Kerosene Vale Ash Dam and Dry Ash Repository – Stage 2 Water Quality Assessment April 2013 to March 2014

Reference:

EnergyAustralia NSW

2/18/2015

Contents

Tables

Figures

Figure 7: Kerosene Vale Ash Dam Seepage Detection Bore WGM1/D5 Long-term Trends in Conductivity, Sulphate and Boron since October 2007. Periods of Stage 2 Ash placement, including initial Stage since April 2009, Blocked toe drains from April 2007 and Sub-surface drain seepage collection from October 2010 are shown.

Figure 8: Lidsdale Cut Long-term trends in Conductivity, Sulphate and Boron since October 2007 compared to the Pre-Stage I Baselines. Periods for Blocked toe drains (from April 2007) and KVAR Stage 2 Sub-surface drains (from October 2010) are shown.

Figure 9: Sawyers Swamp Creek Long-term trends in Conductivity, Sulphate and Boron since October 2007, in relation to baseline and goals and the SSCAD and Springvale Mine Water discharge conductivity. Periods of blocked KVAD toe drains (from April 2007), Springvale Mine Water Discharge and pipeline leak (since July 2011), SSCAD pump-back (since March 2010) and KVAD/R seepage collection and diversion to Lidsdale Cut (since October 2010) have also been shown.

Attachments

Attachment 1 Rainfall Data

Attachment 2 Wallerawang Power Station Ash Dam Surface Water and Groundwater Quality Stage 2 from April 2013 to March 2014

EnergyAustralia

Summary

Previously Aurecon has been engaged by EnergyAustralia NSW to perform an assessment on the effect of dry ash placement on surface and groundwater quality in receiving waters in the vicinity of Kerosene Vale Ash Repository (KVAR). This reporting period, however, EnergyAustralia NSW has performed the assessment in-house by suitable qualified reviewers. The data was analysed to assess:

- The changes, if any, in surface and groundwater quality due to seepage collection and diversion systems at:
    - The Sawyers Swamp Creek Ash Dam (SSCAD) v-notch pump-back system
    - Sub-surface drains in the Kerosene Vale Ash Dam (KVAD) under the dry ash placement at Kerosene Vale Ash Repository (KVAR)
    - Diversion of the KVAD groundwater to Lidsdale Cut via the unblocked KVAD toe drains
    - Diversion of the Lidsdale Cut discharge from Sawyers Swamp Creek (SSC) to the SSCAD
- The effects of the Stage 1 and Stage 2 dry ash placement on surface and groundwater receiving waters with the effects of the local coal mining and the Springvale Mine water discharge taken into consideration.

The assessment of surface and groundwater quality found that the seepage collection and diversion systems have typically reduced the conductivity, sulphate and trace metals in the local groundwater bores at the KVAD/R such that, other than the local mineral effects, the water quality and trace metals met the local/ANZECC guidelines. The reductions provided evidence that the Stage 1 and Stage 2 dry ash placements are not measurably affecting the groundwater quality.

This, together with the local KVAD/R seepage and more detailed measurements in Sawyers Swamp Creek, indicated no significant effects on the creek receiving water. Additionally, although the SSCAD seepage had previously been found to affect the conductivity in Sawyers Swamp Creek, more recently the conductivity within the creek has increased corresponding to the conductivity of Springvale Mine water, with effects on trace metals evident.

The water quality within Lidsdale Cut was elevated in trace metals which were above the local/ANZECC guidelines. As this increase was not observed within the groundwater bores, this was associated with seepage from the overburden deposits at the back of the void.

Since the commencement of continuous Springvale Mine water discharge, the inflows have altered the water quality and trace metal concentrations in Sawyers Swamp Creek, thereby compromising future assessments of the SSCAD and KVAD/R effects on the creek. However, it is recommended that the SSCAD and KVAD/R seepages, Sawyers Swamp Creek and the mine water continue to be monitored so that the effects of the mine water and local background conditions are not assigned by others to the activities of the ash placement. Prior to August 2012, seepage from SSCAD dominated the conductivity conditions in Sawyers Swamp Creek, except during periods of high rainfall and the previous Springvale Mine water pipeline leak and continuous discharge to the creek. Water quality, including conductivity, continued to meet the local/ANZECC (2000) guideline goals and there was no evidence of the effects of the seepage on trace metals at WX7.

1. Introduction

Wet slurry ash placement from Wallerawang Power Station was originally deposited in the Kerosene Vale Ash Dam (KVAD). Once the KVAD was full, it was capped with clay and wet ash placement was directed to the Sawyers Swamp Creek Ash Dam (SSCAD).

In 2002, Delta Electricity (now EnergyAustralia NSW) obtained approval for conversion of the wet ash slurry placement process at Wallerawang Power Station to dry ash placement within Kerosene Vale Ash Repository (KVAR). Based on the move from wet ash placement to dry ash placement, operations at SSCAD ultimately ceased[1], and dry ash placement commenced on top of the clay capping of the KVAD.

Stage 1 of the placement was completed and capped in February 2009 with approval for further placement in the Stage 2 obtained in November 2008. The Stage 2 Area ash placement commenced in April 2009 (stage 2A), continuing into a second phase of placement beginning on 19th January 2012 (stage 2B). During the stage 2 dry ash placement, Delta Electricity installed seepage collection and diversion systems underneath the KVAR and reinstated the KVAD toe drains to minimise effects of local groundwater on the ash repository site, continuing protection for Sawyers Swamp Creek through a recirculation process for seepage groundwater.

Then as a result of a lower demand for electricity ash placement operations at Wallerawang Power Station ceased. Wallerawang Power Station's Unit 7 had been removed from service in January 2014 and Unit 8 was placed on a 3 month recall in March 2014. Following on from this, the continuing lower demand and a lack of access to competitively priced coal has resulted in a decision being made to permanently close Unit 7, which will now be deregistered and undergo a decommissioning, deconstruction and rehabilitation process. Although Unit 8 was in a state that meant it could be returned to service if the need arose, no ash has been deposited into the KVAR since 1st April 2014. At present, EnergyAustralia NSW is in negotiations with NSW Treasury to produce a plan for the decommissioning, deconstruction and rehabilitation of the entire operational facility at Wallerawang, including the ash placement area. Options for this site still include catchment management and biodiversity development, with the potential for ash reclamation.

Previously Aurecon has been engaged to assess the combined effects of the Stage 1 and Stage 2 dry ash placements on surface and groundwater quality in receiving waters. However for this reporting period (April 2013 to March 2014), EnergyAustralia NSW has performed the assessment in-house by a suitably qualified person. The study takes into account the potential benefits of the seepage collection and diversion works, as well as any influences of Springvale Mine water inflows and other, non-ash related, catchment inputs to Sawyers Swamp Creek, as well as the local background conditions.

1.1 Previous Report

The previous report (Aurecon, 2014) found that the dry ash placement at Kerosene Vale Ash Repository (KVAR) was having insignificant or undetectable effects on surface and groundwater quality, and concluded that:

- KVAD/R North Wall seepage had no observable effects on the conductivity in Sawyers Swamp Creek, which was decreasing until the beginning of Springvale Mine Water Discharge.
- All the water quality and trace metal concentrations in the creek downstream of the KVAD/R seepage met the local/ANZECC guideline concentrations, with the exception of molybdenum. Both the upstream and downstream molybdenum concentrations were similar and the observed increases both occurred in October 2012, shortly after the mine water discharge began in August 2012.

[1] EnergyAustralia NSW still have the capacity to use the SSCAD for the placement of mill rejects, economiser grit, residual ash from the wash down system and emergency ash placement if required.

However, it was noted that there was no trace metal data for the KVAD/R seepage, so it was recommended that the seepage be tested for trace metals

- The conductivity in Lidsdale Cut and in the groundwater at bore D5 decreased together following reinstatement of the toe drains and installation of the subsurface drains. The improvement in conductivity has continued as the groundwater level in KVAD/R has decreased.
- Unblocking of the KVAD toe drains, installation of the KVAR sub-Surface drains and diversion of this groundwater to Lidsdale Cut provide conditions that reduce the conductivity, sulphate and trace metals in:
  - The local groundwater at bore D5
  - Lidsdale Cut

In addition, until the Springvale mine water discharge commenced, the SSCAD seepage had also been associated with a decrease in conductivity in Sawyers Swamp Creek in line with that observed within the SSCAD. After the commencement of Springvale Mine Water discharge, the conductivity increased and the water quality and trace metals within Sawyers Swamp Creek changed. However, all of the water quality and trace metal concentrations within the creek, downstream of the ash dam v-notch, met the local/ANZECC guideline concentrations, with the exception of copper and molybdenum, which became elevated at the time of the mine water discharge.

High rainfall during the Stage 2 period introduced high concentrations of trace metals from the local mine spoil into Sawyers Swamp Creek downstream of Lidsdale Cut, causing the receiving waters to exceed some of the local environmental goals

Although the water quality data indicates that management of the KVAR ash placement area effectively controls dry ash leachates from affecting the local groundwater and surface water quality, the commencement of the continuous Springvale Mine water discharge has compromised future assessment of potential effects on the Sawyers Swamp Creek receiving water site. As a result, appropriate changes to the monitoring program were advised.

1.2 Information used for this report

In connection with the assessment, the following information has been used:

- Relevant Lend Lease Industrial (LLI) KVAR management reports
- Water quality data in the dry ash runoff collection ponds and a schematic of its diversion to the SSCAD via the return canal (Figure 4)
- Plan of the KVAD final seepage diversion works
- Location of any new water quality sampling sites in the Upper Coxs River
- Surface and Groundwater quality data from 2010 to the present, including:
  - Sawyers Swamp Creek receiving water site, WX7
  - Water quality in the SSCAD and KVAD seepage detection bores
  - Lidsdale Cut water quality
  - Background surface and groundwater data
- Springvale mine water quality data
- SSCAD seepage flows via the v-notch weir to the collection and pump-back system
- Any additional water quality sampling by NALCO relevant to the study

This data and information has been used to assess the effects of seepage collection and diversion systems and to define the inputs affecting water quality for the period of operation of Stage 1, and the current operations of the Stage 2 placement, and their effects on local surface and groundwater quality.

2. Surface and Groundwater Monitoring

This section provides an overview of the climatic conditions experienced over the reporting year and the methods and guidelines used to perform the assessment. Due to the local inputs from coal mining activities in the area, the assessment takes into account the background conditions and provides the locally derived and ANZECC (2000) guideline trigger values, which apply as assessment criteria to the receiving waters. The discharge of Springvale Mine water to Sawyers Swamp Creek has also been taken into consideration.

2.1 Monitoring Design for Differentiation of Water Quality Sources

The locations of the surface and groundwater sampling sites for the various ash dams and ash repositories are shown in Figure 1 and described in this Section.

Surface and groundwater monitoring is performed by Nalco, on behalf of EnergyAustralia NSW, for the assessment of the environmental performance of the KVAR ash placement, as well as seepage effects from the KVAD and SSCAD.

The assessment of the KVAR effects on receiving water sites depends upon differentiating between the effects of leachates from the KVAD, which is located underneath the KVAR, local coal mine inputs and leachates and runoff effects, if any, from the KVAR itself. To do this, groundwater bores were installed to provide baseline conditions prior to commencement of ash placement operations and are situated both up- and down-gradient of the KVAD/R, as well as for the SSCAD.

Ongoing water quality monitoring is performed to confirm that the local ANZECC (2000) guidelines (as applicable) are met in Sawyers Swamp Creek at WX7 (downstream of the ash placement site) and in the groundwater bores D5 and D6. These sites have been used to identify the need for changes to management and to enable contingency actions and investigations to be initiated in a timely manner if these limits are approached.

2.1.1 Groundwater Monitoring & Levels

The up-gradient bores (WGM1/D1 and D2) enable analysis of the effects of various local sources of groundwater flowing into the KVAD/R and SSCAD area. The bores (WGM1/D3 and D4) are located down-gradient of the SSCAD for detection of the SSCAD seepage and bores WGM1/D5 and D6 are the seepage detection bores for the KVAD/R. These two down-gradient bores also sample the combined effects of the local up-gradient inputs, as well as those from the SSCAD and the KVAD/R. Details of the monitoring design were previously set out in Aurecon (2012).

Additionally, Figure 4 indicates that the groundwater at bore D4 mainly flows to Sawyers Swamp Creek. However, as the groundwater seepage is expected to be slower than that from the much higher hydraulic head in the SSCAD, the seepage effects on the creek, if any would be expected to override any groundwater effects (Aurecon, 2014).

The water level in each groundwater bore is also monitored to allow identification of the direction of water movement in the areas from up-gradient of the ash placement areas to Lidsdale Cut. The water level data are also used to confirm that the groundwater level in the KVAD is not reaching the dry ash placement above it.

The monitoring data for the groundwater bores are shown in spreadsheet format in Attachment 2, including the minimums, maximums, means and post-dry ash median, as well as the estimated baseline (pre-placement 90^{th} percentile) and environmental goal concentrations. The data are also summarised in tables throughout the body of the report.

2.1.2 Surface Water Monitoring

The surface water monitoring sites comprise of:

- Lidsdale Cut, which discharged to Sawyers Swamp Creek at WX5 until 2012
- The local background site, WX11, in Dump Creek
- The final receiving water site, WX7, in Sawyers Swamp Creek, which is downstream of Lidsdale Cut and the local background site and upstream of the confluence of Sawyers Swamp Creek with the Upper Coxs River (Figure 4).

The Lidsdale Cut site samples local coal mine groundwater seepage, surface runoff and the KVAD toe drains, which previously entered Sawyers Swamp Creek at WX5, but is collected and then pumped to the SSCAD since July 2012. The Sawyers Swamp Creek receiving water site (WX7) is where the local/ANZECC (2000) freshwater guideline trigger values apply for assessment of seepage effects from KVAD, KVAR, Lidsdale Cut and SSCAD.

2.1.3 Sampling in Upper Sawyers Swamp Creek

As previously recommended by Aurecon (2012), monitoring at selected sites in Sawyers Swamp Creek has continued to be performed by EnergyAustralia NSW and the ash dam contractor (Lend Lease). EnergyAustralia NSW sample at numbered sites, e.g. 93, which have been sampled since June 2012 and include conductivity, alkalinity and trace metals analyses. The sites labelled with “@” are monitored by Lend Lease but only for limited water quality data, such as pH, conductivity and sulphate.

The following sites are sampled in Sawyers Swamp Creek and have been used in this report:

- Site 92, in Sawyers Swamp Creek, upstream of the SSCAD
- Site 225, SSC upstream at 0 m, located immediately downstream of the Sawyers Swamp Creek Ash Dam Spillway, where the Sawyers Swamp Creek bypass water re-enters the creek. Since August 2012, it has also contained the Springvale Mine water discharge.
- SSC@600m, upstream of the SSCAD v-notch, sampled by Lend Lease
- Site 79, the main SSCAD seepage point v-notch
- Site 93, downstream of SSCAD v-notch
- SSC@800m, downstream of the V-notch and upstream of the KVAR north wall seepage pit, sampled by Lend Lease
- Site 83, SSC at 1250 m, Downstream of the ash placement footprint, sampled by Lend Lease

To put the sampling sites into context of the location of the SSCAD v-notch, it should be noted that site 225, SSCAD spillway, is approximately 765 m upstream from the v-notch, while the SSC@ 600m site is 165 m upstream, and the two downstream sites at Site 93 and at Site SSC@800m are located 165 m and 300 m downstream, respectively, refer to Figure 1. The water quality of the downstream sites has been combined to assess the effects, if any, of the SSCAD seepage on the creek. Since conductivity has been the only characteristics to be consistently monitored, it has been used to indicate changes in water quality due to the pump-back system. A change in conductivity has also been used as a tracer for the effects of the mine water discharge.

EnergyAustralia NSW has performed sampling at site 92 since early 2012. This site is located within Sawyers Swamp Creek, upstream of the SSCAD and is used as the creek background water quality site. The data for this site during the current reporting period has been added to Attachment 2 in Part 3.

The following notes and assumptions have been applied to the monitoring sites:

- The v-notch upstream sites, SSCAD spillway (Site 225) and SSC@600m are approximately 765 m and 165 m upstream respectively. It is evident that the water quality between these sites rarely differed and as a result, the water quality of these sites has been combined to provide a representative analysis of the water quality upstream of the SSCAD seepage v-notch.
- Monitoring at the SSCAD v-notch (site 79) commenced in February 2010 to define the concentrations of water of water quality and trace metals seeping from the SSCAD to Sawyers Swamp Creek. It is assumed that concentrations within the v-notch are representative of the concentrations in all the seepage from under the dam wall into creek, as shown in Section 4, Figure 4. It is also likely that the seepage under the dam wall is at a slower rate than that in the v-notch.
- The two sites downstream of the v-notch, Site 93 and SSC@800m, are approximately 165 m and 300 m, respectively, downstream of the SSCAD v-notch
- KVAD/R downstream site, Site 83, is downstream of the northern section of the original KVAD dam wall.

These data, together with the routine, long-term Sawyers Swamp Creek data collected by EnergyAustralia NSW at the receiving water site, WX7, have been used to identify any further improvements in water quality as a result of the many changes mentioned above.

2.1.4 Other data considerations

In addition to the many changes in seepage collections and diversions, which now all report to the Lidsdale cut containment, the Springvale Mine water discharge confounds the assessment of effects of the KVAR. Accordingly, assessment of the sites 158, @ 0m, @600 m, @800 m and @ 1250 m along the SSC from the spillway site 225 identify potential impacts from the adjacent ash placement site. Quality data which characterises KVAD ground water flow and seepage collection is assessed together with the various sampling sites in the upper Sawyers Swamp Creek and at the downstream WX7 receiving water site. Effects of the KVAR Stage 2 placement on surface water and trace metal changes assessed against the environment goals, and ANZECC guidelines, are discussed in Section 3 and Section 5.

2.2 Climatic Conditions

The average annual rainfall at the Lithgow gauge over the period of KVAR ash placement from 2003 to March 2014 decreased from that during the previous reporting period (i.e. 797 mm/year) to 786 mm/year (Attachment 1), which is 91% of the long-term average annual rainfall of 863 mm/year for the region. During the period of April 2013 to March 2014, the monthly average rainfall of 53 mm/month was below the long-term average of 72 mm/month due to below average rainfall in April/May 2013, July-October 2013 and December 2013 to January 2014. This lower than average rainfall for the region is consistent with the records from the onsite weather station at the KVAR being 631 mm for the April to March reporting period.

Since the Stage 2 placement began in April 2010, there has been a series of wet summers due to above average rainfall events. These occurred in summer 2010/11 (November 2010 to January 2011, with a total of 401 mm), 2011/12 (February to March 2012, with a total of 342 mm) and 2012/13 (January to February 2013, with a total of 297 mm) (Aurecon, 2014). A similar high rainfall for the summer (February to March 2014) of the reporting period was a two monthly total of 218 mm; these high rainfalls being the result of single rainfall events on one day of each month of 35 and 45 mm respectively.

2.3 Methods & Guidelines

Routine surface and groundwater quality monitoring is performed on behalf of EnergyAustralia NSW by Nalco Analytical Resources who measure conductivity, pH and temperature in the field with a calibrated instrument. Groundwater bores are pumped and sampled after allowing time for the water level within the bore to reestablish. The depth to the water level from the top of the bore pipe is measured using a dip meter and the water surface elevation is calculated to AHD (m) after allowing for the pipe height.

In-house methods based upon Standard methods (APHA, 1998), which are equivalent to those specified in DEC (2004), are applied for the general water quality determination of alkalinity, sulphate, chloride, calcium, magnesium, potassium, sodium, total dissolved solids (TDS) and total suspended solids (TSS, also referred to as non-filterable residue, NFR). The trace metals and elements monitored are the same for both surface and groundwater: copper, cadmium, chromium, lead, zinc, iron, mercury, manganese, selenium, silver, arsenic, barium, boron and fluoride. Beryllium, molybdenum and nickel have been monitored since July 2007 but beryllium monitoring was ceased in April 2010 and aluminium has been monitored since July 2010. Speciated arsenic has been added to the monitoring program as required.

The principle of the ANZECC (1995) guidelines for protection of groundwater, where the potential future use of the water resource is considered, has been taken into account as part of this assessment. In this regard, the Irrigation, Ecosystem and additional guidelines for protection of livestock or drinking water has been used, where appropriate, to provide a wider context of the ANZECC (2000) guidelines, to define acceptable ambient water quality at the KVAD/R Stage 2 receiving water sites.

The ANZECC Guidelines for Groundwater Protection in Australia and the NEPC (1999, update in May 2013) require the background water quality in groundwater bores to be taken into consideration. For the purpose of this report, the background concentrations for groundwater have been defined as the 90th percentile of the pre-placement concentrations, or the ANZECC guideline default trigger values, whichever is higher. Additionally, local guidelines are based on the ANZECC (2000) guideline approach of estimating local guidelines by using the 90th percentile for naturally mineralised, highly disturbed groundwater. Therefore the background 90th percentiles that are higher than the default trigger values are used as the local guidelines. The local and ANZECC guidelines trigger values used are referred to as Environmental Goals and are shown in Table 1.

Table 1: Pre-dry Ash Placement Water Quality Baseline 90th Percentile at Background and Receiving Water Sites and resulting Guidelines or Goals for KVAD/R Groundwater, Lidsdale Cut and Sawyers Swamp Creek

	Groundwater				Surface Water		
Element (mg/L)	**Background Groundwater (WGM1/D2)**	**KVAD & KVAR Groundwater (WGM1/D5)**	**Lidsdale Cut (WX5)**	**Groundwater Guidelines# or Goals**	**Dump Creek (WX11)**	**Sawyers Swamp Creek (WX7)**	**Surface Water Guidelines# or Goals**
	Pre-placement (1988-2003) 90th Percentile	**Pre-placement (1988-2003) 90th Percentile**	**Pre-placement (1992-2003) 90th Percentile**		**Pre-placement (1991-2003) 90th Percentile**	**Pre-placement (1991-2003) 90th Percentile**	
pH	5.4	4.5	6.9	6.5 – 8.0	8.0	7.6	6.5 – 8.0
Cond (µS/cm)	310	810	952	2560^	770	760	2200
TDS	258	550	650	2000++	772	584	1500^
SO_4	61	328	359	1000	325	323	1000++
Cl	48	24	34	350	39	27	350+
As	<0.001	0.008	<0.001	0.024	<0.001	<0.001	0.024
Ag	<0.001*	<0.001*	<0.001*	0.00005	<0.001	<0.001*	0.00005
Ba	0.114	0.148	0.054	0.7	0.050	0.043	0.7+++
Be	-	0.006	-	0.1	-	-	0.1
B	0.10	1.7	2.16	**1.7**	1.45	2.33	**1.25**
Cd	0.001	0.004	<0.001	0.001	<0.001	<0.001	0.0015
Cr	0.041	0.041	<0.006	0.004	<0.001	<0.001	0.005
Cu	0.010	0.058	<0.005	0.005	0.002	<0.007	0.005
F	0.28	0.65	1.99	1.5	1.1	1.1	1.5+++
Fe	1.7	14.7	0.7	**1.7**	2.38	0.507	0.3+++
Hg	<0.0007*	<0.0006	<0.0002*	0.00006	<0.0002*	<0.0002*	0.00006
Mn	0.44	2.5	2.12	1.9	1.94	0.829	1.9
Mo	-	-	-	0.01	-	-	0.01+
Ni	0.031	0.137	-	**0.137**	-	-	0.05
Pb	0.010	0.021	0.004	**0.01**	<0.001	0.003	0.005
Se	<0.001	0.001	0.001	0.005	0.003	0.003	0.005
Zn	0.114	0.505	0.304	**0.505**	0.28	0.153	**0.153**

Notes:

* Detection limit used was higher than ANZECC guidelines

^ Groundwater conductivity derived from TDS 90th percentile of 2000 mg/L TDS/0.77; Creek TDS derived from 0.68 x 2200 µS/cm, which is the ANZECC (2000) low land river conductivity for protection of aquatic life

\# ANZECC (2000) guidelines for protection of freshwaters, livestock or irrigation water.

Cadmium, Chromium, Copper, Lead, Nickel and Zinc adjusted for effects of hardness: Ca, Mg in WGM1/D5 22.3, 29.0 mg/L; in Sawyers Swamp Creek 51.6, 38.0 mg/L, respectively

Note: Chromium guideline is 1 ug/L for Cr(VI) and adjusted for hardness effect

Local guidelines using 90th percentile of pre-dry placement data in **bold** (Note: Fe guideline of 0.3 mg/L only marginally lower than WX7 90th percentile, so used ANZECC (2000) guideline)

\+ Irrigation water moderately tolerant crops; irrigation. Note. Molybdenum drinking guideline is 0.05 mg/L

++ Livestock

+++ Drinking water

Figure 1: Surface and Groundwater Monitoring Sites for Sawyers Swamp Creek Ash Dam and Kerosene Vale Ash Dam and Repository

3. Effects of Seepage Collection Diversion and Return Systems on Sawyers Swamp Creek Water Quality and Trace Metals

This section documents the assessment of the likely effects of the Kerosene Vale Ash Repository (KVAR) seepage, the KVAD/R subsurface drains and Sawyers Swamp Creek Ash Dam (SSCAD) seepage collections and return systems on receiving water quality and trace metals in Sawyers Swamp Creek. Since the subsurface drains and KVAD toe drains send the collected seepage to Lidsdale Cut, the effects of potential seepage from Lidsdale Cut, following cessation of v-notch discharge into the creek in April-June 2012, are also assessed.

Due to the effects of Springvale Mine Water discharge on the water quality of Sawyers Swamp Creek, its qualities are discussed first.

3.1 Springvale Mine Water Quality

As previously noted, the Springvale Mine water pipeline has been licenced to discharge to Sawyers Swamp Creek since August 2012, so the effects of mine water discharge has been analysed first. The mine discharges at a rate of 20 ML/day, which is significantly higher than the 68 kL/day currently estimated as the inflow rate of seepage to Lidsdale cut and or other potential seepage discharges.

A copy of the typical Springvale Mine water quality is shown in Table 2, with more accurate trace metal data shown in Table 3.

The mine water is characterised by relatively low dissolved salts, including sulphate and chloride, but has a relatively high conductivity of approximately 1071 µS/cm due to a high (500 mg/L) bicarbonate alkalinity, potentially as a result from the limestone dust applied to the floor and walls of the mine as an explosion inhibitor. The mine water discharge also exhibits relatively low concentrations of trace metals, including Selenium (Se). As the alkalinity of the mine water is higher and the conductivity is lower than within the various ash placement seepage waters, they have been used as a tracer for the mine water discharge to Sawyers Swamp Creek.

Table 2: Typical Springvale Coal Mine Water Quality

Parameter	Mine Water			
(mg/L)	Range			Average
pH	7.1	to	8.6	8.2
COND (uS/cm)	964	to	4077	1071
TSS	1	to	23	5
TDS	368	to	780	648
Turbidity (NTU)	0	to	110	9
Ca	5	to	21	12
Mg	1.9	to	3.0	2.3
K	12	to	200	106
Na	200	to	250	225
ALK	479	to	592	533
SO4	14	to	66	28
Cl	0	to	12	9
NH3	0.1	to	0.8	0.3
NO2+NO3	0.0	to	3.5	2.1
As	0.004	to	7.6	0.184
Ba	0.02	to	0.03	0.03
B	0.02	to	0.14	0.06
Cd	0.01	to	0.07	0.04
Cr (VI)	0.01	to	0.01	0.01
Cu	0.001	to	0.005	0.004
F	0.9	to	1.5	1.2
Pb	0.001	to	0.005	0.003
Hg	0.000	to	0.000	0.000
Se	0.0002	to	0.003	0.0011
Ag	0.001	to	0.001	0.001
Zn	0.005	to	0.06	0.026
Fe	0.02	to	0.38	0.14
Mn	0.004	to	0.03	0.008

N.B.: data is from results for samples taken since October 2009 – March 2014. Samples of Springvale Mine Water were taken prior to the station or as inflow to Sawyers Swamp Creek (at EANSW Site 158)
Results less than detection limit reported as zero

3.2 Sawyers Swamp Creek Ash Dam Pump-back system Water Quality

The water quality in Sawyers Swamp Creek Ash Dam (SSCAD) and in the main seepage point from the ash dam into Sawyers Swamp Creek, i.e. the v-notch, is compared with the water quality within the creek, both upstream and downstream of the v-notch. Changes to the water quality of Sawyers Swamp Creek are assessed in relation to the ash dam seepage collection and pump-back system, which commenced in March 2010. Water quality changes within the creek are also examined to provide an indication of the effects of the Springvale Mine water discharge since August 2012. These are compared to data relevant to pre-placement of the dry ash repository on KVAD, and post Stage 2A ash placement programs.

Table 3: Summary of Average Water Quality in SSCAD for Pre-placement and Post-stage 2 periods and the v-notch seepage compared to Sawyers Swamp Creek Up- and Downstream of the V-notch, Mine Water Discharge, Dump Creek Background and Surface Water Guidelines

Element (mg/L)	Pre-Placement (1996-2003)	Stage 2A Post-Placement (Apr 2010-Jan 2012)	Ongoing Stage 2 Post-Placement Apr 2013-Mar 2014	V-notch Seepage Apr 2013-Mar 2014	SSC Upstream V-notch Seepage Apr 2013-Mar 2014	SSC Downstream V-notch Seepage Apr 2013-Mar 2014	Mine Discharge Water Quality Data Apr 2013 – Mar 2014	Background Upper Sawyers Swamp Creek Apr 2013-Mar 2014	ANZECC (2000) Guidelines# & Goals for SSC
	SSCAD	SSCAD	SSCAD	From SSCAD (Site 79)	SSC (Site 225)	SSC (Site 93)	Springvale Mine Water (Site 158)	WX1 (Site 92)	
pH	5.4	4.8	6.2	7.8	8.5	8.6	7.9	6.5	6.5-8.0
Cond (µS/cm)	1219	1912	1500	1425	1067	1075	1138	144	2200
TDS	858	1418	1078	993	673	676	-	92	1500
SO4	553	910	722	466	31	43	34	24	1000
Cl	18	30	20	25	5	6	9	10	350
Alk	18	19	33	284	553	545	568	20	-
As	0.016	0.0013	0.0023	0.0086	0.022	0.0211	0.021	0.0008	0.024
B	4.7	2.01	1.9	1.3	0.1	0.1	0.07	0.03	**1.25**
Cd	0.012	0.0021	0.0039	0.0001	0.0001	0.0001	-	0.0001	0.0015
Cr	0.005	0.0014	0.001	0.002	0.002	0.002	0.001	0.002	0.005
Cu	0.007	0.0115	0.006	0.002	0.001	0.001	0.001	0.005	0.005
F	9.3	2.15	1.8	1.2	1.1	1.2	-	0.1	1.5
Fe	0.17	0.21	0.05	0.04	0.04	0.07	0.15	0.77	0.3
Mn	1.2	1.34	1.2	0.035	0.009	0.008	0.009	0.08	1.9
Mo	0.15	0.033	0.01	0.018	0.038	0.037	-	0.001	0.01
Ni	0.13	0.041	0.07	0.01	<0.01	<0.01	0.005	0.003	0.05
Pb	0.002	0.001	0.001	0.001	0.001	0.001	-	0.002	0.005
Se	0.151	0.006	0.005	0.001	0.001	0.001	0.0006	0.001	0.005
Zn	0.426	0.136	0.19	0.03	0.02	0.02	0.024	0.03	**0.153**

From the analysis, Table 3 shows the following:

- Conductivity in the creek upstream and downstream of the v-notch is markedly lower than that within SSCAD or the v-notch discharge, indicative of rainfall inflows.
- Alkalinity in the creek (both up- and downstream of the v-notch) is consistently above 500 mg/L, being consistent with that of the Springvale mine water.
- Molybdenum for all waters in this vicinity is above the ANZECC guideline, with exception of the background site, and the arsenic is similar to that in the Springvale mine water.
- Copper in water of the SSCAD is elevated at or above the ANZECC guideline, but in the creek the value is similar to that of Springvale mine water.

It is noted that the average concentration of some of these trace metals has increased since previous testing was performed at the downstream site (SSC at 850 m, EANSW Site 93) – refer to Attachment 2.8. Previous testing resulted in arsenic averaging 0.009 mg/L (now 0.021 mg/L) and molybdenum was 0.02 mg/L (now 0.04 mg/L). As a result, the average molybdenum level is higher than its respective local guideline and higher than in the background site in Sawyers Swamp Creek, upstream of the SSCAD. Similarly, the level of arsenic is approaching its respective local guideline and is higher than in the background site. Copper levels, on the other hand, have decreased from 0.007 mg/L to 0.001 mg/L since previous testing which may be the result of Springvale Mine water being discharged into the creek.

The sampling site at the SSCAD spillway (EANSW Site 225, Figure 1), where the SSCAD freshwater inflow diversion and Springvale mine water discharge enter Sawyers Swamp Creek (SSC) has been sampled for water quality and trace metals since November 2012. Additionally, the water quality and trace metals at the SSC upstream of the ash dam (EANSW Site 92) have been sampled since June 2012. A summary of these results are included in Attachment 2.8. These data show that the combined discharge has elevated arsenic and molybdenum but not copper, while the upstream SSC has low concentrations of these trace metals, again indicating the influence of the Springvale Mine inflows.

It is noted that the second licence discharge point of the Springvale mine water into Sawyers Swamp Creek is located at site 158. Potentially this discharge now dominates the water quality conditions within the Sawyers Swamp Creek catchment, downstream of EANSW sampling site 92. These inflows have eliminated the previous conductivity improvements observed prior to discharge commencing in August 2012, which were thought to be the result of the v-notch pump-back system. The sampling site for Springvale Mine Water (EANSW Site 158, Figure 1) sampled for water quality and some trace metals since January 2010 (refer to Attachment 2.9) shows that Springvale Mine Water discharge has similar water chemistry to that observed at SSCAD spillway and downstream of SSCAD v-notch. Therefore, the Springvale Mine Water discharge is most likely the source of the increase in trace metals within Sawyers Swamp Creek. However, not all trace metals are analysed at the Springvale mine water sampling site.

In order to assist in the clarification of potential changes within Sawyers Swamp Creek due to the mine water discharge both upstream and downstream of the v-notch, changes in conductivity over the period of February 2010 to March 2014 are shown in **Error! Reference source not found.**. Data following August 2012 represents commencement of Springvale Mine Water discharge inflow to the creek.

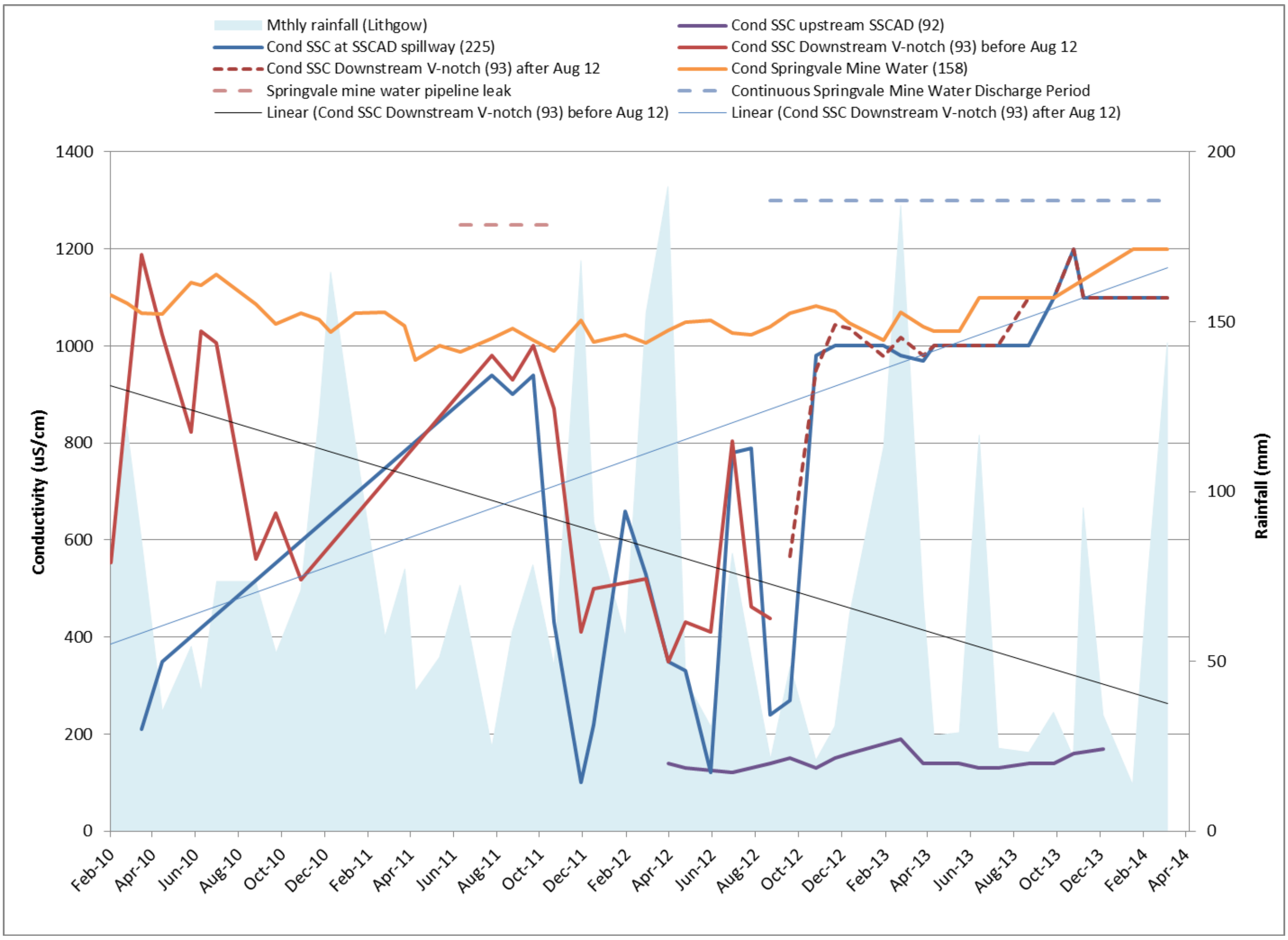

Figure 2: Sawyers Swamp Creek Conductivity Variations from February 2010 to March 2014 at sites upstream and downstream of the v-notch (downstream site is upstream of KVAD seepage). N.B.: Missing data in 2010/11 shown as a straight line between existing data points.

Error! Reference source not found. shows the following changes:

- From 2010 to August 2012, there was an initial long-term trend for decrease in conductivity at the Sawyers Swamp Creek (SSC) downstream site 93 (as defined by the dark-grey line), which is considered to be due to improvements resulting from the SSCAD v-notch pump-back system
- Conductivity at the SSCAD spillway site (225) increased to October 2011 due to a leak in the Springvale Coal Mine pipeline. The conductivity subsequently decreased following the pipeline repair until September 2012.
- After September 2012, the conductivity at the SSCAD spillway located upstream of the v-notch (225), as well as at the site downstream of the v-notch (93) all sharply increased to the same levels of approximately 1000 µS/cm, which closely matches that of the Springvale mine water.
- Conductivity at SSC upstream of SSCAD (EANSW site 92) has remained as fresh water, lower than that observed at the SSCAD spillway, with site 92 being upstream of the Springvale Mine water inflow points

3.3 KVAD/R Seepage and Subsurface Seepage Collection and Diversion Effects

Changes in conductivity within Sawyers Swamp Creek have been assessed in relation to the KVAD/R subsurface drains, used for seepage collection and diversion to Lidsdale Cut since October 2010. As performed in the previous section, water quality changes in the creek in relation to the effects of the Springvale Mine water discharge since August 2012 are also analysed.

EnergyAustralia

Previously the main Kerosene Vale Ash Dam, or Repository (KVAD/R) seepage point into Sawyers Swamp Creek was from Lidsdale Cut, in the form of v-notch discharge at WX5. However, cessation of discharges from Lidsdale Cut to the creek was adopted in April 2012. The water quality within the seepage at Lidsdale Cut, as well as in Sawyers Swamp creek, both upstream and downstream of the seepage collection point and at receiving water site, WX7, is shown in Table 4.

An assessment of the effects of the KVAD/R seepage and local groundwater on the water quality in Lidsdale Cut itself and its ongoing changes, since October 2013 is provided in Section 4.5.

Table 4: Summary of Average Water Quality in Sawyers Swamp Creek at the Receiving Water Site, WX7, compared to KVAD/R North Wall Seepage, Up- and Downstream of the Seepage, Springvale Mine Water discharge, and Surface Water Guidelines*

Element (mg/L)	Sawyers Swamp Creek (WX7)			North Wall KVAD/R Seepage Collection (94)	Upper Sawyers Swamp Creek		Springvale Mine Water	Lidsdale Cut (40)	Dump Creek (WX11)	ANZECC (2000) Guidelines & Goals for SSC
	Pre-Placement (1991-2003) 90th percentile	Stage 2A Post-Placement (Apr 2010-Jan 2012) (Aurecon, 2012)	Ongoing Stage 2 Post-Placement (Apr 2013-Mar 2014)	Ongoing Stage 2 Post-Placement (Apr 2013-Mar 2014)	SSC Upstream KVAD/R Seepage & below V-notch (93) (Apr 2013 - Mar 2014)	SSC Downstream KVAD/R Seepage near D5 (83) (Apr 2013-Mar 2014)	Water Quality Data (Apr 2013 – Mar 2014)	Ongoing Stage 2 Post-Placement (Oct 2013 - Mar 2014)	Background WX11 (Apr 2013 – Mar 2014)	
pH	7.6	7.2	8.7	2.9	8.6	8.6	7.9	3.4	3.2	6.5-8.0
Cond (µS/cm)	760	1006	1117	2833	1075	1075	1138	3917	1667	2200
TDS	584	698	678	2158	676	670	-	4083	1152	1500
SO4	323	356	36	1632	43	34	34	2900	807	1000
Cl	27	18	5	19	6	5	9	29	25	350
Alk	33	162	553	13	545	553	568	13	12.5	-
As	0.001	0.008	0.019	0.0015	0.021	0.02	0.021	0.02	0.0005	0.024
B	2.33	1.59	0.10	4.3	0.1	0.1	0.07	13.3	2.7	**1.25**
Cd	0.001	0.002	0.0001	0.0001	0.0001	0.0001	-	0.0467	0.0008	0.0015
Cr	0.001	0.002	0.001	0.002	0.002	0.002	0.001	0.02	0.002	0.005
Cu	0.007	0.006	0.003	0.004	0.001	0.001	0.001	0.031	0.008	0.005
F	1.1	1.6	1.03	0.4	1.2	1.2	-	28.7	2	1.5
Fe	0.507	0.05	0.06	47.5	0.07	0.06	0.15	4.1	9.3	0.3
Mn	0.829	2.34	0.01	13.42	0.008	0.008	0.009	13	6.7	1.9
Mo	-	32.4	0.037	0.002	0.037	0.036	-	<0.01	0.01	0.01
Ni	-	0.19	0.006	0.18	<0.01	0.01	0.005	1.08	0.52	0.05
Pb	0.003	0.007	0.001	0.001	0.001	0.001	-	0.015	0.006	0.005
Se	0.003	0.002	0.001	0.001	0.001	0.001	0.0006	0.058	0.001	0.005
Zn	0.153	0.54	0.009	0.16	0.02	0.02	0.024	2.84	1.4	**0.153**

N.B.: averages used to allow for effects of mine water discharge

** Mine discharge data taken from EANSW Site 158 (see Attachment 2)

Table 4 documents the following characteristics:

- The KVAD/R seepage sulphate level of 1632 mg/L was the second highest source of sulphate, after Lidsdale Cut (Table 3). However, no notable increase in sulphate was observed from upstream to downstream of the seepage collection point due to the diversion system. Additionally, the average sulphate in Table 4 includes the period following August 2013 when the mine water ceased to be used directly by Wallerawang Power Station and was diverted to Sawyers Swamp Creek. With this data not included, a decrease in sulphate was recorded from April 2013 to August 2013, from 39 mg/L upstream to 28 mg/L downstream of the KVAD/R seepage collection point.
- Typical water quality for the KVAD/R seepage, as sampled at point 94 and diverted to Lidsdale Cute, is elevated conductivity, sulphate, iron, manganese and low pH.
- Alkalinity in the creek downstream of the KVAD/R seepage collection pit is essentially the same as the upstream site and similar to that of the Springvale mine water, which indicates that the KVAD/R seepage collection and diversion system is fully operational.
- Arsenic at the upstream and downstream sites within the creek, including WX7, is similar to the current concentrations in Lidsdale Cut and Springvale mine water. However, cadmium, chromium fluoride, iron, manganese and nickel are significantly lower at WX7 than in Lidsdale Cut, suggesting that the water quality at WX7 is that of Springvale Mine Water.
- The concentrations of cadmium, copper, and chromium have decreased at WX7 since January 2012.
- The pH at the upstream and downstream sites within SSC and at WX7 has increased since January 2012. As a result of these increases, they are now all higher than their respective local guidelines and higher than in the background site Dump Creek.
- It appears that Springvale mine water discharge has lowered the concentrations of sulphate and boron but increased the conductivity at WX7.

The cause of the elevated copper and chromium at WX7 were investigated as part of last year's water quality report (Aurecon, 2014), and was found to be linked to a large increase in trace metal concentrations, including copper and chromium, at WX7 in May 2012. It was suggested that the high groundwater inflow to Lidsdale Cut following the high rainfall in February/March 2012 caused the void to rise and seep into the local mine spoil. The acidic pH and high conductivity, sulphate and trace metals are characteristic of the local mine spoil groundwater. As Lidsdale Cut was discharging to Sawyers Swamp Creek at WX5 at the time, and the trace metal increase did not occur in Sawyers Swamp Creek near D5, but has occurred slightly at Dump Creek and in Lidsdale Cut, the groundwater seepage must have entered the creek via the Lidsdale Cut v-notch discharge. In addition, although the KVAD/R upstream site previously had elevated copper (Aurecon, 2014), Table 4 shows that the copper concentration has decreased to less than the ANZECC (2000) guidelines. It is, therefore, unlikely that the increase is the result of KVAD/R Stage 1 and Stage 2 ash placements.

However, to clarify the effects of the mine water, if any, on the cadmium, fluoride, molybdenum and lead concentrations within the creek, it is suggested that samples of the mine water discharge taken at EANSW site 158 (Figure 1) be analysed for these metals.

To further assess the effects of the KVAD/R seepage collection and diversion systems, as well as the Springvale mine water discharge, on the water quality in Sawyers Swamp Creek the trends over time are shown in **Error! Reference source not found.**.

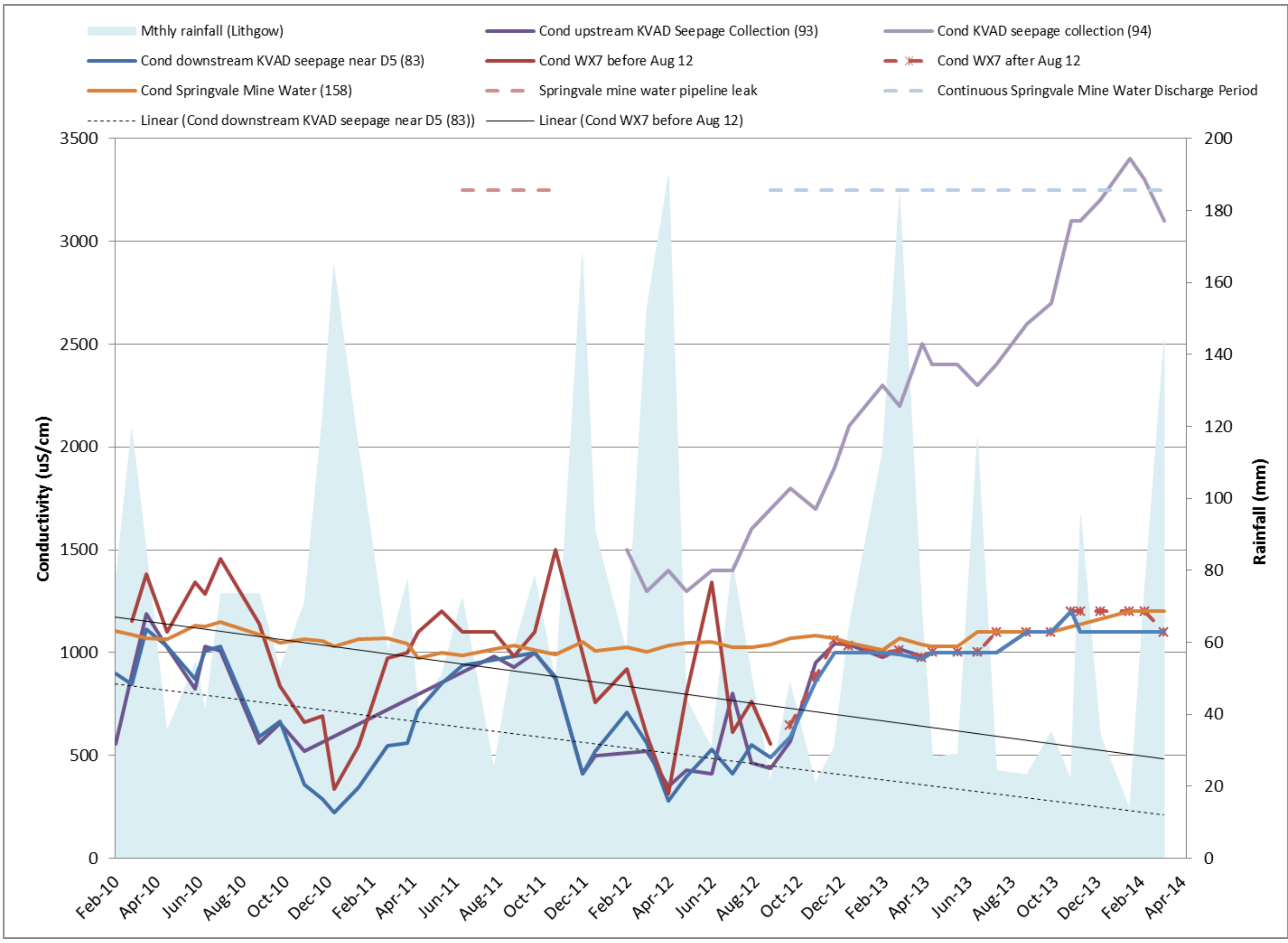

Figure 3 Sawyers Swamp Creek Conductivity Variations from February 2010 to March 2014 at sites upstream and downstream of KVAD/R North Wall seepage collection as well as at Receiving Water Site WX7 (downstream of site near groundwater bore D5) in comparison to conductivity within KVAD/R North Wall seepage collection.

Error! Reference source not found. documents the following changes:

- Prior to the mine water discharge in August 2012, there was a trend for decrease in conductivity in Sawyers Swamp Creek at both the KVAD/R downstream site and at the receiving water site WX7, which is located downstream of the Dump Creek inflow (Figure 1). This is indicative of fresh water flows into the stream from its catchment. This trend was evident even with the intermediate effect of the Springvale pipeline leak in 2011. These changes are considered to be due to improvements resulting from the KVAD/R seepage collection and diversion system to Lidsdale Cut.
- After the Springvale discharge began, in August 2012, the conductivity at both of the KVAD/R sites, as well as at WX7, increased sharply to all be at the same levels of approximately 1000 µS/cm between September and October 2012 and has since steadily increased to that of Springvale Mine water

In the same manner, the alkalinity at both the upstream and downstream site has increased from an average of approximately 120 mg/L before October 2012 to 490 mg/L after October 2012, to its current concentration of approximately 550 mg/L. The increased concentration is similar to that observed within the Springvale mine water discharge, confirming the dominant effects of the mine water discharge on the water quality of the creek. This increase was initially observed at WX7 (Aurecon, 2014) and has continued (see Table 4).

4. Stage 1 and Stage 2 Dry Ash Placement Effects on Ground and Surface water Quality

This section assesses the likely effects, if any, of dry ash placement operations at Kerosene Vale Ash Repository (KVAR) on the local groundwater quality. Effects on the local surface water and groundwater by the subsurface drains, the Sawyers Swamp Creek Ash Dam (SSCAD) seepage collection and return system and diversion of the Lidsdale Cut discharge to the SSCAD have been taken into account. Additionally, the potential effects on local groundwater of the Springvale Mine water discharge to Sawyers Swamp Creek are also considered.

The aim of the seepage collection and diversion system management measures is for the receiving water quality at the groundwater bore WGM1/D5 and in Sawyers Swamp Creek (WX7) to meet the local/ANZECC (2000) guideline values for the characteristics detailed in Table 1 following dry ash placement. This approach presumes that any exceedences of the trigger values in the receiving waters by non-ash related changes in the area, including increased background concentrations or the influence of the Springvale mine water discharge, can be taken into account.

Long-term trends in groundwater quality and trace metals are examined for changes from pre- to post-dry ash placement in the following groundwater bores:

- SSCAD seepage detection bores, WGM1/D3 and D4
- KVAD/R groundwater seepage detection bores WGM1/D5 and D6.

Groundwater quality changes at all the bores are compared to changes in the background bores, D1 and D2, and Lidsdale Cut. The overall effects on the final receiving water site in Sawyers Swamp Creek at WX7 are also included.

The seepage collection and pump-back system installed to minimise effects of the ash dam on Sawyers Swamp Creek and the local groundwater quality as the SSCAD v-notch seepage, has operated since May 2010. Consequently, residual effects of seepage from the ash dam under the dam wall on groundwater bores D3 and D4 are still taken into consideration as they are up-gradient of the Stage 2 ash placement and may affect the groundwater flowing into the placement area.

4.1 Groundwater Flow Directions

The groundwater flow directions are used to help explain why groundwater quality changes occur in the groundwater under and around the KVAD/R, as well as potential effects of seepage into Sawyers Swamp Creek. The flow directions have been examined in previous reports (i.e. Aurecon 2014) as it was shown that the conductivity in Lidsdale Cut was reduced to be similar to that at bore D5 when the sub-surface drains under the Stage 2 Area were first connected to the Kerosene Vale Ash Dam (KVAD) toe drains. Additionally, bore D5 samples the groundwater seepage on its way to Sawyers Swamp Creek, which is nearby (Figure 1).

Error! Reference source not found. displays the groundwater level contours, as inferred from water levels measured during sampling, and overall, indicative flow paths in the Kerosene Vale ash placement areas. The level contours have changed since the previous report (Aurecon, 2014) likely as a result of the ongoing drawdown of the water table under the KVAR by the toe drains and sub-surface drains as previously suggested by Aurecon (2012). The indicative KVAD/R seepage flow paths to the KVAD toe drains and toward the low point of Lidsdale Cut are shown. Seepage from the KVAD, under the KVAR that is intercepted by the toe drains, is also shown. Any seepage that is not collected by the sub-surface drains or toe drains is shown as flowing to the local groundwater in **Error! Reference source not found.**. Additionally, the SSCAD dam wall seepage to Sawyers Swamp Creek that is not collected by the v-notch pump-back system is also shown to flow to the local groundwater.

EnergyAustralia

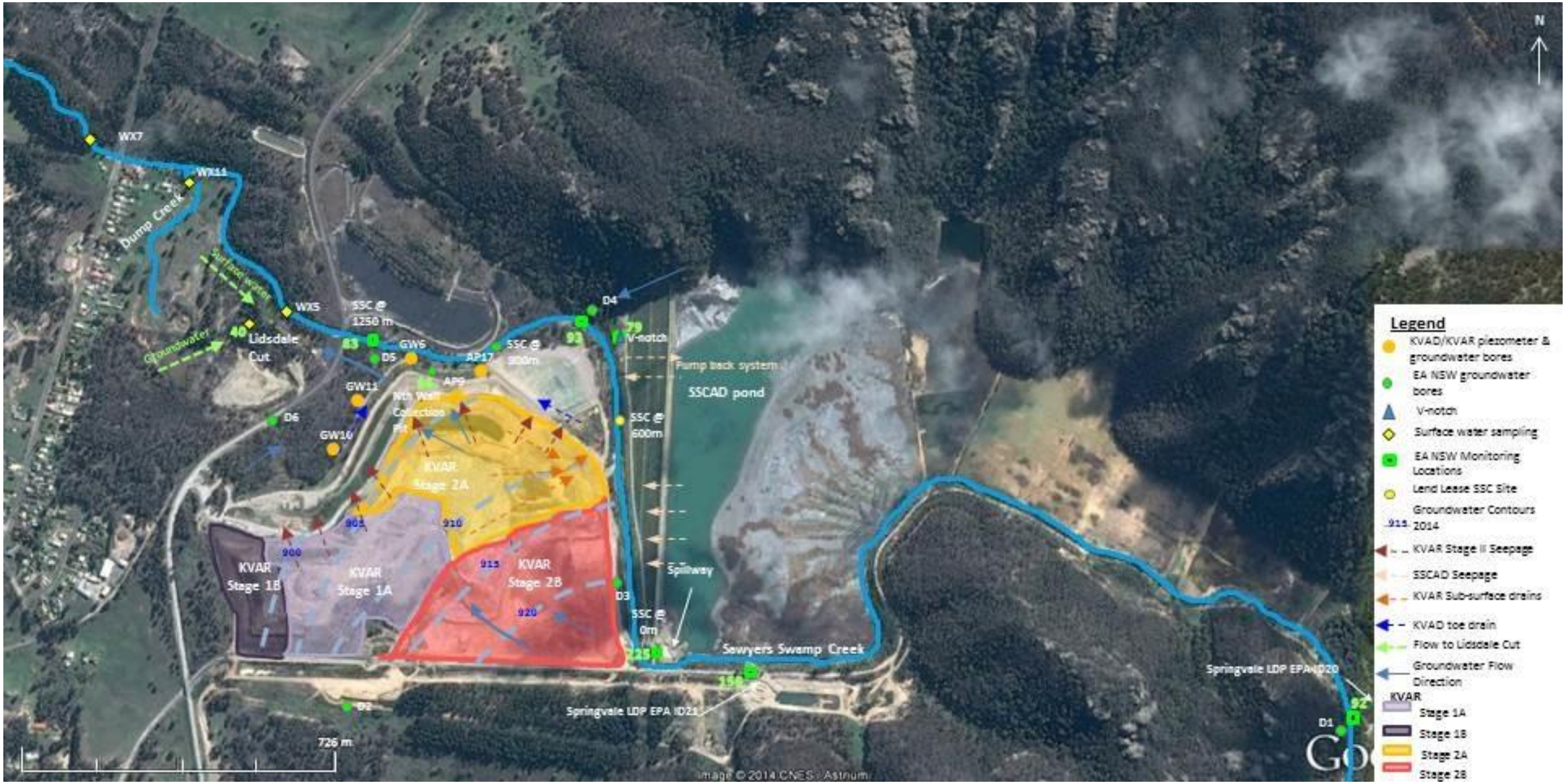

Figure 4 Kerosene Vale Ash Dam and Stages 1 and 2 Dry Ash Repository Groundwater Level (RL m) with inferred Flow Directions (based on measurements taken during groundwater monitoring)

The groundwater levels and inferred contours show that the unblocked toe drains have drawn the ash placement groundwater level to far below the assumed KVAD clay capping level of RL 918m along the western and northern wall (Figure 4). These changes in the groundwater level contours indicate that the sub-surface drains installed under the south-eastern section of the Stage 2A area are having a drawdown effect on the groundwater. From these observations, it appears that the sub-surface drains are taking groundwater from the ash south-eastern section of ash placement and directing it into the KVAD toe drains and being collected at Lidsdale Cut.

Since the unblocking of the toe drains and installation of the sub-surface drains, the groundwater flow directions, the likely sources of groundwater and effects on the water quality in bores D5 and D6, as well as in Lidsdale Cut have become more apparent, based on the following observations:

- Groundwater in the KVAD, under ash placement Stages 1 and 2, is flowing towards Sawyers Swamp Creek via the bore D5 and then to Lidsdale Cut, not directly to the creek, although before June 2012, indirectly via WX5 licenced discharge flow.
- Although seepage from the SSCAD (the main flow now collected at the v-notch seepage and pumped back into the dam) most likely affects the groundwater at D4 on the right abutment of the ash dam wall, a groundwater level of RL 906 m means it is unlikely to significantly affect the KVAD/R groundwater. The flow paths shown in Figure 4 indicate that the groundwater at bore D4 flows mainly to Sawyers Swamp Creek through and recharging to bore D5.
- Background groundwater for the KVAD/R is measured at bores D2 and D3, which are both up-gradient of the KVAD. The D2 and D3 up-gradient sources flow into the KVAD, under the KVAR. Bore D1 is up-gradient of the SSCAD and its flow appears to dilute the groundwater within bore D3, which samples seepage into the area of D3 from SSCAD.
- Some of the up-gradient water appears to flow around the southern edge of the KVAD where it dilutes KVAD seepage flowing towards bore D6.This is recharge from the bore D2 direction and also further west from the south side coal seam gradients.

4.2 Sawyers Swamp Creek Ash Dam Water Quality

The changes in water quality in the Sawyers Swamp Creek Ash Dam, from October 2007 to the current Stage 2 dry ash placement in Kerosene Vale Ash Repository are shown in Table 3. The selenium concentration has decreased by an order of magnitude from 0.15 mg/L to 0.005 mg/L and is equal to the ANZECC (2014) guideline in the v-notch seepage water. Long-term trends in conductivity and sulphate, as well as the trace metals boron, manganese, nickel and zinc are shown in Figure 5.

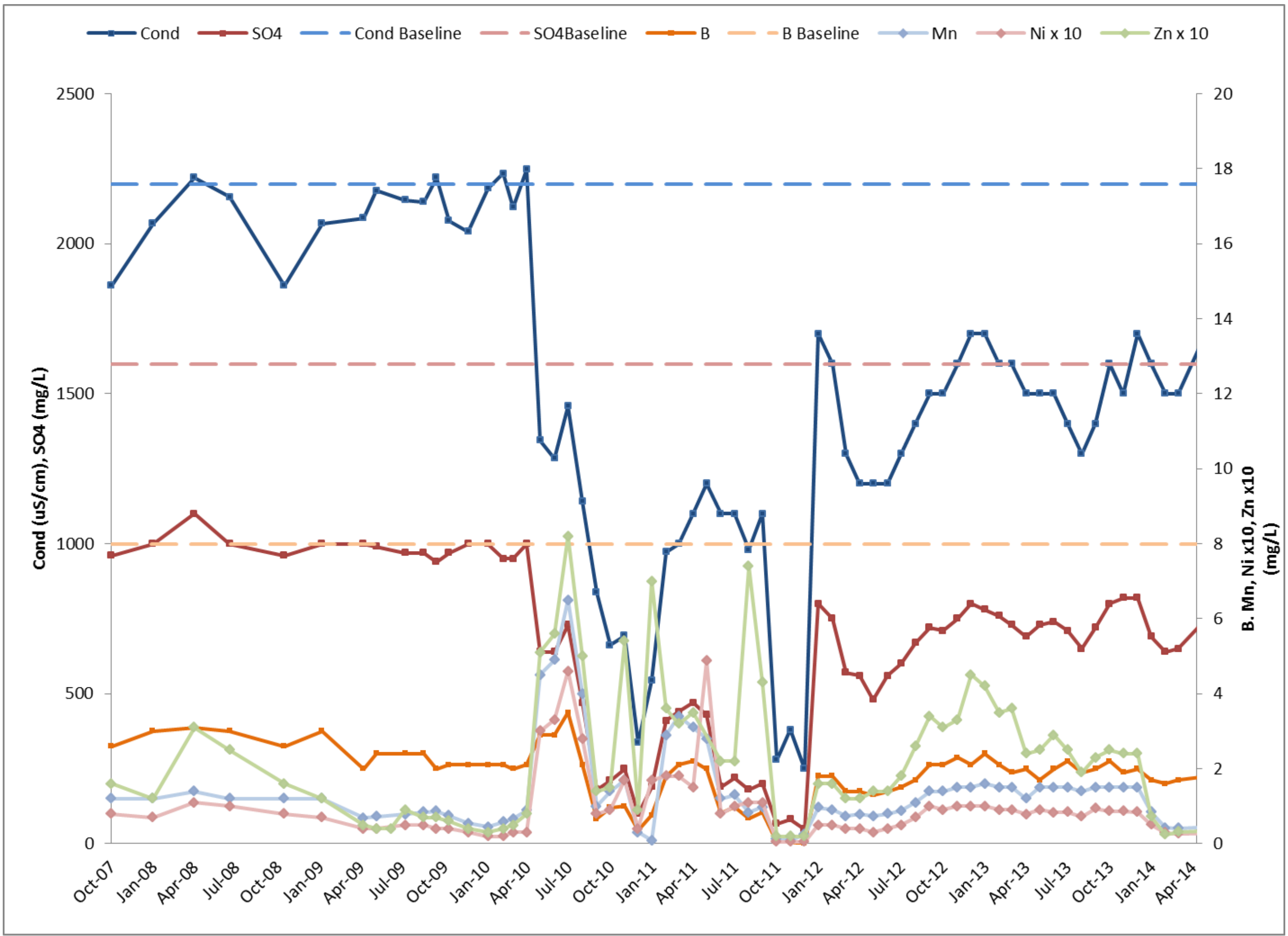

Figure 5: Sawyers Swamp Creek Ash Dam Long-term Trends in Conductivity, Sulphate, Boron and Trace Metals since October 2007

Figure 5 shows the following changes since October 2010:

- The conductivity, sulphate and boron concentrations have all decreased to below their baseline since April 2010
- Concentrations of manganese, nickel and zinc decreased until 2010 when concentrations increased following the heavy rainfall experienced in summer 2010/11 and, again, following the rainfall events during February/March 2012, January/February 2013 and June 2013. The rainfall inflows occurring to the SSCAD are those of the northern and eastern catchments to the dam.
- The conductivity returned to levels between 1000 and 1500 µS/cm after the February/March 2012 decrease, with a similar trend being observed in sulphate and boron levels.
- The trace metal increases observed after high rainfall events suggest that the large inflows of freshwater infiltrated the ash deposits, leaching the trace metals and selenium from the ash and into the water in the dam. Although the reason for the trace metal concentrations to remain elevated throughout 2012/13 are not known, their concentrations have decreased since January 2014 and their concentrations in the v-notch discharge were not elevated (refer to Table 3).

The water quality and trace metal analyses performed on water collected from the SSCAD v-notch is expected to represent the residual seepage from the base of the dam wall. The average concentrations in Table 3 show that all the elements, except boron and molybdenum, were lower than the local surface water or groundwater goals (Table 1). Therefore, a significant increase in concentrations in Sawyers Swamp Creek or groundwater bores D3 or D4 near the base of the dam wall is unlikely to be the result of the SSCAD seepage.

4.3 SSCAD Groundwater Quality

The Sawyers Swamp Creek Ash Dam (SSCAD) seepage detection bores, WGM/D3 and D4, are situated down-gradient of the SSCAD and up-gradient of the Kerosene Vale Ash Dam (KVAD) and Kerosene Vale Ash Repository (KVAR) Stage 1 and Stage 2 areas (Figure 1). Bore D3 samples groundwater affected by ash dam seepage from near the left abutment of the ash dam wall while D4 samples the right abutment. The conductivity at D3 has always been lower than at D4 (Table 5) as it is diluted by inflows of low salinity groundwater from up-gradient of the SSCAD (see flow paths in Figure 4).

Changes in the SSCAD seepage detection bores have been reviewed using data from pre-placement 90th percentile baselines (prior to May 2003 at bore D4) and the background bore D2. This data has been compared to the post-placement medians for the periods of Stage 1, including capping since April 2009 (i.e. May 2003 to March 2010), Stage 2A dry ash placement (April 2010 to January 2012) and the current Stage 2 placement (April 2013 to March 2014), as shown in Table 5.

Since bore D4 is situated near the lower section of Sawyers Swamp Creek, where it passes the dam wall and the v-notch seepage, the water quality and trace metals at this bore are expected to show any effects of residual seepage from the dam wall following the installation of the v-notch pump-back system. To assess changes in bore D4 during the current period, the medians have been compared to those during previous periods together with the 90th percentile baseline in Table 5.

Table 5: Median Water Quality for SSCAD V-notch Seepage and Seepage affected Groundwater bores during Post-Stage 1 and Post-Stage 2 compared to the Groundwater Background, Seepage Bore WGM1/D4 Baseline and Groundwater Guidelines or Goals

Element (mg/L)	SSCAD Seepage Affected Bores						V-Notch Seepage (79) April 2013 to March 2014	Background April 2013 to March 2014	D4 Baseline (Pre-Stage I 90th Percentile)	ANZECC (2000) Guidelines & Goals for Groundwater
	Stage 1 & Cap May 2003 to March 2010		Stage 2A Post-Placement April 2010 to January 2012		Stage 2 Post-Placement April 2013 to March 2014					
	D3	D4	D3	D4	D3	D4	SSCAD	D2	D4	
pH	6.2	5.9-8	5.9	5.8	6.0	5.8	7.8	3.6	6.8	6.5-8.0
Cond (µS/cm)	693	1276	746	1500	660	1500	1425	600	728	2600
TDS	430	1120	450	1200	380	1250	993	325	510	2000
SO4	110	720	115	770	104	825	466	185	201	1000
Cl	82	27	105	33	85	33	25	39	45	350
B	0.03	1.2	0.03	1.5	0.03	1.8	1.3	0.15	0.49	**1.7**
Cu	0.005	0.0008	0.002	0.001	0.003	0.001	0.002	0.006	0.010	**0.005**
F	0.05	0.05	0.05	0.1	1.2	19	1.2	1.2	0.24	1.5
Fe	0.1	46.5	0.03	43	0.1	0.1	0.04	0.1	86	**1.7**
Mn	0.63	17	0.73	18	0.6	18	0.035	0.8	6.5	**1.9**
Ni	0.13	0.04	0.13	0.05	0.1	0.03	0.01	0.08	0.023	**0.137**
Se	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.002	0.005
Zn	0.065	0.08	0.14	0.08	0.05	0.05	0.03	0.12	0.06	**0.505**

The summary data within Table 5 shows:

- Bore D3 conductivity is now lower than during the Stage 1 dry ash placement. The trace metals have shown no significant changes other than a slight decrease in manganese, zinc and nickel and an increase is observed for iron.
- The conductivity in Bore D4 has increased by approximately 225 µS/cm since Stage 1 dry ash placement and is slightly higher than that measured in the v-notch seepage
- The majority of trace metals at D4 have shown no notable changes since Stage 1 dry ash placement and are mostly higher than those measured at the v-notch. However, changes have occurred in the concentrations of boron, fluoride and iron. The boron and fluoride concentrations have increased to above their local/ANZECC (2000) guidelines, whilst the iron concentration has significantly decreased to below the local goal for iron. If the SSCAD seepage was the cause of the elevated boron and fluoride at D4 (1.2 to 1.8 mg/L and 0.05 to 19 mg/L, respectively), the effects of the seepage should have been apparent at bore D3. However, this is not the case. On the other hand, the SSCAD seepage may be the cause of the decreased iron within D4.

Long-term changes in conductivity, sulphate and boron at bore D4 are displayed in Figure 6. Comparison with the changes in the SSCAD in Figure 5 shows the effect of the SSCAD. Although the SSCAD levels began to decrease from 2005, the conductivity, sulphate and boron concentrations in bore D4 continued to increase to have similar levels as those in the SSCAD and consistently exceeded their baselines, except during rainfall events (Aurecon, 2014). The lack of a trend for decrease in conductivity, sulphate and boron at D4 since 2010, unlike that observed in SSCAD, suggests that the installation of the v-notch pump-back has not provided an improvement in groundwater quality. This is not surprising as the majority of the v-notch discharge entered the creek, and did not infiltrate into the surrounding area. The concentrations in D4 are therefore almost exclusively influenced by water from the wider area of the ash dam seeping into the local groundwater. Hence, the main improvement from the installation of the v-notch pump-back system was on the surface water quality in Sawyers Swamp Creek (see Section 4.6).

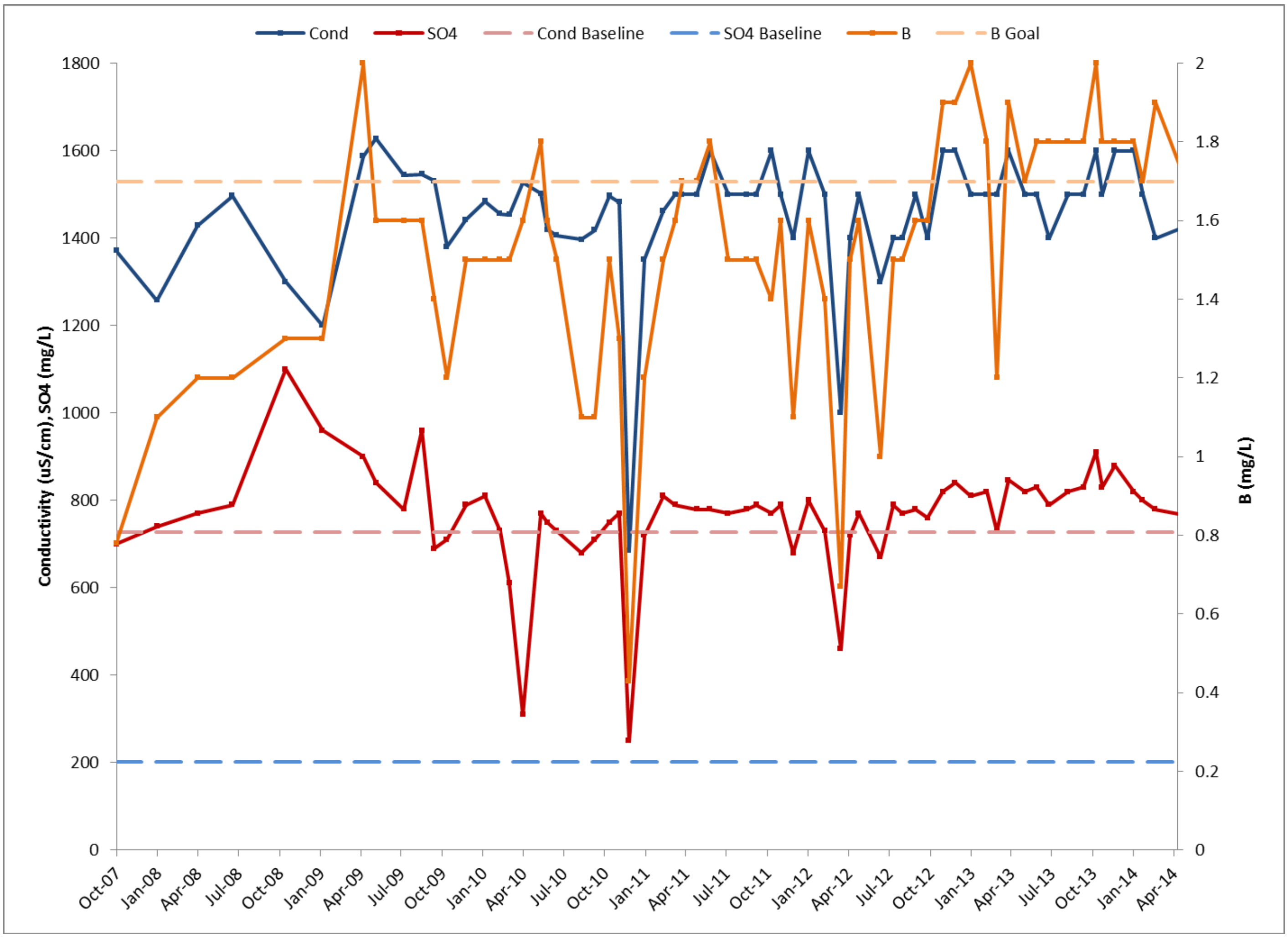

Figure 6: Sawyers Swamp Creek Ash Dam Seepage Detection Bore WGM1/D4 Long-term Trends in Conductivity, Sulphate and Boron since October 2007.

In summary, Figure 6 shows that the conductivity, sulphate and boron in the SSCAD seepage detection bore WGM1/D4 has exhibited a steady increase from October 2007 to 2009, followed by stabilisation to the current elevated levels. However, Table 3 in Section 3.2 and examination of Sawyers Swamp Creek data in Attachment 2 indicates that, prior to the Springvale mine water discharge, there was no evidence of effects of groundwater seepage from the area sampled by bore D4. This is considered to be due to the slow rate of groundwater seepage into Sawyers Swamp Creek relative to the normal catchment inflows and the consistent level of the water sampled at this bore.

4.4 KVAD and KVAR Groundwater Quality

The changes in conductivity at the groundwater bores WGM1/D5 and D6 have been explored in relation to the KVAD/R sub-surface drains and the effects on the water quality on Lidsdale Cut in Section 3.3. This section examines the groundwater quality in these two bores in relation to potential effects of the KVAR Stage 2 ash placement. Changes from pre-placement, during the Stage 1 placement and capping and during the initial Stage 2 dry ash placement are considered.

The knowledge of the groundwater flow directions as shown in Figure 4 explains how the inflowing up-gradient, low conductivity (i.e. salinity) groundwater dilutes the KVAD water collected by the toe drains and sub-surface drains from under the KVAR. This is subsequently directed to Lidsdale Cut via the unblocked toe drains. Previous reports show that the conductivity in Lidsdale Cut and bore D5 were previously reduced to be similar to that at bore D6 (at 900-1100 uS/cm soon after the sub-surface drains were connected to the KVAD toe drains). Since then, the conductivities have continued to decrease at bore D5 to be less than that in bore D6 (< 500 uS/cm). The continuing decrease of conductivity suggests that the groundwater level drawdown created by the toe drains and sub-surface drains drawing high level water flows east, is depleting the amount of high salinity water present in the KVAD on the western side adjacent to bore D5. Similarly, rainfall fresh water is recharging to the groundwater upslope of the dame and into the collection drains constructed into the dam wall and also from collection points to Lidsdale Cut. However, a spike in the Lidsdale Cut occurring between October 2013 and March 2014, which saw conductivity levels reach approximately twice the conductivity levels in bore D6, suggests that an amount of high salinity groundwater had remained in the KVAD, continues to be transported to Lidsdale Cut via the drawdown associated with the toe drains.

The elements that had higher concentrations than the local guidelines during the ongoing Stage 2 ash placement are highlighted in Table 4. To assess changes in the groundwater potentially affected by the KVAD/R ash placement, the medians for Bores D5 and D6 have been compared to those during previous periods together with the background groundwater concentrations recorded at bore D2 and the 90th percentile baseline in Table 6.

During 2010 to 2012, bore D6 initially had a lower median conductivity and sulphate than in bore D5, but during 2013 to 2014, bore D5 has the lower conductivity and sulphate. In addition, the concentrations of iron, manganese and nickel have decreased in bore D5 and boron and molybdenum are now lower than the local/ANZECC (2000) guidelines. Other changes in concentrations within D5 included slight increases in arsenic, cadmium and zinc and increases by an order of magnitude in copper and lead. Additionally, trace metal concentrations for arsenic, chromium, copper, manganese, nickel and zinc have increased in bore D6, while lead concentrations have decreased to below the local/ANZECC guidelines. There were no other significant changes in concentrations of the other trace metals in either bore, including selenium, which remained low. In regard to the changes in trace metals in the area, it should be noted that the low pH observed in D5 and D6, and also seen in background bore D2, suggests pyrite oxidation (Deutsch, 2005) of the residual coal and chitter located in the Kerosene Vale mine void below the KVAR. Pyrite oxidation and its associated acidification are known to release trace metals into groundwater, which could account for the increase in arsenic, cadmium, zinc, copper and lead observed in D5 and increased arsenic, chromium, copper, manganese, nickel and zinc observed in D6.

Further to the changes observed in the local groundwater, the flow directions indicate that bores D5 and D6 collect the groundwater seepage from under the KVAR on its way to Sawyers Swamp Creek, which is nearby. Therefore the KVAR sub-surface drains, together with the KVAD toe drains, could be expected to improve the conductivity in the creek by decreasing the salinity in the local groundwater through the drawdown collection process Thus a collection and treatment system for all water reporting to Lidsdale cut should be considered) so that the ongoing trends of improved groundwater can be continued.

Table 6: Median Water Quality for Dry Ash KVAD/R Groundwater Seepage Bores during Post-Stage 1, Initial Stage 2 and Stage 2 Ash Placement Compared to Current Groundwater Background Bore WGM1/D2, Bore WGM1/D5 Baseline and Groundwater Guidelines

Element (mg/L)	KVAD & KVAR Dry Ash Placement Monitoring Bores						Background April 2013 to March 2014	D5 Baseline (Pre-Stage I 90th Percentile)	ANZECC (2000) Guidelines & Goals for Groundwater
	Stage 1 & Cap May 2003 to March 2010		Stage 2A Post-Placement (April 2010 to January 2012)		Stage 2 Post-Placement (April 2013 to March 2014				
	D5	D6	D5	D6	D5	D6	D2	D5	
pH	3.6	3.2	3.6	3.2	4.9	3.1	3.6	4.5	6.5-8.0
Cond (µS/cm)	1917	1110	1356	1216	620	1500	600	810	2600
TDS	1600	600	1000	730	390	865	325	550	2000
SO4	1100	350	680	485	210	635	185	328	1000
Cl	18	56	15	48	21	40	39	24	350
As	0.001	0.005	0.001	0.001	0.004	0.0045	0.15	0.008	**0.024**
B	4.8	0.8	2.2	0.74	0.84	0.80	0.006	1.7	**1.7**
Cd	0.0024	0.0004	0.002	0.001	0.0069	0.0004	1.2	0.004	0.001
Cr	0.003	0.0026	0.001	0.002	0.006	0.004	0.1	0.041	0.004
Cu	0.013	0.0030	0.008	0.005	0.025	0.006	0.8	0.058	0.005
F	1.1	0.2	0.8	0.4	0.3	19	0.08	0.65	1.5
Fe	4.85	38	1.7	14.5	1.51	0.5	0.001	14.7	**1.7**
Mn	8.55	3.6	7.5	3.5	3.2	3.8	0.12	2.5	1.9
Mo	0.005	0.008	0.010	0.010	<0.01	<0.01	3.6	-	0.010
Ni	0.83	0.335	0.54	0.35	0.2	0.54	600	0.137	**0.137**
Pb	0.016	0.005	0.007	0.012	0.023	0.004	325	0.021	**0.010**
Se	0.001	<0.001	0.002	0.002	<0.002	0.001	185	0.002	0.005
Zn	1.5	0.335	1.1	0.895	1.22	1.15	39	0.505	**0.505**

To clarify the influence of KVAR seepage, if any, on the local groundwater and surface water quality, long-term changes for conductivity, sulphate and boron within D5 are displayed in Figure 7. Bore D5 is used as the primary indicator of potential effects on Sayers Swamp Creek as it has been shown to collect the groundwater seepage from under the KVAR on its way to the creek.

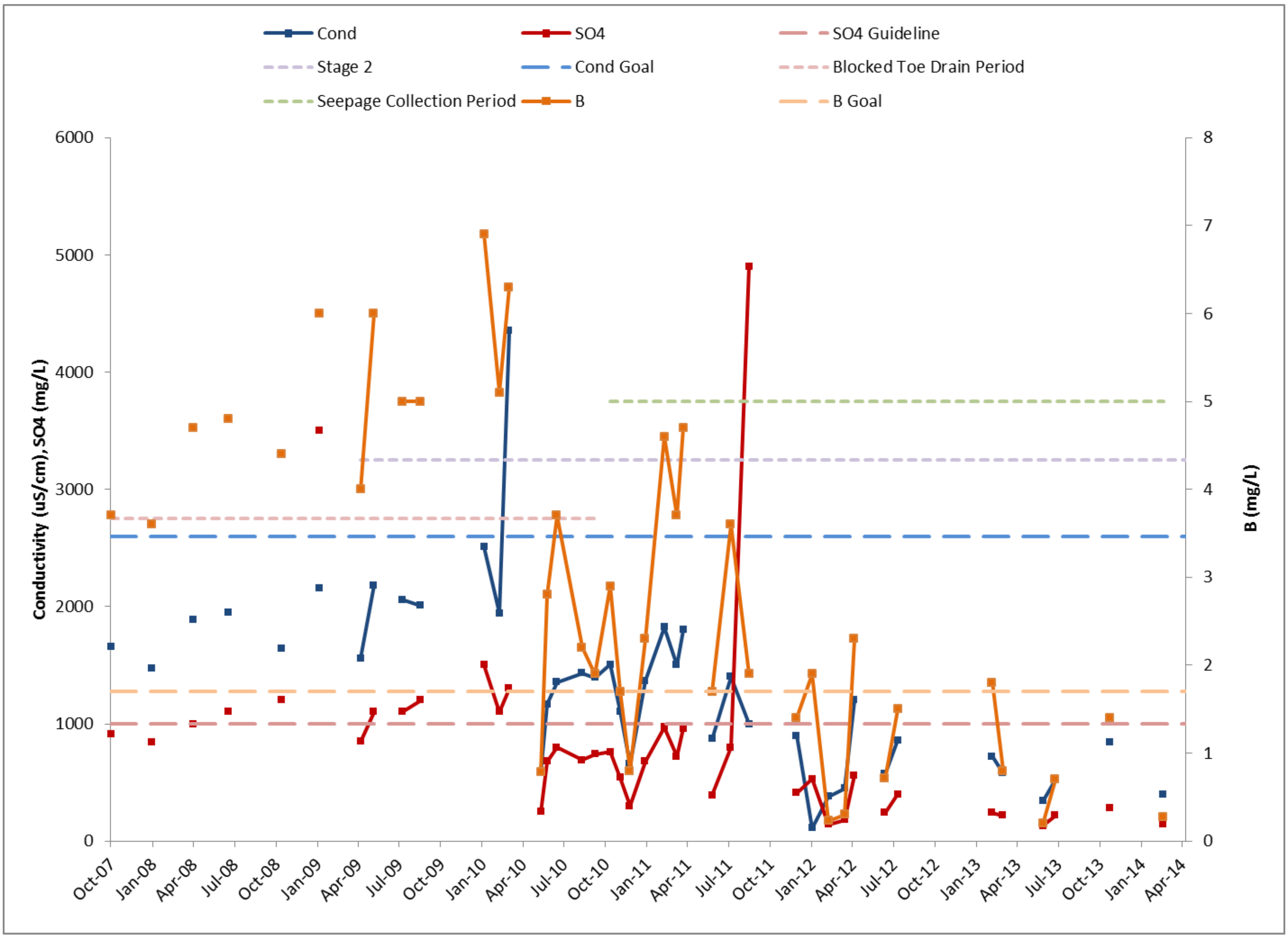

Figure 7: Kerosene Vale Ash Dam Seepage Detection Bore WGM1/D5 Long-term Trends in Conductivity, Sulphate and Boron since October 2007. Periods of Stage 2 Ash placement, including initial Stage since April 2009, Blocked toe drains from April 2007 and Sub-surface drain seepage collection from October 2010 are shown.

Figure 7 shows that the conductivity, sulphate and boron at bore D5 have all decreased since the installation of the KVAD/R seepage collection system to be similar to, or below, the Stage 1 pre-placement background levels. Besides from boron, they have also had concentrations consistently below their respective environmental goals.

As previously discussed in Section 3.3, the lower concentrations in bore D5 during the Stage 2 ash placement appear to be due to the increased ability of the low conductivity background water to enter the KVAD underneath the KVAR since the installation of the sub-surface drains and unblocking of the KVAD toe drains, with subsequent collection by a Lidsdale cut water collection system.

If ash placement at KVAR was significantly affecting the groundwater concentrations, they would not be at their current concentrations. This is supported by the apparent lack of effects on bore D5, of the high rainfall events witnessed during summers 2010/11, 2011/12 and 2012/13 (refer to Section 2.1 and Attachment 1), in comparison to the large changes observed at bore D4 (Figure 6). Therefore, the lower variability at D5 may be due to effective sealing of the KVAD by the combined effects of the clay capping and placement of dry ash on top of the capping, which was on top of the KVAD and now covered with the KVAR ash placement.

It is for these reasons that these observations and trends support the previous suggestion that leachates from the dry ash, if any, have not affected the local groundwater, even with increased rainfall events experienced in recent summers. The effects of wet and dry weather on the local groundwater quality and the indicated lack of dry ash leachate effects are anticipated to be confirmed by ongoing monitoring.

4.5 Lidsdale Cut

This section examines the effect of Kerosene Vale Ash Dam and Repository (KVAD/R) and local groundwater seepage, as well as the diversion systems, on the water quality in Lidsdale Cut. The relationships of observed water quality and trace metal changes within Lidsdale Cut are investigated in this section. Table 7 details the water quality changes at Lidsdale Cut from pre-dry ash placement to Stage 1, which is now capped, and the various Stage 2 periods, including the present Stage 2 reporting period. This information has been used to confirm the findings from the previous section on potential inputs from the KVAR to the local groundwater by identifying any links between the KVAD/R groundwater and that in the Lidsdale Cut.

Table 7: Median Lidsdale Cut Water Quality during Stage 1 and Capping and Stage 2 Dry Ash Placement periods Compared to the Current Groundwater Quality at WGM1/D5 and Relative to the Pre-Placement Baseline 90th Percentile and Groundwater Guidelines

Element (mg/L)	KVAD & KVAR Groundwater (WGM1/D5)	Lidsdale Cut (Site 40)					KVAR Typical Seepage Collection (Site 94)	ANZECC (2000) Guidelines & Goals for Groundwater
	Ongoing Stage 2 Post-Placement (Apr 2013-Mar 2014)	Pre-Placement (1992-2003) 90th Percentile	Stage 1 & Cap Post-Placement (May 2003-March 2010)	Initial Stage 2 Post-Placement (April 2009-March 2010)	Stage 2A Post-Placement (April 2010-January 2012)**	Ongoing Stage 2 Post-Placement (Apr 2013 - Mar 2014)	Ongoing Stage 2 Post-Placement (Apr 2013 - Mar 2014)	
pH	4.9	6.9	4.3	3.4	4.8	3.4	3.4	6.5-8.0
Cond (µS/cm)	620	952	1178	1965	1011	4100	4750	2600
TDS	390	650	870	1500	740	4200	5900	2000
SO4	210	359	580	970	460	3150	3950	1000
Cl	21	34	18	19	21	32	34	350
Alk	71	38	30	85	85	13	-	-
As	0.004	<0.001	0.002	0.002	0.002	0.017	0.033	0.024
B	0.84	2.16	2.5	5.2	2.4	13.5	19	**1.7**
Cd	0.0069	<0.001	0.0008	0.0008	0.0013	0.04	0.08	0.001
Cr	0.006	<0.006	0.001	0.0013	0.001	0.018	0.04	0.004
Cu	0.025	<0.005	0.003	0.003	0.004	0.029	0.09	0.005
F	0.3	1.99	3.1	6.7	2.6	32	38	1.5
Fe	1.51	0.07	0.54	3.05	0.04	4.0	4.4	**1.7**
Mn	3.2	2.12	3.7	6.3	4.1	13	18	1.9
Mo	<0.01	-	0.005	0.01	<0.01	<0.01	0.005	0.01
Ni	0.2	-	0.375	0.54	0.28	1.04	1.35	**0.137**
Pb	0.023	0.004	0.003	0.003	0.002	0.011	0.007	**0.01**
Se	<0.002	0.001	<0.001	0.001	0.002	0.063	0.09	0.005
Zn	1.22	0.304	0.36	1.2	0.52	2.85	3.5	**0.505**

** Sampling for Lidsdale Cut not performed between July and November 2011 and sampling performed at WX5 from November 2011 to October 2013, due to access restrictions.

Table 7 documents the following changes in the Lidsdale Cut water quality:

- All the water quality and trace metals, except for conductivity, TDS, Chlorine, Alkalinity and Arsenic, have higher concentrations than the local/ANZECC (2000) guidelines
- Conductivity and sulphate, as well as all trace metals have increased to be higher than the pre-placement 90th percentile baselines and nickel is now higher than during the Stage 1 period
- Alkalinity and pH has decreased since the post-placement Stage 1 period.

As noted in section 4.4, the alkalinity and pH decreases suggest pyrite oxidation (Deutsch, 2005) of the residual coal and chitter located in the Kerosene Vale mine void below the KVAR. Pyrite oxidation and its associated acidification are known to release trace metals into groundwater, which could potentially account for the increase in trace metal concentrations within Lidsdale Cut. This is because all KVAD seepage points are directed to Lidsdale cut.

The aforementioned increases in trace metal concentrations occurred in October 2013, with similar increases occurring at bore D5 in November 2013 (see Attachment 2). Most of the trace metal concentrations were higher within the Lidsdale Cut than in bore D5, with the exception of copper, lead and zinc, which had higher concentrations in bore D5.

These observations are consistent with the release of trace metals into the groundwater in the KVAD, underneath the KVAR as well as at bore D5, by pyrite oxidation. The affected groundwater is collected by the KVAD/R toe drains and sub-surface drains and directed to Lidsdale Cut, thereby resulting in the increases in trace metal concentrations noted above. As a result, the Lidsdale Cut trace metal concentrations, including selenium, now are all above their local/ANZECC (2000) guideline trigger values. Values for iron are indicative of this proposition as noted with the comparison of North Wall seepage collection, the resulting Lidsdale cut and Dump Creek.

Figure 8 documents the long-term trends for conductivity, sulphate and boron in Lidsdale Cut.

A comparison of Figure 7 and Figure 8 shows similar changes in conductivity, sulphate and boron in the Lidsdale Cut as in bore D5 since October 2007. However, in June 2012, following the prevention of discharge from Lidsdale Cut to Sawyers Swamp Creek in April 2012, the concentrations of the parameters increased to above those in bore D5. These water quality changes were also associated with a period of dry weather, following the summer flood, and suggest that the inflows from the KVAD/R drains, as well as mine water seepage from the creek into the void, are determined by rainfall runoff conditions.

Lidsdale Cut was stopped from discharging to Sawyers Swamp Creek and the water has been pumped out to the SSCAD via the ash slurry return pipeline since July 2012. Although the void is the low point for collection of groundwater flows in the area and it also receives the sub-surface water from the KVAD/R drains, including as indicated by KVAR site 94, the water level is now kept at a level lower than Sawyers Swamp Creek. Under these conditions, it is unlikely that seepage from Lidsdale Cut could enter Sawyers Swamp Creek. In fact, it is possible that the creek water could seep into the void, particularly in periods of high rainfall as observed in June 2013, and be pumped out together with the sub-surface drain water and groundwater flows to the SSCAD. As a result, it was suggested in the previous report (Aurecon, 2014) that sampling be ceased at Lidsdale Cut. However, sampling was recommenced in April 2013 due to changes in the Lidsdale Cut management plan, with the need to maintain water levels below the outflow level of the WX5 outflow point, to ensure Lidsdale Cut was not indirectly impacting on Sawyers Swamp Creek. Pumping records indicate a consistent volume of 100 ML is pumped annually from Lidsdale Cut.

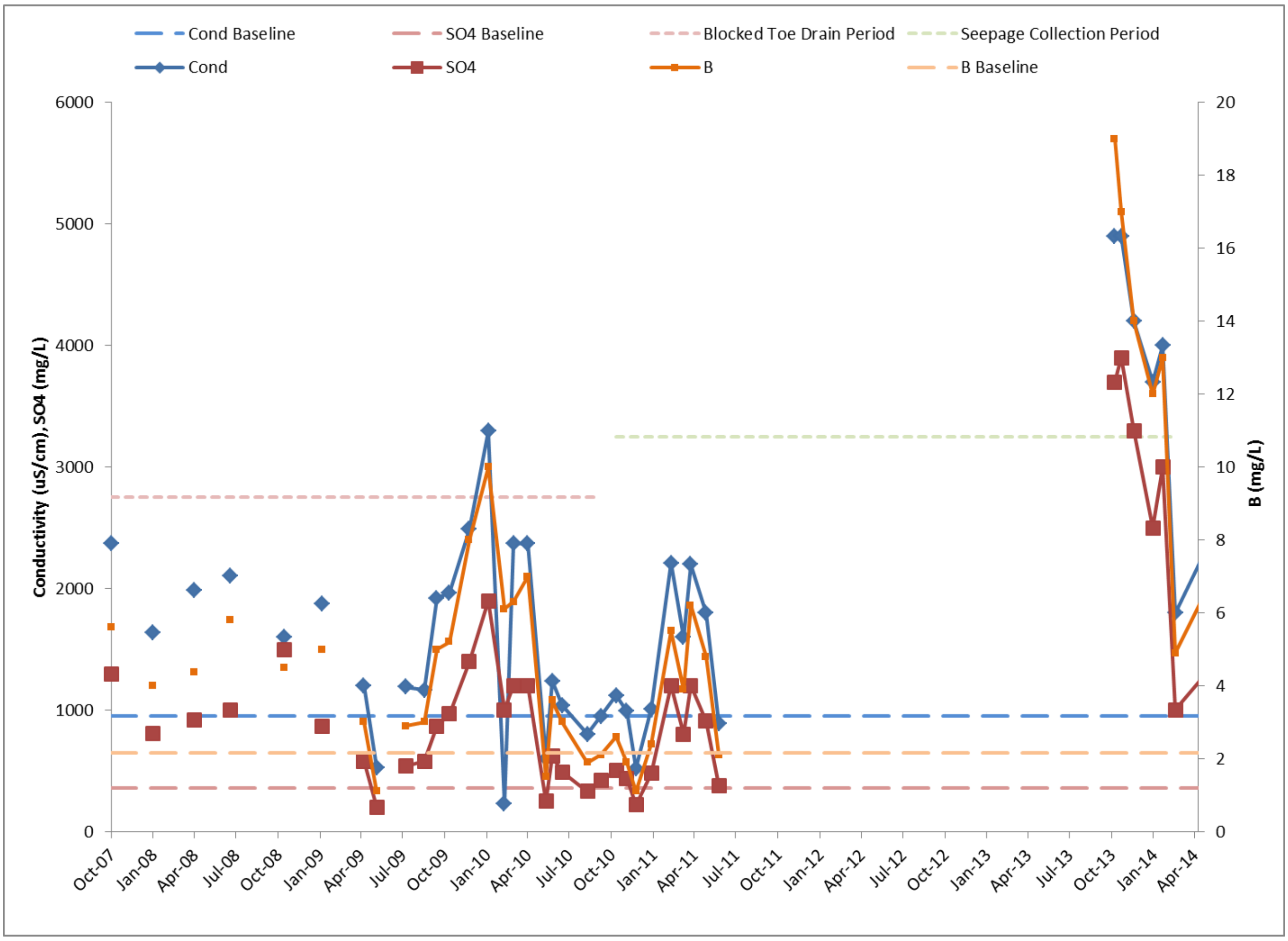

Figure 8: Lidsdale Cut Long-term trends in Conductivity, Sulphate and Boron since October 2007 compared to the Pre-Stage I Baselines. Periods for Blocked toe drains (from April 2007) and KVAR Stage 2 Sub-surface drains (from October 2010) are shown.

It was also suggested in the previous report (Aurecon, 2014) that it was possible that seepage from the overburden deposits at the back of the void, following a heavy rainfall event, may have entered Lidsdale Cut due to the fact that it is the low point for collection of groundwater. This would therefore account for the increase in trace metals, conductivity and sulphate. Hence, it is recommended that water quality in the void continues to be sampled as part of the routine sampling program.

4.6 Sawyers Swamp Creek

Changes in the water quality and trace metals at the Sawyers Swamp Creek receiving water site (WX7) were analysed and reviewed in Section 3 in relation to the inputs of seepage water from under the SSCAD wall and seepage from the current Stage 2 dry ash placement at KVAD/R, as well as the discharge and potential seepage from Lidsdale Cut and inflows from Dump Creek. The effects of the Springvale mine water pipeline leak since July 2011 and its licenced discharge from the Mine into SSC from August 2012 are also considered. As WX7 is the final receiving water site for both of the ash placement areas (SSCAD & KVAD/R), this section examines the overall effects of surface and groundwater seepage on the WX7 receiving waters.

Figure 9 documents the trends for conductivity, sulphate and boron at WX7 since October 2007. The trends are compared to the conductivity in the SSCAD and Springvale Mine water discharge, as well as the various ash management periods that may have affected the water quality at WX7. These include:

- The period when the KVAD toe drains were found to be blocked and consequently unblocked to allow the seepage water to drain into Lidsdale Cut;
- SSCAD v-notch pump-back installation;
- KVAD/R sub-surface drain seepage collection and diversion to Lidsdale Cut; and

- Springvale Mine water pipeline leak and licenced discharge periods

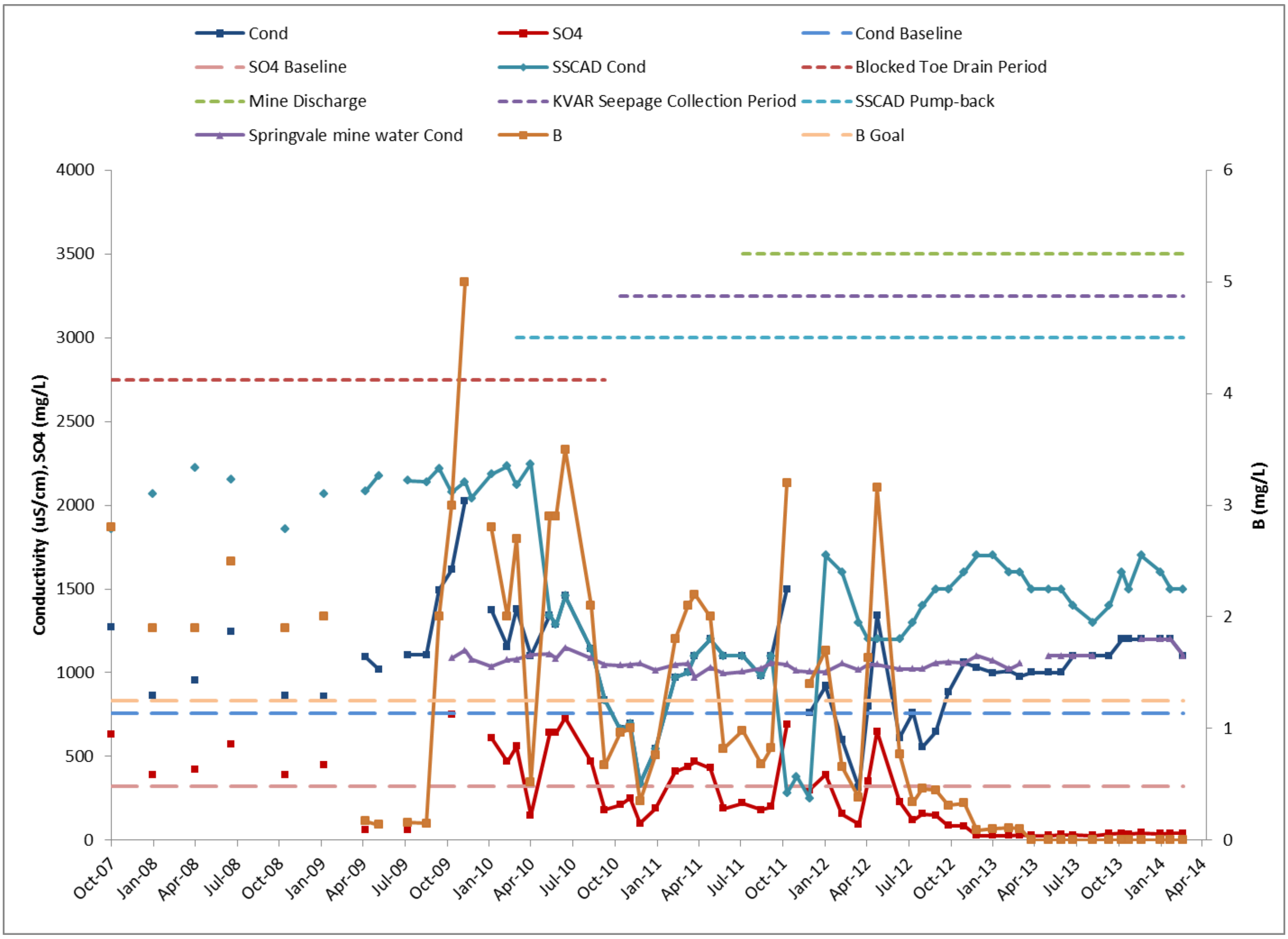

Figure 9: Sawyers Swamp Creek Long-term trends in Conductivity, Sulphate and Boron since October 2007, in relation to baseline and goals and the SSCAD and Springvale Mine Water discharge conductivity. Periods of blocked KVAD toe drains (from April 2007), Springvale Mine Water Discharge and pipeline leak (since July 2011), SSCAD pump-back (since March 2010) and KVAD/R seepage collection and diversion to Lidsdale Cut (since October 2010) have also been shown.

The concentrations of conductivity, sulphate and boron have all decreased from their peaks after the toe drains were unblocked, which demonstrated the potential effects of the KVAD/R seepage on the creek without a seepage collection system. Additionally, the SSCAD pump-back system was installed at approximately the same time, and this was closely followed by the installation of the KVAD/R sub-surface drains.

The water quality data from the last reporting period, as detailed in (Aurecon, 2014), clarified the influence of the SSCAD seepage on the water quality at the Sawyers Swamp receiving water site WX7. Insofar that, prior to installation of the seepage works in mid-2012 and early 2011, the conductivity at the WX7 receiving water site tended to follow that of the SSCAD conductivity. After installation of these systems, the WX7 conductivity decreased in April 2012 to its lowest level since the late 1990s (Aurecon, 2014). However, the SSCAD conductivity also decreased at this time, and the WX7 conductivity essentially continued to follow that of the SSCAD trend. The main differences between these two trends during this period were the large decrease, closely followed by an increase of conductivity at WX7, relative to the SSCAD. These changes at WX7 have been associated with heavy rainfall followed by the mine water pipeline leaks. Additionally, since August 2012, when the mine water discharge to the creek became continuous, the conductivity at WX7 continued to increase and, as a consequence, there is currently no association between the SSCAD conductivity trend and that at WX7.

Since the mine water discharge to the creek became continuous, the concentrations of sulphate and boron at WX7 have decreased, and continued to remain below their respective goals or pre-KVAR baselines. On the other hand, conductivity has increased again to 1100 µS/cm. As a result of this increase, the conductivity is now similar to that of the Springvale Mine water influence (Figure 9). As mentioned in Section 3, the conductivity increase was the result of relatively high conductivity in the Mine water discharge, which is mainly due to the high concentration of alkaline salts, rather than sulphate (Table 3).

Table 3 also indicates that, although WX7 is downstream of the Dump Creek (WX11) site, the elevated concentrations of sulphate (807 mg/L) and boron (2.7 mg/L) at WX11 has not prevented the mine water from diluting the WX7 concentrations to low levels. This reinforces the view that the mine water flow rate is much higher than that of the local catchment runoff or the combined seepage rates from the SSCAD and the KVAD/R ash placement areas. This is further supported by the fact that the WX11 conductivity of 1667 µS/cm has been diluted at WX7 to approximately 1100 µS/cm by the mine water due to a continuous 20 ML/day inflow.

4.7 Overall Effects of Groundwater Seepage from Ash Placements on Sawyers Swamp Creek Receiving Waters

From the above considerations, the following overall effects of groundwater seepage from the KVAD/R and SSCAD on the WX7 receiving waters, assessed in consideration with the local background conditions and the Springvale mine water discharge, are:

- Prior to August 2012, seepage from SSCAD dominated the conductivity conditions in Sawyers Swamp Creek, except during periods of high rainfall and the previous Springvale Mine water pipeline leak to the creek. Water quality, including conductivity, continued to meet the local/ANZECC (2000) guideline goals and there was no evidence of the effects of the seepage on trace metals at WX7.
- After unblocking of the toe drains and installation of the KVAD/R sub-surface drains, there were no detectable effects of the Stage 1 and Stage 2 dry ash placements on water quality and trace metals in the creek.
- The water level within Lidsdale Cut has been maintained at a level lower than that of Sawyers Swamp Creek following blocking of the Lidsdale Cut discharge v-notches in April 2012. Accordingly, Lidsdale Cut water qualities are unlikely to have affected the creek receiving water.
- Concentrations of copper, chromium and cadmium have increased at WX7 most likely as the results of local mine spoil seepage and the influence of the Dump Creek catchment.
- The upper (above KVAD/R) and lower (below KVAD/R and Lidsdale Cut) Sawyers Swamp Creek water quality conditions have now been dominated by the Springvale Mine water discharge. The mine water has lowered the concentrations of boron, fluoride, nickel and zinc at WX7 to below the local/ANZECC (2000) goals.

5. Discussion

Seepage from the Sawyers Swamp Creek Ash Dam, and potentially some input from the associated groundwater bore D4, is confirmed as the main influence of the conductivity in Sawyers Swamp Creek, prior to continuous Springvale mine water discharge began in August 2012. However, the seepage always met the local/ANZECC guidelines and had no significant effects on trace metals within the creek. These conditions have now been exceeded by the Springvale Mine water discharge.

The mine water has completely modified the water quality and trace metals in Sawyers Swamp Creek, by increases in pH and with evidence of elevated molybdenum, however the water quality of the creek downstream of the SSCAD v-notch has continued to meet the local/ANZECC guidelines. Springvale Mine water discharge is currently expected to continue indefinitely and or increase. Monitoring of the SSCAD v-notch water quality will continue as the only means of determining the potential effects of the SSCAD seepage on the creek. Monitoring of the SSCAD will continue and it is expected that the water quality within the SSCAD itself may change, or may already be in the process of changing, as a result of the diversion of the KVAD/R groundwater and Lidsdale Cut water reticulation system being pumped back to the ash dam.

Prior to April 2012 the water quality of Springvale Mine inflows was previously poorly understood. Subsequently, sampling has been performed in order to confirm effects, if any, on the creek. The results show that the water quality of Sawyers Swamp Creek is very similar to that of the Springvale Mine water discharge, suggesting that the creek now represents the Springvale Mine inflows. .

Repair of the KVAD toe drains and installation of sub-surface drains under the KVAR has drawn down the groundwater, and in the process drawn poor quality water towards the KVAD. Consequently, the water quality and trace metals in Lidsdale Cut (the receptacle of the drains) remains a representation of the subsurface water quality of the regional and KVAD site, which is also at this stage receiving inflow of rainfall runoff from the KVAR Stage 1-2 partial surface catchment. However, these changes have not been observed in bore D5, suggesting KVAR Stage 1 and Stage 2 dry ash placements are not significantly increasing the salinity and trace metal concentration in the local groundwater, and as a result, were not expected to affect the conditions in Sawyers Swamp Creek. Hence, other than the effects of the local background conditions and the mine water, the water quality and trace metal concentrations remain lower than the local/ANZECC (2000) guidelines in the creek's receiving waters.

The dominant effect of the Springvale Mine water discharge on the Sawyers Swamp Creek receiving water site means that the WX7 site should be considered as no longer useful for consideration as the final receiving site for the KVAR. As a result, this would leave only bore D5 as the site for indication of potential effects on the Sawyers Swamp Creek receiving waters for the KVAR. However, it would be practical to maintain the existing water quality monitoring in Sawyers Swamp Creek so that EnergyAustralia NSW is not incorrectly designating effects of the local coal mine conditions and the Springvale Mine water discharge. Consequently, we do not recommend any change to the current monitoring program.

In summary, the key points are:

- SSCAD – previously confirmed as contributing to conductivity levels within Sawyers Swamp Creek, but does not exceed the local/ANZECC guidelines for water quality and trace metals
- KVAD – unblocking of the toe drains and installation of sub-surface drains have reduced effects on the local groundwater quality to an acceptable level, when the background conditions are taken into account because all water is collected to Lidsdale Cut and prevented from entering the catchment surface water system.
- KVAR – no evidence of significant effects on surface or groundwater quality.

- Springvale Mine water discharge – the water quality conditions in Sawyers Swamp Creek have now been dominated by the mine water discharge but, except for pH, cadmium, chromium, copper and lead, the creek continued to meet the local/ANZECC guidelines for water quality and trace metals.

6. Conclusions

The findings of this assessment of effects of the Stage 1 and Stage 2 KVAR dry ash placement areas and the Sawyers Swamp Creek Ash Dam seepage on the ground and surface water, taking into consideration the number of management changes (i.e. toe drains, sub-surface drains, SSCAD v-notch pump-back system and cessation of Lidsdale Cut discharge) and the commencement of the continuous discharge of Springvale Mine water, lead to the following conclusions:

- The SSCAD seepage was initially associated with a decrease in conductivity in Sawyers Swamp Creek in accordance with that in the SSCAD prior to the Springvale Mine water discharge began, after which the conductivity increased and the water quality and trace metal concentration also changed. All the water quality and trace metal concentrations in the creek, downstream of the ash dam v-notch, met the local/ANZECC guidelines, with the exception of molybdenum, which has remained high since the time of the mine water discharge.
- All the water quality and trace metal concentrations in the creek downstream of the KVAD/R seepage met the local/ANZECC guideline concentrations, with the exception of molybdenum. However, both the upstream and downstream molybdenum concentrations were similar and were previously noted to occur in October 2012, shortly after the mine discharge began in August 2012. However, it has been noted that there is no molybdenum level concentration data for the Springvale Mine Water, so it was recommended that the seepage be tested for this to allow comparison between the molybdenum levels observed in the creek to that of the Springvale Mine Water discharge.
- Unblocking of the KVAD toe drains, installation of the KVAR sub-surface drains and diversion of the groundwater to Lidsdale Cut provided conditions that reduced the conductivity, sulphate and trace metals in:
    - The local groundwater at bore D5
    - Sawyers Swamp Creek receiving water site, which had the water quality and trace metal concentrations lower than the local/ANZECC guidelines other than effects of the local background and the Springvale mine water.
- High rainfall and pyrite oxidation of the residual coal and chitter located in the Kerosene Vale mine void below the KVAR introduced high concentrations of trace metals into Lidsdale Cut, causing the water quality within Lidsdale Cut to exceed the majority of local environmental goals.
- Although the water quality data indicates that the KVAR ash placement management is effectively controlling dry ash leachates from influencing the local surface and groundwater quality, the commencement of the continuous Springvale Mine water discharge has compromised future assessment of potential impacts on the Sawyers Swamp Creek receiving water site. As a consequence, relevant changes to the monitoring program are recommended and should include similar test suites for all sites.

7. Recommendations

From the findings of this study and the domination of the water quality in Sawyers Swamp Creek by the Springvale Mine Water discharge, the following recommendations are made:

- All water quality parameters will be audited for consistency, particularly with an update for the quality analysis relevant to Springvale Mine Water.
- Influences of Dump Creek be considered.
- Continue all monitoring as previously performed into the next reporting period.
- Continue with developing the Lidsdale Cut Management Plan to ensure ongoing management of these waters

8. References

ANZECC, 1995. Guidelines for Groundwater Protection in Australia. In: *National Water Quality Management Strategy, Commonwealth of Australia.* s.l.:Australian and New Zealand Environmental Conservation Council, ACT.

ANZECC, 2000. *Australian Water Quality Guidelines for Fresh and Marine Waters.* s.l.:Australian and New Zealand Environmental Conservation Council, ACT.

APHA, 1998. *Standard Methods for the examination of Water and Wastewater.* 20th ed. s.l.:American Public Health Association.

Aurecon, 2010. *KVAD Stage II Water Quality Assessment October 2007 to March 2010,* s.l.: Draft report to Delta Electricity Westen, 18th June 2010.

Aurecon, 2012. *Kerosene Vale Ash Dam and Dry Ash Repository Stage 2A Water Quality Assessment April 2010 to January 2012,* s.l.: Report to Delta Electricity Western, 9th October 2012.

Aurecon, 2014. *Kerosene Vale Ash Dam and Dry Ash Repository Stage 2 Water Quality Assessment February 2012 to March 2013,* s.l.: Report to EnergyAustralia NSW, 16th January 2014.

Connell Wagner, 2008. *Kerosene Vale Ash Dam Groundwater November 2001 to July 2007,* s.l.: Report to Delta Electricity Western, 15th February 2008.

Deutsch, W., 2005. *Groundwater Geochemistry: Fundamentals and Applications to Contamination.* Second ed. s.l.:Lewis Publishers.

EnergyAustralia

Attachment 1 Rainfall Data

Lithgow Rainfall data from January 2000 to March 2014 (mm/month) from Bureau of Meteorology

Year(s)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
2000	57.0	22.2	271.4	50.6	53.4	32.2	37.4	51.2	43.0	75.0	119.2	59.0	871.6
2001	105.4	90.6	89.6	84.4	28.8	9.0	63.2	30.8	46.4	58.8	80.0	26.6	713.6
2002	87.8	187.0	69.4	40.2	67.6	22.6	16.8	17.0	21.2	3.0	22.0	47.2	601.8
2003	25.4	135.0	48.6	38.4	54.0	43.2	20.6	0.0	18.6	82.4	121.0	68.8	656.0
2004	35.0	98.2	22.4	10.4	35.2	16.2	30.2	50.8	34.8	118.4	113.8	88.6	654.0
2005	102.8	104.6	60.8	28.6	14.2	117.2	53.4	21.8	82.4	88.2	103.8	39.4	817.2
2006	204.2	15.8	17.0	10.8	6.4	6.8	54.2	12.0	59.2	3.2	32.2	72.7	494.5
2007	92.6	141.4	71.6	44.6	56.6	223.0	24.9	65.4	9.0	37.8	134.7	67.0	968.6
2008	118.6	85.0	48.6	59.8	11.0	61.1	36.9	45.4	88.2	66.2	83.3	113.2	817.3
2009	25.2	165.8	28.0	74.3	80.9	44.5	35.9	48.8	63.0	69.0	23.6	81.5	740.5
2010	76.7	119.2	85.1	35.2	54.4	40.9	73.5	73.5	52.4	70.9	122.8	164.6	969.2
2011	114.0	57.2	77.2	41.2	51.2	72.4	24.6	58.7	78.4	48.4	168.0	91.0	882.3
2012	57.1	152.6	189.8	44.4	30.6	81.8	50.8	21.2	48.6	20.8	30.9	64.1	792.7
2013	113.2	184.2	67.6	28.1	29.0	116.6	24.4	23.2	35.0	21.8	95.2	34.2	772.5
2014	*13.6*	*74*	*143.8*										

N.B.: Data within the table which are in italics represent observations which have not been fully quality controlled (BOM, 2014)

EnergyAustralia

Onsite Rainfall data 2013-2014 measured by Lend Lease.

Date	April	May	June	July	August	September	October	November	December	January	February	March
1	0.2	0	0	0	0	0	4.4	0	0	0	0	12
2	0	0	27	0.2	0	0	5.8	0	0	0	0	8
3	0	0	4.6	0	0	0	0.6	0	0	2.4	0	0.5
4	0	0	0	0	0	0	0	0.2	0	0	0	1
5	0.2	0	0	0	0	0	0	0	7.5	0	0	4
6	0	0	0.2	0	0	0	0	0	5.5	0	0	2
7	0.2	0	0.4	0	1.2	0	0	0	0	0	0	0
8	8.6	0	0.2	0	11	0	0	0	0	0.5	0	1
9	0	0	0.2	0	1.8	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0.5	0.5	0	0
11	0	0.2	6.4	0.2	0	0	13.8	1.4	0	1	0	0
12	0	0	0.2	0	0.4	0	0	0.6	0	0	0	0
13	0	0	12.8	0.2	3	0	0	20	0	0	0	4
14	0	9	0	0.2	0	1.6	7.8	0	0	0	4	39
15	0	0	0	1.8	0.4	0	0	0	0	0	7.6	16.5
16	22	0	0	0.2	0	1.2	0	2.8	0	0	10.8	0
17	0.4	1.2	0	6.6	3	38.8	0	6.6	0	0	9	0
18	0	0	0	0.2	0	1.8	6.8	6.6	0	0	0	0
19	0	0	0	1	0.4	0	0	9	0	0	0	0
20	0	0	0	9	0.4	0	0	0	0	0	45.4	0
21	1	0	0	0.4	0	3.6	0	0	0	0	0	2
22	0	0	0.4	0	0	0	0	0.2	0	0	0	0
23	0	9.8	1.8	0	0.4	0	3.6	0	0	0	0	1
24	0	4	11	0	0.8	0	0.4	0	0	0	0	1.5
25	0	0.2	19.2	0	0.2	0	0	0	30	6	0	9
26	0	0	31	0.2	0	0	0	0	0	0.5	0	0
27	0	0	1.6	0	0	0	0	0	0	0	0.6	25
28	0	0.2	0	0	0	0	0	0	0	0	7.6	0
29	0	0.6	3.4	0.2	0	0.6	0	0	0	0		4
30	0	0.2	1.4	0	0	0	0	0	0	0		0
31		0		0	0		0.4		0	0		0
Total	**32.6**	**25.4**	**121.8**	**20.4**	**23**	**47.6**	**43.6**	**47.4**	**43.5**	**10.9**	**85**	**130.5**

Attachment 2 Wallerawang Power Station Ash Dam Surface Water and Groundwater Quality Stage 2 from April 2013 to March 2014

Attachment contains:

- Post-dry ash placement raw data and summary statistics from April 2013 to March 2014:
    1. Water quality data and summary for Sawyers Swamp Creek WX7 and Background at Dump Creek WX11
    2. Water quality data and summary for Lidsdale Cut WX5
    3. Water quality data and summary for Sawyers Swamp Creek at WX1 – upstream of SSCAD, EANSW site 92
    4. Water quality data and summary for SSCAD groundwater seepage detection bore WGM1/D3 and WGM1/D4
    5. Water quality data and summary for KVAD/R seepage detection groundwater bores WGM1/D5 and WGM1/D6
    6. Water quality data and summary for background groundwater bores WGM1/D1 and WGM1/D2
    7. Water quality data and summary for SSCAD
    8. Water quality data and summary from Sawyers Swamp Creek monitoring from SSCAD Spillway to near WGM1/D5
        - Sawyers Swamp Creek upstream @ 0 m where SSCAD diversion and Springvale Mine Water discharge, since August 2012, enters SSC at spillway.
        - Sawyers Swamp Creek Ash Dam seepage from v-notch (water collected and recycling back into dam).
        - Sawyers Swamp creek downstream at @850m near Bore D4 – upstream seepage from KVAD wall and below SSCAD v-notch seepage point, EANSW site 93.
        - KVAD/R seepage water Northern wall collection pit from the KVAD on the north-side of KVAR drains, EANSW site 86.
        - Sawyers Swamp Creek at 1250 m near bore D5, EANSW site 83 – downstream seepage from KVAD wall.
    9. Water quality data and summary for Springvale Mine Water discharge
- Pre-dry ash placement summaries for data prior to April 2003

N.B.: Post-dry ash placement Stage 1 and initial Stage 2 Raw data and summary statistics are included in previous reports:

- Stage 1 data from May 2003 to July 2007 in Connell Wagner (2008)
- Initial Stage 2 data from August/October 2007 to April 2010 in Aurecon (2010)
- Stage 2A Water quality assessment from April 2010 to January 2012 in Aurecon (2012)
- Water quality data of Sawyers Swamp Creek data from February 2010 to March 2013 and Ongoing Stage 2 water quality assessment from February 2012 to March 2013 in Aurecon (2014)

1. Water Quality Data and Summary for Sawyers Swamp Creek WX7 and Background at Dump Creek WX11

a) Sawyers Swamp Creek at Wolgan Road Bridge, WX7 (mg/L)

Sawyers Swamp Creek WX7 Pre-Dry Ash Placement Summary 1991 to April 2003 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0010	0.3	22.0	0.0010	0.9	0.04	20	0.0010	19	440	0.001	0.004	0.6	0.29	0.00010	12	15
Maximum	<0.01	0.6	84.0	<0.05	2.9	0.05	57	<0.002	82	1478	<0.01	0.009	3.1	0.93	0.00020	36	39
Minimum	0.0010	0.1	5.0	0.0010	0.2	0.03	4	0.0010	6	30	0.001	0.001	0.1	0.05	0.00010	1	4
90th percentile	0.0010	0.5	33.0	0.0010	2.3	0.04	38	0.0010	27	760	0.001	0.007	1.1	0.51	0.00020	27	22

Continued……..Sawyers Swamp Creek WX7 Pre-Dry Ash Placement Data 1991 to April 2003 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.6		40		0.002	7.0	0.002	160	308	0.10
Maximum	1.5		120		<0.01	9.3	<0.006	540	800	0.34
Minimum	0.2		11		0.001	6.1	0.001	38	20	0.00
90th percentile	0.8		86		0.003	7.6	0.003	323	584	0.15

Sawyers Swamp Creek WX7 Post-Stage 2 Dry Ash Placement April 2013 to March 2014 (mg/L)																	
Date	Ag	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
10/04/2013	0.001	0.15	510	0.012	0.1	0.019	6	0.0001	5	1000	0.001	0.001	1.40	0.03	0.00003	12	3.0
17/05/2013	0.001	0.24	510	0.014	0.08	0.020	6	0.0001	5	1000	0.001	0.029	1.30	0.06	0.00003	11	2.9
13/06/2013	0.001	0.22	550	0.017	0.09	0.019	7	0.0001	6	1000	0.001	0.003	1.20	0.08	0.00003	10	3.0
11/07/2013	0.001	0.08	560	0.014	0.11	0.018	6	0.0001	5	1100	0.001	0.001	1.20	0.05	0.00003	12	4.0
23/08/2013	0.001	0.20	600	0.013	0.09	0.022	5	0.0001	5	1100	0.001	0.001	0.05	0.06	0.00003	11	3.0
26/09/2013	0.001	0.33	550	0.016	0.08	0.027	6	0.0001	5	1100	0.002	0.001	0.10	0.35	0.00003	11	4.0
23/10/2013	0.001	0.12	590	0.018	0.11	0.021	5	0.0001	6	1200	0.002	0.001	1.20	0.02	0.00003	11	3.0
6/11/2013	0.001	0.12	580	0.025	0.1	0.022	5	0.0001	5	1200	0.002	0.001	1.10	0.01	0.00003	11	3.0
5/12/2013	0.001	0.14	540	0.024	0.11	0.022	5	0.0001	5	1200	0.002	0.001	1.50	0.04	0.00003	10	3.0
15/01/2014	0.001	0.17	560	0.024	0.1	0.026	5	0.0001	5	1200	0.002	0.001	1.20	0.01	0.00003	11	3.0
5/02/2014	0.001	0.13	560	0.025	0.09	0.025	5	0.0001	5	1200	0.002	0.001	1.10	0.02	0.00003	10	3.0
5/03/2014	0.001	0.20	530	0.025	0.1	0.027	5	0.0001	5	1100	0.002	0.001	1.00	0.03	0.00003	12	3.0

Continued…….Sawyers Swamp Creek WX7 Post-Stage 2 Dry Ash Placement April 2013 to March 2014 (mg/L)										
Date	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	Zn
10/04/2013	0.02	0.033	230	0.005	0.001	8.6	0.001	28	550	0.009
17/05/2013	0.01	0.034	230	0.005	0.003	8.5	0.001	27	640	0.008
13/06/2013	0.00	0.034	240	0.005	0.001	8.6	0.001	32	680	0.011
11/07/2013	0.01	0.034	260	0.004	0.001	8.7	0.001	30	650	0.007
23/08/2013	0.01	0.034	260	0.004	0.001	8.7	0.001	27	670	0.007
26/09/2013	0.08	0.035	250	0.005	0.001	8.6	0.001	38	740	0.025
23/10/2013	0.00	0.037	270	0.005	0.001	8.7	0.001	40	800	0.007
6/11/2013	0.00	0.037	260	0.005	0.001	8.7	0.001	37	710	0.009
5/12/2013	0.01	0.036	250	0.007	0.001	8.7	0.001	45	680	0.006
15/01/2014	0.01	0.040	260	0.007	0.001	8.7	0.001	39	660	0.003
5/02/2014	0.01	0.045	230	0.008	0.001	8.7	0.001	41	660	0.007
5/03/2014	0.00	0.042	250	0.008	0.001	8.7	0.001	42	700	0.008

Sawyers Swamp Creek WX7 Post-Stage 2 Dry Ash Placement April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	0.18	553	0.019	0.10	0.022	5	0.0001	5	1117	0.001	0.003	1.03	0.06	0.00003	11	3.2
Maximum	0.001	0.33	600	0.025	0.11	0.027	7	0.0001	6	1200	0.002	0.029	1.50	0.35	0.00003	12	4.0
Minimum	0.001	0.08	510	0.012	0.08	0.018	5	0.0001	5	1000	0.001	0.001	0.05	<0.01	0.00003	10	2.9
50th percentile	0.001	0.16	555	0.018	0.10	0.022	5	0.0001	5	1100	0.002	0.001	1.20	0.04	0.00003	11	3.0

Continued…….Sawyers Swamp Creek WX7 Post-Stage 2 Dry Ash Placement April 2013 to March 2014 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.01	0.037	249	0.006	0.001	8.7	0.001	36	678	0.009
Maximum	0.08	0.045	270	0.008	0.003	8.7	0.001	45	800	0.025
Minimum	0.00	0.033	230	0.004	0.001	8.5	0.001	27	550	0.003
50th percentile	0.01	0.036	250	0.005	0.001	8.7	0.001	38	675	0.008

b) Background at Dump Creek, WX 11 (mg/L)

Dump Creek WX11 Pre-Dry Ash Placement Summary 1991 to April 2003 (mg/L)																	
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0010	0.1	7.0	0.0010	0.6	0.03	32	0.0010	23	567	0.001	0.002	0.5	1.36	0.00020	23	24
Maximum	0.0010	0.4	16.0	0.0010	3.3	0.05	71	0.0010	83	1371	0.001	0.002	1.2	11.00	0.00020	36	42
Minimum	0.0010	0.0	0.0	0.0010	0.0	0.02	18	0.0010	8	320	0.001	0.001	0.2	0.03	0.00020	14	14
90th percentile	0.0010	0.3	15.0	0.0010	1.5	0.05	58	0.0010	39	770	0.001	0.002	1.1	2.38	0.00020	31	35

Continued........Dump Creek WX11 Pre-Dry Ash Placement Summary 1991 to April 2003 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.6		76		0.001	6.6	0.002	209	559	0.09
Maximum	2.2		156		0.001	8.0	0.003	593	984	0.32
Minimum	0.1		39		0.001	3.6	0.001	88	362	0.00
90th percentile	1.9		110		0.001	8.0	0.003	325	772	0.28

Dump Creek WX11 Post-Dry Ash Placement Data (mg/L) April 2013 to March 2014																	
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
10/04/2013	0.0005	3.0	12.5	0.0005	3.2	0.02	78	0.0005	24	1800	0.001	0.006	2.3	9.60	0.00003	33	76
17/05/2013	0.0005	3.7	12.5	0.0005	1.8	0.02	59	0.0008	25	1500	0.001	0.007	1.8	5.40	0.00003	25	61
13/06/2013	0.0005	2.4	12.5	0.0005	1.2	0.01	39	0.0008	18	1000	0.001	0.004	1.0	3.30	0.00003	15	39
11/07/2013	0.0005	3.2	12.5	0.0005	2.8	0.02	69	0.0008	24	1500	0.001	0.004	1.9	9.20	0.00003	28	69
23/08/2013	0.0005	3.6	12.5	0.0005	2.2	0.02	64	0.0007	26	1400	0.002	0.005	1.5	5.70	0.00003	23	67
26/09/2013	0.0005	3.2	12.5	0.0005	2.0	0.02	59	0.0007	27	1400	0.002	0.013	1.5	8.70	0.00003	22	60
23/10/2013	0.0005	4.0	12.5	0.0005	2.7	0.03	70	0.0008	28	1700	0.002	0.009	2.1	8.70	0.00003	27	71
6/11/2013	0.0005	4.1	12.5	0.0010	3.0	0.02	81	0.0009	27	1800	0.003	0.014	2.4	11.00	0.00003	33	80
5/12/2013	0.0005	4.1	12.5	0.0005	3.3	0.02	86	0.0009	26	1900	0.003	0.006	2.9	11.00	0.00003	35	84
15/01/2014	0.0005	3.6	12.5	0.0005	3.6	0.03	89	0.0007	25	2000	0.002	0.016	2.5	13.00	0.00003	39	86
5/02/2014	0.0005	3.4	12.5	0.0005	3.6	0.03	93	0.0006	24	2000	0.002	0.008	2.4	13.00	0.00003	39	88
5/03/2014	0.0005	3.6	12.5	0.0005	3.4	0.03	91	0.0009	24	2000	0.002	0.007	2.1	13.00	0.00003	36	82

Continued…….Dump Creek WX11 Post-Dry Ash Placement Data (mg/L) April 2013 to March 2014										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
10/04/2013	7.7	0.01	120	0.50	0.005	3.1	0.001	868	1200	1.60
17/05/2013	5.3	0.01	90	0.42	0.005	3.2	0.001	640	960	1.10
13/06/2013	3.8	<0.01	58	0.29	0.003	3.3	0.001	420	590	1.00
11/07/2013	6.2	<0.01	110	0.47	0.004	3.3	0.001	720	1100	1.20
23/08/2013	5.4	<0.01	98	0.36	0.005	3.2	0.001	660	970	1.10
26/09/2013	5.1	<0.01	93	0.41	0.005	3.3	0.001	660	1000	1.20
23/10/2013	5.8	<0.01	110	0.47	0.009	3.1	0.001	810	1200	1.40
6/11/2013	7.2	<0.01	130	0.62	0.009	3.2	0.001	950	1300	1.70
5/12/2013	8.2	<0.01	130	0.65	0.007	3.1	0.001	980	1200	1.50
15/01/2014	8.4	<0.01	130	0.67	0.008	3.1	0.001	1000	1400	1.60
5/02/2014	8.5	<0.01	120	0.67	0.006	3.0	0.001	1000	1400	1.80
5/03/2014	8.8	<0.01	120	0.66	0.006	3.1	0.001	980	1500	1.60

Dump Creek WX11 Post-Dry Ash Placement Data (mg/L) April 2013 to March 2014																	
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	3.5	12.5	0.0005	2.7	0.02	73	0.0008	25	1667	0.002	0.008	2.0	9.30	0.00003	30	72
Maximum	<0.001	4.1	12.5	0.0010	3.6	0.03	93	0.0009	28	2000	0.003	0.016	2.9	13.00	0.00003	39	88
Minimum	<0.001	2.4	12.5	0.0005	1.2	0.01	39	0.0005	18	1000	0.001	0.004	1.0	3.30	0.00003	15	39
50th percentile	<0.001	3.6	12.5	0.0005	2.9	0.02	74	0.0008	25	1750	0.002	0.007	2.1	9.40	0.00003	31	74

Continued…….Dump Creek WX11 Post-Dry Ash Placement Data (mg/L) April 2013 to March 2014										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	6.7	<0.01	109	0.52	0.006	3.2	0.001	807	1152	1.40
Maximum	8.8	0.01	130	0.67	0.009	3.3	0.001	1000	1500	1.80
Minimum	3.8	<0.01	58	0.29	0.003	3.0	0.001	420	590	1.00
50th percentile	6.7	0.01	115	0.49	0.006	3.2	0.001	839	1200	1.45

2. Water Quality Data and Summary for Lidsdale Cut WX5

Lidsdale Cut WX5 Pre-Dry Ash Placement Summary 1991 to April 2003 (mg/L)																
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0010	2.4	14.0	0.0010	1.7	0.04	28	0.0010	26	750	0.003	0.003	1.5	0.51	0.00020	39	17
Maximum	0.0010	3.2	50.0	0.0010	2.2	0.06	32	0.0010	78	1134	0.010	0.005	2.2	1.00	0.00020	53	21
Minimum	0.0010	0.7	1.0	0.0010	0.5	0.03	24	0.0010	15	378	0.001	0.002	1.0	0.07	0.00020	16	8
90th percentile	0.0010	3.1	38.0	0.0010	2.2	0.05	31	0.0010	34	952	0.006	0.005	2.0	0.70	0.00020	51	20

Continued........Lidsdale Cut WX5 Pre-Dry Ash Placement Summary 1991 to April 2003 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	1.4		62		0.003	4.7	0.001	266	518	0.22
Maximum	2.3		84		0.004	6.9	0.001	400	671	0.40
Minimum	0.2		31		0.002	3.2	0.001	92	400	0.07
90th percentile	2.1		77		0.004	6.9	0.001	359	650	0.30

Lidsdale Cut Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																	
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
10/04/2013																	
16/05/2013																	
13/06/2013																	
10/07/2013																	
22/08/2013																	
26/09/2013						1.040											
24/10/2013	<0.001	220	13	0.031	19	0.025	340	0.0840	32	4900	0.036	0.050	38.0	6.7	0.00003	270	120
7/11/2013	<0.001	220	13		17	0.018	340	0.0650	34	4900	0.030	0.050	37.0	5.9	0.00003	290	120
5/12/2013	<0.001	180	13	0.026	14	0.048	280	0.0440	31	4200	0.023	0.040	36.0	5.2	0.00010	230	91
16/01/2014	<0.001	120	13	0.015	12	0.032	220	0.0360	27	3700	0.010	0.017	24.0	2.0	0.00003	200	72
6/02/2014	<0.001	140	13	0.017	13	0.026	260	0.0340	32	4000	0.012	0.017	28.0	2.7	0.00003	220	85
6/03/2014	<0.001	52	13	0.009	4.90	0.075	97	0.0170	16	1800	0.006	0.013	9.0	1.8	0.00003	73	28

Continued……..Lidsdale Cut Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
10/04/2013										
16/05/2013										
13/06/2013										
10/07/2013										
22/08/2013										
26/09/2013										
24/10/2013	17	<0.01	330	1.60	0.033	3.3	0.086	3700	5300	3.90
7/11/2013	18	<0.01	350	1.60	0.024	3.3	0.068	3900	5800	4.30
5/12/2013	14	<0.01	270	1.20	0.014	3.3	0.063	3300	4200	3.20
16/01/2014	11	<0.01	320	0.87	0.008	3.5	0.046	2500	3500	2.30
6/02/2014	12	<0.01	320	0.84	0.008	3.4	0.062	3000	4200	2.50
6/03/2014	5	<0.01	87	0.35	0.004	3.5	0.024	1000	1500	0.81

Lidsdale Cut Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	155.33	13	0.020	13.32	0.181	256	0.0467	29	3917	0.020	0.031	28.7	4.1	0.00004	214	86
Maximum	<0.001	220	13	0.031	19.0	1.040	340	0.0840	34	4900	0.036	0.050	38.0	6.7	0.00010	290	120
Minimum	<0.001	52.00	13	0.009	4.90	0.018	97	0.0170	16	1800	<0.001	0.013	9.0	1.8	0.00003	73	28
50th percentile	<0.001	160	13	0.017	13.50	0.032	270	0.0400	32	4100	0.018	0.029	32.0	4.0	0.00003	225	88

Continued……..Lidsdale Cut Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	13	<0.01	280	1.08	0.015	3.4	0.058	2900	4083	2.84
Maximum	18	<0.01	350	1.60	0.033	3.5	0.086	3900	5800	4.30
Minimum	5	<0.01	87	0.35	0.004	3.3	0.024	1000	1500	0.81
50th percentile	13	<0.01	320	1.04	0.011	3.4	0.063	3150	4200	2.85

3. Water Quality Data and Summary for Sawyers Swamp Creek at WX1 – upstream of SSCAD and Springvale Mine Water Discharge, EANSW site 92

Sawyers Swamp Creek Upstream of SSCAD WX1 (EANSW Site 92) Pre-Dry Ash Placement Summary June 2012 to March 2013 (mg/L)																	
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	0.9	26	0.001	0.0	0.026	3	0.0001	10	144	0.002	0.003	0.1	0.95	<0.00005	2.7	1
Maximum	<0.001	5.1	46	0.002	0.1	0.079	6	0.0001	12	190	0.005	0.009	0.1	3.90	<0.00005	6.0	2
Minimum	<0.001	0.2	13	0.001	0.0	0.011	1	0.0001	8	120	0.001	0.001	0.1	0.09	0.00006	1.8	1
50th percentile	<0.001	0.7	28	0.001	0.0	0.014	3	0.0001	10	140	0.002	0.002	0.1	0.72	<0.00005	2.0	1

Continued………Sawyers Swamp Creek Upstream of SSCAD WX1 (EANSW Site 92) Pre-Dry Ash Placement Summary June 2012 to March 2013 (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.166	0.0033	26.1	0.004	0.001	6.5	0.001	23	95	0.03
Maximum	1.000	0.0050	30.0	0.007	0.007	7.0	0.001	52	120	0.05
Minimum	0.002	0.0005	20.0	0.001	0.001	6.3	0.001	13	69	0.01
50th percentile	0.065	0.0050	26.0	0.005	0.001	6.5	0.001	22	97	0.03

Sawyers Swamp Creek Upstream of SSCAD WX1 (EANSW Site 92) Post-Dry Ash Placement Data April 2013 to December 2013 (mg/L)																
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
10/04/2013	0.0005	0.74	12.5	0.0005	0.025	0.014	1.2	0.0001	9	140	0.0005	0.009	0.05	0.81	<0.00005	1.8	0.58
16/05/2013	0.0005	0.45	12.5	0.0005	0.025	0.014	1.2	0.0001	10	140	0.0005	0.009	0.05	0.51	<0.00005	2	0.61
13/06/2013	0.0005	0.96	12.5	0.0005	0.04	0.013	1.2	0.0001	10	130	0.0005	0.004	0.05	0.35	<0.00005	2	0.5
10/07/2013	0.0005	0.57	12.5	0.0005	0.03	0.011	0.96	0.0001	10	130	0.0005	0.001	0.05	0.91	<0.00005	2	0.5
22/08/2013	0.0005	0.79	29	0.0005	0.025	0.013	1.7	0.0001	10	140	0.002	0.0005	0.1	0.26	<0.00005	2	0.5
26/09/2013	0.0005	0.75	28	0.0005	0.025	0.011	1.8	0.0001	10	140	0.002	0.002	0.1	0.91	<0.00005	2	0.5
24/10/2013	0.0005	1.3	38	0.001	0.025	0.033	3	0.0001	12	160	0.003	0.003	0.1	1.6	<0.00005	3	1
5/12/2013	0.0005	5.1	12.5	0.002	0.07	0.07	4.5	0.0001	12	170	0.005	0.009	0.1	0.79	<0.00005	4	2

Continued……..Sawyers Swamp Creek Upstream of SSCAD WX1 (EANSW Site 92) Post-Dry Ash Placement Data April 2013 to December 2013 (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
10/04/2013	0.07	0.005	27	0.005	0.002	6.3	0.001	24	69	0.025
16/05/2013	0.067	0.0005	26	0.005	0.001	6.3	0.001	24	84	0.024
13/06/2013	0.016	0.0005	25	0.001	0.001	6.3	0.001	23	97	0.03
10/07/2013	0.054	0.0005	26	0.001	<0.001	6.3	0.001	24	74	0.022
22/08/2013	0.064	0.0005	28	0.002	0.0005	6.5	0.001	23	93	0.019
26/09/2013	0.059	0.0005	26	0.002	0.0005	6.8	0.001	22	100	0.016
24/10/2013	0.15	0.0005	29	0.003	0.003	6.8	0.001	18	100	0.022
5/12/2013	0.16	0.0005	27	0.007	0.007	6.4	0.001	36	120	0.052

Sawyers Swamp Creek Upstream of SSCAD WX1 (EANSW Site 92) Post-Dry Ash Placement Data April 2013 to December 2013 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	1.3	19.7	0.0008	0.0	0.02	2	0.0001	10	144	0.002	0.005	0.1	0.77	<0.00005	2	1
Maximum	<0.001	5.1	38.0	0.0020	0.1	0.07	5	0.0001	12	170	0.005	0.009	0.1	1.60	<0.00005	4	2
Minimum	<0.001	0.5	12.5	0.0005	0.0	0.01	1	0.0001	9	130	0.001	0.001	0.1	0.26	<0.00005	2	1
50th percentile	<0.001	0.8	12.5	0.0005	0.0	0.01	1	0.0001	10	140	0.001	0.004	0.1	0.80	<0.00005	2	1

Continued........Sawyers Swamp Creek Upstream of SSCAD WX1 (EANSW Site 92) Post-Dry Ash Placement Data April 2013 to December 2013 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.1	0.0011	27	0.00	0.002	6.5	0.001	24	92	0.03
Maximum	0.2	0.0050	29	0.01	0.007	6.8	0.001	36	120	0.05
Minimum	0.0	0.0005	25	0.00	0.001	6.3	0.001	18	69	0.02
50th percentile	0.1	0.0005	27	0.00	0.001	6.4	0.001	24	95	0.02

4. Water Quality Data and Summary for SSCAD Groundwater Seepage Detection Bores WGM1/D3 and WGM1/D4

a) WGM1/D3

WGM1/D3 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)																	
	Ag*	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
Average	0.0010		115.0	0.010	0.0500	0.29	19	0.0010	64	623	0.009	0.005	0.190	4.90	0.00040	8	20
Maximum	0.0010		229.0	0.043	0.2200	5.70	31	0.0010	140	773	0.026	0.040	0.730	21.00	0.00090	38	28
Minimum	0.0010		8.0	0.001	0.0050	0.08	6	0.0010	25	342	0.001	0.001	0.040	0.50	0.00010	1	2
90th percentile	0.0010		154.0	0.027	0.1900	0.15	24	0.0010	77	720	0.020	0.010	0.330	9.40	0.00070	9	25

Continued……..WGM1/D3 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)												
	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
Average	0.6		69	0.08	0.008	6.0	0.001	94	349	10.0	920.2	0.06
Maximum	1.9		109	0.09	0.074	6.9	0.003	144	660	11.1	921.5	0.20
Minimum	0.1		31	0.07	0.001	4.6	0.001	20	125	8.7	919.1	0.01
90th percentile	0.7		85	0.09	0.014	6.4	0.002	116	470	10.9	921.3	0.11

WGM1/D3 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
Date	Ag*	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
10/04/2013	0.0005	0.09	90	0.004	0.025	0.08	14	0.0001	75	560	0.0005	0.011	11	0.05	0.000025	6.2	17
17/05/2013	0.0005	0.07	58	0.003	0.025	0.064	12	0.0001	78	520	0.0005	0.012	0.005	0.05	0.000025	6	16
13/06/2013	0.0005	0.1	55	0.002	0.07	0.069	13	0.0001	55	460	0.003	0.005	0.34	0.05	0.000025	5	18
10/07/2013	0.0005	0.08	64	0.003	0.07	0.076	15	0.0003	54	480	0.001	0.007	1.9	0.05	0.000025	6	20
22/08/2013	0.0005	0.09	100	0.003	0.025	0.078	18	0.0001	75	580	0.002	0.002	5	0.05	0.0009	6	24
26/09/2013	0.0005	0.51	100	0.004	0.025	0.084	16	0.0001	73	570	0.002	0.003	11	0.1	0.000025	6	21
24/10/2013	0.0005	0.06	100	0.006	0.025	0.09	19	0.0001	85	660	0.004	0.003	0.74	0.1	0.000025	8	25
7/11/2013	0.0005	0.04	87	0.002	0.025	0.086	18	0.0001	89	660	0.003	0.002	0.02	0.1	0.000025	7	23
5/12/2013	0.0005	0.12	84	0.004	0.025	0.097	21	0.0001	97	710	0.003	0.003	0.08	0.1	0.000025	7	27
16/01/2014	0.0005	0.07	90	0.004	0.025	0.094	20	0.0001	85	680	0.002	0.011	0.51	0.1	0.000025	7	26
6/02/2014	0.0005	0.14	95	0.003	0.025	0.099	20	0.0001	85	680	0.002	0.006	1.5	0.1	0.000025	7	26
6/03/2014	0.0005	0.08	59	0.001	0.025	0.093	18	0.0001	80	660	0.002	0.002	0.03	0.1	0.000025	7	23

Continued……..WGM1/D3 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
Date	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
10/04/2013	0.92	0.005	56	0.099	0.0005	6.1	0.001	69	350	9.5	920.7	0.038
17/05/2013	0.42	0.005	61	0.05	0.004	5.8	0.001	66	300	9.6	920.6	0.13
13/06/2013	0.55	0.0005	52	0.087	0.001	5.7	0.001	71	280	9.3	920.9	0.096
10/07/2013	0.57	0.001	56	0.098	0.001	5.8	0.001	83	260	9.4	920.8	0.17
22/08/2013	0.66	0.0005	66	0.097	0.0005	6	0.001	74	340	9.7	920.5	0.049
26/09/2013	0.62	0.0005	66	0.099	0.003	6	0.001	75	380	9.8	920.4	0.044
24/10/2013	0.58	0.003	81	0.1	0.0005	5.9	0.001	90	400	10.4	919.8	0.041
7/11/2013	0.61	0.0005	75	0.098	0.0005	6	0.001	98	380	10.6	919.6	0.039
5/12/2013	0.79	0.0005	79	0.11	0.0005	6.1	0.001	130	380	9.5	920.7	0.051
16/01/2014	0.67	0.0005	78	0.13	0.005	6	0.001	120	360	9.9	920.3	0.055
6/02/2014	0.63	0.0005	75	0.12	0.004	5.9	0.001	110	370	9.9	920.3	0.042
6/03/2014	0.93	0.0005	65	0.1	0.001	5.7	0.001	130	400	8.9	921.3	0.069

WGM1/D3 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0005	0.1	89.4	0.0034	0.03	0.09	19	0.0001	84	650	0.003	0.004	2.4	0.09	0.00013	7	24
Maximum	0.0005	0.5	100.0	0.0060	0.03	0.10	21	0.0001	97	710	0.004	0.011	11.0	0.10	0.00090	8	27
Minimum	0.0005	0.0	59.0	0.0010	0.03	0.08	16	0.0001	73	570	0.002	0.002	0.0	0.05	0.00003	6	21
50th percentile	0.0005	0.1	92.5	0.0035	0.03	0.09	19	0.0001	85	660	0.002	0.003	0.6	0.10	0.00003	7	25

Continued……..WGM1/D3 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.7	<0.01	73	0.11	0.002	6.0	0.001	103	376	9.84	920.36	0.05
Maximum	0.9	<0.01	81	0.13	0.005	6.1	0.001	130	400	10.60	921.30	0.07
Minimum	0.6	<0.01	65	0.10	0.001	5.7	0.001	74	340	8.90	919.60	0.04
50th percentile	0.6	<0.01	75	0.10	0.001	6.0	0.001	104	380	9.85	920.35	0.05

b) WGM1/D4

WGM1/D4 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)																
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0010		96.0	0.003	0.2700	0.37	30	0.0020	30	584	0.005	0.012	0.150	54.60	0.00090	6	19
Maximum	0.0010		282.0	0.012	0.6100	6.70	58	0.0040	86	990	0.019	0.100	0.720	120.00	0.00330	46	47
Minimum	0.0010		20.6	0.001	0.0700	0.05	16	0.0010	6	161	0.001	0.001	0.001	0.10	0.00020	0	2
90th percentile	0.0010		168.0	0.006	0.4900	0.33	44	0.0030	45	728	0.012	0.036	0.240	86.00	0.00200	7	27

Continued……..WGM4/D1 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	4.6		29	0.02	0.006	6.3	0.009	118	327	1.3	905.8	0.04
Maximum	12.0		82	0.02	0.022	7.3	0.100	350	768	1.5	906.3	0.10
Minimum	0.1		4	0.01	0.001	5.2	0.001	11	96	0.8	905.3	0.00
90th percentile	6.5		42	0.02	0.011	6.8	0.002	201	510	1.4	906.0	0.06

WGM1/D4 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
Date	Ag*	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
10/04/2013	0.0005	0.01	35	0.002	1.9	0.023	85	0.0001	32	1600	0.0005	0.004	49	0.05	0.000025	10	75
16/05/2013	0.0005	0.005	38	0.003	1.7	0.023	110	0.0001	33	1500	0.0005	0.026	33	0.05	0.000025	10	79
13/06/2013	0.0005	0.025	50	0.003	1.8	0.009	110	0.0001	33	1500	0.0005	0.0005	22	0.05	0.000025	10	77
10/07/2013	0.0005	0.025	12.5	0.003	1.8	0.022	110	0.0001	33	1400	0.0005	0.002	38	0.05	0.000025	9	75
22/08/2013	0.0005	0.04	40	0.003	1.8	0.023	110	0.0001	33	1500	0.001	0.0005	28	0.05	0.000025	9	78
26/09/2013	0.0005	0.03	30	0.005	1.8	0.021	110	0.0001	33	1500	0.002	0.001	79	0.1	0.000025	9	76
24/10/2013	0.0005	0.005	60	0.004	2	0.02	110	0.0001	34	1600	0.002	0.0005	27	0.1	0.000025	10	81
7/11/2013	0.0005	0.005	38	0.002	1.8	0.02	110	0.0001	33	1500	0.002	0.0005	21	0.1	0.000025	9	77
5/12/2013	0.0005	0.04	32	0.003	1.8	0.018	100	0.0001	34	1600	0.003	0.003	16	0.1	0.000025	9	74
16/01/2014	0.0005	0.01	33	0.003	1.8	0.019	100	0.0001	32	1600	0.002	0.002	15	0.1	0.000025	10	72
6/02/2014	0.0005	0.005	35	0.003	1.7	0.02	96	0.0001	32	1500	0.001	0.0005	16	0.1	0.000025	9	68
6/03/2014	0.0005	0.005	40	0.003	1.9	0.021	95	0.0001	32	1400	0.001	0.001	17	0.1	0.000025	9	66

Continued……..WGM1/D4 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
Date	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
10/04/2013	19	0.005	130	0.035	0.0005	6	0.001	846	1300	1	906.12	0.05
16/05/2013	19	0.005	130	0.03	0.002	5.8	0.001	820	1200	1	906.12	0.066
13/06/2013	18	0.0005	130	0.037	0.0005	5.9	0.001	830	1200	0.9	906.22	0.064
10/07/2013	17	0.0005	120	0.034	0.001	5.5	0.001	790	1200	1	906.12	0.053
22/08/2013	18	0.0005	130	0.03	0.0005	5.7	0.001	820	1200	1	906.12	0.044
26/09/2013	18	0.0005	130	0.033	0.0005	5.7	0.001	830	1300	1	906.12	0.053
24/10/2013	18	0.0005	140	0.035	0.0005	6	0.001	910	1300	1	906.12	0.059
7/11/2013	18	0.0005	130	0.033	0.0005	5.8	0.001	830	1300	1	906.12	0.055
5/12/2013	18	0.0005	130	0.032	0.0005	5.9	0.001	880	1200	1	906.12	0.06
16/01/2014	17	0.0005	130	0.036	0.0005	5.8	0.001	820	1200	1	906.12	0.064
6/02/2014	16	0.0005	120	0.035	0.0005	5.8	0.001	800	1200	1	906.12	0.05
6/03/2014	17	0.0005	120	0.033	0.0005	5.9	0.001	780	1300	0.9	906.22	0.049

WGM1/D4 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0005	0.0	38.5	0.0033	1.83	0.02	104	0.0001	33	1525	0.002	0.001	27.4	0.09	0.00003	9	74
Maximum	0.0005	0.0	60.0	0.0050	2.00	0.02	110	0.0001	34	1600	0.003	0.003	79.0	0.10	0.00003	10	81
Minimum	0.0005	0.0	30.0	0.0020	1.70	0.02	95	0.0001	32	1400	0.001	0.001	15.0	0.05	0.00003	9	66
50th percentile	0.0005	0.0	36.5	0.0030	1.80	0.02	105	0.0001	33	1500	0.002	0.001	19.0	0.10	0.00003	9	75

Continued........WGM1/D4 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	17.5	<0.01	129	0.03	0.001	5.8	0.001	834	1250	0.99	906.13	0.05
Maximum	18.0	<0.01	140	0.04	0.001	6.0	0.001	910	1300	1.00	906.22	0.06
Minimum	16.0	<0.01	120	0.03	0.001	5.7	0.001	780	1200	0.90	906.12	0.04
50th percentile	18.0	<0.01	130	0.03	0.001	5.8	0.001	825	1250	1.00	906.12	0.05

5. Water Quality Data and Summary for KVAD/R Groundwater Seepage Detection Bores WGM1/D5 and WGM1/D6

a) WGM1/D5

WGM1/D5 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)																
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0010		18.0	0.004	1.2900	0.17	12	0.0020	20	701	0.017	0.019	0.410	6.90	0.00030	16	20
Maximum	0.0010		90.0	0.013	2.0000	1.70	23	0.0050	90	1050	0.055	0.080	1.020	17.00	0.00070	23	34
Minimum	0.0010		1.0	0.001	0.0800	0.01	5	0.0010	8	283	0.003	0.001	0.100	0.10	0.00020	7	8
90th percentile	0.0010		51.0	0.008	1.7000	0.15	20	0.0040	24	810	0.041	0.058	0.650	14.70	0.00060	19	26

Continued……..WGM1/D5 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	1.6		61	0.13	0.010	3.8	0.001	259	470	4.8	899.6	0.34
Maximum	4.0		127	0.14	0.050	5.4	0.002	380	1913	8.8	902.0	2.63
Minimum	0.5		7	0.11	0.002	2.8	0.001	92	48	2.3	895.4	0.03
90th percentile	2.5		70	0.14	0.021	4.5	0.002	328	550	8.3	901.7	0.51

WGM1/D5 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																	
Date	**Ag***	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
10/04/2013																	
17/05/2013																	
13/06/2013	0.0005	4	12.5	0.0005	0.2	0.02	17	0.0006	5	340	0.004	0.009	0.4	0.09	<0.00005	7	10
10/07/2013	0.0005	6.6	12.5	0.0005	0.7	0.027	24	0.0007	11	520	0.003	0.003	0.5	0.55	<0.00005	10	21
22/08/2013																	
26/09/2013																	
24/10/2013																	
7/11/2013	0.0005	27	130	0.007	1.4	0.086	33	0.013	36	840	0.01	0.044	0.1	2.9	0.00018	20	39
5/12/2013																	
16/01/2014																	
6/02/2014																	
6/03/2014	0.0005	3.9	12.5	0.0005	0.27	0.025	16	0.0007	6	400	0.002	0.006	0.4	0.12	<0.00005	7	10

Continued……..WGM1/D5 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
10/04/2013												
17/05/2013												
13/06/2013	1.7	<0.001	9	0.097	0.003	3.7	<0.002	130	200	3.7	900.49	0.25
10/07/2013	2.9	<0.001	24	0.18	0.003	3.8	<0.002	220	350	7.7	896.49	0.35
22/08/2013										8.2	895.99	
26/09/2013										8	896.19	
24/10/2013										8.3	895.89	
7/11/2013	4.8	0.003	59	0.3	0.042	6.1	<0.02	280	540	8.4	895.79	2.2
5/12/2013										8.3	895.89	
16/01/2014										8.4	895.79	
6/02/2014										8.4	895.79	
6/03/2014	1.6	<0.001	10	0.1	0.003	3.7	<0.002	140	240	4	900.19	0.23

WGM1/D5 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
	Ag*	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
Average	<0.001	15.5	71.3	0.0038	0.84	0.06	25	0.0069	21	620	0.006	0.025	0.3	1.51	<0.00005	14	25
Maximum	<0.001	27.0	130.0	0.0070	1.40	0.09	33	0.0130	36	840	0.010	0.044	0.4	2.90	0.00018	20	39
Minimum	<0.001	3.9	12.5	0.0005	0.27	0.03	16	0.0007	6	400	0.002	0.006	0.1	0.12	<0.00005	7	10
50th percentile	<0.001	15.5	71.3	0.0038	0.84	0.06	25	0.0069	21	620	0.006	0.025	0.3	1.51	<0.00005	14	25

Continued........WGM1/D5 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
Average	3.2	<0.01	35	0.20	0.023	4.9	<0.002	210	390	7.75	896.44	1.22
Maximum	4.8	<0.01	59	0.30	0.042	6.1	<0.02	280	540	8.40	900.19	2.20
Minimum	1.6	<0.01	10	0.10	0.003	3.7	<0.002	140	240	4.00	895.79	0.23
50th percentile	3.2	<0.01	35	0.20	0.023	4.9	<0.002	210	390	8.30	895.89	1.22

b) *WGM1/D6*

WGM1/D6 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)																
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0010		27.0	0.003	0.0780	0.18	22	0.0020	53	948	0.011	0.016	0.140	93.30	0.00040	7	25
Maximum	0.0010		390.0	0.015	1.1000	1.90	33	0.0090	160	1430	0.032	0.260	0.650	174.20	0.00090	48	34
Minimum	0.0010		0.0	0.001	0.2700	0.02	14	0.0010	23	601	0.001	0.001	0.001	0.01	0.00010	4	17
90th percentile	0.0010		39.0	0.005	0.9800	0.21	27	0.0030	65	1100	0.020	0.021	0.280	123.00	0.00070	9	30

Continued…….WGM1/D6 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	4.0		45	0.12	0.007	4.5	0.016	340	603	10.8	896.2	0.11
Maximum	5.4		90	0.21	0.023	5.8	0.100	536	902	11.4	896.9	0.57
Minimum	1.4		26	0.02	0.001	1.4	0.001	190	320	10.1	895.6	0.00
90th percentile	4.8		55	0.19	0.043	5.5	0.043	381	736	11.2	896.6	0.23

WGM1/D6 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
Date	**Ag***	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
10/04/2013	0.0005	1.1	12.5	0.002	0.4	0.017	9.3	0.0001	53	810	0.001	0.009	3.9	0.3	0.000025	5.6	34
17/05/2013	0.0005	1.5	12.5	0.005	0.32	0.02	13	0.0014	60	950	0.002	0.01	37	0.05	0.000025	6	37
13/06/2013	0.0005	4.1	12.5	0.002	0.45	0.019	8.7	0.0006	32	1000	0.004	0.005	1.5	0.6	0.000025	6	59
10/07/2013	0.0005	4.8	12.5	0.002	0.51	0.022	5.2	0.0005	26	930	0.002	0.006	0.76	0.6	0.000025	6	65
22/08/2013	0.0005	3.6	12.5	0.002	0.41	0.017	6.3	0.0001	26	880	0.002	0.001	0.74	0.5	0.000025	6	59
26/09/2013	0.0005	2.8	12.5	0.002	0.4	0.019	8.8	0.0001	31	1000	0.003	0.002	25	0.5	0.000025	6	55
24/10/2013	0.0005	2.4	12.5	0.002	0.44	0.022	10	0.0001	35	980	0.004	0.003	10	0.5	0.000025	6	53
7/11/2013	0.0005	2.5	12.5	0.003	0.87	0.022	29	0.0002	36	1400	0.007	0.01	15	0.5	0.000025	14	61
5/12/2013	0.0005	4	12.5	0.006	0.77	0.027	22	0.0028	45	1600	0.004	0.009	16	0.8	0.000025	8	72
16/01/2014	0.0005	3.8	12.5	0.007	0.82	0.028	23	0.0009	44	1600	0.004	0.006	22	0.7	0.000025	8	74
6/02/2014	0.0005	3.1	12.5	0.006	0.9	0.026	29	0.0006	44	1700	0.004	0.009	40	0.6	0.000025	8	75
6/03/2014	0.0005	3.9	12.5	0.008	1	0.027	29	0.0007	46	1800	0.004	0.005	57	0.5	0.000025	8	74

Continued……..WGM1/D6 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
10/04/2013	1.9	0.005	69	0.23	0.001	4.4	0.001	281	580	10.8	896.15	0.24
17/05/2013	2.5	0.005	72	0.27	0.01	3.3	0.001	300	540	11.2	895.75	0.7
13/06/2013	1.5	0.0005	82	0.5	0.003	3.4	0.001	560	660	11.1	895.85	1.6
10/07/2013	0.76	0.0005	86	0.52	0.002	3.6	0.001	400	630	11	895.95	1.1
22/08/2013	1	0.0005	77	0.39	0.0005	3.5	0.001	370	560	11.2	895.75	0.9
26/09/2013	1.6	0.0005	79	0.46	0.0005	3.3	0.001	410	680	11.2	895.75	1.1
24/10/2013	1.9	0.0005	79	0.45	0.0005	3.6	0.001	440	660	11.2	895.75	0.99
7/11/2013	3.5	0.002	89	0.52	0.005	3.1	0.001	610	860	11.1	895.85	1.1
5/12/2013	4	0.0005	92	0.63	0.008	3	0.001	660	870	10.7	896.25	2
16/01/2014	4.2	0.0005	96	0.65	0.004	3	0.001	680	920	10.7	896.25	1.6
6/02/2014	5.3	0.0005	86	0.56	0.003	2.9	0.001	750	1000	10.7	896.25	1.2
6/03/2014	6	0.0005	83	0.61	0.004	3	0.001	770	1200	10.8	896.15	1.3

WGM1/D6 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0005	3.3	12.5	0.0045	0.70	0.02	20	0.0007	38	1370	0.004	0.006	23.2	0.58	0.00003	8	65
Maximum	0.0005	4.0	12.5	0.0080	1.00	0.03	29	0.0028	46	1800	0.007	0.010	57.0	0.80	0.00003	14	75
Minimum	0.0005	2.4	12.5	0.0020	0.40	0.02	6	0.0001	26	880	0.002	0.001	0.7	0.50	0.00003	6	53
50th percentile	0.0005	3.4	12.5	0.0045	0.80	0.02	23	0.0004	40	1500	0.004	0.006	19.0	0.50	0.00003	8	67

Continued……..WGM1/D6 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)											
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	3.4	<0.01	85	0.53	0.003	3.2	0.001	586	844	10.95	896.00	1.27
Maximum	6.0	<0.01	96	0.65	0.008	3.6	0.001	770	1200	11.20	896.25	2.00
Minimum	1.0	<0.01	77	0.39	0.001	2.9	0.001	370	560	10.70	895.75	0.90
50th percentile	3.8	<0.01	85	0.54	0.004	3.1	0.001	635	865	10.95	896.00	1.15

EnergyAustralia

6. Water Quality Data and Summary for Background Groundwater Bores WGM1/D1 and WGM1/D2

a) WGM1/D1

WGM1/D1 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0010		16.0	0.002	0.0500	0.16	2	0.0010	48	210	0.016	0.016	0.190	0.19	0.00020	3	3
Maximum	0.0010		32.0	0.006	0.3500	2.00	19	0.0030	92	394	0.045	0.170	0.660	15.70	0.00060	10	15
Minimum	0.0010		1.5	1.000	0.0100	0.03	0	0.0010	15	99	0.001	0.001	0.001	0.00	0.00010	0	0
90th percentile	0.0010		24.0	0.004	0.1000	0.09	5	0.0010	78	305	0.041	0.035	0.410	5.60	0.00040	6	5

Continued……..WGM1/D1 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.4		27		0.010	5.3	0.002	4	143	4.0	944.0	0.08
Maximum	1.0		65		0.035	6.8	0.003	31	302	6.1	946.3	0.23
Minimum	0.1		8		0.001	4.2	0.001	0	50	1.9	942.1	0.01
90th percentile	0.7		44		0.018	5.9	0.002	9	215	5.3	945.0	0.12

WGM1/D1 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
Date	Ag*	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
10/04/2013	0.0005	0.23	12.5	0.0005	0.05	0.063	1.1	0.0001	21	140	0.0005	0.002	0.01	0.05	0.000025	3.5	3.5
16/05/2013	0.0005	0.1	12.5	0.0005	0.05	0.044	1	0.0001	16	120	0.0005	0.008	0.02	0.05	0.000025	3	3.5
13/06/2013	0.0005	0.13	12.5	0.0005	0.06	0.038	1.6	0.0001	19	130	0.001	0.003	0.04	0.05	0.000025	3	3
10/07/2013	0.0005	0.59	12.5	0.0005	0.04	0.036	1.4	0.0001	21	130	0.001	0.004	0.24	0.05	0.000025	3	3
22/08/2013	0.0005	1.3	12.5	0.0005	0.03	0.034	1.2	0.0001	24	130	0.002	0.004	0.09	0.05	0.000025	2	2
26/09/2013	0.0005	1.5	12.5	0.0005	0.03	0.031	1.3	0.0001	23	130	0.002	0.004	0.24	0.1	0.000025	2	2
24/10/2013	0.0005	0.74	12.5	0.0005	0.03	0.03	1.3	0.0001	26	140	0.003	0.003	0.02	0.1	0.000025	2	2
7/11/2013	0.0005	0.69	12.5	0.0005	0.03	0.027	1.3	0.0001	27	140	0.002	0.002	0.02	0.1	0.000025	2	2
5/12/2013	0.0005	0.46	12.5	0.0005	0.03	0.032	1.3	0.0001	27	140	0.003	0.006	0.04	0.1	0.000025	2	2
16/01/2014	0.0005	0.14	12.5	0.0005	0.28	0.029	15	0.0001	28	390	0.002	0.004	0.54	0.1	0.000025	3	12
6/02/2014																	
6/03/2014																	

Continued……..WGM1/D1 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
Date	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
10/04/2013	0.088	0.005	17	0.005	0.0005	5.8	0.001	20	48	1.9	946.22	0.029
16/05/2013	0.03	0.005	15	0.005	0.0005	5.8	0.001	14	64	2.9	945.22	0.033
13/06/2013	0.1	0.0005	16	0.002	0.0005	5.7	0.001	15	73	3	945.12	0.054
10/07/2013	0.06	0.0005	18	0.002	0.0005	5.6	0.001	11	73	2.9	945.22	0.082
22/08/2013	0.043	0.0005	20	0.002	0.002	5.7	0.001	9	96	3.1	945.02	0.05
26/09/2013	0.079	0.0005	21	0.003	0.001	5.5	0.001	8	140	3.5	944.62	0.068
24/10/2013	0.26	0.0005	21	0.003	0.001	5.5	0.001	8	100	3.8	944.32	0.075
7/11/2013	0.34	0.0005	21	0.003	0.0005	5.6	0.001	8	110	3.9	944.22	0.078
5/12/2013	0.48	0.0005	20	0.004	0.0005	5.7	0.001	8	78	3.9	944.22	0.1
16/01/2014	2.9	0.0005	35	0.009	0.0005	5.6	0.001	120	200	4.4	943.72	0.085
6/02/2014										4.7	943.42	
6/03/2014										4.9	943.22	

WGM1/D1 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0005	0.6	12.5	0.0005	0.06	0.03	3	0.0001	23	161	0.002	0.004	0.1	0.08	0.00003	2	4
Maximum	0.0005	1.5	12.5	0.0005	0.28	0.04	15	0.0001	28	390	0.003	0.008	0.5	0.10	0.00003	3	12
Minimum	0.0005	0.1	12.5	0.0005	0.03	0.03	1	0.0001	16	120	0.001	0.002	0.0	0.05	0.00003	2	2
50th percentile	0.0005	0.6	12.5	0.0005	0.03	0.03	1	0.0001	24	130	0.002	0.004	0.0	0.10	0.00003	2	2

Continued……..WGM1/D1 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.5	<0.01	21	0.00	0.001	5.6	0.001	22	104	3.73	944.39	0.07
Maximum	2.9	0.01	35	0.01	0.002	5.8	0.001	120	200	4.90	945.22	0.10
Minimum	0.0	<0.01	15	0.00	0.001	5.5	0.001	8	64	2.90	943.22	0.03
50th percentile	0.1	0.00	20	0.00	0.001	5.6	0.001	9	96	3.80	944.32	0.08

b) WGM1/D2

WGM1/D2 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)																
	Ag*	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
Average	0.0070		14.0	0.001	0.0500	0.17	2	0.0010	36	255	0.013	0.007	0.170	1.10	0.00030	2	5
Maximum	0.0200		138.0	0.002	0.3000	3.00	13	0.0010	104	445	0.048	0.080	0.750	13.00	0.00090	5	16
Minimum	0.0010		0.0	0.001	0.0050	0.01	0	0.0010	9	97	0.001	0.001	0.001	0.03	0.00010	0	0
90th percentile	0.0160		24.0	0.001	0.1000	0.11	5	0.0010	48	310	0.041	0.010	0.280	1.70	0.00070	4	9

Continued……..WGM1/D2 Pre-Dry Ash Placement Background Summary 1988 to April 2003 (mg/L)												
	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
Average	0.3		32	0.03	0.008	4.6	0.001	45	160	5.9	914.3	0.07
Maximum	0.8		66	0.03	0.007	5.6	0.001	102	345	8.7	917.6	0.18
Minimum	0.0		11	0.02	0.001	2.9	0.001	6	10	2.7	911.5	0.01
90th percentile	0.4		42	0.03	0.010	5.4	0.001	61	258	7.3	917.2	0.11

WGM1/D2 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
Date	Ag*	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
10/04/2013	0.0005	0.22	12.5	0.0005	0.025	0.045	1.1	0.0001	32	360	0.001	0.004	0.17	0.05	0.000025	4.2	16
17/05/2013	0.0005	0.3	12.5	0.0005	0.1	0.04	2.7	0.0001	29	480	0.0005	0.008	2	0.05	0.000025	4	25
13/06/2013	0.0005	0.28	12.5	0.0005	0.05	0.047	1.8	0.0001	29	400	0.003	0.004	0.1	0.05	0.000025	4	20
10/07/2013	0.0005	0.2	12.5	0.0005	0.03	0.04	1.5	0.0001	25	380	0.001	0.009	0.04	0.05	0.000025	4	23
22/08/2013	0.0005	0.27	12.5	0.0005	0.1	0.038	2.3	0.0001	34	480	0.002	0.004	1.7	0.05	0.00005	3	24
26/09/2013	0.0005	0.27	12.5	0.0005	0.09	0.036	2.2	0.0001	36	510	0.002	0.007	4.7	0.1	0.000025	3	21
24/10/2013	0.0005	0.24	12.5	0.0005	0.14	0.035	2.5	0.0001	38	590	0.003	0.006	3.2	0.1	0.000025	3	22
7/11/2013	0.0005	0.24	12.5	0.0005	0.15	0.033	2.8	0.0001	39	650	0.003	0.005	0.69	0.1	0.000025	3	22
5/12/2013	0.0005	0.28	12.5	0.0005	0.13	0.033	2.5	0.0001	41	590	0.003	0.006	0.73	0.1	0.000025	3	20
16/01/2014	0.0005	0.2	12.5	0.0005	0.16	0.034	2.5	0.0001	42	630	0.002	0.004	0.63	0.1	0.000025	3	19
6/02/2014	0.0005	0.18	12.5	0.0005	0.15	0.035	2.6	0.0001	39	640	0.001	0.004	0.76	0.1	0.000025	3	19
6/03/2014	0.0005	0.2	12.5	0.0005	0.15	0.036	2.4	0.0001	40	610	0.002	0.009	3.8	0.1	0.000025	3	18

Continued……..WGM1/D2 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
Date	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
10/04/2013	0.4	0.005	35	0.049	0.001	4.8	0.001	113	260	7.8	912.4	0.06
17/05/2013	0.78	0.005	47	0.08	0.003	4.1	0.001	160	270	7.9	912.3	0.11
13/06/2013	0.49	0.0005	39	0.058	0.002	4.2	0.001	130	300	7	913.2	0.092
10/07/2013	0.48	0.0005	39	0.054	0.0005	4.6	0.001	120	190	7.6	912.6	0.075
22/08/2013	0.71	0.0005	49	0.068	0.002	3.9	0.001	160	290	7.8	912.4	0.087
26/09/2013	0.69	0.0005	56	0.075	0.002	3.8	0.001	160	350	7.7	912.5	0.097
24/10/2013	0.78	0.0005	55	0.086	0.003	3.7	0.001	190	350	7.9	912.3	0.12
7/11/2013	0.81	0.0005	59	0.094	0.003	3.5	0.001	190	370	7.9	912.3	0.13
5/12/2013	0.75	0.0005	57	0.086	0.003	3.5	0.001	180	300	7.7	912.5	0.12
16/01/2014	0.75	0.0005	60	0.086	0.003	3.4	0.001	190	310	7.9	912.3	0.12
6/02/2014	0.75	0.0005	58	0.08	0.002	3.4	0.001	190	330	8	912.2	0.1
6/03/2014	0.76	0.0005	53	0.081	0.002	3.6	0.001	180	320	7.8	912.4	0.12

WGM1/D2 Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0005	0.2	12.5	0.0005	0.13	0.04	2	0.0001	39	588	0.002	0.006	2.0	0.09	0.00003	3	21
Maximum	0.0005	0.3	12.5	0.0005	0.16	0.04	3	0.0001	42	650	0.003	0.009	4.7	0.10	0.00005	3	24
Minimum	0.0005	0.2	12.5	0.0005	0.09	0.03	2	0.0001	34	480	0.001	0.004	0.6	0.05	0.00003	3	18
50th percentile	0.0005	0.2	12.5	0.0005	0.15	0.04	3	0.0001	39	600	0.002	0.006	1.2	0.10	0.00003	3	21

Continued……..WGM1/D2 Pre-Dry Ash Placement Data April 2013 to March 2014 (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.8	<0.01	56	0.08	0.003	3.6	0.001	180	328	7.84	912.36	0.11
Maximum	0.8	0.00	60	0.09	0.003	3.9	0.001	190	370	8.00	912.50	0.13
Minimum	0.7	<0.01	49	0.07	0.002	3.4	0.001	160	290	7.70	912.20	0.09
50th percentile	0.8	0.00	57	0.08	0.003	3.6	0.001	185	325	7.85	912.35	0.12

7. Water Quality and Summary for SSCAD

Sawyers Swamp Creek Ash Dam Pre-Dry Ash Placement Summary 1991 to April 2003 (mg/L)																
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0010		18.0	0.0160	4.7	0.13	56	0.0120	18	1219	0.005	0.007	9.3	0.17	0.00020	53	11
Maximum	0.0010		53.0	0.0390	8.6	0.15	140	0.0200	74	2578	0.018	0.035	14.0	0.45	0.00020	110	18
Minimum	0.0010		5.0	0.0030	2.7	0.11	33	0.0060	8	86	0.001	0.001	7.2	0.03	0.00010	35	7
90th percentile	0.0010		28.4	0.0340	8.0	0.14	107	0.0200	28	2004	0.013	0.016	11.4	0.29	0.00020	88	15

Continued……..Sawyers Swamp Creek Ash Dam Pre-Dry Ash Placement Summary 1991 to April 2003 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	1.2	0.15	137	0.13	0.002	5.4	0.151	553	858	0.43
Maximum	1.7	0.19	380	0.15	0.005	6.5	0.379	1390	2170	0.65
Minimum	0.8	0.11	46	0.11	0.001	4.7	0.029	351	215	0.10
90th percentile	1.7	0.18	287	0.15	0.005	6.0	0.298	1029	1604	0.58

Sawyers Swamp Creek Ash Dam Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
10/04/2013	0.0005	2	12.5	0.002	2	0.073	58	0.005	21	1500	0.0005	0.018	2.4	0.05	0.000025	35	15
16/05/2013	0.0005	2.5	12.5	0.002	1.7	0.071	59	0.0053	19	1500	0.0005	0.01	2.3	0.16	0.000025	38	16
13/06/2013	0.0005	1.7	12.5	0.002	2	0.065	61	0.0051	20	1500	0.0005	0.009	0.05	0.04	0.000025	37	16
10/07/2013	0.0005	1.6	12.5	0.002	2.2	0.066	60	0.005	20	1400	0.0005	0.009	2.1	0.03	0.000025	37	17
22/08/2013	0.0005	0.3	12.5	0.001	1.9	0.063	55	0.0038	19	1300	0.001	0.0005	1.7	0.005	0.000025	34	15
26/09/2013	0.0005	1.2	12.5	0.002	2	0.066	59	0.0041	19	1400	0.002	0.003	1.9	0.1	0.000025	35	16
24/10/2013	0.0005	1.6	12.5	0.003	2.2	0.067	62	0.0044	20	1600	0.002	0.004	2.2	0.07	0.000025	36	16
7/11/2013	0.0005	1	12.5	0.002	1.9	0.078	61	0.0048	20	1500	0.002	0.003	2	0.02	0.000025	37	16
5/12/2013	0.0005	1.4	12.5	0.002	2	0.077	63	0.0043	22	1700	0.002	0.006	2.1	0.08	0.000025	38	17
16/01/2014	0.0005	0.08	99	0.004	1.7	0.061	52	0.0023	19	1600	0.002	0.002	1.8	0.005	0.000025	34	14
6/02/2014	0.0005	0.04	98	0.003	1.6	0.054	51	0.0014	19	1500	0.001	0.004	1.7	0.01	0.000025	32	14
6/03/2014	0.0005	0.15	81	0.002	1.7	0.05	54	0.0013	18	1500	0.002	0.002	1.8	0.01	0.000025	33	14

Continued……..Sawyers Swamp Creek Ash Dam Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
10/04/2013	1.2	0.005	230	0.078	0.0005	5.5	0.006	691	940	0.24
16/05/2013	1.5	0.005	220	0.09	0.0005	5.2	0.007	730	1100	0.25
13/06/2013	1.5	0.014	210	0.083	0.0005	5.5	0.007	740	1100	0.29
10/07/2013	1.5	0.015	230	0.084	0.0005	5.4	0.006	710	1000	0.25
22/08/2013	1.4	0.018	210	0.072	0.0005	6.8	0.003	650	990	0.19
26/09/2013	1.5	0.02	220	0.094	0.0005	5.6	0.004	720	1100	0.23
24/10/2013	1.5	0.016	230	0.087	0.0005	5.4	0.004	800	1100	0.25
7/11/2013	1.5	0.027	240	0.087	0.0005	5.8	0.006	820	1100	0.24
5/12/2013	1.5	0.03	240	0.084	0.0005	5.3	0.006	820	1200	0.24
16/01/2014	0.84	0.037	260	0.051	0.0005	8	0.003	690	1100	0.073
6/02/2014	0.43	0.043	240	0.029	0.0005	8.1	0.003	640	1100	0.025
6/03/2014	0.41	0.042	230	0.027	0.0005	7.9	0.003	650	1100	0.032

EnergyAustralia

Sawyers Swamp Creek Ash Dam Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	1.1	32.5	0.0023	1.9	0.07	58	0.0039	20	1500	0.001	0.006	1.8	0.05	0.00003	36	16
Maximum	<0.001	2.5	99.0	0.0040	2.2	0.08	63	0.0053	22	1700	0.002	0.018	2.4	0.16	0.00003	38	17
Minimum	<0.001	0.0	12.5	0.0010	1.6	0.05	51	0.0013	18	1300	0.001	0.001	0.1	0.01	0.00003	32	14
50th percentile	<0.001	1.3	12.5	0.0020	2.0	0.07	59	0.0044	20	1500	0.002	0.004	2.0	0.04	0.00003	36	16

Continued........Sawyers Swamp Creek Ash Dam Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	1.2	<0.01	230	0.07	0.001	6.2	0.005	722	1078	0.19
Maximum	1.5	0.04	260	0.09	0.001	8.1	0.007	820	1200	0.29
Minimum	0.4	<0.01	210	0.03	0.001	5.2	0.003	640	940	0.03
50th percentile	1.5	0.02	230	0.08	0.001	5.6	0.005	715	1100	0.24

8. Water quality data and summary from Sawyers Swamp Creek monitoring from SSCAD Spillway to near WGM1/D5

a) Sawyers Swamp Creek upstream @ 0 m where SSCAD diversion and Springvale Mine Water discharge, since August 2012, enters SSC at spillway.

SSC upstream @ 0 m where SSCAD diversion and Springvale Mine Water enter SSC at spillway (EANSW Site 225) Summary from November 2012 to March 2013 (mg/L)																
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	0.2	514	0.014	0.1	0.019	5	0.0002	8	613	0.001	0.002	1.2	0.02	0.00005	11.2	0
Maximum	<0.001	0.3	530	0.019	0.1	0.022	6	0.0002	14	1000	0.001	0.004	1.3	0.04	0.00005	12.0	0
Minimum	<0.001	0.1	490	0.012	0.1	0.017	4	0.0002	5	100	0.001	0.001	1.2	0.01	0.00005	11.0	0
50th percentile	<0.001	0.2	520	0.014	0.1	0.019	5	0.0002	7	660	0.001	0.001	1.2	0.02	0.00005	11.0	0

Continued……..SSC upstream @ 0 m where SSCAD diversion and Springvale Mine Water enter SSC at spillway (EANSW Site 225) Summary from November 2012 to March 2013 (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.012	0.0200	240	0.010	0.001	8.2	0.002	20	422	0.030
Maximum	0.027	0.0200	270	0.010	0.002	9.2	0.002	22	700	0.040
Minimum	0.001	0.0200	220	0.010	0.001	6.9	0.002	16	89	0.020
50th percentile	0.015	0.0200	240	0.010	0.001	8.3	0.002	20	530	0.030

EnergyAustralia

SSC upstream @ 0 m where SSCAD diversion and Springvale Mine Water enter SSC at spillway (EANSW Site 225) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																	
Date	Ag	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
10/04/2013	0.0005	0.6	510	0.015	0.1	0.026	5	0.0001	4	1000	0.001	0.001	1.5	0.03	<0.00005	10	2
16/05/2013	0.0005	1.3	520	0.019	0.1	0.035	5	0.0001	5	1000	0.001	0.001	1.3	0.04	<0.00005	11	2
13/06/2013	0.0005	0.1	560	0.018	0.1	0.021	5	0.0001	5	1000	0.001	0.001	1.2	0.02	<0.00005	10	3
10/07/2013	0.0005	0.3	570	0.019	0.1	0.030	5	0.0001	5	1000	0.001	0.001	1.2	0.02	<0.00005	11	3
22/08/2013	0.0005	0.2	580	0.014	0.1	0.025	5	0.0001	5	1000	0.002	0.001	0.1	0.01	<0.00005	11	3
26/09/2013	0.0005	0.4	560	0.020	0.1	0.028	5	0.0001	5	1100	0.002	0.001	1.1	0.3	<0.00005	11	3
24/10/2013	0.0005	0.1	600	0.024	0.1	0.022	4	0.0001	5	1200	0.002	0.001	1.3	0.005	<0.00005	11	2
7/11/2013	0.0005	0.2	570	0.027	0.1	0.029	4	0.0001	5	1100	0.002	0.001	1.2	0.005	<0.00005	10	3
5/12/2013	0.0005	0.1	530	0.026	0.1	0.024	5	0.0001	5	1100	0.003	0.001	1.2	0.01	<0.00005	10	3
16/01/2014	0.0005	0.2	560	0.025	0.1	0.027	5	0.0001	5	1100	0.002	0.001	1.2	0.005	<0.00005	11	3
6/02/2014	0.0005	0.2	530	0.029	0.1	0.028	4	0.0001	5	1100	0.002	0.001	1.2	0.005	<0.00005	10	3
6/03/2014	0.0005	0.1	540	0.026	0.1	0.026	4	0.0001	5	1100	0.002	0.001	1.1	0.005	<0.00005	11	3

Continued……..SSC upstream @ 0 m where SSCAD diversion and Springvale Mine Water enter SSC at spillway (EANSW Site 225) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
Date	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	Zn
10/04/2013	0.003	0.036	250	0.005	0.002	8.3	0.001	25	580	0.022
16/05/2013	0.012	0.038	230	0.005	0.003	8.2	0.001	23	700	0.022
13/06/2013	0.006	0.033	230	0.005	0.001	8.4	0.001	25	650	0.024
10/07/2013	0.003	0.04	260	0.005	0.002	8.4	0.001	25	600	0.025
22/08/2013	0.018	0.032	250	0.004	0.001	8.5	0.001	23	660	0.015
26/09/2013	0.030	0.037	260	0.004	0.001	8.5	0.001	30	770	0.023
24/10/2013	0.008	0.037	280	0.005	0.001	8.5	0.001	35	670	0.027
7/11/2013	0.006	0.041	260	0.005	0.001	8.5	0.001	33	650	0.025
5/12/2013	0.004	0.039	260	0.006	0.001	8.6	0.001	35	690	0.032
16/01/2014	0.006	0.044	240	0.006	0.001	8.5	0.001	38	710	0.028
6/02/2014	0.006	0.03	230	0.006	0.001	8.6	0.001	40	700	0.022
6/03/2014	0.005	0.043	240	0.005	0.001	8.5	0.001	36	700	0.021

SSC upstream @ 0 m where SSCAD diversion and Springvale Mine Water enter SSC at spillway (EANSW Site 225) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	0.3	553	0.022	0.1	0.027	5	0.0001	5	1067	0.002	0.001	1.1	0.04	<0.00005	11	3
Maximum	<0.001	1.3	600	0.029	0.1	0.035	5	0.0001	5	1200	0.003	0.001	1.5	0.30	<0.00005	11	3
Minimum	<0.001	0.1	510	0.014	0.1	0.021	4	0.0001	4	1000	0.001	0.001	0.1	0.01	<0.00005	10	2
50th percentile	<0.001	0.2	560	0.022	0.1	0.027	5	0.0001	5	1100	0.002	0.001	1.2	0.01	<0.00005	11	3

Continued……..SSC upstream @ 0 m where SSCAD diversion and Springvale Mine Water enter SSC at spillway (EANSW Site 225) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.009	0.0375	249	0.005	0.001	8.5	0.001	31	673	0.02
Maximum	0.030	0.0440	280	0.006	0.003	8.6	0.001	40	770	0.03
Minimum	0.003	0.0300	230	0.004	0.001	8.2	0.001	23	580	0.02
50th percentile	0.006	0.0375	250	0.005	0.001	8.5	0.001	32	680	0.02

b) Sawyers Swamp Creek Ash Dam seepage from v-notch (water collected and recycling back into dam).

SSCAD Seepage from V-notch (EANSW Site 79) Summary from January 2010 to March 2013 (mg/L)																
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	0.3	88	0.0015	3.3	0.03	102	0.0003	46	1680	0.001	0.003	1.2	0.03	<0.00005	30	49
Maximum	<0.001	1.7	240	0.0015	24.0	0.18	150	0.0010	58	2139	0.002	0.008	1.8	0.22	<0.00005	38	67
Minimum	<0.001	0.0	50	0.0015	0.6	0.02	12	0.0002	37	818	0.001	0.001	0.2	0.01	<0.00005	12	21
90th percentile	<0.001	0.1	85	0.0015	2.4	0.02	110	0.0002	47	1700	0.001	0.003	1.3	0.02	<0.00005	33	52

Continued........SSCAD Seepage from V-notch (EANSW Site 79) Summary from January 2010 to March 2013 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.065	0.01	214	0	0.001	7.4	0.002	739	1251	0.05
Maximum	0.410	0.01	260	0	0.002	8.2	0.002	1000	1600	0.51
Minimum	0.001	0.01	83	0	0.001	6.8	0.002	190	530	0.01
90th percentile	0.046	0.01	225	0	0.001	7.4	0.002	775	1300	0.03

SSCAD Seepage from V-notch (EANSW Site 79) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
Date	Ag	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
10/04/2013	0.0005	0.04	77	0.0005	2.3	0.021	91	0.0001	39	1700	0.0005	0.003	1.5	0.005	<0.00005	29	45
16/05/2013	0.0005	0.06	77	0.0005	2	0.023	99	0.0002	40	1700	0.0005	0.011	1.3	0.01	<0.00005	30	48
13/06/2013	0.0005	0.1	77	0.0005	2	0.021	95	0.0001	38	1600	0.0005	0.004	1.2	0.04	<0.00005	29	46
10/07/2013	0.0005	0.025	79	0.0005	2.5	0.02	100	0.0001	38	1600	0.0005	0.0005	1.3	0.05	<0.00005	31	51
22/08/2013	0.0005	0.21	86	0.0005	2.2	0.037	100	0.0001	40	1600	0.002	0.0005	1.2	0.04	<0.00005	31	49
26/09/2013	0.0005	0.14	530	0.016	0.15	0.028	8.6	0.0001	7	1100	0.002	0.0005	1.1	0.15	<0.00005	12	5
24/10/2013	0.0005	0.07	470	0.016	0.68	0.022	30	0.0001	14	1300	0.002	0.0005	1.3	0.01	<0.00005	16	15
7/11/2013	0.0005	0.05	450	0.015	0.64	0.026	30	0.0001	14	1300	0.002	0.0005	1.2	0.02	<0.00005	16	15
5/12/2013	0.0005	0.13	360	0.013	0.91	0.025	40	0.0001	20	1400	0.003	0.0005	1.3	0.02	<0.00005	17	20
16/01/2014	0.0005	0.14	560	0.022	0.1	0.028	5.2	0.0001	5	1100	0.002	0.0005	1.2	0.02	<0.00005	11	3
6/02/2014	0.0005	0.22	560	0.018	0.09	0.027	5.4	0.0001	5	1100	0.002	0.0005	1.2	0.03	<0.00005	10	3
6/03/2014	0.0005	0.05	76	0.0005	2.1	0.023	96	0.0001	36	1600	0.002	0.0005	1.1	0.03	<0.00005	30	43

Continued........SSCAD Seepage from V-notch (EANSW Site 79) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
Date	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	Zn
10/04/2013	0.067	0.005	220	0.005	0.0005	7.2	0.002	825	1200	0.025
16/05/2013	0.071	0.005	210	0.005	0.0005	6.8	0.001	740	1300	0.034
13/06/2013	0.036	0.0005	210	0.009	0.0005	7	0.001	730	1200	0.04
10/07/2013	0.06	0.0005	230	0.01	0.0005	7	0.001	760	1100	0.034
22/08/2013	0.044	0.0005	230	0.01	0.0005	7.1	0.001	760	1200	0.034
26/09/2013	0.038	0.038	260	0.006	0.001	8.6	0.001	58	790	0.027
24/10/2013	0.0005	0.027	260	0.005	0.0005	8.4	0.001	230	950	0.025
7/11/2013	0.0005	0.028	260	0.005	0.0005	8.4	0.001	250	650	0.026
5/12/2013	0.0005	0.023	240	0.007	0.0005	8.2	0.001	350	840	0.037
16/01/2014	0.0005	0.042	250	0.005	0.0005	8.5	0.001	42	670	0.025
6/02/2014	0.0005	0.041	240	0.005	0.0005	8.5	0.001	38	710	0.019
6/03/2014	0.096	0.0005	190	0.011	0.0005	7.3	0.001	810	1300	0.04

SSCAD Seepage from V-notch (EANSW Site 79) Post-Dry Ash Placement Summary April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	0.1	284	0.0086	1.3	0.03	58	0.0001	25	1425	0.002	0.002	1.2	0.04	<0.00005	22	29
Maximum	<0.001	0.2	560	0.0220	2.5	0.04	100	0.0002	40	1700	0.003	0.011	1.5	0.15	<0.00005	31	51
Minimum	<0.001	0.0	76	0.0005	0.1	0.02	5	0.0001	5	1100	0.001	0.001	1.1	0.01	<0.00005	10	3
50th percentile	<0.001	0.1	223	0.0068	1.5	0.02	66	0.0001	28	1500	0.002	0.001	1.2	0.03	<0.00005	23	32

Continued……..SSCAD Seepage from V-notch (EANSW Site 79) Post-Dry Ash Placement Summary April 2013 to March 2014 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.035	0.018	233	0.01	0.001	7.8	0.001	466	993	0.03
Maximum	0.096	0.042	260	0.01	0.001	8.6	0.002	825	1300	0.04
Minimum	0.001	0.001	190	0.01	0.001	6.8	0.001	38	650	0.02
50th percentile	0.037	0.014	235	0.01	0.001	7.8	0.001	540	1025	0.03

c) Sawyers Swamp creek downstream at @850m near Bore D4 – upstream seepage from KVAD wall and below SSCAD v-notch seepage point, EANSW site 93.

Sawyers Swamp Creek @ 850 m upstream seepage from KVAD wall and below SSCAD V-notch Seepage point (EANSW Site 93) Summary from February 2010 to March 2013 (mg/L)																
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	0.7	290	0.0055	0.4	0.05	20	<0.0002	14	772	0.003	0.005	0.8	0.24	<0.00005	10	10
Maximum	<0.001	5.0	519	0.0160	1.1	0.14	66	0.0001	33	1188	0.005	0.025	1.4	1.32	<0.00005	16	33
Minimum	<0.001	0.0	86	0.0010	0.1	0.02	6	0.0001	5	350	0.001	0.001	0.3	0.02	<0.00005	5	3
90th percentile	<0.001	0.3	220	0.0035	0.2	0.03	11	<0.0002	11	870	0.003	0.002	0.6	0.06	<0.00005	11	6

Continued……..Sawyers Swamp Creek @ 850 m upstream seepage from KVAD wall and below SSCAD V-notch Seepage point (EANSW Site 93) Summary from January 2010 to March 2013 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.246	0.02	162	0.00	0.003	8.1	<0.002	110	484	0.03
Maximum	1.600	0.03	280	0.01	0.011	8.7	<0.002	390	860	0.07
Minimum	0.001	0.01	69	0.00	0.001	7.3	<0.002	31	220	0.01
90th percentile	0.045	0.02	140	0.00	0.002	8.1	<0.002	68	543	0.02

Sawyers Swamp Creek @ 850 m upstream seepage from KVAD wall and below SSCAD V-notch Seepage point (EANSW Site 93) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																	
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
10/04/2013	0.0005	0.16	500		0.12	0.024	7.1	0.0001	5	1000	0.0005		1.4	0.06	<0.00005	11	3.3
16/05/2013	0.0005	0.77	510	0.017	0.1	0.031	6.7	0.0001	6	1000	0.0005	0.001	1.3	0.04	<0.00005	11	3.5
13/06/2013	0.0005	0.1	550	0.018	0.11	0.023	7.9	0.0001	6	1000	0.0005	0.0005	1.2	0.05	<0.00005	10	4
10/07/2013	0.0005	0.07	550	0.015	0.13	0.023	7.1	0.0001	6	1000	0.0005	0.0005	1.1	0.17	<0.00005	11	4
22/08/2013	0.0005	0.19	570	0.013	0.11	0.024	6.4	0.0001	6	1100	0.001	0.0005	1.1	0.03	<0.00005	11	4
26/09/2013	0.0005	0.43	550	0.017	0.11	0.025	7.1	0.0001	6	1100	0.002	0.002	1.1	0.35	<0.00005	11	4
24/10/2013	0.0005	0.14	580	0.022	0.12	0.024	6.1	0.0001	6	1200	0.002	0.0005	1.2	0.02	<0.00005	11	4
7/11/2013	0.0005	0.25	570	0.027	0.1	0.03	5.7	0.0001	5	1100	0.002	0.0005	1.2	0.01	<0.00005	11	3
5/12/2013	0.0005	0.22	520	0.025	0.12	0.033	6.4	0.0001	6	1100	0.003	0.0005	1.3	0.03	<0.00005	10	4
16/01/2014	0.0005	0.17	570	0.026	0.08	0.028	4.6	0.0001	5	1100	0.002	0.0005	1.2	0.02	<0.00005	11	3
6/02/2014	0.0005	0.11	540	0.024	0.08	0.025	4.4	0.0001	5	1100	0.002	0.0005	1.1	0.03	<0.00005	10	3
6/03/2014	0.0005	0.24	530	0.028	0.11	0.034	5.7	0.0001	6	1100	0.002	0.0005	1.1	0.02	<0.00005	11	4

Continued……..Sawyers Swamp Creek @ 850 m upstream seepage from KVAD wall and below SSCAD V-notch Seepage point (EANSW Site 93) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
10/04/2013	0.006	0.034	250	0.005	0.002	8.5	0.001	35	600	0.022
16/05/2013	0.006	0.037	240	0.005	0.002	8.5	0.001	36	650	0.019
13/06/2013	0.0005	0.036	240	0.005	0.001	8.6	0.001	42	650	0.024
10/07/2013	0.021	0.038	250	0.004	0.0005	8.5	0.001	41	640	0.017
22/08/2013	0.009	0.03	250	0.003	0.0005	8.7	0.001	37	650	0.015
26/09/2013	0.053	0.036	260	0.004	0.001	8.6	0.001	47	790	0.023
24/10/2013	0.0005	0.037	280	0.004	0.0005	8.7	0.001	49	690	0.02
7/11/2013	0.0005	0.036	260	0.005	0.0005	8.6	0.001	46	640	0.025
5/12/2013	0.0005	0.037	260	0.007	0.001	8.7	0.001	54	700	0.032
16/01/2014	0.0005	0.042	250	0.006	0.0005	8.7	0.001	37	700	0.023
6/02/2014	0.0005	0.04	230	0.005	0.0005	8.7	0.001	40	700	0.019
6/03/2014	0.0005	0.042	230	0.005	0.001	8.7	0.001	53	700	0.021

Sawyers Swamp Creek @ 850 m upstream seepage from KVAD wall and below SSCAD V-notch Seepage point (EANSW Site 93) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																	
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	0.2	545	0.0211	0.1	0.03	6	0.0001	6	1075	0.002	0.001	1.2	0.07	<0.00005	11	4
Maximum	<0.001	0.8	580	0.0280	0.1	0.03	8	0.0001	6	1200	0.003	0.002	1.4	0.35	<0.00005	11	4
Minimum	<0.001	0.1	500	0.0130	0.1	0.02	4	0.0001	5	1000	0.001	0.001	1.1	0.01	<0.00005	10	3
50th percentile	<0.001	0.2	550	0.0220	0.1	0.03	6	0.0001	6	1100	0.002	0.001	1.2	0.03	<0.00005	11	4

Continued……..Sawyers Swamp Creek @ 850 m upstream seepage from KVAD wall and below SSCAD V-notch Seepage point (EANSW Site 93) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.008	0.037	250	0.00	0.001	8.6	0.001	43	676	0.02
Maximum	0.053	0.042	280	0.01	0.002	8.7	0.001	54	790	0.03
Minimum	0.001	0.030	230	0.00	0.001	8.5	0.001	35	600	0.02
50th percentile	0.001	0.037	250	0.01	0.001	8.7	0.001	42	670	0.02

d) KVAD/R seepage water Northern wall collection pit from the KVAD on the north-side of KVAR drains, EANSW site 86.

Seepage water Northern wall collection pit near GW6 (EANSW Site 86) Summary from February 2010 to March 2013 (mg/L)																	
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average									19	1430							
Maximum									25	2400							
Minimum									16	803							
90th percentile									19	1500							

Continued……..Seepage water Northern wall collection pit near GW6 (EANSW Site 86) Summary from January 2010 to March 2013 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average						4.2		746	1195	
Maximum						6.1		1200	1800	
Minimum						2.9		350	110	
90th percentile						4.0		695	1150	

EnergyAustralia

Seepage water Northern wall collection pit near GW6 (EANSW Site 86) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																	
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
10/04/2013	0.0005	1.1	12.5	0.001	3.5	0.014	98	0.0001	11	2400	0.0005	0.033	0.6	43	<0.00005	85	61
17/05/2013	0.0005	1.2	12.5	0.001	3	0.013	140	0.0001	17	2400	0.0005	0.0005	0.5	45	<0.00005	89	68
13/06/2013	0.0005	1.4	12.5	0.001	3	0.002	130	0.0001	17	2300	0.0005	0.0005	0.05	31	<0.00005	74	65
10/07/2013	0.0005	1.3	12.5	0.0005	3.7	0.009	150	0.0001	18	2400	0.0005	0.0005	0.05	37	<0.00005	84	74
22/08/2013	0.0005	1	12.5	0.0005	4	0.006	170	0.0001	18	2600	0.002	0.0005	0.05	48	<0.00005	93	81
26/09/2013	0.0005	1.4	12.5	0.001	4.1	0.005	160	0.0001	19	2700	0.002	0.001	0.4	46	<0.00005	91	77
24/10/2013	0.0005	1.6	12.5	0.002	5	0.006	200	0.0001	20	3100	0.002	0.0005	0.5	55	<0.00005	110	88
7/11/2013	0.0005	1.7	12.5	0.002	4.7	0.005	200	0.0001	20	3100	0.002	0.001	0.4	57	<0.00005	110	88
5/12/2013	0.0005	2.4	12.5	0.002	5	0.003	200	0.0001	21	3200	0.003	0.002	0.6	52	<0.00005	110	93
16/01/2014	0.0005	1.7	12.5	0.003	5.5	0.004	210	0.0001	21	3400	0.003	0.001	0.6	59	<0.00005	120	92
6/02/2014	0.0005	1.2	12.5	0.002	5.3	0.003	210	0.0001	21	3300	0.002	0.0005	0.4	61	<0.00005	130	90
6/03/2014	0.0005	2.3	12.5	0.002	4.7	0.002	180	0.0001	19	3100	0.002	0.002	0.5	36	<0.00005	97	73

Continued…….Seepage water Northern wall collection pit near GW6 (EANSW Site 86) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
10/04/2013	12	0.005	160	0.14	0.003	2.9	0.001	1280	1700	0.14
17/05/2013	12	0.005	160	0.14	0.001	3	0.001	1300	1900	0.1
13/06/2013	11	0.0005	140	0.14	0.001	3	0.001	1100	1100	0.15
10/07/2013	12	0.0005	170	0.15	0.0005	3	0.001	1400	1700	0.14
22/08/2013	13	0.0005	190	0.14	0.0005	2.9	0.001	1400	2000	0.13
26/09/2013	13	0.001	190	0.16	0.001	2.9	0.001	1500	2300	0.16
24/10/2013	15	0.002	220	0.18	0.001	2.9	0.001	2000	2300	0.2
7/11/2013	15	0.002	230	0.2	0.001	2.9	0.001	2300	2500	0.21
5/12/2013	15	0.004	220	0.2	0.001	2.9	0.001	1800	2400	0.21
16/01/2014	16	0.002	230	0.26	0.0005	2.9	0.001	2000	3000	0.19
6/02/2014	14	0.002	250	0.25	0.0005	2.8	0.001	1900	2600	0.15
6/03/2014	13	0.0005	180	0.22	0.0005	2.8	0.001	1600	2400	0.15

Seepage water Northern wall collection pit near GW6 (EANSW Site 86) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	1.5	13	0.0015	4.3	0.01	171	0.0001	19	2833	0.002	0.004	0.4	47.50	<0.00005	99	79
Maximum	<0.001	2.4	13	0.0030	5.5	0.01	210	0.0001	21	3400	0.003	0.033	0.6	61.00	<0.00005	130	93
Minimum	<0.001	1.0	13	0.0005	3.0	0.00	98	0.0001	11	2300	0.001	0.001	0.1	31.00	<0.00005	74	61
50th percentile	<0.001	1.4	13	0.0015	4.4	0.01	175	0.0001	19	2900	0.002	0.001	0.5	47.00	<0.00005	95	79

Continued……..Seepage water Northern wall collection pit near GW6 (EANSW Site 86) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	13.417	0.002	195	0.18	0.001	2.9	0.001	1632	2158	0.16
Maximum	16.000	0.005	250	0.26	0.003	3.0	0.001	2300	3000	0.21
Minimum	11.000	0.001	140	0.14	0.001	2.8	0.001	1100	1100	0.10
50th percentile	13.000	0.002	190	0.17	0.001	2.9	0.001	1550	2300	0.15

e) Sawyers Swamp Creek at 1250 m near bore D5, EANSW site 83 – downstream seepage from KVAD wall.

Sawyers Swamp Creek @ 1250 m near GW Bore D5 (EANSW Site 83) Summary from February 2010 to March 2013 (mg/L)																
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	0.4	220	0.0054	0.4	0.04	18	<0.0002	15	704	0.003	0.002	0.7	0.24	<0.00005	9	10
Maximum	<0.001	3.7	520	0.0150	1.7	0.13	55	0.0000	33	1113	0.003	0.006	1.4	1.70	<0.00005	23	30
Minimum	<0.001	0.0	30	0.0010	0.1	0.02	5	0.0000	5	220	0.003	0.001	0.2	0.01	<0.00005	3	2
90th percentile	<0.001	0.3	135	0.0030	0.2	0.03	12	<0.0002	13	710	0.003	0.001	0.6	0.09	<0.00005	9	7

Continued……..Sawyers Swamp Creek @ 1250 m near GW Bore D5 (EANSW Site 83) Summary from January 2010 to March 2013 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.449	0.02	145	0.11	0.002	8.0	<0.002	116	444	0.03
Maximum	3.200	0.03	554	0.20	0.008	8.6	<0.002	360	790	0.21
Minimum	0.007	0.01	31	0.01	0.001	7.3	<0.002	24	150	0.01
90th percentile	0.190	0.02	115	0.11	0.001	8.0	<0.002	76	400	0.02

Sawyers Swamp Creek @ 1250 m near GW Bore D5 (EANSW Site 83) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																	
Date	Ag	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
10/04/2013	0.0005	0.14	510	0.014	0.1	0.021	5.3	0.0001	5	1000	0.0005	0.0005	1.5	0.07	<0.00005	9.5	2.8
16/05/2013	0.0005	1.4	520	0.016	0.1	0.029	5.1	0.0001	5	1000	0.0005	0.0005	1.3	0.07	<0.00005	11	2.8
13/06/2013	0.0005	0.15	550	0.018	0.1	0.02	6.4	0.0001	5	1000	0.0005	0.0005	1.2	0.09	<0.00005	10	3
10/07/2013	0.0005	0.13	570	0.014	0.11	0.022	5.5	0.0001	5	1000	0.0005	0.0005	1.2	0.06	<0.00005	11	3
22/08/2013	0.0005	0.24	580	0.014	0.09	0.024	5.2	0.0001	5	1100	0.002	0.0005	1.1	0.05	<0.00005	11	3
26/09/2013	0.0005	0.31	560	0.018	0.08	0.027	5.4	0.0001	5	1100	0.002	0.003	1.1	0.32	<0.00005	11	3
24/10/2013	0.0005	0.14	590	0.021	0.1	0.022	4.5	0.0001	5	1200	0.002	0.0005	1.3	0.02	<0.00005	11	3
7/11/2013	0.0005	0.13	580	0.025	0.09	0.027	4.4	0.0001	5	1100	0.002	0.0005	1.2	0.01	<0.00005	11	3
5/12/2013	0.0005	0.16	540	0.024	0.1	0.024	4.9	0.0001	5	1100	0.002	0.0005	1.3	0.03	<0.00005	10	3
16/01/2014	0.0005	0.19	560	0.025	0.08	0.03	4.5	0.0001	5	1100	0.002	0.0005	1.2	0.005	<0.00005	11	3
6/02/2014	0.0005	0.14	530	0.026	0.08	0.025	4.5	0.0001	5	1100	0.002	0.0005	1.1	0.02	<0.00005	10	3
6/03/2014	0.0005	0.22	540	0.026	0.09	0.03	4.6	0.0001	5	1100	0.002	0.0005	1.1	0.02	<0.00005	12	3

Continued……..Sawyers Swamp Creek @ 1250 m near GW Bore D5 (EANSW Site 83) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
Date	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	Zn
10/04/2013	0.006	0.034	250	0.005	0.002	8.5	0.001	26	580	0.024
16/05/2013	0.006	0.036	250	0.005	0.002	8.4	0.001	27	670	0.016
13/06/2013	0.002	0.034	230	0.006	0.0005	8.6	0.001	31	660	0.029
10/07/2013	0.007	0.038	250	0.005	0.0005	8.5	0.001	30	580	0.024
22/08/2013	0.004	0.031	250	0.005	0.0005	8.7	0.001	27	650	0.022
26/09/2013	0.053	0.035	250	0.006	0.001	8.7	0.001	33	790	0.024
24/10/2013	0.006	0.036	280	0.005	0.0005	8.7	0.001	40	760	0.028
7/11/2013	0.004	0.039	270	0.005	0.0005	8.6	0.001	35	660	0.025
5/12/2013	0.0005	0.039	260	0.005	0.0005	8.7	0.001	39	660	0.027
16/01/2014	0.0005	0.042	250	0.006	0.0005	8.7	0.001	37	660	0.022
6/02/2014	0.0005	0.03	240	0.006	0.0005	8.7	0.001	40	650	0.026
6/03/2014	0.0005	0.042	240	0.006	0.0005	8.7	0.001	39	720	0.021

Sawyers Swamp Creek @ 1250 m near GW Bore D5 (EANSW Site 83) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)																	
	Ag*	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	0.3	553	0.0201	0.1	0.03	5	0.0001	5	1075	0.002	0.001	1.2	0.06	<0.00005	11	3
Maximum	<0.001	1.4	590	0.0260	0.1	0.03	6	0.0001	5	1200	0.002	0.003	1.5	0.32	<0.00005	12	3
Minimum	<0.001	0.1	510	0.0140	0.1	0.02	4	0.0001	5	1000	0.001	0.001	1.1	0.01	<0.00005	10	3
50th percentile	<0.001	0.2	555	0.0195	0.1	0.02	5	0.0001	5	1100	0.002	0.001	1.2	0.04	<0.00005	11	3

Continued........Sawyers Swamp Creek @ 1250 m near GW Bore D5 (EANSW Site 83) Post-Dry Ash Placement Data April 2013 to March 2014 (mg/L)										
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.008	0.036	252	0.01	0.001	8.6	0.001	34	670	0.02
Maximum	0.053	0.042	280	0.01	0.002	8.7	0.001	40	790	0.03
Minimum	0.001	0.030	230	0.01	0.001	8.4	0.001	26	580	0.02
50th percentile	0.004	0.036	250	0.01	0.001	8.7	0.001	34	660	0.02

9. Water quality and summary for Springvale Mine Water discharge

Springvale Mine Water (EANSW Site 158) Typical water quality (mg/L)																	
Date	Ag	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cr(VI)	Cu	F	Fe	Hg	K
Average	0.001	0.18	533	0.184	0.06	0.03	12	0.04	9	1071	0.017	0.01	0.004	1.20	0.14	0.00	106
Maximum	0.001	1.40	592	7.600	0.14	0.03	21	0.07	12	4077	0.061	0.01	0.005	1.50	0.38	0.00	200
Minimum	0.001	0.01	479	0.004	0.02	0.02	5	0.01	0	964	0.001	0.01	0.001	0.90	0.02	0.00	12
50th percentile	0.001	0.09	537	0.009	0.06	0.03	12	0.04	9	1055	0.004	0.01	0.005	1.20	0.14	0.00	106

Continued……..Springvale Mine Water (EANSW Site 158) Typical water quality (mg/L)															
Date	Mg	Mn	Mo	Na	NH3	Ni	NO2+NO3	Pb	pH	Se	SO4	TDS	TSS	Turbidity	Zn
Average	2.3	0.008		225	0.3	0.005	2.1	0.003	8.2	0.0011	28	648	5	9	0.026
Maximum	3.0	0.030		250	0.8	0.005	3.5	0.005	8.6	0.0030	66	780	23	110	0.060
Minimum	1.9	0.004		200	0.1	0.003	0.0	0.001	7.1	0.0002	14	368	1	0	0.005
50th percentile	2.1	0.006		225	0.2	0.005	2.0	0.003	8.2	0.0008	26	657	4	3	0.027

Springvale Mine Water Data (EANSW Site 158) Data April 2013 to March 2014 (mg/L)																	
Date	Ag	Al	ALK	As	B	Ba	Ca	Cd	Cl	COND	Cr	Cr(VI)	Cu	F	Fe	Hg	K
2/04/2013		0.35		0.014	0.08						0.001		0.005		0.14		
6/05/2013		0.22	570	0.016	0.06		8		9	1100	0.002		0.002				
3/06/2013		0.66	550	0.024	0.06		12		8	1100	0.001		0.001		0.38		
11/06/2013																	
17/06/2013																	
24/06/2013																	
1/07/2013		0.07	570	0.020	0.06		12		9	1100	0.001		0.001		0.18		
8/07/2013																	
15/07/2013																	
22/07/2013																	
29/07/2013																	
5/08/2013		0.10	570	0.016	0.08		11		9	1100	0.001		0.001		0.13		
12/08/2013																	
19/08/2013																	
26/09/2013																	
24/10/2013																	
7/11/2013																	
18/12/2013		0.10	570	0.023	0.05		14		8	1200	0.001		0.001		0.22		
23/12/2013																	
30/12/2013																	
6/01/2014		0.02	570	0.022	0.06		13		8	1200	0.0005		0.001		0.02		
13/01/2014																	
20/01/2014																	
28/01/2014																	
3/02/2014		0.02	580	0.027	0.07		12		9	1200	0.0005		0.001		0.11		
10/02/2014																	
17/02/2014																	
24/02/2014																	
3/03/2014		0.01	560	0.028	0.09		13		9	1100	0.0005		0.001		0.02		
10/03/2014																	
17/03/2014																	
24/03/2014																	

Continued……..Springvale Mine Water Data (EANSW Site 158) Data April 2013 to March 2014 (mg/L)															
Date	Mg	Mn	Mo	Na	NH3	Ni	NO2+NO3	Pb	pH	Se	SO4	TDS	TSS	Turbidity	Zn
2/04/2013	2.4	0.007			0.4	0.005				0.0010					0.030
6/05/2013	2.4	0.006			0.4	0.005			7.9	0.0009	26		5	3	0.023
3/06/2013	2.7	0.010			0.4	0.004			7.9	0.0005	24		23	32	0.010
11/06/2013											25		4	3	
17/06/2013											25		4	3	
24/06/2013											26		3	2	
1/07/2013	2.9	0.015			0.5	0.003	1.0		7.9	0.0003	19		7	6	0.021
8/07/2013											20		5	21	
15/07/2013											23		7	5	
22/07/2013											23		7	6	
29/07/2013											23		7	7	
5/08/2013	2.8	0.016			0.5	0.005	1.0		8.0	0.0002	24		9	8	0.023
12/08/2013											24		10	8	
19/08/2013											21		4	12	
26/09/2013															
24/10/2013															
7/11/2013															
18/12/2013	2.5	0.007			0.2	0.005	1.5		8.0	0.0008	34		18	23	0.038
23/12/2013											44		1	1	
30/12/2013											46		1	1	
6/01/2014	2.6	0.007			0.2	0.005	3.5		7.9	0.0008	42		1	1	0.024
13/01/2014											44		1	1	
20/01/2014											45		1	0	
28/01/2014											47		4	0	
3/02/2014	2.7	0.010			0.3	0.005	3.5		7.9	0.0002	44		5	5	0.021
10/02/2014											48		5	4	
17/02/2014											36		1	1	
24/02/2014											32		1	0	
3/03/2014	3.0	0.005			0.1	0.005	3.5		7.9	0.0010	45		1	0	0.024
10/03/2014											46		1	1	
17/03/2014											43		1	0	
24/03/2014											50		1	0	

Springvale Mine Water Data (EANSW Site 158) Data Summary April 2013 to March 2014 (mg/L)																
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cr(VI)**	**Cu**	**F**	**Fe**	**Hg**	**K**
Average		0.17	568	0.021	0.07		12		9	1132	0.001		0.001		0.15		
Maximum		0.66	580	0.028	0.09		14		9	1200	0.002		0.005		0.38		
Minimum		0.01	550	0.014	0.05		8		8	1100	0.001		0.001		0.02		
50th percentile		0.10	570	0.022	0.06		12		9	1100	0.001		0.001		0.14		

Continued........Springvale Mine Water Data (EANSW Site 158) Data Summary April 2013 to March 2014 (mg/L)															
Date	**Mg**	**Mn**	**Mo**	**Na**	**NH3**	**Ni**	**NO2+NO3**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**TSS**	**Turbidity**	**Zn**
Average	2.7	0.009			0.3	0.005	2.3		7.9	0.0006	34		5	5	0.024
Maximum	3.0	0.016			0.5	0.005	3.5		8.0	0.0010	50		23	32	0.038
Minimum	2.4	0.005			0.1	0.003	1.0		7.9	0.0002	19		1	0	0.010
50th percentile	2.7	0.007			0.4	0.005	2.5		7.9	0.0008	33		4	3	0.023