/2009	7.4	800	9	1450	81.9	0.737	0.0080	<0.005	0.002	<0.005	3.826	<0.01	0.063	0.01	0.031
20/07/2009	7.3	780	10	1410	69	0.773	0.0038	<0.005	0.002	<0.005	2.684	<0.010	0.109	0.007	0.085
17/08/2009	7.3	950	10	1730	124	0.612	0.0032	<0.005	0.001	<0.005	1.68	<0.01	0.075	0.01	0.045
15/09/2009	7.4	950	21	1720	140	0.548	0.0030	0.0003	0.0009	<0.005	2.464	0.0002	0.278	0.0131	0.1004
19/10/2009	7.2	870	4	1580	81	0.517	0.0032	0.0001	0.0013	<0.005	2.631	0.0005	0.102	0.0067	0.0326
16/11/2009	7.5	840	2	1520	69.6	0.379	0.0098	<0.0001	0.0012	<0.005	1.751	0.0007	0.071	0.009	0.0145
14/12/2009	7.7	1,300	14	2370	107	0.311	0.0086	<0.0001	0.0009	<0.005	1.42	0.0005	0.153	0.0077	0.0099
For Aquatic Ecosystems	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,000			1,000	5		0.01	1.00	0.4		0.1		1	20.000

Table 1-2 Dawesley Creek downstream of the Mine site

DATE	pH	TDS by EC	TSS	NDUCTIVI	SULPHATE	LUMINIUM	ARSENIC	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	ANGANES	NICKEL	ZINC
	units	total mg/l	mg/L	uS/cm	total mg/l	total mg/l	total mg/L	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l
12-Jan-2001	2.8	2,900		5,220	4,070	397.0		0.066	0.005	0.019	23.40	0.007	31.50	0.12	19.600
5-Feb-2001	2.8	4,200		7,380	7,730	698.0		0.108	0.012	0.013	41.60	0.0016	73.30	0.127	38.900
13-Mar-2001	2.8	5,000		8,760	8,870	943.0		0.207	<0.030	0.083	48.00	0.008	80.80	0.678	49.400
6-Apr-2001	2.9	2,600		4,580	2,770	209.0		0.025	0.008	0.030	25.80	0.0016	31.30	0.118	10.700
7-May-2001	3.0	2,700		4,820	3,470	249.0		0.030	0.008	0.013	16.30	0.0033	22.40	0.0914	12.600
13-Jun-2001	3.4	1,300		2,340	1,060	60.3		0.070	<0.003	0.042	16.20	0.001	5.03	0.0851	5.180
2-Jul-2001	3.8	1,100		2,080	963	54.6		0.008	<0.003	0.015	22.10	0.0007	3.82	0.0628	3.651
8-Aug-2001	4.3	960		1,740	438	23.6		0.013	<0.003	0.026	9.40	0.002	1.98	0.0628	2.020
12-Sep-2001	4.4	610		1,100	218	13.2		0.010	0.003	0.028	5.57	0.0013	0.83	0.04	1.030
9-Oct-2001	6.3	1,100		2,050	318	5.3		0.005	<0.003	0.010	3.55	<0.0005	1.16	0.053	0.831
10-Nov-2001	4.0	1,200		2,160	530	17.4		0.013	<0.003	0.018	5.11	<0.0005	2.92	0.129	1.938
5-Dec-2001	4.4	1,100		1,960	487	14.8		0.006	<0.003	0.011	6.87	<0.0005	2.72	0.0657	2.000
14-Jan-2003	3.7	3,400		6,000	4,020	336.0		0.030	<0.003	0.024	5.95	0.0011	24.70	0.0602	12.900
03-Feb-2003	No Flow														
10-Mar-2003	3.6	3,700		6,590	2,550	406.0		0.116	<0.003	0.215	9.40	0.0023	51.60	1.227	27.900
1-Apr-2003	3.4	3500		6200	4,006	294.0		0.060	0.011	0.095	11.1	0.0020	30.2	0.0681	22.6
5-May-2003	3.3	2,900		5,180	3,738	216.0		0.041	0.006	0.087	4.81	0.0021	28.90	0.5142	13.030
12-Jun-2003	5.6	1,400		2,440	887	4.8		0.010	<0.003	0.012	7.10	<0.0005	8.17	0.0796	1.020
22-Jul-2003	6.5	1,400		2,550	941	27.1		0.007	<0.003	0.007	15.60	0.0013	1.95	0.0238	1.227
19-Aug-2003	5.2	1,400		2,450	772	17.1		0.018	<0.003	0.029	4.53	0.001	1.47	0.0365	1.161
10-Sep-2003	5.2	1,400		2,560	756	18.5		0.015	<0.003	0.032	4.37	0.0008	2.65	0.1037	1.393
21-Oct-2003	5.6	1,600		2,800	928	9.0		0.017	<0.003	0.023	3.48	0.0006	3.58	0.072	1.218
11-Nov-2003	6.7	1,500		2,760	1,014	4.2		0.007	<0.003	0.007	2.48	<0.0005	4.67	0.0427	0.397
10-Dec-2003	7	1,100		1,920	348	2.3		0.004	0.003	0.006	2.11	<0.0005	0.84	0.0319	0.119
12-Jan-2005	No Flow														
11-Feb-2005	7.2	1400		2440	692	1.5		0.002	<0.003	0.005	11.00	0.001	8.77	0.0298	0.187
22-Mar-2005	7.5	970		1760	211	2.6		0.001	<0.003	0.006	6.12	0.0012	1.02	0.027	0.214
13-Apr-2005	7.3	1600		2870	1220	2.0		0.001	<0.003	0.005	3.02	0.0006	4.35	0.014	0.158
18-May-2005	8.8	1200		2130	528	1.7		0.001	<0.003	0.003	2.11	<0.0005	2.41	0.0359	0.146
15-Jun-2005	4.2	1200		2150	1090	87.1		0.025	0.004	0.034	11.60	0.0007	6.79	0.1473	4.846
13-Jul-2005	6.4	1200		2180	660	24.1		0.008	<0.003	0.015	8.46	0.0015	1.31	0.0355	1.205
23-Aug-2005	7.1	1100		2020	382	8.5		0.004	<0.003	0.010	4.35	0.0016	0.72	0.0181	0.393
5-Sep-2005	6.7	1300		2410	766	3.0		0.004	0.003	0.011	2.25	<0.0005	2.59	0.0383	0.284
18-Oct-2005	6.6	1700		2990	1240	5.2		0.007	<0.003	0.150	2.26	<0.0005	4.09	0.0373	0.398
21-Nov-2005	4.4	1480		2680	969	2.9		0.036	<0.003	0.015	17.80	<0.0005	15.88	0.2282	4.070
15-Dec-2005	7.4	1060		1920	405	4.3		0.005	<0.003	0.012	4.00	0.0006	1.38	0.0346	0.886
16-Jan-2007	No Flow														
13-Feb-2007	No Flow														
13-Mar-2007	No Flow														
16-Apr-2007	No Flow														
15-May-2007	6.8	1400		2490	855	1.9		0.0033	0.003	0.0073	2.20	<0.0005	1.793	0.0364	0.224
13-Jun-2007	6.5	1400		2440	930	47.3		0.004	<0.003	0.014	24.20	<0.0005	1.636	0.0509	0.554
23-Jul-2007	4.9	1400		2530	927	6.6		0.005	<0.003	0.011	1.54	<0.0005	2.11	0.0408	0.992
20-Aug-2007	6.5	1400		2500	918	4.8		0.003	<0.003	0.0054	1.08	<0.0005	2.688	0.0296	0.305
13-Sep-2007	7.1	1200		2170	603	2.6		0.002	<0.003	0.0039	1.74	<0.0005	0.5691	0.0212	0.143
15-Oct-2007	7.3	1400		2580	774	1.6		0.0009	<0.003	0.0029	1.18	<0.0005	0.6097	0.0192	0.124
19-Nov-2007	7	1600		2850	1180	0.1		0.0015	<0.003	0.0014	0.13	<0.0005	4.847	0.0397	0.101
19-Jan-2009	No Flow														
16-Feb-2009	No Flow														
**/03/2009	No Flow														
**/04/2009	No Flow														
18-May-2009	4.2	1800	3	3330	1670	17.3	<0.001	0.017	0.001	0.03	0.46	<0.01	6.95	0.131	2.220
10-Jun-2009	6.7	1200	28	2150	597	2.9	0.003	<0.005	0.002	0.008	1.62	<0.01	0.779	0.028	0.332
20-Jul-2009	6	1300	42	2390	981	11.0	0.0023	0.006	0.003	0.022	4.35	<0.010	3.41	0.058	0.766
17-Aug-2009	5.7	1400	24	2460	819	5.0	0.0008	<0.005	<0.001	0.008	1.81	<0.01	1.15	0.046	0.547
15-Sep-2009	6.1	1300	17	2370	867	4.0	0.0007	0.003	0.0003	0.009	2.14	<0.0001	1.23	0.031	0.368
19-Oct-2009	6.9	1100	34	2060	483	3.2	0.0014	0.0015	0.0007	<0.005	2.38	0.0002	0.505	0.0198	0.194
16-Nov-2009	7.2	1100	14	1980	396	0.9	0.0029	<0.005	<0.001	<0.005	1.65	<0.01	0.345	0.021	0.117
14-Dec-2009	6.7	1200	18	2140	354	1.2	0.0011	0.0013	0.0004	<0.005	1.89	<0.0001	0.768	0.0308	0.178
For Aquatic Ecosystems	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,500			1,000	5		0.01	1.00	0.4		0.1		1	20.000

Table 1-3 Dawesley Creek downstream of Melbourne Bridge

DATE	pH	TDS by EC	TSS	NDUCTIVI	SULPHATE	LUMINIUM	ARSENIC	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	ANGANES	NICKEL	ZINC
	units	total mg/l	total mg/L	uS/cm	total mg/l	total mg/l	total mg/L	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l
12-Jan-2001	3.3	2,200		4,020	1,970	125.00		0.0193	<0.030	0.009	4.13	0.0091	17.10	0.131	6.70
5-Feb-2001	3.3	3,600		6,450	3,410	217.00		0.0140	<0.030	0.002	6.29	0.0040	30.40	0.139	9.36
13-May-2001	No Flow														
6-Apr-2001	3.3	3,000		5,330	3,570	313.00		0.1050	0.008	0.042	8.85	0.0043	36.00	0.143	22.40
7-May-2001	3.3	2,900		5,150	3,220	271.00		0.0684	0.005	0.015	7.01	0.0046	30.00	0.102	17.20
13-Jun-2001	3.3	1,300		2,290	1,130	74.50		0.0758	<0.003	0.036	4.03	0.0013	5.58	0.087	5.85
2-Jul-2001	3.6	1,200		2,130	1,030	55.10		0.0097	<0.003	0.036	1.79	0.0023	5.67	0.070	5.00
8-Aug-2001	3.9	1,000		1,890	669	40.00		0.0124	<0.003	0.014	18.10	0.0035	3.02	0.071	3.40
12-Sep-2001	5.1	570		1,040	176	9.91		0.0081	<0.003	0.034	4.11	0.0035	0.72	0.033	0.82
9-Oct-2001	6.8	1,000		1,840	269	2.06		0.0035	<0.003	0.006	1.51	<0.0005	1.00	0.039	0.52
14-Nov-2001	3.9	1,400		2,480	808	46.10		0.0252	<0.003	0.045	0.53	0.0010	4.65	0.208	3.72
5-Dec-2001	4.1	1,200		2,120	580	18.70		0.0063	<0.003	0.012	0.69	0.0008	3.52	0.065	2.49
6-Jan-2003	No Flow														
03-Feb-2003	No Flow														
10-Mar-2003	No Flow														
1-Apr-2003	No Flow														
5-May-2003	No Flow														
12-Jun-2003	4.3	1,200		2120	616	11.80		0.0289	<0.003	0.016	0.24	0.0080	3.30	0.077	3.26
22-Jul-2003	4.7	1,400		2450	1,010	5.18		0.0170	<0.003	0.009	0.10	<0.0005	3.22	0.052	1.59
19-Aug-2003	4.4	1,300		2430	724	18.30		0.0220	<0.003	0.017	2.77	<0.0005	2.21	0.053	2.21
10-Sep-2003	5	1,300		2310	601	1.91		0.0091	<0.003	0.009	2.04	<0.0005	3.66	0.075	1.46
21-Oct-2003	4.5	1,400		2470	562	2.73		0.0133	<0.003	0.011	0.68	<0.0005	2.53	0.087	1.37
11-Nov-2003	6.1	1,400		2560	787	0.32		0.0060	<0.003	0.006	0.37	<0.0005	2.80	0.065	0.67
10-Dec-2003	6.5	1,200		2210	530	0.26		0.0008	0.004	0.003	1.30	<0.0005	1.67	0.038	0.14
12-Jan-2005	No Flow														
11-Feb-2005	6.9	1,100		2050	479	0.95		0.0014	<0.003	0.006	4.37	<0.0005	2.88	0.029	0.11
22-Mar-2005	7.1	1,200		2240	576	0.12		<0.0005	<0.003	0.003	1.66	<0.0005	0.29	0.017	0.02
13-Apr-2005	7	1,400		2500	725	0.18		<0.0005	<0.003	0.002	1.73	<0.0005	0.05	0.013	0.02
18-May-2005	7.4	1,200		2190	449	0.26		<0.0005	<0.003	0.002	0.81	<0.0005	3.44	0.011	0.01
15-Jun-2005	6.9	900		1630	542	3.11		0.0016	<0.003	0.005	2.32	<0.0005	2.66	<0.0005	0.40
13-Jul-2005	6.1	1,200		2220	585	2.42		0.0071	<0.003	0.009	1.55	<0.0005	2.04	0.059	0.95
23-Aug-2005	7.4	1,000		1860	293	3.43		0.0018	<0.003	0.006	3.00	0.0006	0.68	0.016	0.19
05-Sep-2005	7.3	1,300		2310	652	1.06		0.0031	<0.003	0.006	1.90	<0.0005	3.64	0.042	0.16
18-Oct-2005	6.5	1,600		2870	1200	0.47		0.0100	<0.003	0.007	1.21	<0.0005	4.04	0.080	1.15
21-Nov-05	6.6	1,360		2450	666	0.18		0.0087	<0.003	0.004	1.08	<0.0005	8.00	0.090	0.68
15-Dec-05	7.5	1,090		1980	441	0.36		0.0011	<0.003	0.007	1.39	<0.0005	1.99	0.036	0.20
16-Jan-07	No Flow														
13-Feb-07	No Flow														
13-Mar-07	No Flow														
16-Apr-07	No Flow														
15-May-07	6.5	1600		2820	1110	0.568		0.0208	<0.003	0.0137	1.06	<0.0005	5.242	0.0702	1.49
13-Jun-07	7	1400		2480	891	0.408		0.007	<0.003	0.0011	0.47	<0.0005	0.1726	0.0051	0.072
23-Jul-07	5.7	1400		2450	825	0.507		0.0097	0.003	0.0062	0.39	<0.0005	2.523	0.0481	1.35
20-Aug-07	6.5	1300		2400	753	0.49		0.0062	<0.003	0.0053	0.32	<0.0005	2.218	0.0361	0.399
13-Sep-07	7.3	1100		2080	435	0.561		0.0025	<0.003	0.0052	0.78	<0.0005	0.6006	0.0201	0.121
15-Oct-07	7.1	1200		2160	435	0.256		0.0011	<0.003	0.0044	0.91	<0.0005	0.437	0.0164	0.09
19-Nov-07	7	1300		2340	642	0.029		0.0012	<0.003	0.0036	0.13	<0.0005	0.847	0.017	0.076
12-Dec-07	6.6	1800		3320	1110	2.57		<0.005	0.002	0.008	4.82	<0.01	3.22	0.023	0.129
19-Jan-09	No Flow														
16-Feb-09	No Flow														
**/03/2009	No Flow														
**/04/2009	No Flow														
18-May-2009	No Flow														
10-Jun-09	4.5	1600	2	2880	1400	21.770	<0.001	0.05	0.002	0.0180	0.445	<0.010	7.780	0.2430	6.290
20-Jul-09	6.7	1100	8	2030	579	0.952	0.0004	0.01	<0.001	0.0090	0.910	<0.010	3.730	0.0720	0.928
17-Aug-09	6.7	1300	3	2340	642	0.355	0.0004	0.007	<0.001	0.0060	0.727	<0.01	1.350	0.0460	0.660
15-Sep-09	6.9	1200	8	2170	642	0.588	0.0005	0.0034	0.0002	0.0070	1.170	0.000	1.240	0.0323	0.346
19-Oct-09	7.3	1100	20	1930	354	2.312	0.0013	0.0015	0.0009	0.0050	2.588	0.0004	0.560	0.0215	0.193
16-Nov-09	7	1200	7	2100	435	0.318	0.0008	0.0011	0.0003	<0.005	1.898	0.0002	0.853	0.0282	0.116
14-Dec-09	6.7	1400	4	2470	561	0.045	0.0006	0.0005	0.0002	<0.005	1.005	<0.0001	1.140	0.027	0.091
For Aquatic Ecosystems	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,500			1,000	5		0.01	1.00	0.4		0.1		1	20.000

Table 1-4 Nairne Creek (reference site, not influenced by AMD from Brukunga Mine)

DATE	pH units	TDS by EC total mg/l	TSS total mg/L	NDUCTIV uS/cm	SULPHATE total mg/l	LUMINIUM total mg/l	ARSENIC total mg/L	CADMIUM total mg/l	CHROMIUM total mg/l	COPPER total mg/l	IRON total mg/l	LEAD total mg/l	ANGANES total mg/l	NICKEL total mg/l	ZINC total mg/l
12-Jan-2001	7.5	760		1380	50.6	0.280		<0.0005	<0.003	0.014	0.65	0.0071	0.1800	0.0072	0.013
5-Feb-2001	7.7	710		1280	78.5	0.458		<0.0005	<0.003	0.002	0.665	0.0029	0.0411	0.0036	0.009
13-Mar-2001	8	860		1550	86.2	0.362		<0.0005	<0.003	0.014	0.624	0.0016	0.0323	0.0029	0.009
6-Apr-2001	7.9	760		1380	98.2	0.807		<0.0005	<0.003	0.111	1.05	0.0023	0.0265	0.0071	0.034
7-May-2001	7.8	630		1140	74.3	0.294		<0.0005	<0.003	0.017	0.283	0.0023	0.0113	0.0029	0.015
13-Jun-2001	7.2	610		1110	54.9	0.267		<0.0005	<0.003	0.011	0.413	0.0009	0.0134	0.0014	0.017
2-Jul-2001	7.7	690		1260	51.3	0.315		<0.0005	<0.003	0.010	0.395	0.0006	0.0086	0.0028	0.016
8-Aug-2001	7.8	670		1210	44.0	0.563		<0.0005	<0.003	0.019	0.727	0.0018	0.0269	0.0027	0.014
12-Sep-2001	7.7	880		1590	87.6	0.687		<0.0005	<0.003	0.026	1.13	0.0019	0.0352	0.0056	0.043
9-Oct-2001	7.9	840		1520	73.0	0.295		<0.0005	<0.003	0.006	0.479	<0.0005	0.0092	0.0026	0.012
14-Nov-2001	7.6	850		1550	71.2	0.115		<0.0005	<0.003	0.005	0.114	<0.0005	0.0033	0.0036	0.005
5-Dec-2001	7.8	800		1460	46.4	0.109		<0.0005	<0.003	0.009	0.117	0.0006	0.0078	0.0029	0.021
14-Jan-2003	7.5	970		1750	33.5	0.140		<0.0005	<0.003	0.002	0.906	<0.0005	0.0535	0.0033	0.006
11-Feb-2003	7.7	900		1630	46.4	0.396		<0.0005	<0.003	0.006	0.827	0.0011	0.0297	0.004	0.024
10-Mar-2003	7.7	760		1380	73.2	0.136		<0.0005	<0.003	0.001	0.491	<0.0005	0.0313	0.003	0.004
01-Apr-2003	7.4	690		1250	74	0.248		<0.0005	<0.003	0.005	0.478	0.0006	0.017	0.0031	0.011
05-May-2003	7.3	630		1150	60.4	0.208		<0.0005	<0.003	0.003	0.26	<0.0005	0.0047	0.0034	0.009
12-Jun-2003	7.7	670		1220	68.9	0.397		<0.0005	<0.003	0.005	0.762	<0.0005	0.0106	0.0077	0.013
22-Jul-2003	7.5	840		1520	82.6	0.259		<0.0005	<0.003	0.003	0.423	<0.0005	0.0139	0.0045	0.015
19-Aug-2003	7.9	890		1610	84.4	0.398		<0.0005	<0.003	0.005	0.803	0.0006	0.0142	0.0035	0.018
10-Sep-2003	8.1	1,100		1910	105	0.421		<0.0005	<0.003	0.005	0.747	0.0006	0.0254	0.0061	0.024
21-Oct-2003	7.7	950		1730	104	0.293		<0.0005	<0.003	0.005	0.338	<0.0005	0.0104	0.0061	0.008
11-Nov-2003	7.7	820		1490	79.5	0.069		<0.0005	<0.003	0.005	0.202	<0.0005	0.0056	0.0047	0.006
10-Dec-2003	7.7	720		1300	83.4	0.193		<0.0005	<0.003	0.005	0.196	<0.0005	0.01	0.0043	0.009
12-Jan-2005	No Flow														
11-Feb-2005	No Flow														
7-Mar-2005	No Flow														
13-Apr-2005	No Flow														
02-May-2005	7.4	770		1390	160	0.255		<0.0005	<0.003	0.011	0.503	<0.0005	0.0186	0.0047	0.031
15-Jun-2005	7.7	630		1150	122	0.694		<0.0005	<0.003	0.013	1.21	0.0019	0.1095	0.0009	0.036
13-Jul-2005	7.6	870		1570	105	0.198		<0.0005	<0.003	0.005	0.239	<0.0005	0.0085	0.0022	0.033
23-Aug-2005	8.1	580		1050	71.8	0.439		<0.0005	<0.003	0.004	0.523	0.0006	0.0075	<0.0005	0.016
05-Sep-2005	8.3	860		1550	115	0.170		<0.0005	0.004	0.005	0.334	<0.0005	0.0095	0.0024	0.021
18-Oct-2005	7.9	930		1690	107	0.112		<0.0005	<0.003	0.006	0.287	<0.0005	0.0204	0.0071	0.022
21-Nov-2005	7.8	871		1580	99	0.124		<0.0005	<0.003	0.0053	0.366	<0.0005	0.0236	0.0056	0.016
15-Dec-2005	8.2	799		1450	83.1	0.035		<0.0005	<0.003	0.0043	0.124	<0.0005	0.0041	0.0069	0.009
16-Jan-2007	No Flow														
13-Feb-2007	No Flow														
13-Mar-2007	7.7	730		1320	83.7	0.03		<0.0005	<0.003	0.0013	0.396	<0.0005	0.0046	0.0041	0.008
16-Apr-2007	No Flow														
15-May-2007	7.7	610		1110	67.5	0.066		<0.0005	<0.003	0.0025	0.358	<0.0005	0.008	0.0023	0.014
13-Jun-2007	8.1	500		905	41.1	0.077		<0.0005	<0.003	0.0028	0.724	<0.0005	0.0147	0.0018	<0.003
23-Jul-2007	7.8	1,000		1830	93.3	0.292		<0.0005	0.003	0.003	1.02	<0.0005	0.0397	0.0032	0.009
20-Aug-2007	7.8	1,000		1860	84.3	0.105		<0.0005	<0.003	0.0016	0.673	<0.0005	0295/0.030	0.0023	0.006
13-Sep-2007	8	810		1470	66.6	0.052		<0.0005	<0.003	0.0012	0.539	<0.0005	0.0118	0.0019	0.004
15-Oct-2007	No Flow														
20-Nov-2007	No Flow														
17-Dec-2007	No Flow														
19-Jan-2009	No Flow														
16-Feb-2009	No Flow														
**/03/2009	No Flow														
**/04/2009	No Flow														
18-May-2009	No Flow														
10-Jun-2009	7.4	320	5	585	36.9	0.892	0.004	<0.005	0.002	<0.005	0.866	<0.01	0.007	<0.005	0.016
20-Jul-2009	7.5	900	8	1640	93.9	0.758	0.0025	<0.005	0.002	0.007	0.874	<0.010	0.01	<0.005	0.038
17-Aug-2009	8	940	2	1710	98.4	0.105	0.003	<0.005	<0.001	<0.005	0.182	<0.01	0.005	<0.005	0.021
15-Sep-2009	8.5	1,100	2	1920	138	0.075	0.0037	<0.0001	0.0003	0.006	0.1956	<0.0001	0.045	0.0035	0.0105
19-Oct-2009	7.7	760	5	1380	75.6	0.717	0.0029	<0.0001	0.001	<0.005	0.8664	0.0008	0.017	0.0045	0.0205
16-Nov-2009	7.7	900	2	1630	99.3	0.139	0.0076	<0.0001	0.0004	0.008	0.3362	0.0013	0.019	0.0065	0.009
14-Dec-2009	7.8	970	3	1750	67.2	0.177	0.007	<0.0001	0.0005	0.006	0.4612	0.0009	0.009	0.0042	0.0126
For Aquatic Ecosystems	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,000		1,000		5		0.01	1.00	0.4		0.1		1	20.000

Table 1-5 Downstream Nairne Creek junction

DATE	pH units	TDS by EC total mg/l	TSS total mg/L	NDUCTIVI uS/cm	SULPHATE total mg/l	LUMINIUM total mg/l	ARSENIC total mg/L	CADMIUM total mg/l	CHROMIUM total mg/l	COPPER total mg/l	IRON total mg/l	LEAD total mg/l	ANGANES total mg/l	NICKEL total mg/l	ZINC total mg/l
1-Jan-2001	No Flow														
5-Feb-2001	No Flow														
5-Mar-2001	No Flow														
6-Apr-2001	No Flow														
7-May-2001	No Flow														
13-Jun-2001	4.2	1,100		1920	786	30.70		0.0495	<0.003	0.024	0.379	0.0013	4.480	0.0660	4.180
2-Jul-2001	4.2	1,200		2180	861	30.80		0.0164	<0.003	0.038	0.285	0.0017	5.640	0.0717	4.990
8-Aug-2001	4.2	1,200		2190	678	15.30		0.0118	<0.003	0.027	0.498	0.0016	3.100	0.0696	2.890
12-Sep-2001	7.0	630		1140	153	5.54		0.0037	<0.003	0.016	4.090	0.0019	0.504	0.0213	0.394
9-Oct-2001	5.4	1,100		1940	403	3.15		0.0095	<0.003	0.015	0.348	0.0005	1.930	0.0799	1.290
14-Nov-2001	7.2	1,300		2270	447	0.208		0.0048	<0.003	0.005	0.252	<0.0005	1.670	0.0662	0.753
5-Dec-2001	6.9	1,300		2430	533	0.347		0.0042	<0.003	0.007	0.506	0.0010	2.500	0.0809	1.270
06-Jan-2003	No Flow														
03-Feb-2003	No Flow														
10-Mar-2003	No Flow														
01-Apr-2003	No Flow														
05-May-2003	No Flow														
12-Jun-2003	4.4	1,500		2630	812	16.20		0.0352	<0.003	0.011	0.266	<0.0005	4.600	0.0844	3.990
22-Jul-2003	4.6	1,200		2140	616	7.21		0.0300	<0.003	0.010	0.092	<0.0005	3.331	0.0570	2.827
19-Aug-2003	4.8	1,200		2120	406	3.98		0.019	<0.003	0.01	0.095	<0.0005	1.866	0.0527	2.036
10-Sep-2003	6.3	1,200		2110	418	0.80		0.0076	<0.003	0.007	0.309	<0.0005	2.109	0.0563	1.221
21-Oct-2003	7.2	1,300		2340	463	0.181		0.0041	<0.003	0.005	0.257	<0.0005	1.794	0.0583	0.422
11-Nov-2003	6.7	1,400		2550	628	0.165		0.0039	<0.003	0.003	0.362	<0.0005	2.547	0.0671	0.694
10-Dec-2003	6.5	1,800		3200	667	0.036		0.0008	0.004	0.001	0.952	<0.0005	2.753	0.0293	0.092
12-Jan-2005	No Flow														
11-Feb-2005	No Flow														
22-Mar-2005	6.6	1,700		3120	770	0.194		<0.0005	<0.003	0.003	0.691	<0.0005	3.032	0.017	0.036
13-Apr-2005	No Flow														
02-May-2005	No Flow														
15-Jun-2005	7	1,600		2920	675	0.394		0.0058	<0.003	0.006	0.298	<0.0005	1.673	0.0266	0.445
13-Jul-2005	5.6	1,500		2750	775	1.2		0.0087	<0.003	0.009	0.293	<0.0005	4.100	0.0674	1.271
23-Aug-2005	7.5	1,000		1900	376	0.507		0.0019	<0.003	0.005	0.452	<0.0005	1.74	0.0237	0.112
05-Sep-2005	7.3	1,200		2170	486	0.331		0.0016	<0.003	0.005	0.722	<0.0005	1.62	0.0276	0.141
18-Oct-2005	7.2	1,100		2080	386	0.319		0.002	<0.003	0.005	0.455	<0.0005	0.92	0.0247	0.114
21-Nov-2005	7	1,140		2060	426	0.317		0.0021	<0.003	0.0034	0.719	<0.0005	1.879	0.0298	0.203
15-Dec-2005	6.9	1,380		2490	552	0.181		0.0006	<0.003	0.0011	0.688	<0.0005	1.892	0.0311	0.095
16-Jan-2007	No Flow														
13-Feb-2007	No Flow														
13-Mar-2007	No Flow														
16-Apr-2007	No Flow														
15-May-2007	7.2	980		1780	250	1.72		0.0031	0.003	0.0109	2.13	0.0005	0.8708	0.0258	0.38
16-Jun-2007	7.4	1,300		2310	633	0.102		0.0018	<0.003	0.0066	0.554	<0.0005	0.9541	0.0311	0.303
23-Jul-2007	6.9	1,200		2170	603	0.218		0.0117	0.007	0.006	0.293	<0.0005	2.233	0.0704	1.11
20-Aug-2007	7.1	1,300		2280	549	0.204		0.0023	<0.003	0.0021	0.302	<0.0005	0.5472	0.0214	0.167
13-Sep-2007	6.9	1,500		2740	723	0.1		0.0026	<0.003	0.0013	0.498	<0.0005	1.306	0.0222	0.184
15-Oct-2007	6.3	1,600		2960	786	0.034		<0.0005	<0.003	<0.0010	0.43	<0.0005	1.124	0.0174	0.112
20-Nov-2007	No Flow														
17-Dec-2007	No Flow														
19-Jan-2009	No Flow														
16-Feb-2009	No Flow														
**/03/2009	No Flow														
**/04/2009	No Flow														
10-June-2009	7.8	430	12	776	95.1	1.048	0.002	<0.005	0.002	0.01	1.803	<0.01	0.087	0.009	0.121
20-July-2009	4.5	1,000	12	1830	444	7.103	0.0006	0.016	<0.001	0.019	0.414	<0.010	2.07	0.091	1.97
17-Aug-09	7.2	1,300	4	2270	483	0.309	0.0005	0.006	<0.001	<0.005	0.317	<0.01	1.19	0.036	0.52
15-Sep-09	7.8	1,300	4	2270	537	0.351	0.0006	0.0027	0.0003	0.006	0.8831	<0.0001	0.821	0.0298	0.2069
19-Oct-09	7.4	970	7	1760	280	0.554	0.0008	0.002	0.0004	<0.005	1.298	0.0002	0.806	0.025	0.2067
16-Nov-09	No Flow														
14-Dec-09	6.9	1,600	6	2820	510	0.13	0.0008	0.0003	0.0004	<0.005	0.674	0.0001	0.719	0.0129	0.0395
For Aquatic	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
Ecosystems	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,000			1,000	5		0.01	1.00	0.4		0.1		1	20.000

Table 1-6 Dawesley Creek downstream at South East Freeway

DATE	pH units	TDS by EC total mg/l	TSS total mg/L	NDUCTIV uS/cm	SULPHATE total mg/l	LUMINIUI total mg/l	ARSENIC total mg/L	CADMIUM total mg/l	CHROMIUI total mg/l	COPPER total mg/l	IRON total mg/l	LEAD total mg/l	ANGANES total mg/l	NICKEL total mg/l	ZINC total mg/l
1-Jan-2001	No Flow														
5-Feb-2001	No Flow														
5-Mar-2001	No Flow														
6-Apr-2001	No Flow														
7-May-2001	No Flow														
13-Jun-2001	4.2	1,100		2,050	846	24.90		0.0552	<0.003	0.021	0.278	0.002	4.860	0.068	4.560
2-Jul-2001	4.3	1,200		2,230	832	25.30		0.0177	<0.003	0.021	0.204	0.003	4.850	0.071	4.650
8-Aug-2001	4.4	1,300		2,310	713	15.10		0.0137	<0.003	0.014	0.228	0.001	3.420	0.066	3.460
12-Sep-2001	6.4	620		1,130	189	7.28		0.0056	0.003	0.028	4.420	0.003	0.662	0.028	0.532
9-Oct-2001	4.7	1,200		2,080	495	5.88		0.0068	<0.003	0.012	0.360	<0.0005	2.480	0.057	1.700
14-Nov-2001	6.3	1,200		2,150	402	0.29		0.0034	<0.003	0.006	0.145	<0.0005	1.380	0.042	0.506
5-Dec-2001	6.5	1,300		2,320	475	0.25		0.0018	<0.003	0.009	0.526	0.001	1.620	0.042	0.539
06-Jan-2003	No Flow														
03-Feb-2003	No Flow														
10-Mar-2003	No Flow														
01-Apr-2003	No Flow														
05-May-2003	No Flow														
12-Jun-2003	4.7	1,400		2500	709	5.60		0.0330	<0.003	0.007	0.163	<0.0005	3.844	0.0722	3.539
22-Jul-2003	5.3	1,100		1970	500	0.98		0.0171	<0.003	0.006	<0.030	<0.0005	2.372	0.0588	2.032
19-Aug-2003	4.7	1,200		2160	470	5.18		0.0206	<0.003	0.010	0.071	<0.0005	1.959	0.0517	2.154
10-Sep-2003	5.0	1,100		2070	414	1.72		0.0100	<0.003	0.011	0.194	<0.0005	2.341	0.0625	1.544
21-Oct-2003	6.1	1,300		2290	494	0.189		0.0046	<0.003	0.005	0.073	<0.0005	1.482	0.051	0.557
11-Nov-2003	6.1	1,300		2440	554	0.116		0.0038	<0.003	0.005	0.118	<0.0005	1.687	0.0463	0.415
10-Dec-2003	No Flow														
12-Jan-2005	No Flow														
11-Feb-2005	No Flow														
7-Mar-2005	No Flow														
13-Apr-2005	No Flow														
02-May-2005	No Flow														
15-Jun-2005	No Flow														
13-Jul-2005	8.1	2,700		4830	225	0.558		<0.0005	<0.003	0.005	0.946	<0.0005	0.0431	<0.0005	0.008
23-Aug-2005	6.8	1,100		2080	458	0.328		0.0042	<0.003	0.006	0.147	0.0007	1.8614	0.0354	0.408
05-Sep-2005	7.1	1,200		2140	475	0.228		0.0026	<0.003	0.005	0.476	<0.0005	1.47	0.029	0.202
18-Oct-2005	6.7	1,100		1960	332	0.243		0.002	<0.003	0.006	0.207	<0.0005	0.473	0.0258	0.152
21-Nov-2005	6.8	1,100		2000	411	0.085		0.002	<0.003	0.0044	0.211	<0.0005	1.497	0.0231	0.178
15-Dec-2005	7.1	1,180		2140	426	0.113		0.005	<0.003	0.0026	0.562	<0.0005	0.6377	0.0157	0.083
16-Jan-2007	No Flow														
13-Feb-2007	No Flow														
13-Mar-2007	No Flow														
16-Apr-2007	No Flow														
15-May-2007	6.7	1,000		1830	369	<0.020		0.0008	<0.003	0.0083	0.265	<0.0005	0.6318	0.0124	0.052
13-Jun-2007	7.1	1,200		2220	624	0.058		0.0018	<0.003	0.0049	0.387	<0.0005	0.3017	0.0154	0.24
23-Jul-2007	6.5	1,200		2180	600	0.053		0.0049	<0.003	0.0039	0.112	<0.0005	1.08	0.032	0.772
20-Aug-2007	6.6	1,300		2280	570	0.104		0.0021	<0.003	0.0033	0.131	<0.0005	1286/0.141	0.0154	0.184
13-Sep-2007	6.5	1,500		2640	642	0.057		0.002	<0.003	0.0036	0.383	<0.0005	0.3854	0.016	0.165
15-Oct-2007	6.8	1,600		2940	759	0.054		0.001	0.003	0.0033	0.289	<0.0005	0.5559	0.011	0.132
20-Nov-2007	No Flow														
17-Dec-2007	No Flow														
19-Jan-2009	No Flow														
16-Feb-2009	No Flow														
**/03/2009	No Flow														
**/04/2009	No Flow														
18-May-2009	No Flow														
10-Jun-2009	7.2	1,000	8	1830	327	0.756	0.001	0.006	0.002	0.048	0.91	<0.010	0.281	0.024	0.388
20-Jul-2009	4.9	940	6	1700	381	2.343	0.0003	0.012	<0.001	0.014	0.221	<0.010	1.44	0.062	1.47
17-Aug-2009	6.9	1,300	1	2300	507	0.102	<0.0003	0.007	<0.001	0.008	0.109	<0.010	0.645	0.033	0.605
15-Sep-2009	7.2	1,200	26	2210	558	0.216	0.0004	0.0027	0.0003	0.01	0.5187	<0.0001	0.624	0.0235	0.1657
19-Oct-2009	7.1	940	12	1710	236	0.712	0.0009	0.0016	0.0004	0.006	1.573	0.0003	0.366	0.0191	0.1231
16-Nov-2009	No Flow														
14-Dec-2009	No Flow														
For Aquatic	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
Ecosystems	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,000			1,000	5		0.01	1.00	0.4		0.1		1	20.000

Table 1-7 Mount Barker Creek

DATE	pH	TDS by EC	TSS	NDUCTIVI	SULPHATE	LUMINIUM	ARSENIC	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	ANGANES	NICKEL	ZINC
	units	total mg/l	total mg/L	uS/cm	total mg/l	total mg/l	total mg/L	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l
12-Jan-2001	8.1	2,400		4,230	223.0	0.614		0.0006	<0.003	0.009	0.445	0.0076	0.2920	0.012	0.026
05-Feb-2001	8.1	2,800		5,060	234.0	0.573		<0.0005	<0.003	0.013	0.276	0.0009	0.2140	0.005	0.013
13-Mar-2001	8.0	2,700		4,770	229.0	0.650		<0.0005	<0.003	0.018	0.336	0.0025	0.4200	0.007	0.028
06-Apr-2001	8.2	3,600		6,350	264.0	0.846		<0.0005	<0.003	0.066	0.454	0.0019	0.1670	0.005	0.031
07-May-2001	8.1	4,000		7,120	662.0	0.635		0.0050	<0.003	0.016	0.443	0.0021	1.1000	0.021	0.182
13-Jun-2001	7.0	880		1,590	327.0	0.354		0.0107	<0.003	0.055	0.246	0.0013	1.0600	0.045	1.440
02-Jul-2001	7.4	1,300		2,300	362.0	0.345		0.0100	<0.003	0.010	0.207	0.0010	0.8080	0.042	1.127
08-Aug-2001	7.8	2,100		3,780	240.0	0.305		0.0040	<0.003	0.020	0.284	0.0020	0.2660	0.018	0.502
12-Sep-2001	4.9	840		1,530	317.0	4.850		0.0141	<0.003	0.015	1.210	0.0016	1.3300	0.056	1.600
09-Oct-2001	7.8	1,100		1,950	198.0	0.427		0.0016	<0.003	0.006	0.223	0.0010	0.3630	0.015	0.166
14-Nov-2001	7.8	3,200		5,630	257.0	0.089		0.0050	<0.003	0.002	0.358	<0.0005	0.0186	0.003	<0.003
05-Dec-2001	7.8	1,100		2,040	168.0	0.231		0.0006	<0.003	0.003	0.304	0.0008	0.1310	0.007	0.027
14-Jan-2003	7.9	1,500		2770	276	0.567		<0.0005	<0.003	0.001	0.475	0.0012	0.3973	0.0048	0.023
03-Feb-2003	No Flow														
10-Mar-2003	7.9	1,900		3490	234	0.126		<0.0005	<0.003	<0.001	0.224	<0.0005	0.3386	0.0071	0.005
07-Apr-2003	No Flow														
05-May-2003	No Flow														
12-Jun-2003	7.4	990		1800	199	1.140		<0.0005	<0.003	0.003	1.22	0.0016	0.1715	0.0077	0.055
22-Jul-2003	8.0	4,800		8410	542	0.039		0.0006	<0.003	0.003	0.221	<0.0005	0.012	0.0047	<0.003
19-Aug-2003	7.6	1,400		2500	193	0.433		0.0011	<0.003	0.003	0.789	0.0013	0.1089	0.0094	0.127
10-Sep-2003	7.8	980		1770	194	0.514		0.0027	<0.003	0.004	0.436	0.0017	0.3244	0.0194	0.214
21-Oct-2003	7.8	1,500		2780	202	0.341		0.0006	<0.003	0.002	0.436	0.0008	0.2826	0.0091	0.033
11-Nov-2003	7.8	4,000		7100	365	0.056		0.0007	<0.003	<0.001	0.247	<0.0005	0.0273	0.0048	<0.003
10-Dec-2003	7.6	1,600		2850	153	0.207		<0.0005	<0.003	<0.001	0.372	<0.0005	0.3431	0.0073	0.018
12-Jan-2005	No Flow														
11-Feb-2005	No Flow														
22-Mar-2005	8	3400		5990	375	0.241		<0.0005	<0.003	0.002	0.166	<0.0005	0.1764	0.0062	0.006
13-Apr-2005	No Flow														
02-May-2005	No Flow														
15-Jun-2005	7.6	1300		2370	252	0.223		<0.0005	<0.003	0.002	0.275	<0.0005	0.0759	0.0045	0.029
13-Jul-2005	8	2800		4950	234	0.081		<0.0005	<0.003	0.004	0.147	<0.0005	0.0121	<0.0005	0.005
23-Aug-2005	8	1500		2770	129	0.139		<0.0005	<0.003	0.003	0.290	<0.0005	0.0076	0.0012	0.004
05-Sep-2005	7.7	1200		2200	120	0.19		<0.0005	0.004	0.003	0.220	<0.0005	0.1782	0.0073	0.036
18-Oct-2005	7.8	1600		2890	114	0.138		<0.0005	0.004	0.005	0.36	<0.0005	0.0249	0.004	0.004
21-Nov-2005	7.4	1150		2090	153	0.488		<0.0005	0.003	0.004	0.805	0.0011		0.0075	
15-Dec-2005	7.6	1260		2280	244	0.297		<0.0005	<0.003	<0.0010	0.454	<0.0005	0.4166	0.0071	0.016
16-Jan-2007	No Flow														
13-Feb-2007	No Flow														
13-Mar-2007	8.3	2500		4490	151	0.13		<0.0005	<0.003	<0.0010	0.23	<0.0005	0.202	0.0041	0.005
16-Apr-2007	No Flow														
15-May-2007	7.5	1200		2250	263	0.127		0.0019	<0.003	0.0036	1.03	0.0008	1.065	0.0222	0.559
13-Jun-2007	7.6	1100		2050	217	0.79		0.0005	<0.003	0.0022	0.646	<0.0005	0.1759	0.0059	0.135
23-Jul-2007	7.4	1300		2380	217	0.218		<0.0005	<0.003	0.0025	0.612	<0.0005	0.1128	0.0054	0.079
20-Aug-2007	7.4	1300		2430	204	0.125		<0.0005	<0.003	0.0016	0.38	<0.0005	0992/0.108	0.0036	0.051
13-Sep-2007	7.7	1100		2060	151	0.081		<0.0005	<0.003	0.0012	0.427	<0.0005	0.0982	0.0029	0.036
15-Oct-2007	7.5	1300		2300	199	0.044		<0.0005	0.003	0.0011	0.362	0.0012	0.1543	0.0027	0.019
20-Nov-2007	No Flow														
12-Dec-2007	7.7	1500		2790	296	0.056		<0.005	<0.001	<0.005	0.339	<0.01	0.505	0.005	0.014
19-Jan-2009	No Flow														
16-Feb-2009	No Flow														
**/03/2009	No Flow														
**/04/2009	No Flow														
18-May-2009	No Flow														
10-Jun-2009	7.8	1200	2	2180	148	0.028	<0.001	<0.005	<0.001	<0.005	0.262	<0.010	0.076	<0.005	0.029
20-Jul-2009	7.4	1100	6	1950	169	0.409	0.0008	<0.005	0.001	0.005	0.615	<0.010	0.194	0.009	0.239
17-Aug-2009	7.6	1400	4	2440	218	0.105	0.0007	<0.005	<0.001	<0.005	0.306	<0.01	0.121	0.006	0.094
15-Sep-2009	7.6	1100	1	1960	231	0.088	0.0007	0.0004	0.0003	<0.005	0.3878	0.0002	0.182	0.0064	0.0412
19-Oct-2009	7.6	870	3	1570	97.5	0.277	0.001	0.0002	0.0006	<0.005	0.6369	0.0008	0.056	0.0052	0.031
16-Nov-2009	No Flow														
14-Dec-2009	7.4	1100	6	1960	134	0.121	0.0011	<0.0001	0.0003	<0.005	0.5559	0.0004	0.337	0.004	0.0104
For Aquatic	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
Ecosystems	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,000			1,000	5		0.01	1.00	0.4		0.1		1	20.000

Table 1-8 Bremer River

DATE	pH	TDS by EC	TSS	INDUCTIVI	SULPHATE	ALUMINIUM	ARSENIC	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	MANGANES	NICKEL	ZINC
	units	total mg/l	total mg/L	uS/cm	total mg/l	total mg/l	total mg/L	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l
12-Jan-2001	7.9	2,000		3,670	171.0	0.509		0.0007	<0.003	0.008	0.462	0.0073	0.5690	0.0163	0.032
5-Feb-2001	8.0	2,200		3,940	184.0	0.819		0.0006	<0.003	0.014	0.627	0.0022	0.4500	0.0071	0.036
13-Mar-2001	8.2	3,500		6160	211.0	0.452		<0.0005	<0.003	0.015	0.269	0.0017	0.2220	0.0046	0.018
6-Apr-2001	7.9	2,000		3,540	195.0	0.604		<0.0005	<0.003	0.061	0.429	0.0026	0.3370	0.0069	0.260
7-May-2001	8.0	2,300		4,040	189.0	0.342		<0.0005	<0.003	0.012	0.250	0.0016	0.2850	0.0046	0.017
13-Jun-2001	7.2	800		1,440	272.0	0.795		0.0013	<0.003	0.074	0.819	0.0046	0.2700	0.0119	0.354
2-Jul-2001	7.8	1,400		2,590	320.0	0.310		0.0025	<0.003	0.012	0.263	0.0011	0.2290	0.0161	0.420
8-Aug-2001	8.1	2,400		4,340	429.0	0.176		0.0024	<0.003	0.014	0.163	0.0012	0.3300	0.0165	0.188
12-Sep-2001	7.0	670		1,220	153.0	3.300		0.0042	<0.003	0.020	2.510	0.0035	0.4790	0.0235	0.511
9-Oct-2001	7.5	1,000		1,880	132.0	0.326		0.0007	<0.003	0.004	0.342	0.0008	0.1620	0.0093	0.053
14-Nov-2001	7.8	1,400		2,450	202.0	0.231		<0.0005	<0.003	0.002	0.228	<0.0005	0.1980	0.0069	0.011
5-Dec-2001	7.8	1,500		2,650	188.0	0.205		<0.0005	<0.003	0.005	0.149	0.0008	0.1050	0.0053	0.017
14-Jan-2003	7.9	1,900		3,450	151	0.602		<0.0005	<0.003	<0.001	0.647	0.001	0.392	0.0056	0.024
03-Feb-2003	No Flow														
10-Mar-2003	8.1	2,200		4,010	204	0.220		<0.0005	<0.003	0.001	0.314	0.0009	0.317	0.0060	0.025
01-Apr-2003	No Flow														
##########	No Flow														
12-Jun-2003	7.4	780		1,420	118	2.340		<0.0005	0.003	0.007	2.060	0.0021	0.102	0.0171	0.049
22-Jul-2003	7.1	1,100		1,910	178	0.402		0.0011	<0.003	0.003	0.534	0.0008	0.115	0.0086	0.088
19-Aug-2003	7.7	2,400		4,360	206	<0.020		<0.0005	<0.003	0.003	0.073	<0.0005	0.004	0.0020	0.006
10-Sep-2003	7.7	1,200		2170	182	0.507		0.0011	<0.003	0.004	0.461	0.001	0.201	0.013	0.102
21-Oct-2003	7.9	1,400		2610	217	0.417		<0.0005	<0.003	0.003	0.465	0.0006	0.2901	0.0089	0.027
11-Nov-2003	8.2	1,300		2420	202	0.69		0.0009	0.004	0.003	0.706	0.0009	0.3392	0.0075	0.035
10-Dec-2003	7.7	1,700		3140	204	0.14		<0.0005	<0.003	0.001	0.254	<0.0005	0.2447	0.0067	0.008
12-Jan-2005	No Flow														
11-Feb-2005	No Flow														
22-Mar-2005	8	2,600		4570	179	0.182		<0.0005	<0.003	0.002	0.238	<0.0005	0.2711	0.0047	0.013
13-Apr-2005	No Flow														
##########	No Flow														
15-Jun-2005	8	2,500		4410	322	0.426		0.0006	<0.003	0.004	0.22	<0.0005	0.0717	0.0029	0.035
13-Jul-2005	7.8	1,900		3450	287	0.189		0.0015	<0.003	0.004	0.239	<0.0005	0.1632	0.011	0.14
23-Aug-2005	7.9	1,500		2710	192	0.212		<0.0005	<0.003	0.003	0.238	<0.0005	0.0499	0.0043	0.032
5/09/2005	7.8	1,300		2290	199	0.356		<0.0005	0.004	0.003	0.557	0.0006	0.1397	0.0048	0.029
18-Oct-2005	7.8	1,100		2040	142	0.27		<0.0005	<0.003	0.003	0.137	<0.0005	0.1459	0.0071	0.021
21-Nov-2005	7.6	1,150		2090	154	2.19		0.0012	0.007	0.0078	3.22	0.0043	0.6598	0.0168	0.124
15-Dec-2005	8	1,280		2320	172	0.24		<0.0005	<0.003	0.0014	0.346	<0.0005	0.3475	0.0072	0.074
16-Jan-2007	No Flow														
13-Feb-2007	No Flow														
13-Mar-2007	8.2	2,400		4350	188	0.042		<0.0005	<0.003	<0.0010	0.166	<0.0005	0.4881	0.0016	0.005
16-Apr-2007	No Flow														
##########	7.4	1,200		2110	283	0.186		0.0008	<0.003	0.0036	0.602	0.0005	0.4128	0.0087	0.13
13-Jun-2007	7.5	1,000		1830	225	0.143		<0.0005	<0.003	0.0026	0.56	<0.0005	0.1081	0.0053	0.068
23-Jul-2007	7.6	1,300		2410	211	0.329		<0.0005	<0.003	0.0023	0.625	<0.0005	0.0679	0.0043	0.064
20-Aug-2007	7.5	1,400		2560	227	0.195		<0.0005	<0.003	0.0017	0.38	<0.0005	0937/0.099	0.0034	0.034
13-Sep-2007	7.8	1,400		2600	197	0.154		<0.0005	<0.003	0.0014	0.351	<0.0005	0.1475	0.0028	0.028
15-Oct-2007	7.7	1,300		2400	230	0.058		<0.0005	<0.003	<0.0010	0.194	<0.0005	0.1037	0.0019	0.007
20-Nov-2007	No Flow														
12-Dec-2007	7.7	1,600		2970	126	0.036		<0.005	<0.001	<0.005	0.439	<0.01	0.222	<0.005	0.006
19-Jan-2009	No Flow														
16-Feb-2009	No Flow														
**/03/2009	No Flow														
**/04/2009	No Flow														
##########	No Flow														
10-Jun-2009	7.7	660	5	1200	77.4	0.245	0.001	<0.005	0.002	<0.005	0.436	<0.010	0.034	<0.005	0.026
20-Jul-2009	7.3	1,000	8	1880	150	0.554	0.0009	<0.005	0.002	0.005	0.79	<0.010	0.131	0.007	0.152
17-Aug-2009	7.6	1,500	3	2710	237	0.139	0.0007	<0.005	<0.001	<0.005	0.37	<0.01	0.127	0.005	0.063
15-Sep-2009	7.4	1,200	4	2150	173	0.3	0.0009	0.0002	0.0008	<0.005	1.034	0.0006	0.26	0.0053	0.034
19-Oct-2009	7.5	800	8	1450	88.8	0.378	0.001	0.0003	0.0007	<0.005	0.7079	0.0008	0.063	0.0055	0.0297
16-Nov-2009	No Flow														
14-Dec-2009	7.5	1,300	12	2380	88.8	0.278	0.0012	<0.0001	0.0006	<0.005	0.5973	0.0004	0.384	0.0035	0.0112
For Aquatic	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
Ecosystems	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,000			1,000	5		0.01	1.00	0.4		0.1		1	20.000

Appendix 2 – Additional Monitoring

Metal Concentration

Table 2-1 Mine clarifying pond

DATE	pH	TDS by EC	TSS	INDUCTIVI	SULPHATE	ALUMINIUM	ARSENIC	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	MANGANES	NICKEL	ZINC
	units	total mg/l	total mg/L	uS/cm	total mg/l	total mg/l	total mg/L	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l
19/01/2009	No Flow														
16/02/2009	No Flow														
**/03/2009	No Flow														
**/04/2009	No Flow														
18/05/2009	5.7	2100	11	3750	2360	0.279	<0.001	<0.005	0.002	<0.005	4.397	<0.010	18.1	0.016	0.053
10/06/2009	9.3	1900	13	3420	1970	6.159	<0.001	<0.005	0.001	0.005	1.297	<0.01	0.819	<0.005	0.036
20/07/2009	9.3	1800	69	3170	2020	8.666	0.0008	<0.005	0.002	0.007	2.89	<0.010	0.27	0.007	0.171
17/08/2009	9.2	1700	13	3000	1480	6.801	0.0006	<0.005	<0.001	<0.005	1.267	<0.010	0.105	<0.005	0.061
15/09/2009	9.2	1800	9	3160	2520	14.27	0.0007	0.0001	0.0003	<0.005	0.609	<0.0001	0.074	0.0016	0.0223
19/10/2009	9.3	1800	8	3260	2530	8.061	0.0005	0.0002	0.001	<0.005	0.5487	<0.0001	0.042	0.002	0.0233
16/11/2009	9.1	1900	2	3350	1620	6.56	0.0007	<0.005	<0.001	<0.005	0.226	<0.01	0.021	<0.005	0.01
14/12/2009	8.7	2000	6	3520	1940	5.549	<0.0003	<0.0001	0.0003	<0.005	0.0213	<0.0001	0.218	0.0004	0.0028
For Aquatic	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
Ecosystems	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,000			1,000	5		0.01	1.00	0.4		0.1		1	20.000

Table 2-2 Seepage Collection Pond

DATE	pH	TDS by EC	TSS	INDUCTIVI	SULPHATE	ALUMINIUM	ARSENIC	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	MANGANES	NICKEL	ZINC
		total mg/l	tal mg/	uS/cm	total mg/l	total mg/l	total mg/L	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l	total mg/l
13/Mar/2001	2.5	5,700		9,990	11,500	334		0.0484	<0.030	0.09	2,770	0.0056	140	0.279	19.20
13/Jun/2001	2.6	3,900		6,970	8,450	679		0.2010	0.117	0.108	1,460	0.0542	50	0.124	44.10
12/Sep/2001	2.6	5,000		8,850	10,700	1140		0.2900	7.71	12.3	962	0.024	66.1	2.787	65.90
05/Dec/2001	2.7	5,400		9,520	11,400	767		0.1690	<3.0	<3.0	1,930	0.001	109	1.536	39.30
10/Mar/2003	2.8	5,500		9610	9,250	364		0.0717	0.061	0.184	2,460	0.0008	118	0.724	22.50
12/Jun/2003	2.8	4600		8190	10064	540		0.2136	0.222	0.448	1500	0.0337	61.3	0.884	36.80
10/Sep/2003	2.9	3,900		6850	7,943	570		0.1698	0.228	0.978	674	0.0129	40	2.052	35.70
10/Dec/2003	2.6	5,200		9140	9,240	355		0.0636	0.071	0.213	2,240	0.0027	107	0.746	27.20
22/Mar/2005	2.7	5,100		8970	8,110	222		0.0249	0.008	0.0300	2,190	0.0015	105	0.155	14.78
15/Jun/2005	2.9	3,200		5780	6,000	485		0.0666	0.058	0.2470	631	0.0026	55.5	0.761	23.60
05/Sep/2005	2.9	3,800		6730	6,860	579		0.1732	0.132	2.8490	517	0.0062	43	0.048	37.10
15/Dec/2005	3.0	5,420		9530	10,400	839		0.1805	0.059	0.4558	1,430	0.0056	97.62	1.313	47.70
13/Mar/2007	2.7	5,200		9,090	5,760	207		0.0228	0.06	0.0968	1,680	0.0012	94.7	0.4859	<0.003
27/Apr/2007	2.8	4,000		7,120	6,600	480		0.1459	0.049	0.3223	910	0.0103	62.54	0.8096	28.60
15/May/2007	2.8	4,700		8,340	8,280	419		0.1712	0.15	0.3276	1,760	0.106	55.27	1.0940	37.90
13/Jun/2007	3	4,800		8,470	9,510	779		0.0862	0.11	0.2196	1,250	0.0015	72.02	1.4950	31.70
23/Jul/2007	2.8	4,400		7,760	8,490	771		0.3101	0.081	0.4312	1,080	0.0306	46.37	1.1560	46.20
20/Aug/2007	2.9	3,900		6,920	6,930	594		0.2190	0.096	0.5794	655	0.0091	42.4	1.3770	36.20
13/Sep/2007	2.8	4,100		7,280	7,770	575		0.1305	0.046	0.1705	874	0.0069	49.78	0.8712	32.20
15/Oct/2007	2.9	4,400		7,750	7,710	294		0.0422	0.055	0.1074	1,660	0.0015	74.5	0.5622	18.90
19/Nov/2007	2.7	4,800		8,490	9,780	830		0.2290	0.161	0.6170	1,110	0.026	88.7	2.5020	20.27
12/Dec/2007	2.9	5,300		9,360	9,150	279		0.0800	0.062	0.1710	2,140	0.092	115.7	0.9410	20.66
19/01/2009	2.7	4,900	39	8,640	8,610	219	0.007	0.0470	0.037	0.1190	1,928	0.092	94.2	0.5140	11.20
16/Feb/2009	2.6	5,000	20	8,840	8,310	182	<0.001	0.0460	0.039	0.1130	1,860	0.093	90.6	0.4790	9.85
**/Mar/2009	Not Collected														
01/Apr/2009	Not Collected														
18/May/2009	2.6	4,700	42	8,260	8130	37.75	0.003	0.024	0.01	0.011	3247	0.104	102	0.067	2.49
10/Jun/2009	2.8	3,300	56	5,870	6090	611.8	0.019	0.153	0.1	0.384	674.4	0.014	34.2	1.24	24.3
20/Jul/2009	2.8	3,800	16	6,790	7920	809.1	0.0423	0.243	0.178	1.11	685.2	0.012	44.1	1.83	43.7
17/Aug/2009	2.9	3,600	47	6,480	6480	686.5	0.019	0.172	0.108	0.534	573.3	0.016	41	1.49	31.2
15/Sep/2009	2.9	3,100	30	5,540	6900	309.4	0.0161	0.139	0.0904	0.465	323.4	0.0135	39.8	1.145	31.7
19/Oct/2009	2.7	2,900	47	5,110	4440	323.6	0.008	0.143	0.0803	0.374	387.3	0.0077	27	1.222	26
16/Nov/2009	2.7	3,400	20	6,080	5190	417.8	0.0071	0.096	0.07	0.377	574.9	0.03	34.9	0.886	18.7
14-Dec-09	2.7	4,500	35	8,020	9960	2608	0.0077	0.0782	0.0608	0.274	1698	0.0019	113	0.8844	109
For Aquatic	<6.5/>9.0					0.08	0.042	0.0004		0.0018		0.006	2.5	0.013	0.015
Ecosystems	Adjusted for hardness (based on 210 mg/L as $CaCO_3$)							0.00228		0.00936		0.06608		0.0676	0.078
Irrigation	<6/>8.5					5		0.01	0.10	0.2	0.2	2	0.2	0.2	2.000
Livestock	no value	2,500			1,000	5		0.01	1.00	0.4		0.1		1	20.000

Rainfall

Figure 4-1 Monthly rainfall (2009)

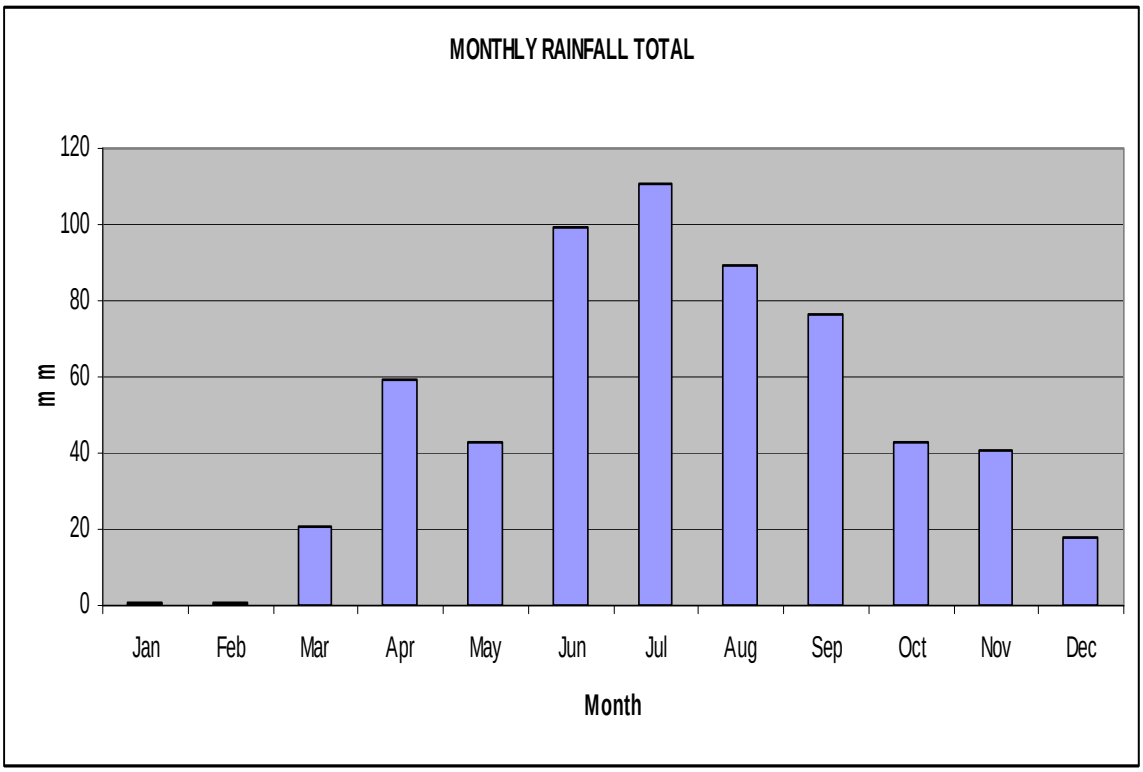
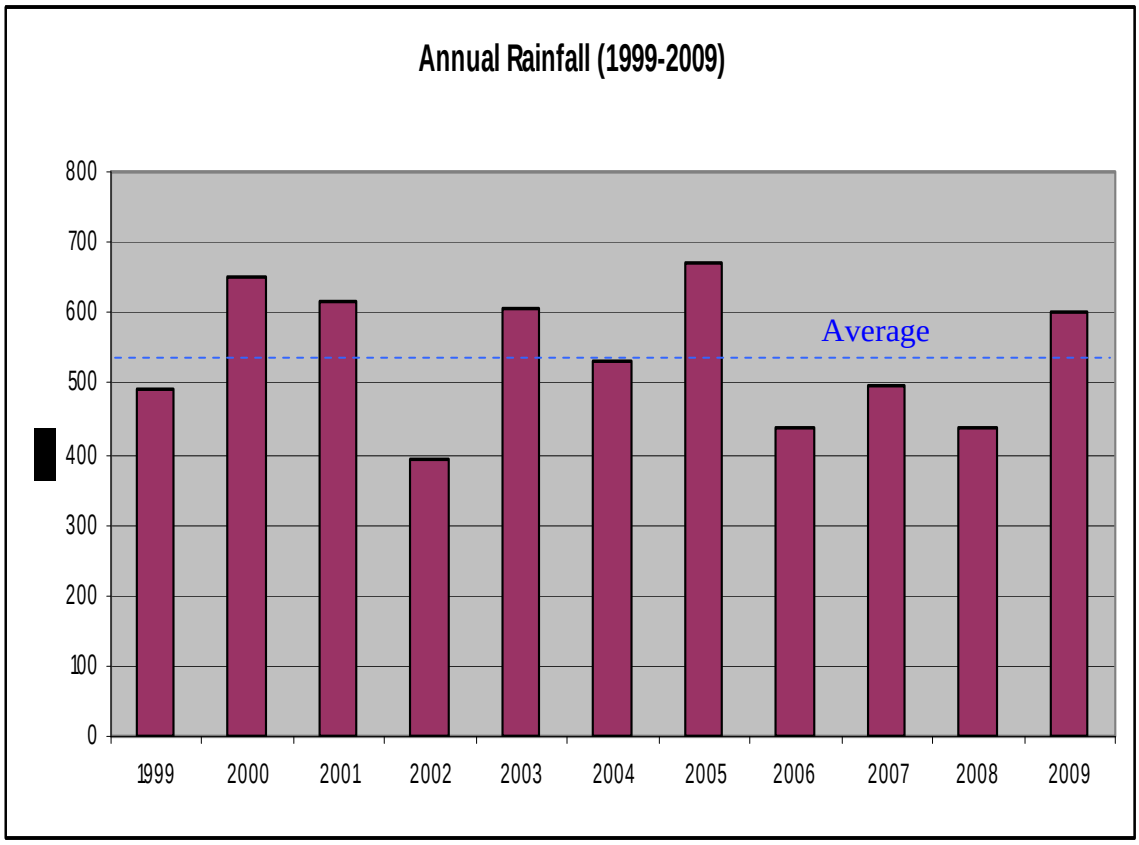


Figure 4-2 Average annual rainfall



Plant Operation

Table 4-4 Throughput and operation (as a percentage of available time)

	January	February	March	April	May	June	
Plant Operation % 24/7	10	14	22	33	58	100	
Kilolitres treated	1056	2462	2504	4929	6397	15714	
	July	**August**	**September**	**October**	**November**	**December**	**Total**
Plant Operation % 24/7	98	100	100	99	74	10	59.8 Ave
Kilolitres treated	34977	27058	31455	25096	9875	4778	33062

Appendix 3 – Reporting Requirements

Report section	Requirements	✗ / ✓
Certification	• Certification by authorisation holder that report is true and accurate	✓
Report identification	• EPA licence number • name and address of licensed site • period covered by report (eg October 2004–October 2005) • date of submission, version number • person responsible for the report	✓ ✓ ✓ ✓ ✓
Monitoring objective	• monitoring objective stated in the authorisation • other monitoring requirements (eg assessment criteria) stated in the authorisation	✓ ✓
Monitoring plan	• statement on whether the approved monitoring plan was adhered to and details on any deviation from the approved monitoring plan or licence conditions and reasons for the deviation	✓
Monitoring results—presentation	• summary of all current results in a graph or table that includes the assessment criteria and highlights results that do not comply with the assessment criteria • analytical methods and the limits of reporting (LoR) for each analyte reported • summary of previous results (sufficient to highlight trends) • calculation of pollutant load discharged into the environment (where required by condition of authorisation)	✓ ✓ ✓
Monitoring results—quality assurance / quality control (QA/QC) evaluation	• discussion of data completeness • evaluation of QC information from the laboratory and the field data, ie data representativeness, precision and accuracy	✓ ✓
Discussion and interpretation of results	• discussion of results where criteria was exceeded • review of trends when compared with previous monitoring data • discussion of results based on monitoring objective(s)	✓ ✓ ✓
Conclusions and proposed actions	• conclusions on meeting monitoring objective, compliance with assessment criteria and impact on environment • major assumptions or uncertainties • conclusions about effectiveness of the monitoring plan and overview of any proposed	✓ ✓ ✓

	changes to monitoring plan (if required) • proposed actions to address non-compliance	✓

Appendix 4 – Macro invertebrate Report