Project: Kerosene Vale Ash Dam and Dry Ash Repository

KVAR Stage 2A Water Quality Assessment April, 2010 to January, 2012

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Contents

Tables

Figures

Plates

Attachments

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Summary

Aurecon has been engaged by Delta Electricity to assess:

- The potential water quality improvements in surface and groundwater quality due to installation of seepage collection and diversion systems at:
    - the Sawyers Swamp Creek Ash Dam (SSCAD) v-notch pump-back system
    - sub-surface drains under the dry ash Kerosene Vale Ash Repository (KVAR), which are located inside the Kerosene Vale Ash Dam (KVAD) and
    - diversion of the KVAD groundwater to Lidsdale Cut via the unblocked KVAD toe drains.
- The effects of the Stage 1 and Stage 2A dry ash placements on surface and groundwater receiving waters.

The seepage collection and diversion systems have reduced the salinity (conductivity), sulphate and trace metals in the KVAD local groundwater seepage to Sawyers Swamp Creek and in Lidsdale Cut itself. These reductions provided evidence that the Stage 1 and Stage 2A dry ash placements are not measurably affecting the surface and groundwater quality.

Potential effects on the water quality at the Sawyers Swamp Creek receiving water site could not be confirmed due to Springvale Mine water inflows and other, non-ash related, catchment inputs to the creek. Further monitoring is recommended to assess the situation once the Springvale Mine water has been stopped from entering the creek.

1. Introduction

In 2002, Delta Electricity obtained approval for conversion of the wet slurry ash placement process at Wallerawang Power Station to dry ash. Wet slurry ash placement in Sawyers Swamp Creek Ash Dam (SSCAD) was stopped[1] and dry ash was placed on top of the first wet ash dam, Kerosene Vale Ash Dam (KVAD). When the KVAD was full of ash, wet ash placement was directed to the SSCAD and ultimately the KVAD was capped with clay so dry ash placement could be undertaken.

The dry placement is called the Kerosene Vale Ash Repository (KVAR). Stage 1 of the placement was completed and capped in February, 2009. Approval was obtained for further placement in the Stage 2 Area at the KVAR in November, 2008. The Stage 2 Area is in two parts: Stages 2A and 2B. Placement in the Stage 2A area began soon after in April, 2009. Placement in the Stage 2B Area began on 19th January, 2012.

The locations of the various ash dams and repositories are shown in Figure 1 and are described in the next Section.

1.1 Background

In March, 2010, the NSW Environment Protection Authority (EPA) Branch of the Department of Environment and Climate Change (DECC) undertook a review of the Wallerawang Power Station licence L766. As a result, Pollution Reduction Programs (PRP) were added to the revised licence dated 20th April, 2010 to reduce discharges of salinity and trace metals. The PRPs required Delta Electricity to undertake the following work:

- U1 Works Program to reduce Salinity and Metals
  - U1.1 Install and commission a seepage collection and return system to ensure that any seepage from the Sawyers Swamp Creek Ash Dam is intercepted, collected, and returned to the Sawyers Swamp Creek Ash Dam.
  - U1.2 Upgrade or re-install the Kerosene Vale Wet Ash Dam (KVAD) seepage collection and diversion system to ensure that any seepage from the Kerosene Vale Wet Ash Dam is intercepted, collected, and returned to the Lidsdale Open Cut void.

Subsequently, Delta Western complied with the PRPs by:

- Installing a seepage collection and return system to minimise seepage from the SSCAD into Sawyers Swamp Creek (SSC) in May, 2010
- Unblocking the KVAD toe drains and reinstating the seepage collection and diversion system to the Lidsdale Cut in October, 2010.

As part of the reinstatement of the KVAD toe drain seepage collection and diversion system, Delta Western installed a new sub-surface drain to lower the groundwater table in the KVAD, in the area under the KVAR placement. The underground drainage system was designed to lower the groundwater level in the KVAD to at least 1 metre below it’s clay capping, which forms the base of the KVAR’s dry ash placement. This underground drainage system has been connected to the existing KVAD toe drain seepage collection system, so that the groundwater drained from under the KVAR area is diverted to Lidsdale Cut, together with the groundwater drained from the KVAD itself.

[1] Delta Electricity still have the capability to use the Sawyers Swamp Creek Ash Dam for the placement of economiser grit, mill rejects, residual ash from the wash down system and emergency ash placement if necessary

Seepage and surface runoff water collected in the Lidsdale Cut overflows to Sawyers Swamp Creek, downstream of the KVAD/R area. Groundwater drainage from under the KVAR Stage 1 area is directed to the power station return canal.

1.2 Aims and Objectives

Delta Electricity advised Aurecon that they have completed their annual review of the Development Consent conditions of approval for KVAR Stage 2 and require confirmation that there has been an improvement in the water quality in Sawyers Swamp Creek and the upper Coxs River after implementation of the SSCAD and KVAR seepage collection and diversion works, and that the KVAR is not interfering with local surface and groundwater quality.

One of the primary objectives of the design and operation of the KVAR is to have no adverse impact on the local ground or surface water quality. More specifically, this means that leachates from the dry ash placement should not increase concentrations of the various water quality characteristics in the receiving waters by more than the locally derived guidelines (based on the 90th percentile of the background, pre-placement sites) or the ANZECC (2000) guidelines for protection of aquatic life, whichever is higher.

As indicated in previous reports, it has been necessary to establish local guidelines for some elements, due to the effects of mineralisation (coal bearing strata) in the ash placement area. The ANZECC (2000) guideline default trigger values and the locally derived guidelines are shown in Table 1, Section 2.7.

1.3 Previous Report

The previous report (Aurecon, 2010) noted that the Operational Environmental Management Plan (OEMP) incorrectly assumed that the KVAR was a contaminated site and applied the DEC (2007) Contaminated Sites Guidelines for assessment of groundwater contamination under the dry ash placement itself rather than assessing effects on receiving waters. However, as ash is not classified as a hazardous material, the OEMP approach was not used in the 2010 report and the ANZECC (2000) guideline approach of assessing the likely impact of water quality and trace metals on receiving waters, which was used in previous reports, was continued to be used in the 2010 report. The ANZECC (2000) guideline approach was also used in this report.

As requested by Delta Electricity, a detailed investigation of the pathway that ash leachates from the KVAR may take in reaching the local groundwater and Sawyers Swamp Creek was undertaken in a previous investigation (Aurecon, 2010). Sampling of the groundwater under the dry ash placement by Delta Electricity showed that rainfall infiltration through the ash accumulated at the base of the ash due to difficulty in passing through the clay capping on top of the KVAD. Hence it was found that the initial Stage 2 Area dry ash placement was having insignificant or undetectable effects on surface or groundwater quality, including selenium, in receiving waters due to:

- limited rainfall infiltration into the groundwater due to the dry ash itself and compaction by machinery;
- placement of the dry ash on the clay capping of the KVAD and its limited permeability;
- the highly mineralised nature of the catchment
- effects of the blocked KVAD toe drains on local groundwater quality;
- attenuation of selenium in ash leachate due to uptake by local soils or mine spoil.

The benefits of the dry ash placement management and the clay capped KVAD were demonstrated by the improved Stage I groundwater quality before the KVAD toe drains became blocked in 2007. The insignificant or minor effects with dry ash were shown to have provided the expected outcome of the dry ash placement project. However, a definitive assessment of the effects of the initial Stage 2 dry ash placement was not possible due to effects of the blocked KVAD toe drains, which caused increases in salinity and trace metals in the groundwater under the dry ash placement, as well as in seepage to Sawyers Swamp Creek. As the toe drains were unblocked in February, 2011, improvements in water quality in the creek are expected to be shown by examination of the data in this report.

The 2010 assessment also noted improvements in water quality, particularly trace metals, in the SSCAD. The improvements were due to the ending of wet flyash placement (under normal operating conditions), and corresponding leachates, into the ash dam since conversion to dry ash placement at the KVAR. However, the lack of flushing of the ash dam pond caused an increase in salinity and boron in the pond and there was a corresponding increase in seepage from the dam into Sawyers Swamp Creek. Even with these increases, the concentrations in the creek remained below the local guideline trigger values at the receiving water site, WX7, the location of which is shown in Figure 1.

Note that, in this report, metals such as cadmium, lead and zinc are called trace metals and non-metals such as selenium, boron and fluoride are called trace elements.

1.4 Scope

Aurecon has been engaged by Delta Electricity to review all ground and surface water monitoring data at the KVAR, KVAD and in Sawyers Swamp Creek to identify any improvement or otherwise in water quality in Sawyers Swamp Creek after the reinstatement of the KVAD seepage collection and diversion system and the installation of the SSCAD seepage collection and return system. The assessment is to include possible improvements in water quality in the upper Coxs River due to implementation of these seepage collection and diversion works. Delta Electricity also requires the report to assess the interaction of current Delta Electricity activities at the KVAR on surface and groundwater quality in the area.

1.5 Information provided by Delta Electricity

In connection with the assignment, Delta Electricity has provided copies of:

- Plan of KVAD seepage diversion works;
- Map of SSCAD dam showing the location of the seepage return system;
- Water quality data in the upper Coxs River, up- and downstream of the junction with Sawyers Swamp Creek and a map of the location of sampling sites;
- 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
- Provided water quality data monitored by the ash placement contractor, Lend Lease Infrastructure (LLI) from:
    - Sawyers Swamp Creek
    - copy of groundwater level contours in the Stage 1 and 2 areas prepared by LLI to provide an indication of the direction of groundwater flow (see Figure 8);

- Copy of relevant correspondence with OEH on the water quality expectations
- Springvale mine water quality to address effects of a pipeline leak on Sawyers Swamp Creek (This is described in Section 3.1)
- SSCAD seepage flows via the v-notch weir
- Lithgow rainfall data from the Bureau of Meteorology from January, 2000 to January, 2012 (see Attachment 1).

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

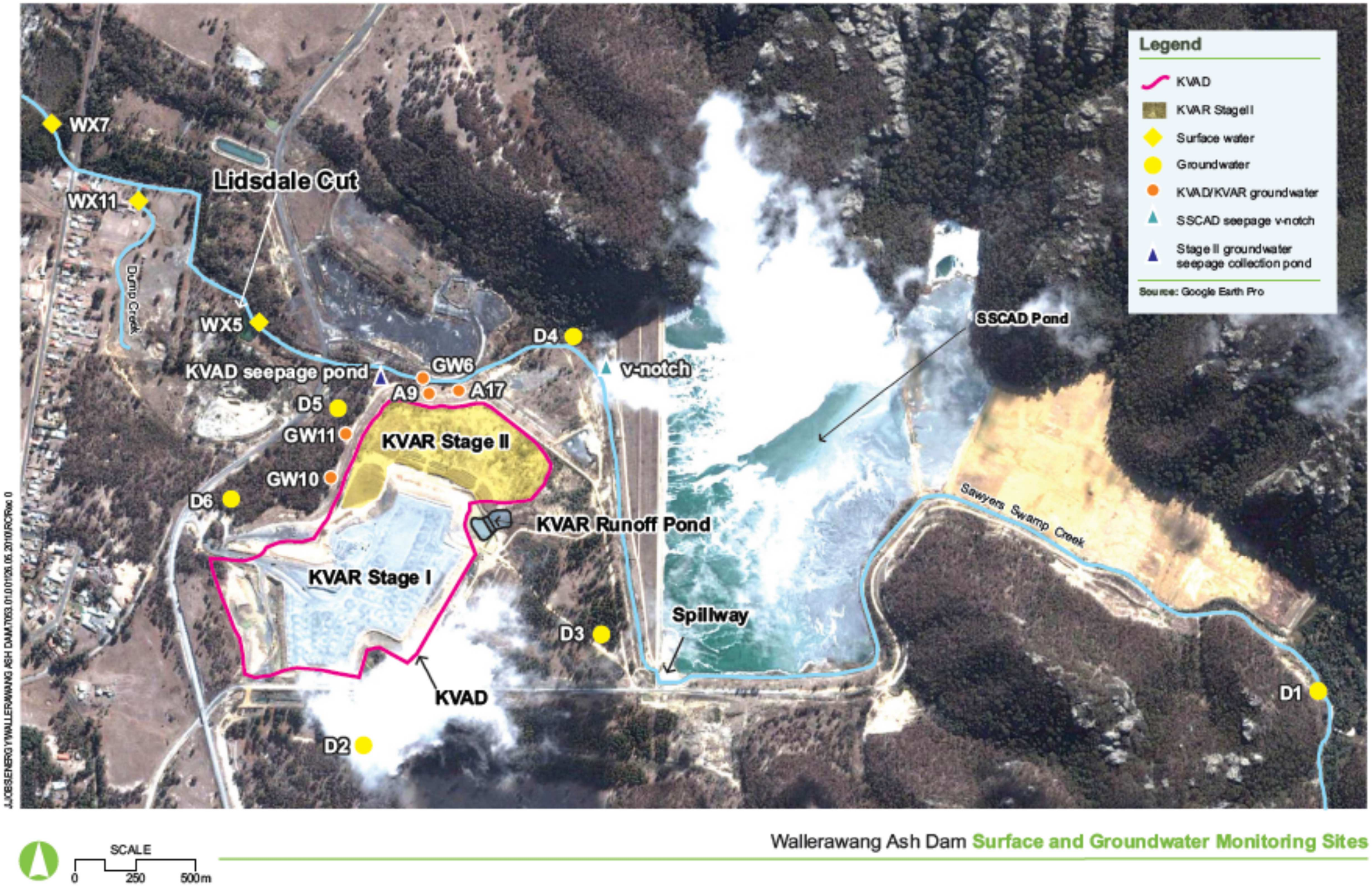

Figure 1 – Surface and Groundwater Monitoring Sites for Sawyers Swamp Creek Ash Dam and Kerosene Vale Dry Ash Placement Area

2. Surface and Groundwater Quality Monitoring

This Section provides an overview of the groundwater and surface water quality monitoring at the KVAD and KVAR used for assessment of effects, if any, of leachates from the KVAR on the local surface and groundwater quality. Due to local inputs from coal mining activities in the area, the assessment takes into account the local background conditions and provides the locally derived and ANZECC (2000) guideline trigger values, which apply as assessment criteria to the receiving waters.

2.1 Monitoring Design for Differentiation of Water Quality Sources

Surface and groundwater quality monitoring is undertaken by Delta Electricity for assessment of the environmental performance of the KVAR ash placement and seepage effects from the SSCAD. The assessment of the KVAR effects depends upon separating the effects of leachates from the KVAD, under the KVAR, local coal mine inputs and leachates and runoff effects, if any, from the KVAR itself that may reach the receiving water sites. To do this, the groundwater bore locations were established well before dry ash placement began in the following manner to allow for the effects of the various sources:

- Bore WWGM1/D1 is up-gradient of the SSCAD and samples groundwater from the escarpment behind the ash dam
- Bore WWGM1/D2 samples groundwater affected by local coal measures and is up-gradient of the KVAD and seepage from the SSCAD. This is the background groundwater quality for the KVAD and KVAR
- Bores WWGM1/D3 and D4 sample groundwater affected by seepage from the SSCAD, as well as the local coal measures, and are up-gradient of the KVAD and KVAR
- Bores WWGM1/D5 and D6 are down-gradient of the KVAD and KVAR and sample groundwater affected by seepage from these sources, as well as the local coal measures. These are the receiving groundwater bores where the local/ANZECC (2000) groundwater guideline trigger values apply for assessment of seepage effects from KVAD and KVAR.

Surface water quality monitoring locations were also established in Sawyers Swamp Creek before dry ash placement began. The assessment of the KVAR and SSCAD effects on the creek depends upon separating the effects of seepage from the SSCAD, KVAD and KVAR, as well as local coal mine inputs to the creek. This was undertaken in the following manner to allow for the effects of the various sources:

- Water quality site WX11, in Dump Creek, samples rainfall runoff and groundwater seepage from local coal measures and surface emplacements. This is the background water quality for Sawyers Swamp Creek, which also receives inputs from local coal measures and surface emplacements as it passes through the area downstream of the SSCAD
- The Lidsdale Cut discharge to the creek, WX5, samples inputs to Sawyers Swamp Creek from the local coal measures and surface emplacements as well as the KVAD toe drains
- Water quality site WX7, in Sawyers Swamp Creek, is downstream of the Lidsdale Cut discharge to the creek and downstream of the junction with Dump Creek. This site is the receiving waters where the local/ANZECC (2000) freshwater guideline trigger values apply for assessment of seepage effects from KVAD, KVAR and SSCAD.

The locations of the various groundwater and surface water sites are shown in Figure 1.

The water quality monitoring is undertaken to confirm that the local/ANZECC (2000) guidelines (as applicable) are met in the groundwater bores D5 and D6 and in Sawyers Swamp Creek and to enable contingency actions and investigations to be initiated in a timely manner if these limits are approached.

2.2 Recent installation of Seepage Collection and Diversion Systems

Delta Electricity has recently installed the following seepage collection and diversion systems to minimise effects of ash placement activities on the water quality in Sawyers Swamp Creek:

- re-instatement of the KVAD toe drains to Lidsdale Cut (February, 2010),
- installation of drains inside the KVAD, under the Stage 2 area, for seepage collection and connection to the KVAD toe drains for diversion to Lidsdale Cut (October, 2010),
- installation of a seepage collection and pump-back system at the main SSCAD dam wall V-notch seepage site (March, 2010).

As these works have further complicated the assessment of effects of the KVAR, this report has also taken into account the effects of these works on the water quality in Sawyers Swamp Creek, as well as the local groundwater. In addition, rainfall in the area increased just after the works were installed due to a “La Niña” event that continued during summer 2011/12 (see Section 2.5).

Delta Electricity ash placement contractor, LLI, routinely monitors water quality in Sawyers Swamp Creek upstream of Lidsdale Cut, and this water quality data was used to assess the effects of the above seepage collection and diversion systems. The contractor undertakes measurements of general water quality such as conductivity and pH, as well as some trace metals at various times and sites, on behalf of Delta Electricity as part of the management of the ash placement. Their measurements began in February 2010 and are continuing. Data to February, 2012 was used in this report.

Lend Lease Infrastructure has five water quality sampling sites in Sawyers Swamp Creek. Their locations are referenced by the SSCAD Spillway, the v-notch, and sites upstream and downstream of the KVAD Seepage Pond in Figure 1. The sampling sites, prefixed by SSC, are shown in more detail in Figure 8 and are described by:

- Upstream of the v-notch is located immediately downstream of the Sawyers Swamp Creek Ash Dam Spillway, where the SSC bypass water re-enters the creek (SSC upstream @ 0m). It is labelled as SSC at SSCAD Spillway in the water quality graphs in Section 3.
- Site near the v-notch is SSC @600m
- Site upstream of the KVAD seepage pond is located downstream of the V-notch at the KVAD’s north-eastern corner, near groundwater bore A17, at SSC @ 800m
- Downstream of the KVAD seepage pond is located near bore D5 at SSC @ 1200m.

Note that the KVAD downstream site is only downstream of the northern section of the original ash dam wall. In addition, see cautions regarding the use of the site upstream of KVAD in Section 3.1.

These data, together with the routine, long-term Sawyers Swamp Creek data collected by Delta Electricity at the receiving water site, WX7, were used to identify any improvement, or otherwise, in water quality in Sawyers Swamp Creek after the above works had been installed.

The assessment includes possible improvements in water quality in the upper Coxs River due to implementation of these seepage collection and diversion works.

2.3 Tracers for Dry Ash leachates

The main trace metals and elements of interest in the rainfall runoff from the KVAR ash placement area are selenium, sulphate, boron, nickel and zinc. These elements, except selenium, are also present in the local mineralised coal geology of the area and are mainly due to the placement of mine spoil and chitter in the catchment. Chitter contains pyrites, which release sulphate and trace metals into the local groundwater and surface waters. Hence, selenium is used here as a tracer of direct effects of the previous wet ash systems in the KVAD and SSCAD, as well as for the current dry ash placement on the local surface and groundwater.

Long-term trends in surface and groundwater quality generally use conductivity to trace salinity effects, which in the mineralised area, tends to follow that of sulphate. Sulphate and boron trends are used to show changes due to coal mining activities and flyash management is indicated by selenium concentrations. Boron is used to represent changes in other trace metals when the data shows their changes (increasing or decreasing) are similar. Selenium concentrations are examined for trends if they consistently exceed the ANZECC (2000) guideline of 5 ug/L.

2.4 Groundwater Levels

The water level in each groundwater bore is 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 data are also used to confirm that the groundwater level in the KVAD is not reaching the dry ash placement above it.

Bores WWGM1/D5 and D6 are down-gradient of the ash placement and up-gradient of the Lidsdale Cut for early detection of leachates from the KVAR placement area. Effects of the KVAR on groundwater level changes at these bores are also monitored.

The monitoring data are shown in spread-sheet 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 is also summarised in Tables in the body of the report.

2.5 Climatic Conditions

The average annual rainfall over the period of KVAR ash placement from 2003 to January, 2012 at the Lithgow gauge has remained low at 777 mm/year (Attachment 2), which is 90% of the long-term annual rainfall of 863 mm/year. During the period January, 2010 to January, 2012, the monthly average rainfall of 76.5 mm/month, was above the long-term average of 72 mm/month. According to the Bureau of Meteorology (BOM), there was a recent increase in rainfall, which was due to a “La Niña” event that formed in July, 2010 and peaked between late 2010 and early 2011 (http://www.bom.gov.au/climate/enso/feature/ENSO-feature.shtml). The event continued during summer 2011/12 such that the average monthly rainfall at the Lithgow rainfall gauge from November, 2011 to January, 2012 was 82 mm/month.

2.6 Methods

Routine surface and groundwater water quality monitoring in the area is undertaken monthly on behalf of Delta Electricity by Nalco Analytical Resources who measure conductivity, pH and temperature in the field with a calibrated instrument.

In house methods based upon Standard Methods (APHA, 1998) are used for the general water quality characteristics of alkalinity, sulphate, chloride, calcium, magnesium, sodium, potassium and total dissolved solids (TDS) and total suspended solids (TSS, also known as non-filterable residue, NFR). The trace metals and elements monitored are the same for surface and groundwater: copper, cadmium, chromium, lead, zinc, iron, manganese, mercury, selenium, silver, arsenic, barium, boron and fluoride. Molybdenum, nickel and beryllium have been monitored since July, 2007. Delta Electricity has advised that the in-house methods are equivalent to those specified in DEC (2004), which also uses Standard Methods. (In this regard, it is relevant to note that the groundwater and Sawyers Swamp Creek monitoring is not required under the POEO licence). Trace metals were unfiltered, except for iron and manganese.

Groundwater bores are bailed and sampled after allowing time for the water level in the bore to re-establish. The depth to the water level from the top of the bore is measured using a dip meter.

Since April, 2006 the detection limits (DL) for routine monitoring of most trace metals tested were lower than the ANZECC (2000) guidelines (Table 1). Particular attention has been directed at the trace metals arsenic, cadmium, chromium, copper, mercury, nickel and lead, as well as the trace element selenium, which have been analysed with a low detection limit. However, due to sample matrix interference, silver is currently analysed above the ANZECC guideline trigger value of 0.00005mg/L (see Section 2.10 and Attachment 2).

2.7 Guidelines

The OEMP requires that the ANZECC (2000) Ecosystem Protection Guidelines be used for assessing surface water quality and Irrigation and Ecosystem Protection Guidelines for groundwater. However, as used in previous reports, the principle of the ANZECC (1995) guidelines for protection of groundwater, where the potential future use of the water resource is considered, should also be taken into account. In this regard, the Irrigation, Ecosystem and additional guidelines for protection of livestock or drinking water, 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, was used. The default guidelines for trace metals are shaded grey in the guideline tables and the default for most metals is the 95% species protection. The exceptions are for mercury and selenium, where the guidelines default is 99% species protection (see Table 1).

The ANZECC Guidelines for Groundwater Protection in Australia (1995) and the NEPC (1999) require the background water quality in groundwater bores to be taken into account. As the NEPC (1999) did not define the meaning of “background” concentrations, the baseline concentrations were defined in previous reports as the 90th percentile of the pre-placement concentrations, or the ANZECC guideline default trigger values, whichever is higher. The 90th percentiles, that are higher than the default trigger values, are used as the local guidelines.

2.7.1 Local Guidelines

Local guidelines are based on the ANZECC (2000) guideline approach of estimating local guidelines using the 90th percentile for naturally mineralised, highly disturbed groundwater (condition 3 waterbodies).

Due to local mineralisation effects, local guidelines were derived using the pre-KVAR Stage 1 placement 90th percentile of water quality characteristics that are naturally elevated in the area. They were determined using the water quality measured at the background bore, WGM1/D2, and at the Dump Creek Background site (WX11), before dry ash placement began, and are shown in Table 1. Elevated concentrations at the seepage detection bore WGM1/D5 and Lidsdale Cut (WX5) for pre-KVAR data were also taken into account.

The 90th percentile baseline concentrations for all the water quality characteristics monitored are also shown in Table 1.

The pre-KVAR data used was for the fifteen year period February, 1988 to April, 2003. Note that use of the 90th percentile means that about 10% of the pre-placement concentrations would be above the baseline.

2.7.2 Environmental Goals

From the above considerations, the ANZECC (2000) guideline default trigger values and the local guidelines, with cadmium, chromium, copper, lead, nickel and zinc hardness corrected, are called the environmental goals for the Wallerawang Power Station Sawyers Swamp Creek Ash Dam and the KVAR dry ash placements. The environmental goals for the various elements monitored are shown in Table 1. Note that some of the receiving water monitoring sites had pre-placement water quality and trace metals above the environmental goal concentrations due to local catchment and wet ash inputs before dry ash placement began. These are highlighted blue in the table.

Table 1 shows that the guidelines for groundwater may be different from those used in Swayers Swamp Creek, where the effects on aquatic life are considered. Note that the ANZECC (2000) guideline trigger values for cadmium, chromium, copper, lead, nickel and zinc were adjusted for effects of hardness.

As discussed in Section 2.7.5, the surface water guideline goals apply to the receiving waters of Sawyers Swamp Creek at WX7 (Figure 1). The groundwater goals apply to the seepage detection bore WGM1/D5 and Lidsdale Cut (WX5) and these are used for early warning of potential effects on the Sawyers Swamp Creek receiving waters. These goals are used for assessment of the Stage 2A effects in this report.

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

Element (mg/L)	Background Groundwater (WGM1/D2)	KVAD & KVAR Groundwater (WGM1/D5)	Lidsdale Cut (WX5)		Dump Creek (WX11)	Sawyers Swamp Creek (WX7)	
	Pre-Placement (1988-2003) 90th Percentile	Pre-Placement (1988-2003) 90th Percentile	Pre-Placement (1992-2003) 90th Percentile	Groundwater Guidelines# or Goals	Pre-placement (1991-2003) 90th Percentile	Pre-placement (1991-2003) 90th Percentile	Surface Water Guidelines# or Goals
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	2600^	770	760	2200
TDS	258	550	650	2000++	772	584	1500^
SO4	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 CrVI 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 is 0.05 mg/L

++ Livestock

+++ drinking water

The surface water conductivity guideline of 2,200µS/cm shown in Table 1 was based on the background Dump Creek site, WX11, and the Sawyers Swamp Creek receiving water site, WX7, both having the 90th percentile conductivity more than twice the ANZECC (2000) guideline default upland river trigger value of 350 µS/cm (upland rivers are defined as above 150m altitude). Local mineralisation effects were the cause, as shown by the Dump Creek site, so use of the upland value was not considered appropriate and the higher, ANZECC (2000) lowland (altitude below 150m) river conductivity trigger value of 2,200 µS/cm was used for protection of aquatic life in Swayers Swamp Creek (Connell Wagner, 2008).

Although the background groundwater bore, D2, 90th percentile conductivity was lower than the upland river trigger value of 350 µS/cm, the pre-dry ash placement 90th percentiles at the KVAD groundwater bore D5, as well as the Lidsdale Cut conductivities, were higher than in the creeks. As groundwater seepage into Swayers Swamp Creek would be slow, use of the creek trigger value was not considered appropriate for groundwater. The approach adopted was the ANZECC (1995) guidelines for protection of groundwater, where the potential future use of the water resource is taken into account. As shown in Table 1, the livestock drinking water guideline for salinity, of 2,000 mg/L TDS, was considered relevant to the assessment of groundwater in the area, should the groundwater be used for watering livestock in the future (Connell Wagner, 2008). The TDS was converted to the conductivity local trigger value of 2,600 µS/cm by dividing by the conversion factor 0.77, which was derived from the measured groundwater conductivity and TDS.

The potential water quality improvements due to installation of the seepage collection and diversion systems are assessed in Section 3 using changes in conductivity at the various receiving water sites. Effects of the KVAR Stage 2A placement on water quality and trace metal changes are assessed against the environmental goals, and according to the ANZECC guidelines, in Section 4 and discussed in Section 5.

2.7.3 Early Warning of Water Quality Changes

An early warning of changes in water quality that may potentially approach the relevant local guidelines set out in Table 1 is required for the ash repository management to allow time for investigations of the causes of changes and controls to be implemented if necessary. The approach used is the ANZECC (2000) guideline procedure for assessing changes in water quality. The ANZECC procedure is to compare the 50th percentile (median) in receiving waters with the 90th percentile of the background or pre-KVAR water quality at the receiving water sites. An early warning of changes is signalled when the post-placement 50th percentile exceeds the pre-placement 90th percentile water quality conditions. This approach is supplemented by the use of Control Charts to show concentration changes to local/ANZECC trigger values and the 90th percentile pre-KVAR conditions.

These procedures are applied to each down-gradient groundwater bore, the Lidsdale Cut and Sawyers Swamp Creek to assess long-term changes that are approaching the local/ANZECC trigger values.

2.7.4 Triggers for investigations and Management

With installation of the seepage collection system under the KVAR, most leachates from the KVAR will be collected by the KVAD toe drains and diverted to Lidsdale Cut. This can occur by two flow paths: (a) vertically through the clay capping of the KVAD and emerge in the KVAD toe drains mixed with groundwater from the KVAD or (b) intercepted by the seepage collection system under the KVAR, which is joined to the toe drains and diverted to Lidsdale Cut.

The locally derived and ANZECC (2000) guidelines used in this and the previous reports requires that if concentrations increase above background and approach the relevant local guidelines, and it can be reasonably expected that the changes are due to the KVAR placement, an investigation of the cause should be implemented. In practice, to allow for natural variability, the guideline protocol implies that, if the locally derived environmental goals are consistently exceeded, an investigation of causes and management action of the dry ash placement would be initiated. To allow for the locally enriched minerals in the area, the water quality in the background bore, up-gradient of the ash placement area (WGM1/D2) and changes from pre-KVAR to post-KVAR in bore D5, Lidsdale Cut and WX7 are also taken into account. Changes at the receiving waters due to the effects of seepage from the KVAD also have to be taken into account.

2.7.5 Receiving Waters

Previous reports identified the following receiving water sites for assessment of ash leachate effects from the KVAR dry ash placement:

- Groundwater bore WGM1/D5
- Lidsdale Cut (sampling site WX5)
- Sawyers Swamp Creek at site WX7.

The Sawyers Swamp Creek site is the final receiving water site for the SSCAD, the KVAD and KVAR seepages and the Lidsdale Cut discharge. This site receives inflows from the following sources:

- SSCAD residual seepage from the ash dam wall into Sawyers Swamp Creek, and the local groundwater, since the pump-back system was installed
- Sawyers Swamp Creek, in the areas where it flows through the coal measures upstream of the KVAR and KVAD
- Groundwater inflows, up-gradient of the KVAD/R and down-gradient of the SSCAD
- KVAD/R seepage to the creek where it flows past the downstream sections of the KVAD wall
- Lidsdale Cut discharge of the KVAD toe drains and KVAR sub-surface drains, including groundwater from the local coal measures and surface runoff into the Cut
- the local background catchment of Dump Creek.

Bore WGM1/D5 represents the groundwater receiving water site for seepage from the KVAD/R that was not collected by the KVAD toe drains or the KVAR sub-surface drains that are directed to the KVAD toe drains.

Lidsdale Cut is also a receiving water site that can provide early warning of changes due to seepage from the KVAR. Hence, WX7 is the final receiving water site for the ash placement areas. In this regard, the Lidsdale Cut and bore WGM1/D5 are used to provide early warning for potential effects that may reach the surface water receiving water site, WX7, in Sawyers Swamp Creek. This approach was used in the previous report and has been used here for the current assessment.

As Delta Electricity does not routinely monitor the water quality in Sawyers Swamp Creek where it flows through the coal measures upstream of the KVAD/R, the only surface water background site is WX11 in Dump Creek. Hence, changes in surface water quality in Sawyers Swamp Creek at WX7 were assessed by comparison with the catchment background water quality in Dump Creek at WX11. The receiving water site, WX7, is downstream of Lidsdale Cut and the junction of Dump Creek with Sawyers Swamp Creek and upstream of the junction with the Coxs River (Figure 1).

2.8 Control Charts

Long-term plots are used to allow the identification of trends against the baseline and environmental goals. The trends are tracked using Control Charts (Standard Methods, 1995 and ANZECC guidelines for Monitoring and Reporting, 2000) and the significance of the changes are determined by comparison with the criteria of pre-placement 90th percentiles, post-placement medians, ANZECC (2000) guidelines or local guidelines. As the ANZECC guidelines apply to the receiving waters of Sawyers Swamp Creek, Lidsdale Cut and the KVAD and Stages I and II seepage detection bores D5 and D6, the trends over time are graphed against these environmental goals.

To keep the number of charts manageable, only those parameters of relevance to the Stage II dry ash placement, such as conductivity, sulphate, boron and selenium, or those showing significant unexplained increases above the levels expected from the Stage II Environmental Assessment (PB, 2008) are graphed.

Elevated sulphate and boron concentrations are associated with coal mining activities and can also be elevated in flyash leachate and mine spoil (PPI, 1999). The presence of boron in higher than background concentrations is often associated with other trace metals and elements such as fluoride, nickel and zinc. The data for these and other elements are shown in Attachment 2.

The data are also summarised in Tables in this report, or in spreadsheet format in Attachment 2, including the minimum, maximum and mean as well as the 90th percentile baseline, median post-conversion, ANZECC guidelines and local guideline concentrations.

2.9 KVAR Site Monitoring and Runoff Management

Rainfall runoff from the KVAR dry placement area is collected by an ash perimeter drain which directs the runoff to a Collection Pond (Figure 1). Some of the collected water is reused for dust suppression by spraying on the dry ash deposit. The collection pond is normally kept at a low level by continually pumping water to the power station return canal to prevent it from spilling into Sawyers Swamp Creek.

Delta Electricity's contractor for ash placement at the KVAR, Lend Lease Infrastructure Services (previously Conneq and Bilfinger Berger Services) has installed piezometers at the site for sampling the groundwater height and water quality (bores GW6, 10 and 11 and A9 and 17, shown in Figure 1). They also undertake some water quality monitoring at various sites in Sawyers Swamp Creek from the SSCAD diversion to near the north-west side of the KVAR. This data was used for assessment of the potential improvements in water quality due to installation of the seepage collection and diversion works.

2.10 Data Quality

The data contained in this report was provided by Delta Electricity and LLI and was checked for outliers using the ANZECC (2000) protocol. In accordance with the protocol, outliers of three times the standard deviation from the mean were removed from the dataset provided that no environmental changes had occurred that would account for such a significant change. Outliers have an asterisk next to the data in Attachment 3, thereby stopping the result from being used in statistical analyses by Excel.

As the database covers a long period of observations, it is likely that apparent changes in concentrations for trace metals such as silver, cadmium, chromium, copper and mercury may in fact be due to changes in the accuracy or detection limits of the analytical techniques used.

The OEMP requires the existing monitoring program to continue, with the addition of low detection limit analysis for trace metals (to ensure that the detection limit is lower than guideline values). All of the metals tested, except for silver, met these criteria. Silver has continued to be tested with a detection limit of ten to one hundred times the ANZECC (2000) guidelines. To comply with the OEMP, future silver analytical tests should be undertaken at less than the 0.00005 mg/L detection limit.

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

This Section assesses the likely effects of the KVAD, KVAR Stage 2 sub-drains and SSCAD seepage collection and return system on receiving water quality and trace metals, by following the requirements of the Wallerawang Power Station PRP:

- Install and commission a pump-back system to ensure that any seepage from the Sawyers Swamp Creek Ash Dam is intercepted, collected, and returned to the Sawyers Swamp Creek Ash Dam
- Upgrade or re-install the Kerosene Vale Wet Ash Dam (KVAD) seepage collection and diversion system to ensure that any seepage from the Kerosene Vale Wet Ash Dam is intercepted, collected, and returned to the Lidsdale Open Cut void
- Install a new sub-surface drain inside the KVAD under the KVAR Stage 2 Area and divert the collected seepage to Lidsdale Cut.

The result of the sub-surface drain under the KVAR was to lower the groundwater table, which kept the KVAR placement dry.

There was an increase in rainfall in the Lithgow area at the time of implementing the above works and this complicated the assessment of water quality changes. Accordingly, the water quality in Sawyers Swamp Creek over the period, from before to after installation of the seepage collection and return systems, was reviewed against the change in rainfall over the same period.

3.1 Sawyers Swamp Creek Ash Dam Pump-back System

In this sub-section, the water quality following installation of the ash dam seepage collection and pump-back system is assessed in relation to the water quality in Sawyers Swamp Creek. The monitoring in the creek near the v-notch is undertaken by the ash dam contractor (LLI) and only limited water quality data was collected. Conductivity was the only characteristic consistently monitored and it was used to indicate changes in water quality due to the pump-back system.

As described in Section 2.2, the site upstream of the v-notch is immediately downstream of the SSCAD spillway and the downstream site is located near KVAD's north-eastern corner (Figure 1). This (downstream) site appeared to be affected by seepage from the KVAD, and possibly from the coal handling activities adjacent to the creek and outside of Delta's boundary. Noting these factors, the KVAD north-eastern corner site was used as the v-notch downstream site.

As noted above, conductivity was used to indicate changes in water quality in Sawyers Swamp Creek from before and after implementation of the seepage works. The conductivity in the creek, up- and downstream of the v-notch was examined for changes from before and after installation in March, 2010. Sampling was also undertaken in the creek near the v-notch from July, 2011 and the changes from February 2010 to February, 2012 are shown in Figure 2.

The LLI dataset associated with the v-notch had missing data for both upstream and downstream sites. Accordingly, the periods of missing data are shown as dotted lines in Figure 2.

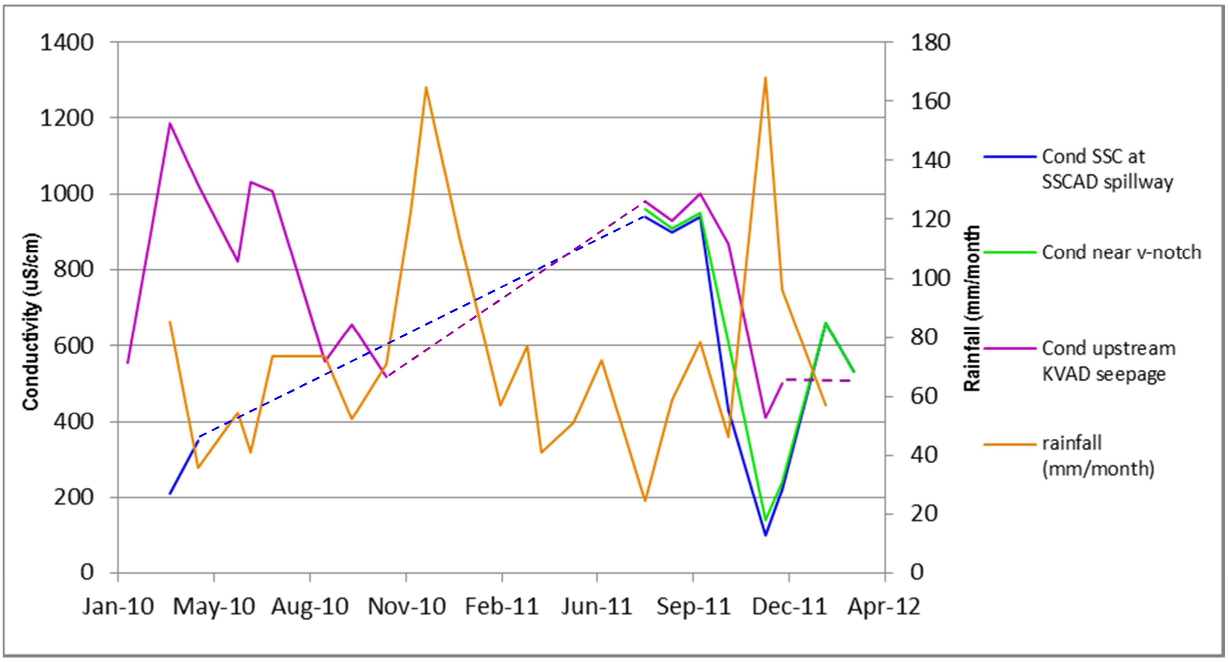

Figure 2 - Sawyers Swamp Creek Conductivity compared to Rainfall Variations from February, 2010 to February, 2012 at sites upstream of the v-notch (SSC at SSCAD spillway), near the v-notch and downstream of the v-notch (SSC site upstream of KVAD seepage pond). (Missing data for spillway and KVAD upstream sites shown as dotted lines).

Figure 2 shows that there was an increase in conductivity in the Sawyers Swamp Creek bypass water at the SSCAD spillway site (other than during the rainfall event from October to December, 2011) up to levels similar to those measured near the v-notch and at the KVAD upstream site.

It is understood that the emergency discharge valve on the pipeline from the Springvale Coal Mine to Wallerawang Power Station developed a leak from July, 2011 and mine water has been leaking into Sawyers Swamp Creek since then. The valve is on the EPA licensed discharge point LDP20 for Wallerawang Power Station. It is also understood that Delta Electricity is negotiating with Centennial Coal to temporarily depressurise the pipe to enable repairs to the valve.

Delta Western has advised that the leak in the Springvale Mine water pipeline was the cause of the high conductivity (about 1000 µS/cm) at the LLI spillway sampling site since July, 2011, as the leak causes relatively large flows of high conductivity water to enter the creek.

The small increase in conductivity near the v-notch, above that at the spillway (Figure 2), may have been due to minor seepage from the base of the ash dam wall upstream of the pump-back system. However, the conductivity of the water from the leak dominated the conditions in the upper Sawyers Swamp Creek and prevented an assessment of any potential improvements resulting from the v-notch pump-back system. It is suggested that Delta Electricity and Centennial Coal repair the leak and that an assessment of potential beneficial effects of the pump-back system be undertaken.

Figure 2 also shows that the KVAD upstream site had a higher conductivity than the creek background at the spillway, even with Springvale Mine water flowing down the creek. This is discussed in the next Section.

3.2 KVAD Seepage Collection and Diversion Effects

Figure 2 also shows that, other than during the rainfall events in December, 2010 and November, 2011, the conductivity at the KVAD upstream site remained in the same range before and after the pump-back was installed in March, 2010 and installation of the KVAD drains under the KVAR (October, 2010).

The much higher conductivity in February and March, 2010 at the KVAD upstream site, compared to that at the spillway site, suggests that seepage from the KVAD, and possibly the local coal placement, cause increased conductivity in the upper Sawyers Swamp Creek. Although the pipeline leak conductivity made comparisons uncertain since July, 2011, the limited 2010 observations are consistent with seepage into the upper Sawyers Swamp Creek from the KVAD and other external inputs in the northern area of the KVAD.

The effect of the relatively high conductivity in the mine water leak on conductivity further down Sawyers Swamp Creek was investigated by examination of changes at sites downstream of the KVAD and at the receiving water site WX7. The location of these sites is shown in Figure 1. The aim of the investigation was to identify potential effects on water quality of installation of the seepage collection from the KVAD under the KVAR and its diversion to Lidsdale Cut. It was expected that any effects of the pipeline leak on water quality in the creek would be identified as part of the investigation.

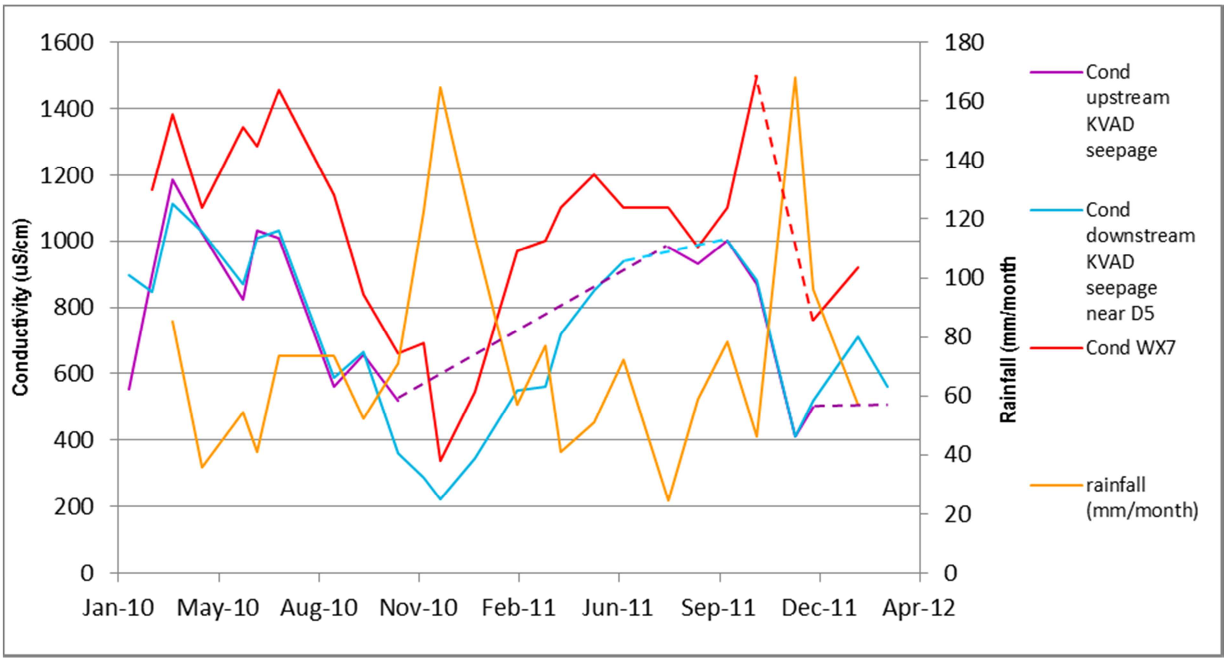

Figure 3 - Sawyers Swamp Creek Conductivity compared to Rainfall Variations from February, 2010 to February, 2012 at sites upstream KVAD to downstream of KVAD seepage (downstream site taken as the LLI site near the groundwater bore D5) as well as at Receiving Water Site WX7

Figure 3 shows that the conductivity at the KVAD upstream site and KVAD downstream site, located to the north-west of the KVAD/R placements, (Figure 1) tended to closely follow each other. This showed there was no significant change in conductivity over the relatively short distance between the up- and downstream creek sites in the northern section of the KVAD. The close relationship between these sites most likely reflects the effects of seepage inputs from the KVAD and external inputs from the catchment.

3.2.1 Sawyers Swamp Creek Receiving Water Site, WX7

As Figure 3 also showed that the conductivity at the receiving water site, WX7, was higher than both the LLI KVAD up- and downstream sites in Sawyers Swamp Creek, the cause was investigated.

The Delta Electricity routine monitoring data at WX7, from before and after the SSCAD pump-back began (March, 2010) and beginning of operation of the KVAD drains under the KVAR (October, 2010), was compared to the rainfall, as well as the conductivity at the Dump Creek site (WX11), which represent the mineralised background conditions in the area, and Lidsdale Cut (WX5) in Figure 4.

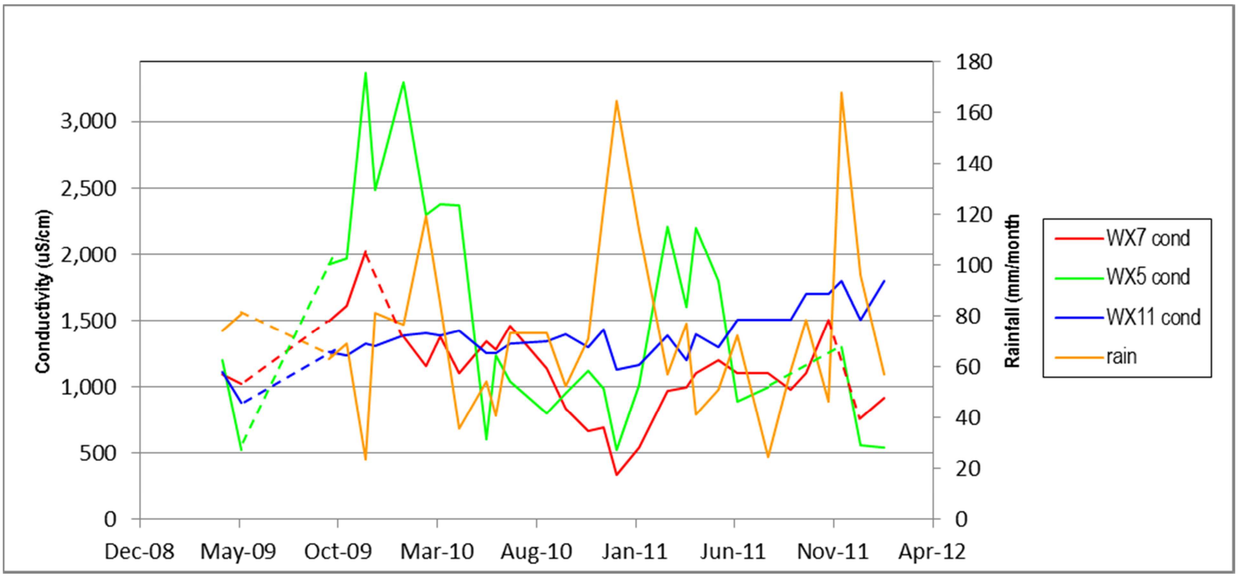

Figure 4 - Sawyers Swamp Creek Conductivity at Receiving Water Site WX7 compared to Rainfall variations and the Dump Creek Background site (WX11) and Lidsdale Cut (WX5) routine monitoring sites downstream of KVAD from January, 2009 to January, 2012

Figure 4 shows no changes in conductivity at WX7 that could be attributed the seepage collection and diversion works. The rainfall caused temporary decreases but the conductivity tended to return to pre-seepage collection levels.

Contrary to the changes at WX7, the conductivity in Dump Creek (WX11) increased, even with the increase in rainfall, indicating that the rain was leaching salts (and other elements – see Section 4.1) from material placed in the catchment by mining activities in the area. Dump Creek enters Sawyers Swamp Creek upstream of WX7 and appears to have added to the salinity at WX7, relative to that measured by LLI in the creek near bore D5 (see Figure 3).

3.2.2 Lidsdale Cut

In addition to inputs from Dump Creek to WX7, the KVAD toe drains direct seepage from the KVAD to Lidsdale Cut (WX5). Since October, 2010, groundwater collected from inside the KVAD, in the area under the KVAR Stage 2, has been added to the toe drains. This increased flow of KVAD groundwater into the Lidsdale Cut caused overflows to Sawyers Swamp Creek, due to the resulting increase in water level in the Cut. The overflow enters the creek upstream of both Dump Creek and WX7.

Figure 4 also shows significant changes in the conductivity in Lidsdale Cut. The conductivity in WX5 increased with increasing rainfall (before the drains were first connected) and after the connection, the conductivity decreased even with the wet weather and mostly stayed low. A high rainfall event from November, 2010 to January, 2011 was followed by a moderate increase in conductivity but subsequently decreased to low levels.

The changes in conductivity in Lidsdale Cut were investigated further by comparison with the conductivity in the groundwater bores, D5 and D6, down-gradient of the KVAD and the drawdown in the groundwater level under the KVAR as measured at the LLI piezometer APA10 (Figure 5). The piezometer was installed deep enough to sample the groundwater in the KVAD under the Stage 2 Area (see Figure 8).

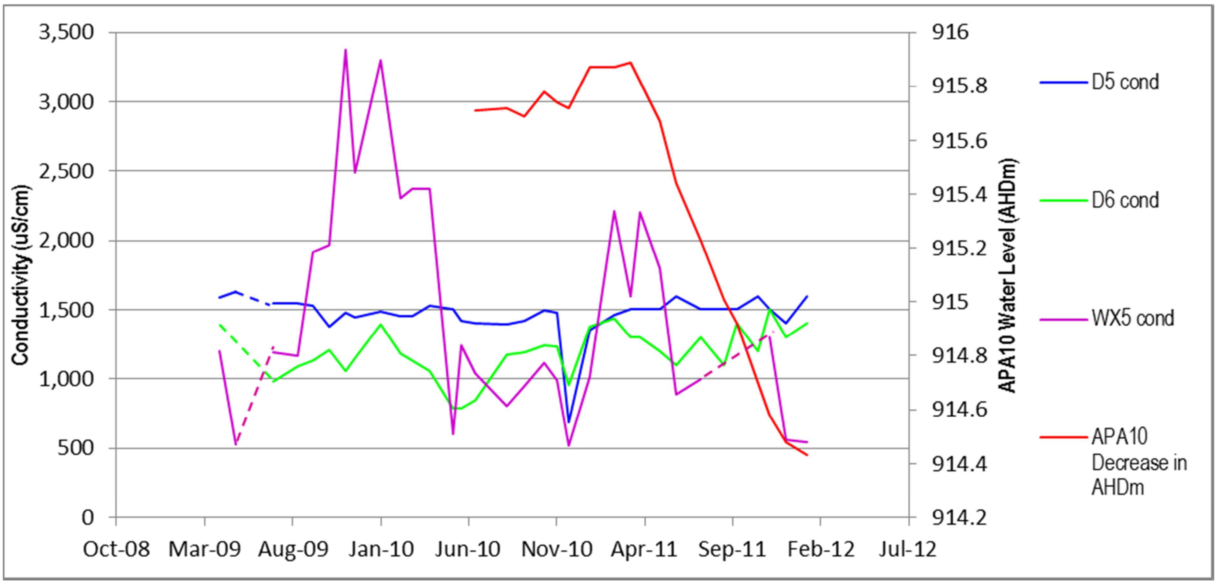

Figure 5 – Lidsdale Cut (WX5) Conductivity compared to KVAD Seepage Detection Bores D5 and D6 Conductivity and the KVAD Groundwater Level decrease at Piezometer APA10 from October, 2010 from January, 2009 to January, 2012

Figure 5 shows a reduction in conductivity at WX5 down to similar conductivity to that in bores D5 and D6 (closer to D6) from when the sub-surface drains under the Stage 2 Area were first connected to the KVAD toe drains in October, 2010. Note that the decrease in water level in the KVAD (as measured at APA10 – location is shown in Figure 8) was delayed but the initial connection of the sub-surface drains to the KVAD toe drains was apparently sufficient to reduce the conductivity in the Lidsdale Cut.

It was noted that the groundwater level at bore D5 was also decreased by about 1m but there was no change at bore D6. This is discussed further in Section 4.3.

Although there were significant rainfall events during the period (Figure 4), the groundwater bore conductivities in Figure 5 show no effects of rainfall on the overall D5 and D6 conductivity, other than a small increase at D6. Hence, it is likely that the lower conductivity in Lidsdale Cut (WX5) was mostly due to diversion of the low conductivity water under the KVAR rather than the increase in rainfall during the period. This suggestion will be confirmed by ongoing monitoring.

In summary, the obvious benefit of the seepage collection and diversion systems was the decrease in conductivity in the Lidsdale Cut. The assessment of the causes of water quality changes in Sawyers Swamp Creek suggests that the decrease in conductivity in Lidsdale Cut may have influenced the concentration at the receiving water site, WX7. Figure 4 shows that the conductivity at WX7 was lower than that in the Cut (WX5) until the conductivity in Dump Creek (WX11) reached or exceeded 1,500 µS/cm in June, 2011. From this time, the WX7 conductivity was similar to that in Dump Creek.

4. Stage 1 and Stage 2A Dry Ash Placement Effects on Surface and Groundwater Quality

This Section reviews the long-term trends in surface and groundwater quality and trace metals at receiving water sites for assessment of changes, if any, due to the KVAR Stage 1 dry ash placement and capping and the current Stage 2A placement. The assessment also included the effects of the seepage collection and diversion systems recently installed. Long-term trends in water quality and trace metals are examined for changes from pre- to post-dry ash placement in the following surface and groundwaters:

- Sawyers Swamp Creek Ash Dam since wet ash placement was stopped and dry ash placement began at the KVAR to take into account residual effects of seepage since the pump-back system was installed
- SSCAD seepage detection bores, WGM1/D3 and D4
- KVAD/R groundwater bores WGM1/D5 and D6
- Lidsdale Cut and changes due to the KVAR Stage 2 seepage collection and diversion system
- Sawyers Swamp Creek receiving water site, WX7.

A schematic outline of the SSCAD dam wall seepage to Sawyers Swamp Creek and the KVAD/R seepage flow paths to the KVAD toe drains and Lidsdale Cut is shown in Plate 1, which includes the recently installed KVAR sub-surface drains.

Plate 1. Schematic of Sawyers Swamp Creek Ash Dam and KVAD/R seepage flow paths to the KVAD toe drains and Lidsdale Cut

The water quality in the ash dam pond was previously shown to be improving due to the dry ash placement and containment of the water in the ash dam to prevent spilling into the creek (Aurecon, 2010). As discussed above, a seepage collection and pump-back system was recently installed to minimise effects of the ash dam on Sawyers Swamp Creek and the local groundwater quality. However, residual effects of seepage from the ash dam pond under the dam wall have to be taken into account in the assessment of the Stage 2A placement effects.

A major change in rainfall, from previously dry weather to wet weather, occurred during the Stage 2A period, and this further complicated the assessment of effects of the dry ash placement.

The aim of the management measures is for the receiving water quality of Sawyers Swamp Creek (WX7), the groundwater bore WWGM1/D5 and Lidsdale Cut (WX5) to meet the local/ANZECC (2000) guideline trigger values for the characteristics defined in Section 2.7.1 during the post-dry ash placement and seepage collection and diversion system periods.

4.1 Sawyers Swamp Creek Ash Dam Water Quality

The continuing changes in water quality in the SSCAD pond, from the time wet ash slurry ash placement was stopped in 2003, to the current Stage 2A period are summarised in Table 2. In the table, the ash dam concentrations are compared to the Dump Creek background concentrations and the local/ANZECC trigger value goals. The parameter values in the ash dam pond and in Dump Creek that exceed the goals are highlighted in blue.

Water quality and trace metal concentrations in the SSCAD are taken into account as part of the KVAR assessment because residual seepages from the SSCAD dam wall may affect the water quality in Sawyers Swamp Creek and the local groundwater. Although these inputs are expected to be minor with the recent installation of the v-notch pump-back system, they are up-gradient of the KVAR placement and need to be taken into account.

Table 2: Summary of Average Water Quality in SSCAD Pond for Pre- and Post-Stage 1, Initial Stage 2 and Stage 2A Periods Compared to Dump Creek Background (during Stage 1/Initial Stage 2 period and current wet weather period) and Surface Water Guidelines or Goals

Element (mg/L)	Pre-Placement (1996-2003) Average	Stage 1&Cap Post-placement (May, 2003-Mar, 2010) Average	Initial Stage 2 Post-placement (April, 2009-March, 2010) Average	Stage 2A Post-placement (April, 2010-January, 2012) Average	Background Dump Creek, WX11, (May, 2003-March, 2010) Average	Background Dump Creek, WX11, (April, 2010-January, 2012) Average	ANZECC (2000) Guidelines & Goals for Sawyers Swamp Creek
	SSCAD	SSCAD	SSCAD	SSCAD	WX11	WX11	
pH	5.4	5.9	6.9	7.1	4.2	3.3	6.5-8.0
Cond (µS/cm)	1219	2197	2142	987	832	1424	2200
TDS	858	1684	1573	763	541	963	1500
SO4	553	1125	973	361	351	640	1000
Cl	18	32	37	18	20	22	350
As	0.016	0.008	0.002	0.0034	0.0008	0.0005	0.024
Cd	0.012	0.0048	0.0022	<0.001	0.0005	0.0006	0.0015
Cr	0.005	0.0019	0.0007	0.0013	0.0019	0.0007	0.005
Cu	0.007	0.0055	0.0028	0.0046	0.004	0.0049	0.005
Fe	0.17	0.107	<0.01	0.05	1.42	4.23	0.3
Mn	1.2	1.06	0.67	1.96	2.85	5.75	1.9
B	4.7	4.1	2.15	1.39	1.35	2.47	**1.25**
F	9.3	4.71	2.16	1.46	0.56	0.81	1.5
Mo	0.152	0.051	0.071	0.012	0.006	0.008	0.01
Ni	0.129	0.07	0.035	0.155	0.223	0.368	0.05
Pb	0.002	0.002	0.001	0.004	0.003	0.002	0.005
Se	0.151	0.04	0.007	<0.002	0.002	<0.001	0.005
Zn	0.426	0.213	0.053	0.457	0.423	0.900	**0.153**

The water quality parameter values in the SSCAD have continued to decrease. Trace metals and elements have generally decreased, with selenium now being less than the detection limit, but the exceptions were for increases in manganese, nickel, and zinc since 2009/10. These increases appear to be due to leaching from the surface ash deposits in the SSCAD by rainfall runoff during the wet

2010/11 period. Boron continued to decrease but remained higher than the Dump Creek (WX11) background, as well as the local trigger value.

Contrary to the effects of rainfall in other parts of the catchment, the water quality parameter values and trace metal concentrations increased in Dump Creek during the wet 2010/11 period (Table 2). Increases occurred for conductivity, sulphate, iron, manganese, boron, fluoride, nickel and zinc in 2010 to January, 2012 and they were all higher than in the ash dam. The increased metal concentrations occurred as the pH decreased from 4.2 in 2009/10 to 3.3 in the current period. This suggests that the increased rainfall was leaching salts and trace metals from material placed in the catchment by mining activities in the area.

Long-term trends in conductivity and sulphate, as well as the trace metals boron, manganese, nickel and zinc in the SSCAD pond are shown in Figure 6. Their concentrations have all declined since 2003 but the metals have shown spikes in concentrations with the recent wet weather, which also caused the conductivity to decrease due to accumulated rainfall and freshwater inflows.

The conductivity sharply increased in January, 2012 as did sulphate, boron and zinc. The conductivity increase was also associated with an increase in selenium from less than detection to 0.014 mg/L (Attachment 2), the highest concentration since early 2008. These January increases suggest that the freshwater has infiltrated the ash deposit and leached the trace metals and selenium from the ash into the water in the dam.

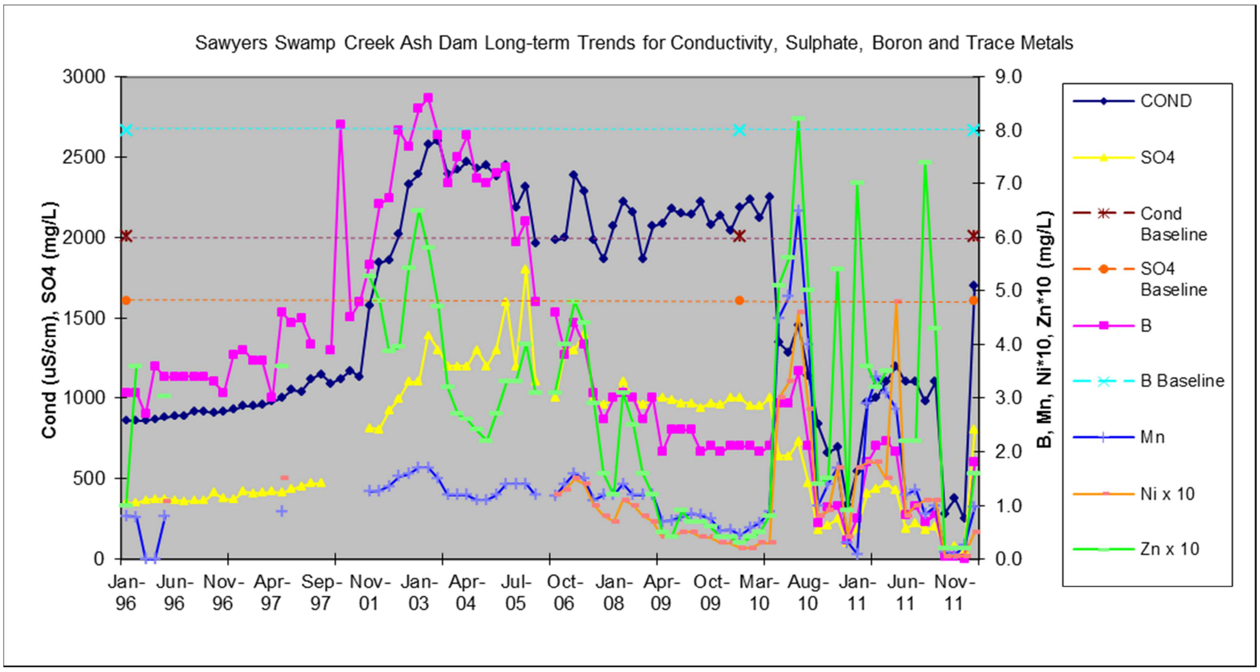

Figure 6 - Sawyers Swamp Creek Ash Dam Pond Long-term Trends in Conductivity, Sulphate, Boron and Trace Metals

The v-notch pump-back system was installed in March, 2010, just before the sharp increase in trace metals in May and would have prevented the main SSCAD seepage flow from entering Sawyers Swamp Creek. The residual seepage from the base of the dam wall, which is minor compared with the normal flow in the creek, is unlikely to cause a significant increase in concentrations in the creek, where it flows near the base of the dam wall.

Some evidence for this is provided by the trace metal measurements from February, 2010 to October, 2010 by LLI at the Sawyers Swamp Creek upstream of the KVAD. There was no flow of Springvale mine water down the creek at that time. LLI measured selenium at less the detection limit of 0.002 mg/L, boron between 0.07 and 1.1 mg/L; manganese <0.01 to 1.6 mg/L; nickel <0.01 mg/L and zinc between <0.01 and 0.06 mg/L. These concentrations were all lower than in the ash dam and the local guideline trigger values.

4.2 SSCAD Groundwater Quality

The SSCAD seepage detection bores, WGM1/D3 and D4, are located down-gradient of the SSCAD and up-gradient of the KVAD and KVAR Stage 1 and Stage 2A dry placement areas (Figure 1). Bore D3 samples groundwater affected by ash dam seepage from near the left abutment of the ash dam wall and bore D4 samples the right abutment. It is necessary to understand the effects of seepage from the SSCAD, if any, on the groundwater down-gradient of the dam wall at bores D3 and D4, as well as in the KVAD under the KVAR dry ash placements. These inputs can then be taken into account in assessing KVAR effects, if any, on the local groundwater at bores D5 and D6 and in Lidsdale Cut.

Changes in the SSCAD seepage detection bores have been assessed using data from pre-placement (90^{th} percentile baselines (before May, 2003 at bore D4) and the background bore, D2, compared to the post-placement medians for periods of Stage 1, including capping since April, 2009 (May, 2003 to March, 2010), during the initial Stage 2 dry ash placement (April, 2009 to March, 2010) and the current Stage 2A placement (April, 2010 to January, 2012), as shown in Table 3.

As bore D4 is located near the lower section of Sawyers Swamp Creek, where it passes the dam wall, the water quality and trace metals at this bore are expected to show any effects of residual seepage from the dam wall since the v-notch pump back system was installed. To assess changes in bore D4 during the current period, the medians have been compared to those during previous periods and its 90^{th} percentile baseline in Table 3.

Table 3: Median Water Quality for SSCAD Seepage affected Groundwater during Post-Stage I and Post-Stage II Compared to Current SSCAD, Groundwater Background, Seepage bore WGM1/D4 Baseline and Groundwater Guidelines or Goals

Element (mg/L)	SSCAD Seepage Affected Bores					Back-ground April, 2010 to January, 2012	D4 Baseline (Pre-Stage I 90th Percentile)	ANZECC Guideline Goals for Groundwater
	Stage 1 & Cap May, 2003 to March, 2010		Initial Stage 2 April, 2009 to March, 2010		Stage 2A April, 2010 to January, 2012			
	D3	D4	D3	D4	D4	D2	D4	
pH	6.2	5.9-8	6.2	5.8	5.8	4.7	6.8	6.5-8.0
Cond (µS/cm)	693	1276	771	1484	1500	320	728	2600
TDS	430	1120	460	1300	1200	230	510	2000
SO4	110	720	120	780	770	110	201	1000
Cl	82	27	100	33	33	23	45	350
Fe	0.10	46.50	0.01	39.0	43.0	0.04	86.0	**1.7**
Mn	0.63	17.0	0.69	17.0	18.0	0.46	6.5	1.9
B	0.03	1.20	0.03	1.5	1.50	0.03	0.49	**1.7**
F	0.05	0.05	0.10	0.10	0.10	0.05	0.24	1.5
Ni	0.130	0.040	0.130	0.040	0.050	0.050	0.023	**0.137**
Se	0.001	0.001	0.002	0.002	0.002	<0.001	0.002	0.005
Zn	0.065	0.080	0.090	0.090	0.080	0.080	0.060	**0.505**

The summary data in Table 3 shows no significant changes in water quality parameters or trace metals, including selenium concentrations in the D4 bore compared to the previous Stage 1 to 2A periods. As noted in previous reports, there has been an increase in conductivity, TDS, sulphate and boron in the groundwater since the pre-stage 1 period due to the effects of increased concentrations in the ash dam, and seepage through the v-notch, with conversion to dry ash and less flushing of the main dam pond.

Long-term changes in conductivity, sulphate and boron, which is used to represent changes in other trace metals, at bore D4 are shown in Figure 7. It can be seen that the effect of the SSCAD increases became evident in April, 2002 after which time they consistently exceeded their baselines, except during rainfall events. Effects of the large rainfall event of December, 2010 on concentrations can be clearly seen. Concentrations in the groundwater have all remained below the local groundwater guidelines during the current period. Reductions in concentrations of these elements at bore D4, if any, due to installation of the V-notch pump-back system will be confirmed by future monitoring.

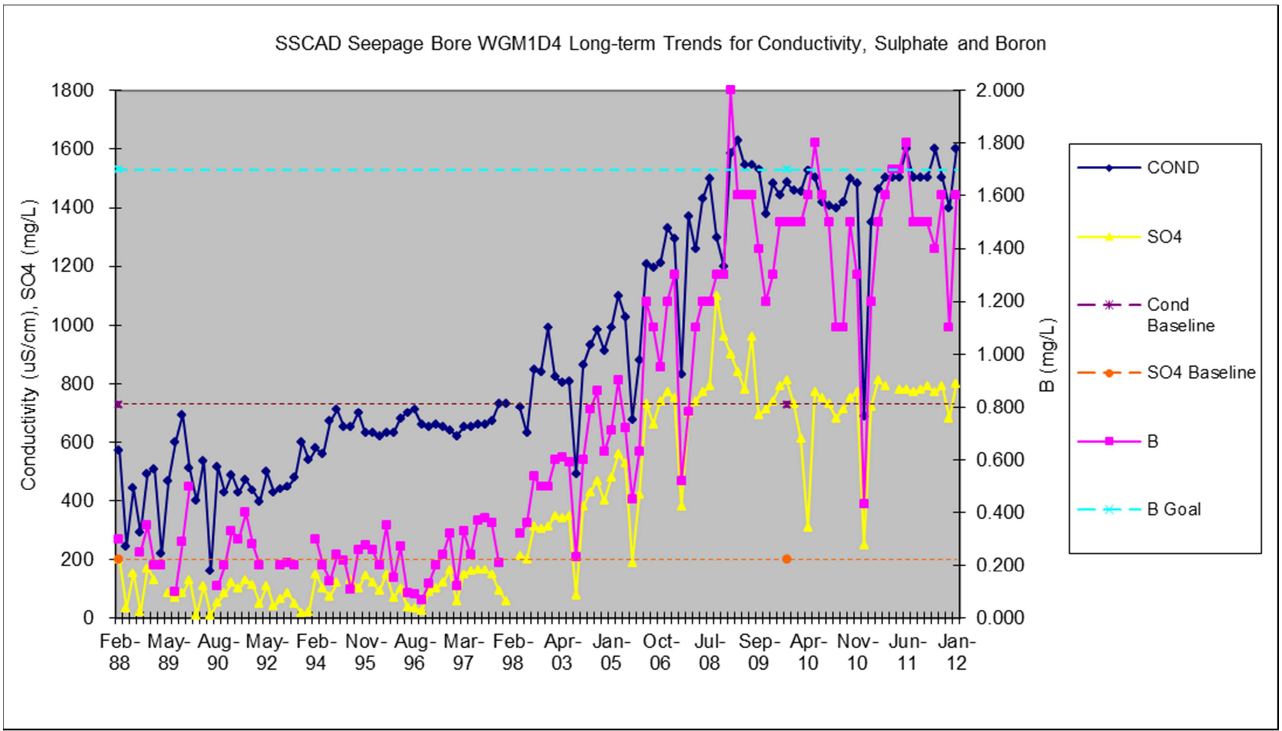

Figure 7 - Sawyers Swamp Creek Ash Dam Seepage Detection Bore WGM1/D4 Long-term Trends in Conductivity, Sulphate and Boron

4.3 KVAD and KVAR Groundwater Quality

The changes in the receiving waters at the groundwater bores WGM1/D5 and D6 are examined in this Section in relation to potential effects of the KVAR Stage 2A. Changes from pre-placement, during the Stage 1 placement and capping and during the initial Stage 2 dry ash placement are examined. However, before this was undertaken, the groundwater level contours in the area were examined to obtain an indication of the groundwater flow directions.

Understanding the groundwater flow directions was necessary because it was shown in Figure 5 that the conductivity in the Lidsdale Cut was reduced to be similar to that at bore D6 when the sub-surface drains under the Stage 2 Area were connected to the KVAD toe drains. In addition, bore D5 samples the groundwater seepage on its way to Sawyers Swamp Creek, which is nearby (Figure 1).

Figure 8 shows the groundwater levels in the area during late 2011 and the inferred flow directions from the high levels at the south of the SSCAD dam wall toward the low point, where bore D5 is located.

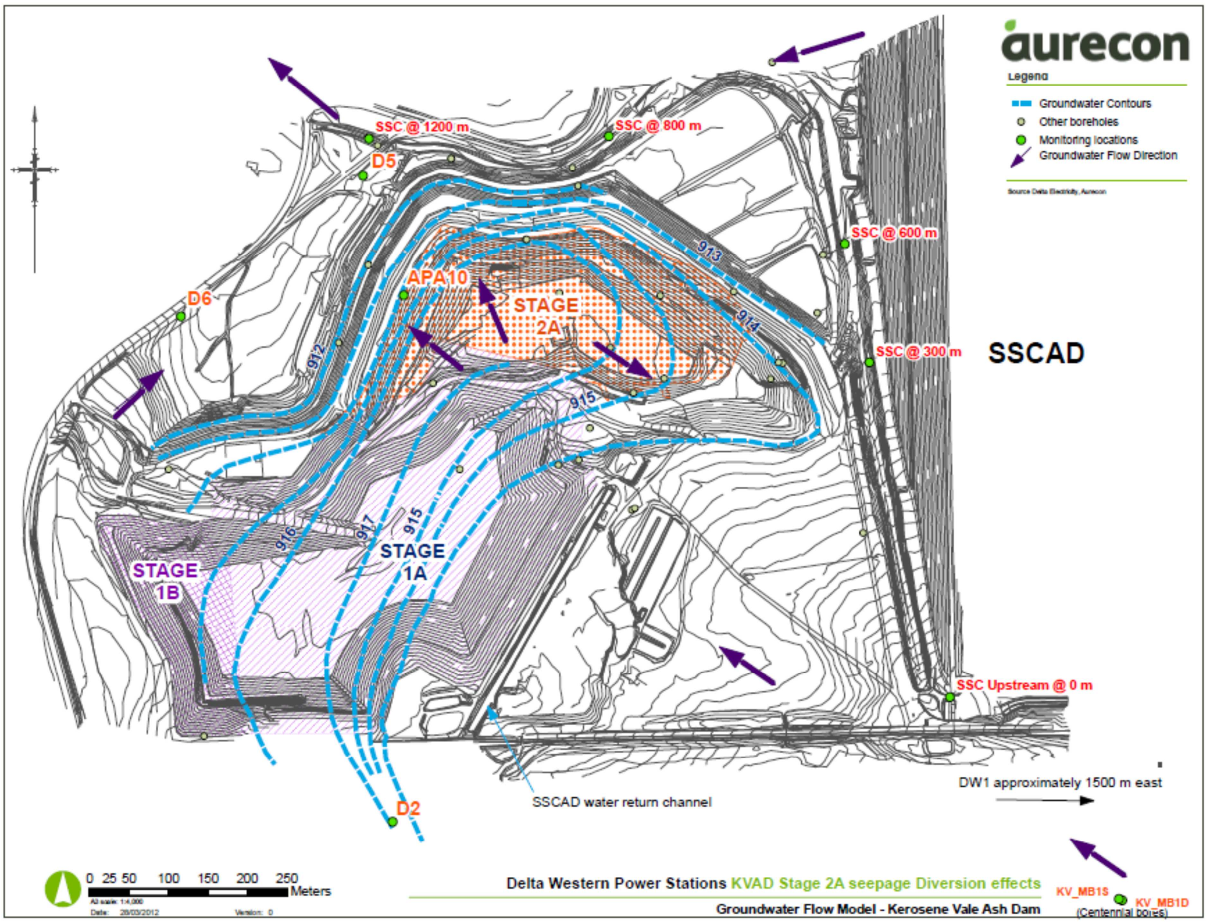

Figure 8 – Kerosene Vale Ash Dam and Stage 1 and Stage 2A Dry Ash Repository Groundwater Level (RL m) Contours with Inferred Flow Directions (from sketch provided by Lend Lease Infrastructure to Delta Electricity)

The groundwater contours show that the groundwater is mounding below the dry ash placement to a maximum height of RL917m, which is 1m below the assumed KVAD capping level of RL918. Figure 5 shows that the seepage collection and drainage systems decreased the water level in the KVAD, under the dry ash placement, by about 1.5m (as measured at AP10, Figure 8). This decrease has prevented groundwater from the KVAD reaching the base of the dry ash placement, as it did in 2009/10. Hence, the drainage works have achieved the objective of reducing the water level in the KVAD and stopped groundwater from the KVAD getting into the dry ash placement.

Note that the mounding below Stage 1 has meant that groundwater has to be drained from the south-western corner into the return canal. The mounding under Stage 2 has some of the groundwater flow directed towards the SSCAD. This has been intercepted by the drains under the Stage 2 area and directed into the KVAD toe drains.

Flow directions indicate the likely sources of groundwater that could affect the water quality in bores D5 and D6 as:

- Seepage water from the SSCAD pond (now collected at the v-notch and pumped back into the dam pond);
- Groundwater in the KVAD, under Stages 1 and 2A, flowing toward Sawyers Swamp Creek

- Background groundwater from up-gradient of the KVAD and SSCAD, which is measured at bore D2 and appears to flow around the southern edge of the KVAD to bore D6.

The flow directions suggest that residual seepage from the SSCAD main pond that enters the local groundwater would be intercepted by the drains installed under the KVAR Stage 2A area and directed to Lidsdale Cut via the KVAD toe drains.

The water quality in the drawn-down KVAD is apparently diluted by inflows of low salinity background groundwater and bore D6 has a lower median conductivity and sulphate than bore D5 as a result of these inflows (Table 4). The flow paths indicate that the low salinity background water flows mostly through the KVAD area, where it increases in conductivity by mixing with the KVAD groundwater, and then flows to D5 (Figure 8). This caused bore D5 to have higher conductivity, sulphate, boron and trace metals than bore D6.

Table 4: Median Water Quality for Dry Ash KVAD/KVAR Groundwater Seepage Bores during Post-Stage 1, Initial Stage 2 and Stage 2A Compared to Current Groundwater Background Bore WGM1/D2 and Bore WGM1/D5 Baseline and Groundwater Guidelines or Goals

Element (mg/L)	KVAD & KVAR Dry Ash Placement Monitoring Bores						Back-ground April, 2010 to January, 2012	D5 Baseline (Pre-Stage I 90th Percentile)	ANZECC Guideline Goals for Ground-water
	Stage I& Cap May, 2003 to March, 2010		Stage II April, 2009 to March, 2010		Stage 2A April, 2010 to January, 2012	Stage 2A April, 2010 to January, 2012			
	D5	D6	D5	D6	D5	D6	D2	D5	
pH	3.6	3.2	3.3	3.2	3.6	3.2	4.7	4.5	6.5-8.0
Cond (µS/cm)	1917	1110	2057	1154	1356	1216	320	810	2600
TDS	1600	600	1800	620	1000	730	230	550	2000
SO4	1100	350	1100	410	680	485	110	328	1000
Cl	18	56	17	57	15	48	23	24	350
As	0.001	0.005	0.001	0.006	0.001	0.001	0.0005	0.008	**0.024**
B	4.8	0.80	5.10	0.76	2.2	0.74	0.03	1.7	**1.7**
Cd	0.0024	0.0004	0.0029	0.0007	0.002	0.001	<0.0001	0.004	0.001
Cr	0.003	0.0026	0.0019	0.002	0.001	0.002	0.0008	0.041	0.004
Cu	0.013	0.003	0.010	0.003	0.008	0.005	0.001	0.058	0.005
Fe	4.85	38.0	14.00	41.0	1.7	14.5	0.04	14.7	**1.7**
Mn	8.55	3.6	11.0	3.9	7.5	3.5	0.46	2.5	1.9
Mo	0.005	0.008	0.005	<0.010	0.010	0.010	0.005	-	0.01
F	1.10	0.20	1.10	0.40	0.80	0.40	0.05	0.65	1.5
Ni	0.830	0.335	0.960	0.470	0.540	0.350	0.050	0.137	**0.137**
Pb	0.016	0.005	0.014	0.005	0.007	0.012	<0.001	0.021	**0.010**
Se	0.001	<0.001	<0.001	0.002	0.002	0.002	<0.001	0.002	0.005
Zn	1.50	0.335	1.50	1.30	1.10	0.895	0.080	0.505	**0.505**

Comparison of median concentrations at bores D5 and D6 (Table 4) with the up-gradient bore D4 (Table 3) for the Stage 2A period shows that boron, nickel and zinc, as well as fluoride in the KVAD/R bores were higher than at bore D4 and the background bore D2. In contrast, the KVAD/R bores have lower concentrations than D4 for conductivity and sulphate but are still higher than D2 and the D5 pre-dry ash placement background concentrations, indicating some influence of the KVAD. The KVAD bores had a lower pH of 3.2 to 3.6, compared to 5.8 at bore D4. This was probably the cause of higher levels of fluoride, nickel and zinc in the KVAD bores (Table 4). From this analysis, bore D5 was used as the main indicator of KVAD seepage effects, consistent with the flow directions indicated in Figure 8.

The low pH in bores D5 and D6 indicates pyrite oxidation (Deutsch, 2005) of the residual coal and chitter in the Kerosene Vale mine void underneath the KVAR. Pyrite oxidation and its associated acidification are known to release trace metals into groundwater.

The summary data in Table 4 shows a decrease in conductivity and sulphate, as well as the trace metals boron and lead, and relatively small decreases for manganese, nickel and zinc at bore D5 compared to the previous Stage 1 to 2A periods. There were no significant changes in concentrations of the other trace metals, including selenium which remained low.

The elements that had higher concentrations than the local guidelines during the Stage 2A period are highlighted in blue in Table 4. Of these, only boron at bore D5 and manganese, nickel and zinc, at both bores D5 and D6, were higher than the bore D5 pre-dry ash placement background concentrations. However, the decrease in concentrations of these elements during the stage 2A period, relative to that during Stage 1 and Initial Stage 2, suggests leachates from the dry ash, due to rainfall infiltration, have not reached the local groundwater in significant concentrations.

The long-term changes for conductivity, sulphate and boron in bore D5 from before dry ash placement, during Stage 1 and to the current Stage 2A placement are examined in Figure 9.

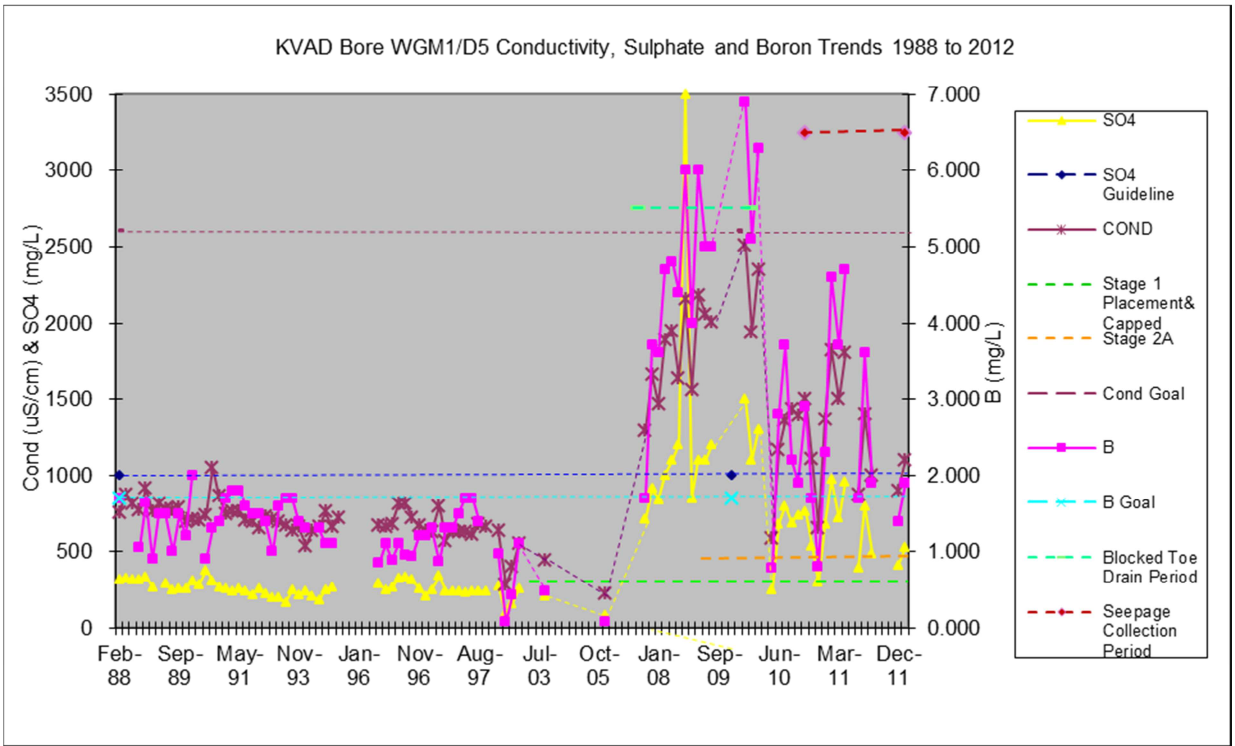

Figure 9 – Kerosene Vale Ash Dam Seepage Detection Bore WGM1/D5 Long-term Trends in Conductivity, Sulphate and Boron (Periods for Stage 1 placement and capped since 2003, Stage 2A, including initial Stage 2 since April 2009, Blocked toe drains and Subsurface drain seepage Periods are shown)

Increases in conductivity, sulphate and boron at bore D5 over the Stage 1 and initial Stage 2 periods was shown by Aurecon (2010) to be due to effects of blocked KVAD toe drains limiting the ability of the low salinity background water to flow into the KVAD groundwater and from there to bore D5. Conductivity, sulphate and boron concentrations varied from low levels in 2003-05 to the highest recorded in 2008-09.

Figure 9 shows that shortly after the toe drains were unblocked in February, 2010, the conductivity and sulphate concentrations decreased to below their local goals, but mostly remained above the pre-dry ash placement levels. Although boron decreased since February, 2010, it remained mostly above its goal of 1.7 mg/L (Table 4). Further decreases were observed since mid-2011, during the Stage 2A period, after installation of the drains under the KVAR in October, 2010 (Figure 9).

As discussed above in Section 3.2.2, the lower concentrations in bore D5 during the Stage 2A period appear to be due to the increased ability of the low conductivity background water to enter the KVAD under the KVAR since the installation of the sub-surface drains.

The apparent lack of effects of the rainfall on bore D5 concentrations may be due to effective sealing of the KVAD capping by the dry ash placement. Evidence for this is the decrease in water level at bore D5, but no change at D6, and the lack of significant change in conductivity at bore D6 during the wet Stage 2A period, compared to the dry previous periods (Table 4). If the increased rainfall was causing additional low conductivity of the groundwater down-gradient of the KVAD, a decrease in conductivity would have also been observed at bore D6. In addition, the conductivity at the background bore D2 remained above 300 uS/cm for all the monitoring periods.

Hence, these observations and trends support the foregoing suggestion that leachates from the dry ash, if any, even with the increased rainfall, have not affected the local groundwater. The effects of wet and dry weather on the local groundwater quality and the indicated lack of dry ash leachate effects will be confirmed by ongoing monitoring.

4.4 Lidsdale Cut

Section 3.2.2 showed the KVAR Stage 2 seepage collection and diversion system was related to a decrease in conductivity in the seepage collection bores at the KVAD, which resulted in a decrease in Lidsdale Cut. Water Quality and trace metal changes in Lidsdale Cut are further investigated in this Section.

Table 5 shows water quality changes at Lidsdale Cut for the periods of pre-dry ash placement to Stage 1 and Capping, Initial Stage 2 and Stage 2A Dry Ash Placements. This information can be used to identify any links between the KVAD groundwater quality and that in the Lidsdale Cut. The changes are compared to the groundwater quality changes at bore D5 over the same periods.

Table 5: Median Lidsdale Cut Water Quality Compared to Groundwater Quality Changes at Bore WGM1/D5 during Stage 1 and Capping, Initial Stage 2 and Stage 2A Dry Ash Placement Relative to Background and Groundwater Guidelines or Goals

Element (mg/L)	KVAD & KVAR Groundwater (WGM1/D5)				Lidsdale Cut (WX5)				
	Pre-Placement (1988-2003) 90th Percentile	Stage1 &Cap Post-placement (May, 2003-March, 2010) 50th Percentile	Initial Stage 2 Post-placement (April, 2009-March, 2010) 50th Percentile	Stage 2A Post-placement (April, 2010-January, 2012) 50th Percentile	Pre-Placement (1992-2003) 90th Percentile	Stage 1 &Cap Post-placement (May, 2003-March, 2010) 50th Percentile	Initial Stage 2 Post-placement (April, 2009-March, 2010) 50th Percentile	Stage 2A Post-placement (April, 2010-January, 2012) 50th Percentile	Groundwater Guidelines# or Goals
pH	4.5	3.6	3.3	3.6	6.9	4.3	3.4	4.8	6.5 – 8.0
Cond/ (µS/cm)	810	1917	2057	1356	952	1178	1965	1011	2600^
TDS	550	1600	1800	1000	650	870	1500	740	2000
SO4	328	1100	1100	680	359	580	970	460	1000
Cl	24	18	17	15	34	18	19	21	350
As	0.008	0.001	0.001	0.001	<0.001	0.002	0.002	0.002	0.024
B	1.7	4.8	5.10	2.2	2.16	2.50	5.20	2.4	**1.7**
Cd	0.004	0.0024	0.0029	0.002	<0.001	0.0008	0.0008	0.0013	0.001
Cr	0.041	0.003	0.0019	0.001	<0.006	0.001	0.0013	0.001	0.004
Cu	0.058	0.0013	0.010	0.008	<0.005	0.003	0.003	0.004	0.005
F	0.65	1.10	1.10	0.80	1.99	3.10	6.70	2.60	1.5
Fe	14.7	4.85	14.00	1.7	0.7	0.54	3.05	0.04	**1.7**
Mn	2.5	8.55	11.0	7.5	2.12	3.70	6.30	4.10	1.9
Mo	-	0.005	0.005	0.010	-	0.005	0.010	<0.010	0.010
Ni	0.137	0.830	0.960	0.540	-	0.375	0.540	0.280	**0.137**
Pb	0.021	0.016	0.014	0.007	0.004	0.003	0.003	0.002	**0.01**
Se	0.001	<0.001	< 0.001	0.002	0.001	<0.001	0.001	0.002	0.005
Zn	0.505	1.50	1.50	1.10	0.304	0.360	1.20	0.520	**0.505**

Table 5 shows a decrease in the Lidsdale Cut median conductivity and sulphate, as well as the trace metals boron, fluoride, iron, manganese, nickel and zinc during the Stage 2A period to levels similar to those before the KVAD toe drains became blocked in April, 2007, and marginally above the baseline concentrations. There were no significant changes in concentrations of the other trace metals, including selenium which remained low.

The above mentioned Lidsdale Cut decreases during the Stage 2A period resulted in the conductivity and sulphate being lower than in the KVAD/R bore D5, as were most of the trace metals, with the exception of fluoride, which was higher than the groundwater concentration.

These observations are consistent with dilution of the water quality in the KVAD, as well as at bore D6, with inflows of low salinity and trace metals from the up-gradient background areas. The diluted groundwater is most likely collected by the KVAR sub-surface drains and directed to Lidsdale Cut, thereby causing the decreases in concentrations noted above.

Some of the Lidsdale Cut elements have concentrations higher than the local guidelines during the Stage 2A period (highlighted in blue in Table 5). As they have remained higher than the bore D5 pre-dry ash placement background concentrations, further reductions, if any to the baseline will be confirmed by ongoing monitoring.

Figure 10 shows the long-term trends for conductivity, sulphate and boron. As predicted (Aurecon, 2010), the water quality in the Cut improved as a result of the unblocking of the toe drains in February, 2010. This was expected to allow low salinity and trace metal background groundwater to flow into the Cut via the KVAD and the results of this can be seen in the control chart.

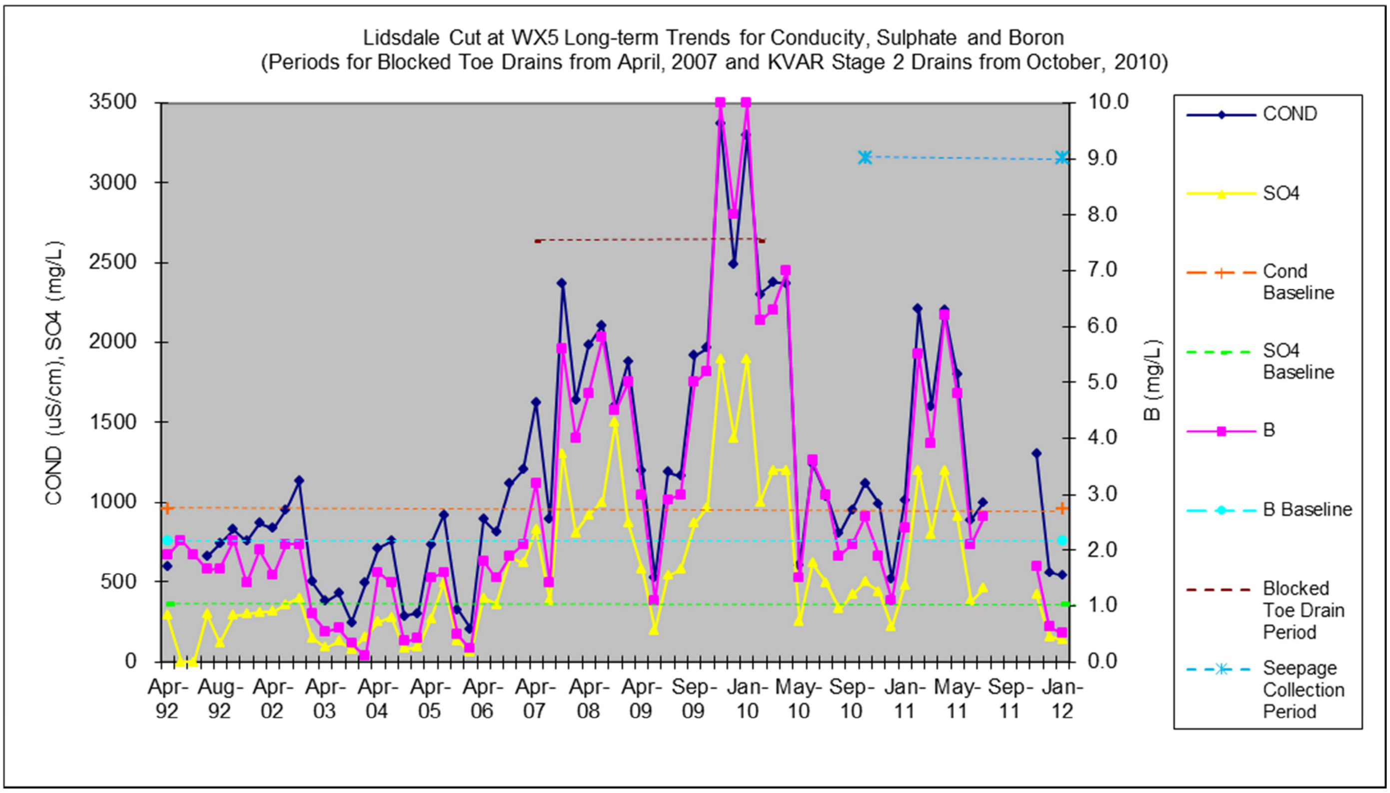

Figure 10 - Lidsdale Cut Long-term Trends in Conductivity, Sulphate and Boron Compared to the Pre-Stage I Baselines (Periods for Blocked toe drains from April, 2007 and KVAR Stage 2 Sub-surface drains from October, 2010 are shown)

A comparison of Figures 9 and 10 shows similar changes in conductivity, sulphate and boron in the Cut as in bore D5 since 1992. Although some effects of rainfall runoff into the Cut are evident, mainly during the most recent rainfall event from October to December, 2011, the variations in conductivity, sulphate and boron are similar, indicating that the water quality in the Cut is mostly determined by the toe drain inflow concentrations. As these inflows now include the KVAR sub-drains, which are intercepting KVAD groundwater, diluted by up-gradient background inflows, concentrations in the

Lidsdale Cut are expected to remain around the current levels, depending on effects of wet and dry weather. This expectation will be confirmed by future monitoring.

4.5 Sawyers Swamp Creek

Changes in the water quality and trace metals at the Sawyers Swamp Creek receiving water site (WX7) from pre-dry ash placement to the current Stage 2A dry ash placement have been examined in relation to potential effects of the conversion from wet ash storage at the SSCAD to dry ash placement at the KVAR. However, water quality and trace metals in the creek are affected by several other sources. Section 3.2.1 showed that the recent conductivity at the Sawyers Swamp Creek receiving water site (WX7) was affected by inflows from Dump Creek (WX11) due to leaching of salts by high rainfall from material placed in the catchment by mining activities in the area. In addition to Dump Creek, the water quality and trace metals in Sawyers Swamp Creek are also affected by the following inputs:

- residual seepage from the SSCAD dam wall that enters the creek (expected to be minor)
- groundwater seepage from the KVAD, as represented by groundwater bore D5, which enters the creek where it flows past the ash dam walls
- Lidsdale Cut, WX5, (with KVAD seepage and additional seepage diverted from under the KVAR area)
- recent leak at the Springvale Mine pipeline emergency discharge valve (Water quality data from 17th Feb to 7th August, 2009 is shown in Table 6 and is used to indicate the quality of the leakage water).

In addition to these inputs, the water quality at WX7 is potentially affected by leachates to the local groundwater from the Stage 1 placement (now capped) and the Stage 2A placement.

The main causes of water quality and trace metal changes at WX7 are examined in Table 6 by comparison of the periods of pre-dry ash placement, Stage 1 and Capping, Initial Stage 2 and Stage 2A Dry Ash Placements with the current WX11, the groundwater bore D5, WX5 and Springvale Mine water quality.

Table 6: Median Sawyers Swamp Creek Water Quality during Stage 1 and Capping, Initial Stage 2 and Stage 2A Dry Ash Placement Compared to Pre-placement Baseline and Creek Inputs from Lidsdale Cut, Springvale Mine Water, Dump Creek and Surface Water Guidelines

Element (mg/L)	Sawyers Swamp Creek (WX7)				Dump Creek (WX11)	KVAD/R Bore WGM1/D5	Springvale Mine Water	Lidsdale Cut (WX5)	
	Pre-placement (1991-2003) 90th Percentile	Stage 1 & Cap Post-placement (May, 2003- Mar, 2010) 50th Percentile**	Stage Initial Stage 2 Post-placement (April, 2009- Mar, 2010) 50th Percentile**	Stage 2A Post-placement (April, 2010- January, 2012) 50th Percentile	Stage 2A Post-placement (April, 2010- January, 2012) 50th Percentile	Stage 2A Post-placement (April, 2010- January, 2012) 50th Percentile	Indicative Water Quality Data ** 50th Percentile	Stage 2A Post-placement (April, 2010- January, 2012) 50th Percentile	Surface Water Guidelines# or Goals^
pH	7.6	6.4	7.9	7.3	3.3	3.6	8.4	4.8	6.5 – 8.0
Cond (µS/cm)	760	1105	1266	1100	1400	1356	1098	1011	2200
TDS	584	800	860	690	935	1000	845#	740	1500^
SO4	323	480	515	300	635	680	44	460	1000 ++
Cl	27	24	18	16	22	15	-	21	350 +
As	<0.001	0.002	0.002	0.004	<0.0005	0.001	0.008	0.002	0.024
B	2.33	2.2	2.0	1.40	2.45	2.2	0.055	2.4	**1.25**
Cd	<0.001	0.0002	0.0002	0.0007	0.0003	0.002	-	0.0013	0.0015
Cr	<0.001	0.0008	0.0008	0.0025	<0.0005	0.001	-	0.001	0.005
Cu	<0.007	0.002	0.0024	0.003	0.004	0.008	<0.01^^	0.004	0.005
F	1.1	0.90	1.00	1.7	0.85	0.80	1.28^^	2.6	1.5+++
Fe	0.507	0.03	0.02	0.02	4.2	1.7	0.19	0.04	0.3+++
Mn	0.829	0.820	0.165	1.7	5.6	7.5	0.015	4.10	1.9
Mo	-	0.005	<0.010	0.02	<0.01	0.010	-	<0.010	0.01 +
Ni	-	0.130	0.135	0.16	0.350	0.540	<0.01^^	0.280	0.050
Pb	0.003	0.002	<0.001	0.002	0.002	0.007	-	0.002	0.005
Se	0.003	<0.001	0.002	<0.002	<0.001	0.002	<0.002	<0.002	0.005
Zn	0.153	0.130	0.110	0.450	0.865	1.10	0.04	0.520	**0.153**

* DL greater than guideline **Springvale Mine affected ^applies to WX7 only ^^average #Condx0.77
** Mine emergency discharge data from Aurecon (2010) for 17th Feb to 7th Aug09

Table 6 shows a decrease in the Sawyers Swamp Creek conductivity, during the Stage 2A period, to be similar to that during the Stage 1 placement. As both WX11 and bore D5 seepage had higher conductivity (above 1400 µS/cm) than at WX7 (1100 µS/cm) during the period, the likely cause was a mixture of Lidsdale Cut and the similar mine water conductivity. There was also a decrease in sulphate at WX7, but it was reduced to be similar to the pre-Stage 1 levels. This decrease appears to be due to dilution of the creek water with the low sulphate mine water.

Changes in trace metal concentrations at WX7 caused by the mine water[2] were evident for:

- boron, diluted to less than the pre-Stage 1 levels by the low concentrations in the mine water
- fluoride, increased to be higher than during all the previous periods due to elevated concentrations in the mine water (the change was not due to inputs from Lidsdale Cut as the concentrations there decreased – see Table 5).

Although manganese showed an order of magnitude increase and zinc increased at WX7, the increases were not due to the mine water but caused by increases in Dump Creek (see Attachment 2). The increases were not due to inputs from Lidsdale Cut as the concentrations there decreased.

There was also an increase in nickel at WX7 (median from 0.160 during initial Stage 2 to 0.350 mg/L in Stage 2A), but the source was not able to be identified. The concentration of nickel in the mine water was previously reported as low (Table 6) and there were decreases for all the sources, except Dump Creek, during the Stage 2A period, including bore D5. Accordingly, seepage from the KVAD and KVAR would not have been the cause (Table 5). The increase in Dump Creek was only minor (average from 0.223 to 0.368 mg/L, Table 2, and median from 0.320 to 0.350 mg/L from initial Stage 2 to Stage 2A – see Attachment 2), so it does not appear to be the only cause of the increase. The increase was also not likely to be due to the dry ash placement because the concentration in Lidsdale Cut decreased during Stage 2A (Table 5). Hence, it is suggested that concentration changes and the source of the nickel at WX7 be investigated during the next reporting period.

Figure 11 shows the trends for conductivity, sulphate and boron at WX7 from before conversion from wet to dry ash to the current Stage 2A placement period. The concentrations initially increased before conversion, due to the effects of dry weather, and then decreased during the Stage 2A period due to prolonged wet weather that lasted from July, 2010 to summer 2011/12.

The SSCAD conductivity is super-imposed on Figure 11 and reduced by half to allow direct comparison with the WX7 conductivity on the same scale. Effects of the rainfall events of December, 2010 and November, 2011 on conductivity in the SSCAD and in Sawyers Swamp Creek are evident in the control chart. In addition, effects of the mine water discharge in 2009 and the pipeline leak in 2011 are evident as a decrease in sulphate and boron, but not conductivity, because the mine water has high conductivity as a result of its high alkalinity.

[2] Indicative water quality data for the mine water is shown in Table 6

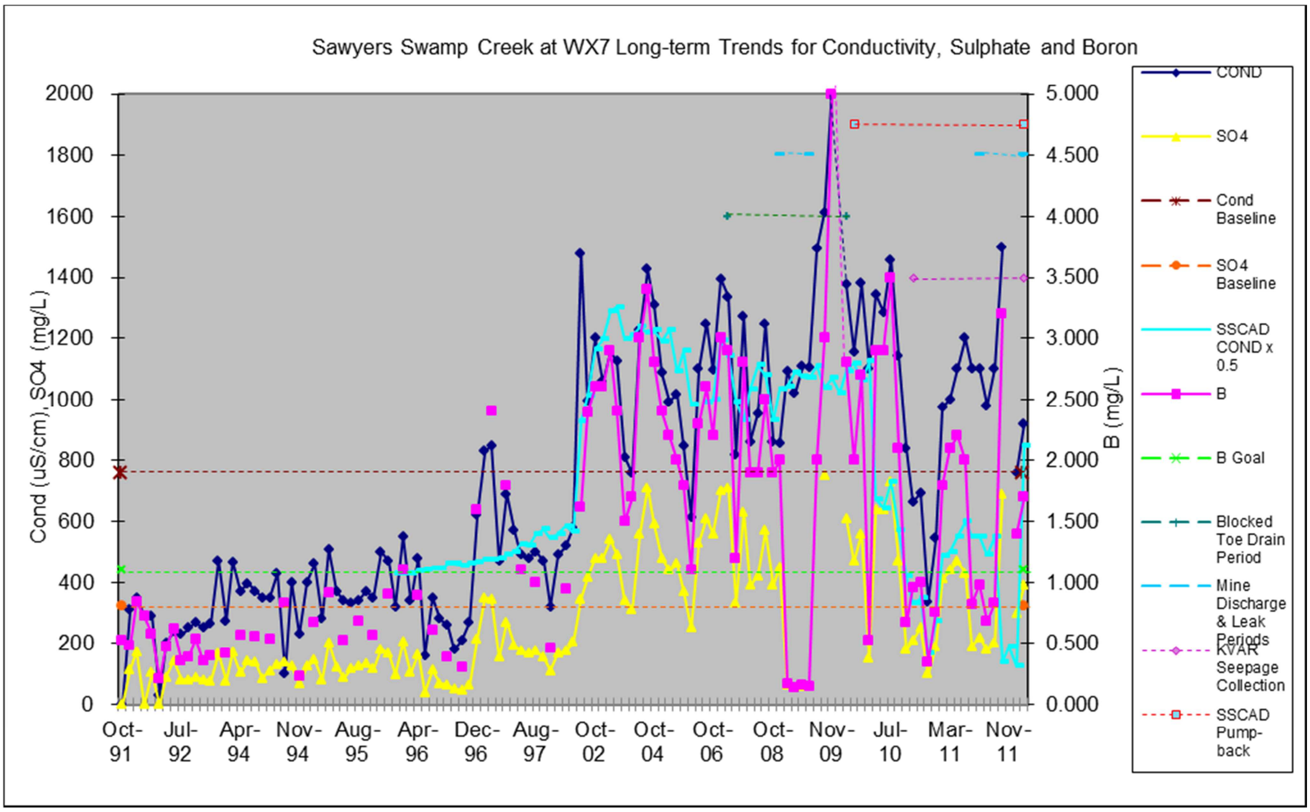

Figure 11 – Sawyers Swamp Creek Long-term trends in Conductivity, Sulphate and Boron showing effects of the Springvale Mine Discharge and compared to SSCAD Conductivity (halved) with Periods shown for the blocked KVAD toe drains, Springvale Mine water discharge and pipeline leak and beginning of the SSCAD pump-back and KVAR seepage collection and diversion to Lidsdale Cut

The WX7 creek site conductivity tended to follow that of the SSCAD pond conductivity until after installation of the pump-back system in February, 2010. Shortly after, the SSCAD conductivity decreased due to the increased rainfall and has remained relatively lower than in the creek since then.

Other than during high rainfall events, the increased rainfall did not cause the creek conductivity at WX7 to decrease in line with that in the ash dam pond. The reasons for the higher conductivity at WX7 since the pump-back system was installed are due to high conductivity input from Dump Creek, and later due to the increased flows to Lidsdale Cut from the KVAR sub-surface drains, as well as the mine water pipeline leak, that is understood to have begun in July, 2011. Hence, the apparent benefits of the pump-back system on water quality and trace metals in Sawyers Swamp Creek cannot be confirmed until the Springvale Mine pipeline emergency discharge valve leak is stopped and the rainfall returns to normal patterns.

Although no clear indication of effects on the Sawyers Swamp Creek receiving water site can be determined due to the various local inputs and climatic changes, the data from the KVAD/R seepage collection bores D5 and D6 and Lidsdale Cut indicated no detectable effects of the Stage 1 and Stage 2A dry ash placements on water quality and trace metals. Effects, if any, of the Stage 1 and Stage 2A placements on the creek receiving water site may become clearer with future monitoring.

5. Discussion

Installation of sub-surface drains in the KVAD, under the KVAR, was shown to decrease the groundwater level by about 1.5m, thereby preventing the KVAD groundwater from rising into the dry ash placement. Installation of the drains also appears to have allowed more low salinity background groundwater to flow into, and mix with, the KVAD groundwater. This reduced the conductivity and sulphate and trace metal concentrations in the KVAD seepage detection bore D5, which samples seepage flowing to Sawyers Swamp Creek.

The dry ash placement on top of the KVAD has apparently sealed the KVAD clay capping and prevented, or minimised, rainfall infiltration leachates from the dry ash entering the KVAD groundwater and adding to the seepage concentrations entering Sawyers Swamp Creek. This appeared to be the case even with the increased rainfall and indicates the benefits of the ash compaction, management and runoff controls used at the site. Sealing of the KVAD capping also suggests that the reduction in concentrations measured in bore D5 was mainly due to increased ability of the background groundwater to flow into the KVAD and that the dry ash placement has limited direct effects of rainfall groundwater recharge on the local groundwater.

Unblocking of the KVAD toe drains and diversion of the KVAD groundwater by the KVAR sub-surface drains to Lidsdale Cut, via the toe drains, also appears to have been the cause of the decreased conductivity and concentrations of sulphate and trace metals in Lidsdale Cut itself. Lidsdale Cut overflows to Sawyers Swamp Creek, so two sources of water quality and trace metal inputs to the Sawyers Swamp Creek receiving water site appear to have been improved by the installation of KVAR sub-surface drains.

An indication of the possible benefits of installation of the SSCAD seepage collection and pump-back system was that there ceased to be a direct relationship between the conductivity in the ash dam pond and that at the Sawyers Swamp Creek receiving water site. However, this is yet to be confirmed when the mine water discharge has been stopped. Although the conductivity was reduced in Lidsdale Cut, it was still higher than in the ash dam pond. By coincidence, the mine water had a similar conductivity to that in Lidsdale Cut, so the conductivity at the receiving water site was reduced to a similar level.

Although the conductivity was reduced at the Sawyers Swamp Creek receiving water site by the seepage collection and diversion systems, it was not possible to assess the benefits on the receiving water for the decreased concentrations of sulphate and trace metals due to effects of the Springvale Mine pipeline emergency discharge valve leak. The mine water caused a decrease in sulphate, but either increased or decreased concentrations of some trace metals, depending on the concentrations in the mine water.

Other than the mine water effects, Dump Creek caused increased salts and contributed to an increase in nickel concentrations at the receiving water site, due to leaching of minerals from the catchment with increased rainfall. Hence, a final assessment of effects on the Sawyers Swamp Creek receiving water site by the seepage collection and diversion systems will have to be done after the pipeline leak is repaired and when the rainfall patterns return to normal.

The decrease in conductivity, sulphate and trace metals in the KVAD and KVAR groundwater bore D5 and in Lidsdale Cut provide evidence that the Stage 1 and Stage 2A dry ash placements have not measurably affected the local groundwater or surface water quality.

Due to the various inputs to the lower reach of Sawyers Swamp Creek, an assessment of effects of the seepage collection and diversion works on the water quality in the upper Coxs River was not possible at this time. It is suggested that this be undertaken after the pipeline leak has been repaired. The intervening period will provide an opportunity for Delta Electricity to collect more water quality data in the Coxs River, upstream and downstream of the junction with Sawyers Swamp Creek for a more definitive assessment.

6. Conclusions

The findings of this study of the seepage collection and return system and assessment of effects of the Stage 1 and Stage 2A dry ash placements on receiving waters lead to the following conclusions:

- 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 salinity (conductivity), sulphate and trace metals in:
  - the KVAD local groundwater seepage to Sawyers Swamp Creek
  - Lidsdale Cut itself, and
  - Potentially at the Sawyers Swamp Creek receiving water site, but this could not be confirmed due to Springvale Mine water inflows to the creek.

- High rainfall during the Stage 2A period infiltrated the ash deposit in the Sawyers Swamp Creek Ash Dam and reduced the salinity (conductivity and sulphate) but leached some trace metals from the ash into the water in the dam. Installation of the v-notch collection and pump-back system, before the increase in rainfall, showed no effects of these changes on the local groundwater and the upper Sawyers Swamp Creek

- Although there ceased to be a direct relationship between conductivity in the Sawyers Swamp Creek Ash Dam and the Sawyers Swamp Creek receiving water site after installation of the v-notch collection and pump-back system, an improvement in the water quality in Sawyers Swamp Creek conductivity could not be confirmed. It was not possible to confirm an improvement in the upper Sawyers Swamp Creek due to salinity inputs from the Springvale Mine pipeline valve. Increased concentrations in Dump Creek, due to leaching of minerals from the catchment due to the increased rainfall, prevented an assessment of benefits to the Sawyers Swamp Creek receiving water site.

- The decreases in conductivity, sulphate and trace metals in the KVAD groundwater and at Lidsdale Cut provide evidence that management of the KVAR dry ash placement effectively controls dry ash leachates from affecting the local groundwater quality. However, flow on effects to the Sawyers Swamp Creek receiving water site could not be confirmed due to the interfering effects of other, non-ash related, inputs to the creek.

7. Recommendations

From the study findings, following recommendations are made:

- Continue negotiations with Centennial Coal to have the Springvale Mine pipeline depressurised to enable repairs to the emergency valve to be effected. Following the necessary repairs, a more complete assessment of potential benefits of the seepage collection and return systems on water quality should be undertaken

- Delta Electricity to include the following Lend Lease Infrastructure (LLI) water quality sites in their routine monitoring programme in the upper Sawyers Swamp Creek, on a monthly basis, to confirm the effects of the seepage collection and diversion works:
  - The LLI site upstream of the v-notch immediately below the SSCAD spillway.
  - The LLI site in Sawyers Swamp Creek near the groundwater bore D5, which receives seepage from the KVAD and is upstream of the Lidsdale Cut inflow and the Sawyers Swamp Creek receiving water site.

- Select a new sampling site in Sawyers Swamp Creek, which is upstream of influence of the KVAD seepage and downstream of the v-notch

- Continue monthly water quality monitoring at the Delta Electricity routine groundwater and surface water monitoring sites and assess:
  - The effectiveness of the v-notch collection and pump-back system in minimising effects of seepage from the Sawyers Swamp Creek Ash Dam on salinity and trace metals in Sawyers Swamp Creek
  - The relative contributions of the KVAR seepage collection and diversion systems and rainfall conditions to improvements in the Lidsdale Cut conductivity, sulphate and trace metals
  - Changes in conductivity, sulphate and trace metals in Lidsdale Cut and the KVAD/KVAR groundwater
  - The effects, if any, of leachates from the Stage 2A dry ash repository on the local surface water quality at the Sawyers Swamp Creek receiving water site

- Investigate the source of the nickel at Sawyers Swamp Creek receiving water site during the next reporting period

- Collect additional water quality and trace metal data in the Coxs River, upstream and downstream of the junction with Sawyers Swamp Creek, for assessment of potential beneficial effects of the seepage collection and diversion works on the river.

8. References

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Attachment 1

Lithgow Rainfall Data from January, 2000 to January, 2012 (mm/month) from

Bureau of Meteorology

Year(s)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
2000	57	22.2	271.4	50.6	53.4	32.2	37.4	51.2	43	75	119.2	59	871.6
2001	105.4	90.6	89.6	84.4	28.8	9	63.2	30.8	46.4	58.8	80	26.6	713.6
2002	87.8	187	69.4	40.2	67.6	22.6	16.8	17	21.2	3	22	47.2	601.8
2003	3.6	135	41.8	38.4	54	43.2	20.6	0	18.6	82.4	121	68.8	627.4
2004	35	98.2	22.4	10.4	35.2	16.2	30.2	50.8	34.8	118.4	113.8	88.6	654
2005	102.8	104.6	55.8	28.6	14.2	117.2	59.2	24.6	87.6	116.5	159.4	48.4	918.9
2006	146.6	32.6	6.4	6.8	6.8	6.8	54.2	5.8	59.2	3.2	32.2	72.7	433.3
2007	92.6	141.4	72.1	44.6	56.6	223	24.9	65.4	9	37.8	134.7	67	969.1
2008	102	84.6	47.6	59.8	11	60.9	37.1	43.6	88.2	66.2	83.3	113.2	797.5
2009	25.2	165.8	28	74.5	80.9	44.5	35.9	48.8	63	69	23.6	81.5	740.7
2010	76.4	119.2	85.1	35.8	54.4	40.9	73.5	73.5	52.4	70.9	122.8	164.6	969.5
2011	114	57.2	77.2	41.2	51.2	72.4	24.6	58.7	78.4	46.2	168	96	885.1
2012	57.1												765.2

Attachment 2: Wallerawang Power Station Ash Dam, Surface Water and Groundwater Quality (Stage 2A Data from May, 2010 to January, 2012).
(Attachment also contains: Pre-Dry Ash Placement Summary data before April, 2003)

NOTE: Post-Dry Ash Placement Stage 1 and Initial Stage 2 Raw Data and Summary statistics are 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)

Post-Dry Ash Placement Stage 2A Raw Data and Summary statistics from May, 2010 to January, 2012.

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 SSCAD Groundwater Seepage Detection Bores WGM1/D3 and 1/D4
4. Water Quality Data and Summary for Background Groundwater Bore WGM1/D2
5. Water Quality Data and Summary for KVAD and KVAR Stage I and II Dry Ash Placements Seepage Detection Groundwater Bores WGM1/D5 and 1/D6
6. Water Quality Data and Summary for SSCAD Pond

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

a) SAWYERS SWAMP CEEK AT WOLGAN ROAD BRIDGE WX7 (mg/L)

Sawyers Swamp Creek WX7 Pre-Dry Ash Placement Summary 1991-April, 2003 (mg/L)																		
	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
Average	0.001	0.274	22	0.001	0.919	0.037		20	0.001	19	44042	0.001	0.004	0.612	0.291	0.0001	12	15
Maximum	<0.01	0.647	84	<0.05	2.900	0.045		57	<0.002	82	147800	<0.01	0.009	3.100	0.927	0.0002	36	39
Minimum	0.001	0.105	5	0.001	0.205	0.030		4	0.001	6	3000	0.001	0.001	0.110	0.050	0.0001	1	4
90th Percentile	0.001	0.4927	33	0.001	2.331	0.043		38	0.001	27	76000	0.001	0.007	1.1	0.507	0.0002	27	22

*Outliers

Continued…………Sawyers Swamp Creek WX7 Pre-Dry Ash Placement Summary 1991-April, 2003 (mg/L)														
	Mn	Mo	NO2+NO3	Na	NFR	Ni	Ortho P	Pb	pH	Se	SiO2	SO4	TDS	TOT P	Zn
Average	0.635		0.061	40	21		0.006	0.002	7.0	0.002	12.2	160	308	0.017	0.099
Maximum	1.510		0.199	120	326		0.031	<0.01	9.3	<0.006	75.0	540	800	0.093	0.342
Minimum	0.153		0.009	11	2		0.001	0.001	6.1	0.001	0.1	38	20	0.001	0.004
90th Percentile	0.829		0.1158	86	23		0.013	0.003	7.6	0.003	22.4	323	584	0.047	0.153

*Outliers

Sawyers Swamp Creek WX7 Post-Stage 2A Ash Placement Data (mg/l) April, 2010 onward.
(Data from August, 2007 to March, 2010 in Aurecon, 2010)

Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
15-Apr-10	0.0005		420	0.002	0.52	0.02	0.001	18	0.0001	10	1,100	0.0005	0.002	1.500	0.05	0.000025	15	11
26-May-10	<0.001		20	<0.001	2.9	0.041		69	0.0003	27	1,344	<0.001	0.003	1.700	0.02	<0.00005	42	49
9-Jun-10	<0.001		<20	<0.001	2.9	0.04		68	0.0003	26	1,285	<0.001	0.002	0.400	0.05	<0.00005	41	48
1-Jul-10	<0.001	3.5	<20	<0.001	3.5	0.041		72	0.0004	20	1,458	<0.001	0.003	0.700	0.12	<0.00005	45	58
25-Aug-10	<0.001	2.5	40	<0.001	2.1	0.028		53	0.0003	21	1,140	<0.001	0.002	1.600	0.03	<0.00005	32	38
23-Sep-10	<0.001	0.9	220	0.002	0.67	0.022		21	<0.0002	12	838	<0.001	0.002	1.200	0.12	<0.00005	14	14
27-Oct-10	<0.001		70	<0.001	0.96	0.021		26	<0.0002	15	662	<0.001	0.001	1.200	0.01	<0.00005	17	16
19-Nov-10	<0.001		70	0.004	1	0.037		30	0.0008	15	694	0.002	0.006	1.800	0.01	<0.00005	19	19
9-Dec-10	<0.001	0.97	30	<0.001	0.35	0.05		15	<0.0002	13	336	<0.001	0.0037	0.500	0.02	<0.00005	7	9.3
12-Jan-11	<0.001	16	60	0.005	0.76	0.073		27	0.0008	16	545	0.002	0.007	1.200	0.02	<0.00005	15	15
24-Feb-11	<0.001	4.9	50	<0.001	1.8	0.047		48	0.0006	21	972	<0.001	0.002	2.100	<0.01	<0.00005	29	30
24-Mar-11	<0.001	1.2	30	<0.001	2.1	0.054		55	0.0006	25	1,000	<0.001	0.002	2.000	<0.01	<0.00005	36	32
8-Apr-11	<0.001	2.8	65	<0.001	2.2	0.063		58	0.001	24	1,100	<0.001	0.003	2.100	0.01	<0.00005	36	32
12-May-11	<0.001	53	250	0.031	2	0.16		56	0.007	26	1,200	0.005	0.015	2.600	0.02	<0.00005	39	31
10-Jun-11	<0.001	2.2	360	0.004	0.82	0.022		25	0.0006	12	1,100	<0.001	0.002	1.600	0.04	<0.00005	18	14
26-Jul-11	<0.001	2.3	360	0.002	0.98	0.016		28	0.0006	12	1,100	0.001	0.002	2.000	0.01	<0.00005	22	15
30-Aug-11	<0.001	21	360	0.009	0.68	0.051		25	0.002	12	980	0.003	0.006	2.100	<0.01	0.00005	18	13
21-Sep-11	<0.001	7.1	420	0.005	0.83	0.026		28	0.001	11	1,100	0.002	0.007	2.100	<0.01	<0.00005	21	14
26-Oct-11	0.0005		190	0.029	3.2	0.19		93	0.02	23	1,500	0.027	0.052	1.8	0.020	0.000025	58	45
15-Nov-11																		
14-Dec-11	0.0005		37	0.003	1.4	0.049		36	0.002	15	760	0.004	0.006	2	0.005	0.000025	25	18
18-Jan-12	<0.001	29	20	0.002	1.7	0.041		45	0.003	17	920	0.003	0.006	1.3	0.25	<0.00005	29	23

Continued……….Sawyers Swamp Creek WX7 Post-Stage 2A Ash Placement Data (mg/l) April, 2010 onward. (Data from August, 2007 to March, 2010 in Aurecon, 2010)															
Date	**Mn**	**Mo**	**NO2+NO3**	**Na**	**NFR**	**Ni**	**Ortho P**	**Pb**	**pH**	**Se**	**SiO2**	**SO4**	**TDS**	**TOT P**	**Zn**
15-Apr-10	0.14	0.02		220		0.04		0.0005	8.40	0.001		150	670		0.09
26-May-10	4.5	<0.01		140		0.3		0.001	6.7	<0.002		640	860.00		0.51
9-Jun-10	4.9	<0.01		130		0.33		<0.001	6.3	<0.002		640	980.00		0.56
1-Jul-10	6.5	<0.01		130		0.46		<0.001	4.1	<0.002		730	1100.00		0.82
25-Aug-10	4	<0.01		120		0.28		0.001	7.2	<0.002		470	760.00		0.5
23-Sep-10	1	<0.01		150		0.08		0.001	8.2	<0.002		180	510.00		0.14
27-Oct-10	1.4	<0.01		81		0.09		<0.001	7.6	<0.002		210	430.00		0.15
19-Nov-10	1.7	<0.01		82		0.17		0.006	7.2	<0.002		250	450.00		0.54
9-Dec-10	0.31	<0.01		37		0.04		<0.001	7.3	<0.002		99	240.00		0.09
12-Jan-11	0.09	<0.01		63		0.17		0.011	7.3	<0.002		190	390.00		0.7
24-Feb-11	2.9	<0.01		96		0.18		0.003	7.1	<0.002		410	690.00		0.36
24-Mar-11	3.4	<0.01		100		0.18		<0.001	6.8	<0.002		440	710.00		0.32
8-Apr-11	3.1	<0.01		130		0.15		0.002	7.3	<0.002		470	800.00		0.35
12-May-11	2.8	<0.01		170		0.48		0.027	7.5	0.002		430	880.00		3.1
10-Jun-11	1.2	0.02		210		0.08		0.002	8.3	<0.002		190	670.00		0.22
26-Jul-11	1.3	0.02		210		0.1		0.002	8.1	<0.002		220	690.00		0.22
30-Aug-11	0.83	0.01		190		0.11		0.005	8	<0.002		180	660.00		0.74
21-Sep-11	0.98	0.02		240		0.11		0.002	8.3	<0.002		200	770.00		0.43
26-Oct-11	3.7	190		170				0.038	6.50	0.003		690	1200		3.3*
15-Nov-11															
14-Dec-11	1.7	37		90				0.005	7.00	0.001		300	530		0.52
18-Jan-12	2.6	<0.01		100		0.16		0.002	6.4	<0.002		390	660		0.47

Sawyers Swamp Creek WX7 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																		
	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
Average	0.0005	11	161.7	0.0082	1.59	0.052		43	0.0023	18	1006	0.0050	0.0064	1.60	0.05	0.000031	28	25.92
Maximum	0.0005	53	420.0	0.0310	3.50	0.190		93	0.0200	27	1500	0.0270	0.0520	2.60	0.25	0.000050	58	58.00
Minimum	0.0005	<10	20.0	0.0020	0.35	0.016		15	0.0001	10	336	0.0005	0.0010	0.40	0.01	0.000025	7	9.30
50th Percentile	0.0005	3	70.0	0.0040	1.40	0.041		36	0.0007	16	1100	0.0025	0.0030	1.70	0.02	0.000025	25	19.00

Continued………… Sawyers Swamp Creek WX7 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)															
	Mn	Mo	NO2+NO3	Na	NFR	Ni	Ortho P	Pb	pH	Se	SiO2	SO4	TDS	TOT P	Zn
Average	2.34	32.441		136		0.185		0.007	7.2	0.002		356	698		0.542
Maximum	6.50	190.000		240		0.480		0.038	8.4	0.003		730	1200		3.100
Minimum	0.09	0.010		37		0.040		0.001	4.1	0.001		99	240		0.090
50th Percentile	1.70	0.020		130		0.160		0.002	7.3	0.002		300	690		0.450

b) *Water Quality Data and Summary for Background at Dump Creek WX11*

Dump Creek WX11 Pre-Dry Ash Placement Background Summary 1991-April, 2003 (mg/L)																		
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	0.13	7	0.001	0.64	0.03		32	0.001	23	56732	0.001	0.002	0.539	1.36	0.0002	23	24
Maximum	0.001	0.38	16	0.001	3.30	0.05		71	0.001	83	137113	0.001	0.002	1.200	11.00	0.0002	36	42
Minimum	0.001	0.04	0	0.001	0.04	0.02		18	0.001	8	32000	0.001	0.001	0.200	0.03	0.0002	14	14
90th Percentile	0.001	0.30	15	0.001	1.45	0.05		58	0.001	39	77000	0.001	0.002	1.100	2.38	0.0002	31	35

Continued……….Dump Creek WX11 Pre-Dry Ash Placement Background Summary 1991-April, 2003 (mg/L)											
	Mn	**Mo**	**Na**	**NFR**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.63		76	5		0.001	6.6	0.002	209	559	0.09
Maximum	2.20		156	12		0.001	8.0	0.003	593	984	0.32
Minimum	0.09		39	2		0.001	3.6	0.001	88	362	0.00
90th Percentile	1.94		110	8		0.001	8.0	0.003	325	772	0.28

Dump Creek WX11 Post-Dry Ash Placement Data (mg/l) April, 2010 onward
(Data from August, 2007 to March, 2010 in Aurecon, 2010)

Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
15-Apr-10	0.0005		10	0.0005	2.1	0.022	0.005	51	0.0002	19	1,428	0.0005	0.005	0.800	3.5	0.000025	27	52
26-May-10	<0.001		<20	<0.001	1.9	0.02		50	0.0003	22	1,258	<0.001	0.004	0.700	3.6	<0.00005	24	50
9-Jun-10	<0.001		<20	<0.001	2.1	0.021		54	0.0023	21	1,252	<0.001	0.003	0.600	4.3	<0.00005	27	51
1-Jul-10	<0.001	1.1	<20	<0.001	2.2	0.02		49	0.0003	20	1,325	<0.001	0.005	0.700	4.3	<0.00005	22	50
25-Aug-10	<0.001	0.92	<20	<0.001	2	0.02		58	0.0003	23	1,341	<0.001	0.004	0.600	2.1	<0.00005	25	57
23-Sep-10	<0.001	1.1	<20	<0.001	2.2	0.024		67	0.0024	21	1,400	<0.001	0.008	0.800	3.9	<0.00005	28	61
27-Oct-10	<0.001		<20	<0.001	2.1	0.02		56	0.0002	20	1,302	<0.001	0.004	0.500	3.6	<0.00005	25	51
19-Nov-10	<0.001		<20	<0.001	2.5	0.022		63	<0.0002	21	1,436	<0.001	0.004	0.700	3.3	<0.00005	28	56
9-Dec-10	<0.001	0.51	<20	<0.001	1.9	0.031		65	0.0022	20	1,134	<0.001	0.0036	0.400	0.28	<0.00005	26	49
12-Jan-11	<0.001	0.61	<20	<0.001	2	0.02		54	<0.0002	20	1,164	<0.001	0.006	0.800	0.57	<0.00005	26	47
24-Feb-11	<0.001	0.99	<20	<0.001	2.7	0.027		60	<0.0002	20	1,390	<0.001	0.002	0.900	2.6	<0.00005	31	58
24-Mar-11	<0.001	0.8	<20	<0.001	2.4	0.024		55	<0.0002	20	1,200	<0.001	0.004	0.500	2.3	<0.00005	28	53
8-Apr-11	<0.001	1.4	<20	<0.001	2.9	0.03		62	0.0003	20	1,400	<0.001	0.004	0.900	4.1	<0.00005	33	60
12-May-11	<0.001	1.4	<20	<0.001	2.1	0.024		53	0.0003	22	1,300	<0.001	0.003	0.900	4.3	<0.00005	26	56
10-Jun-11	<0.001	1.2	<20	<0.001	2.6	0.022		59	0.0002	22	1,500	<0.001	0.002	0.900	5.7	<0.00005	26	59
21-Jul-11	<0.001	1.2	<20	<0.001	2.6	0.021		62	0.0003	24	1,500	<0.001	0.003	0.900	6.3	<0.00005	28	62
30-Aug-11	<0.001	1.4	<20	<0.001	2.6	0.021		67	0.0002	24	1,500	<0.001	0.005	1.000	6.4	<0.00005	29	63
21-Sep-11	<0.001	1.5	<20	<0.001	3.1	0.023		72	0.0003	25	1,700	0.001	0.012	1.100	7.3	<0.00005	33	69
26-Oct-11	0.0005		10	0.0005	2.9	0.022		72	0.0002	24	1,700	0.001	0.002	1.1	7.6	0.000025	33	72
15-Nov-11	0.0005		10	0.0005	3.4	0.024		79	0.00024	26	1,800	0.0005	0.005	1.1	6.300	0.000025	37	79
14-Dec-11	0.0005		10	0.0005	2.8	0.021		70	0.0001	25	1,500	0.0005	0.004	0.9	4.300	0.000025	31	65
18-Jan-12	<0.001	1.6	<20	<0.001	3.3	0.023		78	0.0002	25	1800	<0.001	0.015	1.1	6.3	<0.00005	38	74

Continued……………………..Dump Creek WX11 Post-Dry Ash Placement Data (mg/l) April, 2010 onward
(Data from August, 2007 to March, 2010 in Aurecon, 2010)

Date	Mn	Mo	Na	NFR	Ni	Pb	pH	Se	SO4	TDS	Zn
15-Apr-10	5	0.005	98		0.34	0.002	3.30	0.001	610	890	0.78
26-May-10	4.5	<0.01	93		0.31	0.002	3.3	<0.002	530	690	0.8
9-Jun-10	5	<0.01	98		0.35	0.002	3.4	<0.002	580	850	0.82
1-Jul-10	4.9	<0.01	90		0.35	0.002	3.4	<0.002	600	890	0.86
25-Aug-10	4.8	<0.01	99		0.34	0.001	3.4	<0.002	570	840	0.81
23-Sep-10	5.4	<0.01	110		0.38	0.002	3.4	<0.002	630	960	0.87
27-Oct-10	5	<0.01	93		0.32	0.002	3.4	<0.002	560	870	0.72
19-Nov-10	6	<0.01	120		0.39	0.002	3.3	<0.002	670	950	0.82
9-Dec-10	4.3	<0.01	96		0.28	0.0011	4.2	<0.002	530	830	0.62
12-Jan-11	4.5	<0.01	97		0.28	0.002	3.6	<0.002	540	820	0.57
24-Feb-11	5.8	<0.01	110		0.38	<0.001	3.4	<0.002	650	970	0.76
24-Mar-11	5.3	<0.01	100		0.32	0.002	3.4	<0.002	560	810	0.68
8-Apr-11	6.1	<0.01	110		0.41	0.002	3.2	<0.002	650	970	0.97
12-May-11	4.9	<0.01	98		0.35	0.001	3.2	<0.002	570	880	1
10-Jun-11	5.9	<0.01	110		0.4	0.001	3.3	<0.002	640	920	0.99
21-Jul-11	6.2	<0.01	110		0.41	0.002	3.3	<0.002	660	950	1
30-Aug-11	6.5	<0.01	120		0.42	0.002	3.2	<0.002	700	1100	1
21-Sep-11	7.3	<0.01	130		0.49	0.002	3.2	<0.002	780	1200	1.2
26-Oct-11	7.6		120			0.002	3.10	0.001	750	1200	1.2
15-Nov-11	8.2	0.01	130			0.002	3.10	0.001	810	1300	1.3
14-Dec-11	6	0.01	110			0.009	3.20	0.001	680	1100	0.92
18-Jan-12	7.3	<0.01	140		0.48	0.002	3.1	<0.002	810	1200	1.1

Dump Creek WX11 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																		
	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
Average	0.0005	1.1	10.0	0.0005	2.47	0.023		62	0.0006	22	1424	0.0007	0.0049	0.81	4.23	0.000025	29	58.82
Maximum	0.0005	1.6	10.0	0.0005	3.40	0.031		79	0.0024	26	1800	0.0010	0.0150	1.10	7.60	0.000025	38	79.00
Minimum	0.0005	<10	10.0	0.0005	1.90	0.020		49	0.0001	19	1134	0.0005	0.0020	0.40	0.28	0.000025	22	47.00
50th Percentile	0.0005	1.2	10.0	0.0005	2.45	0.022		61	0.0003	22	1400	0.0005	0.0040	0.85	4.20	0.000025	28	57.50

Continued…………….Dump Creek WX11 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)											
	Mn	Mo	Na	NFR	Ni	Pb	pH	Se	SO4	TDS	Zn
Average	5.75	0.008	108		0.368	0.002	3.3	0.001	640	963	0.900
Maximum	8.20	0.010	140		0.490	0.009	4.2	0.001	810	1300	1.300
Minimum	4.30	0.005	90		0.280	0.001	3.1	0.001	530	690	0.570
50th Percentile	5.60	0.010	110		0.350	0.002	3.3	0.001	635	935	0.865

2. Water Quality Data and Summary for Lidsdale Cut WX5

Lidsdale Cut WX5 Pre-Dry Ash Placement Summary 1992-April, 2003 (mg/L)																		
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	2.43	14	0.001	1.70	0.042		28	0.001	26	74991	0.003	0.003	1.50	0.51	0.0002	39	17
Maximum	0.001	3.17	50	0.001	2.17	0.060		32	0.001	78	113402	0.010	0.005	2.20	1.00	0.0002	53	21
Minimum	0.001	0.70	1	0.001	0.54	0.030		24	0.001	15	37800	0.001	0.002	0.98	0.07	0.0002	16	8
90th Percentile	0.001	3.08	38	0.001	2.16	0.054		31	0.001	34	95200	0.006	0.005	1.99	0.70	0.0002	51	20

Continued……….Lidsdale Cut WX5 Pre-Dry Ash Placement Summary 1992- April, 2003 (mg/l)											
	Mn	**Mo**	**Na**	**NFR**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	1.41		62	7		0.003	4.7	0.001	266	518	0.219
Maximum	2.34		84	15		0.004	6.9	0.001	400	671	0.397
Minimum	0.21		31	3		0.002	3.2	0.001	92	400	0.072
90th Percentile	2.12		77	13		0.004	6.9	0.001	359	650	0.304

Lidsdale Cut WX5 Post-Dry Ash Placement Data (mg/l) April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)																		
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
15-Apr-10	0.0005		10	0.0005	7	0.028	0.011	120	0.0007	28	2370	0.0005	0.007	5.6	3.2	0.000025	100	85
26-May-10	<0.001		<20	0.001	1.5	0.022		30	0.0002	13	603	<0.001	0.002	0.9	0.01	<0.00005	22	19
9-Jun-10	<0.001		<20	0.002	3.6	0.035		64	0.0005	21	1240	<0.001	0.003	2.4	0.18	<0.00005	53	46
1-Jul-10	<0.001	6	<20	0.003	3	0.042		57	0.0003	17	1039	0.001	0.004	2	0.03	<0.00005	43	38
25-Aug-10	<0.001	4.2	<20	0.002	1.9	0.049		44	0.0004	18	803	<0.001	0.003	1.5	0.03	<0.00005	30	29
23-Sep-10	<0.001	5.4	<20	0.002	2.1	0.051		55	0.0056	22	951	<0.001	0.004	2.4	0.03	<0.00005	36	33
27-Oct-10	<0.001		<20	0.003	2.6	0.045		62	0.0014	27	1119	0.002	0.004	3.3	0.05	<0.00005	48	35
19-Nov-10	<0.001		<20	0.002	1.9	0.05		59	0.0013	35	991	<0.001	0.003	3.1	0.04	<0.00005	42	29
9-Dec-10	<0.001	2.8	<20	0.0016	1.1	0.05		32	0.00069	12	519	<0.001	0.0025	1.6	0.01	<0.00005	19	15
12-Jan-11	<0.001	6.5	<20	0.002	2.4	0.059		68	0.0009	28	1011	<0.001	0.003	3.6	0.01	<0.00005	45	31
24-Feb-11	<0.001	22	<20	<0.001	5.5	0.048		150	0.005	11	2211	<0.001	0.004	13	0.97	<0.00005	120	62
24-Mar-11	<0.001	13	<20	0.008	3.9	0.054		110	0.005	40	1600	<0.001	0.006	6.2	0.1	<0.00005	89	49
8-Apr-11	<0.001	20	<20	0.007	6.2	0.045		140	0.005	43	2200	0.001	0.009	8.4	2.4	<0.00005	120	69
12-May-11	<0.001	16	<20	0.003	4.8	0.041		120	0.006	46	1800	<0.001	0.006	7	0.67	<0.00005	92	57
10-Jun-11	<0.001	8.1	<20	0.006	2.1	0.044		68	0.0036	17	890	0.001	0.006	2.6	0.02	<0.00005	40	23
21-Jul-11	<0.001	9.3	<20	0.002	2.6	0.044		72	0.003	28	1000	<0.001	0.005	3.7	0.04	<0.00005	51	30
30-Aug-11																		
21-Sep-11																		
26-Oct-11																		
15-Nov-11	0.0005		180	0.0005	1.7	0.041		54	0.0016	18	1,300	0.0005	0.003	2.3	0.005	0.000025	31	26
14-Dec-11	0.0005		78	0.0005	0.63	0.032		20	0.0007	13	560	0.002	0.002	1	0.100	0.000025	13	10
18-Jan-12	<0.001	2.8	91	<0.001	0.51	0.033		19	0.0004	14	540	<0.001	0.002	0.9	0.02	<0.00005	9	10

Continued…….Lidsdale Cut WX5 Post-Dry Ash Placement Data (mg/l) April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)											
Date	**Mn**	**Mo**	**Na**	**NFR**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
15-Apr-10	13	0.005	170		0.97	0.004	3.3	0.001	1200	1800	1.2
26-May-10	2.8	0.01	41		0.18	<0.001	5.4	<0.002	250	300	0.3
9-Jun-10	7	0.01	90		0.49	0.002	4	<0.002	620	930	0.61
1-Jul-10	5.5	0.01	80		0.4	0.002	5.1	<0.002	490	740	0.52
25-Aug-10	3.6	0.01	59		0.28	0.001	5.1	<0.002	330	520	0.45
23-Sep-10	4.5	0.01	72		0.33	0.001	4.9	<0.002	420	660	0.49
27-Oct-10	5	0.01	81		0.35	0.002	4.7	<0.002	500	820	0.6
19-Nov-10	3.8	0.01	72		0.24	<0.001	4.7	<0.002	440	700	0.46
9-Dec-10	2.1	0.01	36		0.14	<0.001	5.2	<0.002	220	370	0.36
12-Jan-11	4.1	0.01	79		0.28	0.002	4.6	<0.002	480	800	0.37
24-Feb-11	8.4	0.01	170		0.63	0.004	3.5	<0.002	1200	1500	1
24-Mar-11	7	0.1	130		0.5	0.003	4.3	0.005	800	1200	0.85
8-Apr-11	11	0.04	180		0.78	0.007	3.4	0.003	1200	1700	1.2
12-May-11	8.2	0.03	140		0.63	0.004	3.6	0.002	910	1500	1.2
10-Jun-11	2.8	0.15	57		0.21	0.002	5.8	0.004	380	620	0.52
21-Jul-11	3.7	0.03	77		0.28	0.001	4.8	0.002	460	730	0.59
30-Aug-11											
21-Sep-11											
26-Oct-11											
15-Nov-11	1.8	0.01	180		0.15	0.0005	7.30	0.001	420	900	0.36
14-Dec-11	0.6	0.01	81		0.05	0.0005	7.30	0.001	160	380	0.13
18-Jan-12	0.57	0.01	78		0.02	<0.001	7.6	<0.002	140	370	0.07

Lidsdale Cut WX5 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																	
	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
Average	0.0005	10	89.8	0.0027	2.90	0.043		71	0.0022	24	1197	0.0011	0.0041	3.76	0.42	0.000025	53	36.63
Maximum	0.0005	22	180.0	0.0080	7.00	0.059		150	0.0060	46	2370	0.0020	0.0090	13.00	3.20	0.000025	120	85.00
Minimum	0.0005	<10	10.0	0.0005	0.51	0.022		19	0.0002	11	519	0.0005	0.0020	0.90	0.01	0.000025	9	10.00
50th Percentile	0.0005	7	84.5	0.0020	2.40	0.044		62	0.0013	21	1011	0.0010	0.0040	2.60	0.04	0.000025	43	31.00

Continued……….Lidsdale Cut WX5 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)											
	Mn	Mo	Na	NFR	Ni	Pb	pH	Se	SO4	TDS	Zn
Average	5.02	0.026	99		0.364	0.002	5.0	0.002	559	871	0.594
Maximum	13.00	0.150	180		0.970	0.007	7.6	0.005	1200	1800	1.200
Minimum	0.57	0.005	36		0.020	0.001	3.3	0.001	140	300	0.070
50th Percentile	4.10	0.010	80		0.280	0.002	4.8	0.002	460	740	0.520

3. Water Quality Data and Summary for SSCAD Groundwater Seepage Detection Bores WGM1/D3 and 1/D4

a) Water Quality Data and Summary for WGM1/D3

WGM1/D3 Pre-Dry Ash Placement Summary 1988- April, 2003 (mg/L)																	
	Ag	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	115		0.010	0.05	0.292		18.7	0.001	64	62308	0.009	0.005	0.19	4.9	0.0004	8	20.0
Maximum	0.001	229		0.043	0.22	5.700		31.0	0.001	140	77320	0.026	0.040	0.73	21.0	0.0009	38	28.0
Minimum	0.001	8		0.001	0.005	0.080		6.3	0.001	25	34200	0.001	0.001	0.040	0.5	0.0001	1	2.0
90th Percentile	0.001	154		0.027	0.19	0.150		24.0	0.001	77	72000	0.020	0.010	0.33	9.4	0.0007	9	25.0

Continued……….. WGM1/D3 Pre-Dry Ash Placement Summary 1988- April, 2003 (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.592		69	0.080	0.008	6.0	0.001	94	349	10.0	920.2	0.061
Maximum	1.930		109	0.092	0.074	6.9	0.003	144	660	11.1	921.5	0.200
Minimum	0.080		31	0.071	0.001	4.6	0.001	20	125	8.7	919.1	0.010
90th Percentile	0.710		85	0.089	0.014	6.4	0.002	116	470	10.9	921.3	0.110

WGM1/D3 Post-Dry Ash Placement Data (mg/L) April, 2010 onward (data August, 2007 to March, 2010 in Aurecon, 2010)																				
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
16-Apr-10	0.0005	90		0.0005	0.04	0.088	0.0005	17	0.0001	100		776	0.002	0.003	0.05	0.005	0.000025	8		27
27-May-10	<0.001	110		0.002	0.03	0.107		20	0.0002	100		806	0.001	0.006	<0.1	0.02	0.00005	8		32
10-Jun-10	<0.001	80		<0.001	0.05	0.087		17	0.0002	94		698	<0.001	0.002	<0.1	<0.01	0.00005	8		26
1-Jul-10	<0.001	80	0.06	<0.001	0.03	0.079		15	0.0002	81		644	<0.001	0.002	<0.1	0.02	0.00005	7		24
26-Aug-10	<0.001	50	0.19	<0.001	0.03	0.068		13	0.0002	77		555	<0.001	0.004	<0.1	0.03	0.00005	6		20
24-Sep-10	<0.001	50	0.2	<0.001	<0.01	0.078		16	0.0002	100		636	<0.001	0.004	<0.1	0.05	0.00005	6		23
28-Oct-10	<0.001	40		<0.001	<0.01	0.105		19	0.0002	130		747	<0.001	0.002	<0.1	0.02	0.00005	7		26
19-Nov-10	<0.001	40		0.001	<0.01	0.097		18	0.0002	130		744	0.001	0.003	<0.1	0.03	0.00005	7		27
10-Dec-10	<0.001	40	0.28	0.0018	0.04	0.096		15	0.0002	110		660	<0.001	0.0038	<0.1	0.06	0.00005	7		23
13-Jan-11	<0.001	50	0.11	0.004	0.03	0.13		21	0.0002	160		872	<0.001	0.004	<0.1	0.23	0.00005	8		33
25-Feb-11	0.002	50	0.06	0.002	0.03	0.12		20	0.0002	180		940	<0.001	0.002	<0.1	0.03	0.00005	9		32
24-Mar-11	<0.001	50	0.07	0.003	0.04	0.11		19	0.0002	150		870	<0.001	0.002	<0.1	0.03	0.00005	8		31
8-Apr-11	<0.001	68	0.08	0.003	0.03	0.11		19	0.0002	150		900	<0.001	0.002	0.1	0.03	0.00005	8		30
12-May-11	<0.001	63	0.05	0.002	0.03	0.11		17	0.0002	130		840	<0.001	0.002	<0.1	0.01	0.00005	8		29
10-Jun-11	<0.001	51	0.15	0.001	0.04	0.088		15	0.0002	120		790	<0.001	0.002	<0.1	<0.01	0.00005	7		25
21-Jul-11	<0.001	69	0.07	0.002	0.01	0.078		14	0.0002	96		670	0.001	0.003	<0.1	1.1	0.00005	7		23
31-Aug-11	<0.001	39	0.13	0.001	0.01	0.12		21	0.0002	170		940	0.002	0.002	<0.1	<0.01	0.00005	8		33
22-Sep-11	<0.001	61	0.08	0.002	0.01	0.12		22	0.0002	180		1000	0.001	0.002	0.1	0.01	0.00005	9		37
26-Oct-11	0.0005	60		0.002	0.005	0.08		14	0.0001	100		680	0.002	0.002	0.05	0.6	0.000025	7		23
16-Nov-11	0.0005	64		0.002	0.005	0.076		14	0.0001	100		650	0.0005	0.002	0.05	0.71	0.000025	7		23
14-Dec-11	0.0005	50		0.0005	0.015	0.055		9.4	0.0001	67		470	0.0005	0.004	0.05	0.06	0.000025	5		15
18-Jan-12	<0.001	66	0.6	0.007	0.02	0.065		11	0.0002	60		480	0.001	0.007	0.1	7.8	0.00005	6		18

Continued…….WGM1/D3 Post-Dry Ash Placement Data (mg/L) April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
16-Apr-10	0.56	0.005	97	0.09	0.003	6.6	0.001	120	440	10.0	920.20	0.07
27-May-10	0.66	0.01	100	0.14	0.011	6.2	0.002	130	450	10	920.20	0.1
10-Jun-10	0.49	0.01	87	0.12	0.001	6.1	0.002	120	410	9.9	920.30	0.1
1-Jul-10	0.53	0.01	80	0.11	<0.001	5.9	0.002	98	390	9.9	920.30	0.1
26-Aug-10	0.34	0.01	70	0.11	0.001	6.1	0.002	79	360			0.2
24-Sep-10	0.51	0.01	75	0.13	0.001	6	0.002	84	430			0.1
28-Oct-10	0.73	0.01	91	0.12	0.001	6.1	0.002	97	460			0.1
19-Nov-10	0.74	0.01	89	0.12	<0.001	5.9	0.002	110	470	9.5	920.70	0.1
10-Dec-10	0.76	0.01	84	0.12	0.002	5.8	0.002	91	430			0.1
13-Jan-11	1.2	0.01	110	0.18	0.004	5.8	0.002	130	580	9.4	920.80	0.2
25-Feb-11	1.2	0.01	120	0.17	<0.001	6	0.002	150	590			0.2
24-Mar-11	0.76	0.01	120	0.16	0.001	5.7	0.002	140	500	9.4	920.80	0.2
8-Apr-11	1	0.01	110	0.16	0.001	6	0.002	140	540	9.5	920.70	0.2
12-May-11	0.85	0.01	110	0.13	<0.001	5.7	0.002	130	530	9.5	920.70	0.2
10-Jun-11	0.72	0.01	99	0.11	0.001	5.9	0.002	130	450	9.5	920.70	0.2
21-Jul-11	0.66	0.01	87	0.13	<0.001	5.9	0.002	98	530	6.5	923.70	0.2
31-Aug-11	0.98	0.01	120	0.15	0.002	5.7	0.002	140	540	9.5	920.70	0.2
22-Sep-11	1	0.01	130	0.17	<0.001	6	0.002	150	520	9.5	920.70	0.2
26-Oct-11	0.68	0.005	83	0.14	0.001	5.9	0.001	93	430	9.5	920.70	0.14
16-Nov-11	0.66	0.005	84	0.14	0.0005	5.9	0.001	93	450	9.4	920.80	0.14
14-Dec-11	0.44	0.005	63	0.09	0.002	5.7	0.001	66	330	9.8	920.40	0.1
18-Jan-12	0.75	0.01	64	0.16	0.002	5.9	0.002	64	370	10.6	919.60	0.08

WGM1/D3 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																		
	Ag	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0008	60	0.2	0.0022	0.03	0.094		17	0.0002	118	744	0.0012	0.0030	0.07	0.57	0.000045	7	26.36
Maximum	0.0020	110	0.6	0.0070	0.05	0.130		22	0.0002	180	1000	0.0020	0.0070	0.10	7.80	0.000050	9	37.00
Minimum	0.0005	39	0.1	0.0005	0.01	0.055		9	<0.0001	60	470	0.0005	0.0020	0.05	0.01	0.000025	5	15.00
50th Percentile	0.0005	56	0.1	0.0020	0.03	0.092		17	0.0002	105	746	0.0010	0.0020	0.05	0.03	0.000050	7	26.00

Continued……….. WGM1/D3 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.74	0.009	94	0.134	0.002	5.9	0.002	112	464	9.5	920.7	0.132
Maximum	1.20	0.010	130	0.180	0.011	6.6	0.002	150	590	10.6	923.7	0.240
Minimum	0.34	0.005	63	0.090	0.001	5.7	0.001	64	330	6.5	919.6	0.070
50th Percentile	0.73	0.010	90	0.130	0.001	5.9	0.002	115	450	9.5	920.7	0.140

b) Water Quality Data and Summary for WGM1/D4

WGM1/D4 Pre-Dry Ash Placement Summary 1988- April, 2003 (mg/L)																	
Date	**Ag**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	96	0.003	0.27	0.372		30.0	0.002	30	58408	0.005	0.012	0.15	54.6	0.0009	6	18.9
Maximum	0.001	282	0.012	0.61	6.700		58.0	0.004	86	98969	0.019	0.100	0.72	120.0	0.0033	46	47.0
Minimum	0.001	20.60	0.001	0.07	0.050		16.0	0.001	6.00	16100	0.001	0.001	0.001	0.1	0.0002	0	1.8
90th Percentile	0.001	168	0.006	0.49	0.330		43.8	0.003	45	72780	0.012	0.036	0.24	86.0	0.0020	7	26.8

Continued…………..WGM1/D4 Pre-Dry Ash Placement Summary 1988- April, 2003 (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	4.588		29	0.018	0.006	6.3	0.009	118	327	1.3	905.8	0.041
Maximum	12.000		82	0.024	0.022	7.3	0.100	350	768	1.5	906.3	0.100
Minimum	0.094		4	0.011	0.001	5.2	0.001	11	96	0.8	905.3	0.004
90th Percentile	6.500		42	0.023	0.011	6.8	0.002	201	510	1.4	906.0	0.060

WGM1/D4 Post-Dry Ash Placement Data April, 2010 onward (mg/l) (data from August, 2007 to March, 2010 in Aurecon, 2010)																			
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
16-Apr-10	0.0005	10		0.001	1.6	0.018	0.001	99	0.0001	14	1527	0.0005	0.005	0.05	27	0.000025	10		70
27-May-10	0.001	70		0.002	1.8	0.018		110	0.0002	34	1502	0.001	0.002	0.1	34	0.00005	11		75
10-Jun-10	0.001	80		0.001	1.6	0.019		97	0.0002	35	1419	0.001	0.001	0.1	35	0.00005	10		67
1-Jul-10	0.001	60	0.02	0.001	1.5	0.018		92	0.0002	34	1406	0.001	0.001	0.1	39	0.00005	10		67
26-Aug-10	0.001	20	0.01	0.001	1.1	0.018		99	0.0002	39	1397	0.001	0.001	0.1	50	0.00005	8		65
24-Sep-10	0.001	30	0.01	0.001	1.1	0.018		100	0.0002	33	1418	0.001	0.004	0.1	55	0.00005	9		65
28-Oct-10	0.001	20		0.001	1.5	0.018		100	0.0002	30	1497	0.001	0.002	0.1	43	0.00005	9		69
19-Nov-10	0.001	20		0.001	1.3	0.019		100	0.0002	34	1482	0.001	0.001	0.1	45	0.00005	10		70
10-Dec-10	0.001	50	0.07	0.001	0.43	0.048		64	0.0002	20	686	0.001	0.001	0.1	0.01	0.00005	7		26
13-Jan-11	0.001	20	0.02	0.001	1.2	0.031		100	0.0002	35	1351	0.001	0.001	0.1	43	0.00005	10		69
25-Feb-11	0.001	20	0.02	0.001	1.5	0.022		100	0.0002	31	1463	0.001	0.001	0.1	25	0.00005	10		70
24-Mar-11	0.001	26	0.01	0.001	1.6	0.021		110	0.0002	32	1500	0.001	0.001	0.1	24	0.00005	10		74
8-Apr-11	0.001	25	0.03	0.001	1.7	0.021		100	0.0002	31	1500	0.001	0.001	0.1	47	0.00005	11		70
12-May-11	0.001	46	0.02	0.001	1.7	0.02		110	0.0002	30	1500	0.001	0.001	0.1	46	0.00005	11		75
10-Jun-11	0.001	39	0.01	0.001	1.8	0.02		110	0.0002	31	1600	0.001	0.001	0.1	35	0.00005	10		75
21-Jul-11	0.001	33	0.01	0.001	1.5	0.019		100	0.0002	31	1500	0.001	0.001	0.1	55	0.00005	10		69
31-Aug-11	0.001	56	0.03	0.001	1.5	0.018		100	0.0002	33	1500	0.001	0.002	0.1	43	0.00005	10		70
22-Sep-11	0.001	25	0.02	0.001	1.5	0.017		100	0.0002	34	1500	0.001	0.002	0.1	47	0.00005	11		72
26-Oct-11	0.0005	50		0.0005	1.4	0.018		100	0.0001	32	1600	0.0005	0.0005	0.05	48	0.000025	10		73
16-Nov-11	0.0005	10		0.001	1.6	0.019		110	0.0001	34	1500	0.0005	0.002	0.05	36	0.000025	10		77
14-Dec-11	0.0005	23		0.0005	1.1	0.019		100	0.0001	37	1400	0.0005	0.0005	0.05	50	0.000025	10		62
18-Jan-12	0.001	20	0.01	0.002	1.6	0.017		110	0.0002	34	1600	0.001	0.006	0.1	29	<0.00005	11		76

Continued…………………WGM1/D4 Post-Dry Ash Placement Data April, 2010 onward (mg/l) (data from August, 2007 to March, 2010 in Aurecon, 2010)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
16-Apr-10	18	0.005	120	0.04	0.0005	5.6	0.001	310	1200	1.2	905.92	0.08
27-May-10	18	0.01	130	0.05	0.001	6.3	0.002	770	1200	1.2	905.92	0.09
10-Jun-10	17	0.01	120	0.04	0.001	6.2	0.002	750	1100	1.2	905.92	0.1
1-Jul-10	16	0.01	110	0.05	0.001	6.1	0.002	730	1200	1.1	906.02	0.09
26-Aug-10	14	0.01	110	0.05	0.001	5.5	0.002	680	1000			0.1
24-Sep-10	15	0.01	120	0.05	0.001	5.8	0.002	710	1200			0.09
28-Oct-10	18	0.01	120	0.05	0.001	5.9	0.002	750	1200			0.08
19-Nov-10	16	0.01	120	0.04	0.001	5.7	0.002	770	1200	1.1	906.02	0.08
10-Dec-10	4.2	0.01	43	0.01	0.001	6.2	0.002	250	500			0.05
13-Jan-11	16	0.01	110	0.05	0.001	5.1	0.002	720	1200	1.1	906.02	0.09
25-Feb-11	17	0.01	120	0.04	0.001	5.6	0.002	810	1200			0.08
24-Mar-11	18	0.01	120	0.04	0.001	5.6	0.002	790	1100	1.1	906.02	0.08
8-Apr-11	18	0.01	120	0.05	0.001	5.8	0.002		1200	1.2	905.92	0.08
12-May-11	19	0.01	130	0.05	0.001	5.9	0.002	780	1300	1.1	906.02	0.09
10-Jun-11	19	0.01	130	0.05	0.001	5.9	0.002	780	1200	1.1	906.02	0.09
21-Jul-11	18	0.01	130	0.05	0.001	5.9	0.002	770	1200	1.1	906.02	0.09
31-Aug-11	18	0.01	130	0.05	0.001	6.1	0.002	780	1200	1.1	906.02	0.08
22-Sep-11	18	0.01	130	0.04	0.001	5.8	0.002	790	1200	1.1	906.02	0.08
26-Oct-11	19	0.005	120	0.05	0.0005	6.1	0.00	770	1200	1.1	906.02	0.07
16-Nov-11	18	0.005	130	0.04	0.0005	5.5	0.00	790	1300	1.2	905.92	0.09
14-Dec-11	14	0.005	110	0.04	0.0005	5.6	0.00	680	1100	1.1	906.02	0.07
18-Jan-12	18	0.01	140	0.04	0.001	5.3	0.002	800	1400.00	1.2	905.92	0.07

WGM1/D4 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																		
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	34	0.021	0.0010	1.44	0.021		101	0.0002	32	1448	0.0009	0.0017	0.09	38.91	0.000045	10	68.45
Maximum	0.0010	80	0.070	0.0020	1.80	0.048		110	0.0002	39	1600	0.0010	0.0060	0.10	55.00	0.000050	11	77.00
Minimum	0.0005	10	0.010	0.0005	0.43	0.017		64	<0.0001	14	686	0.0005	0.0005	0.05	0.01	0.000025	7	26.00
50th Percentile	0.0010	26	0.020	0.0010	1.50	0.019		100	0.0002	33	1500	0.0010	0.0010	0.10	43.00	0.000050	10	70.00

Continued…………..WGM1/D4 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	16.65	0.009	119	0.044	0.001	5.8	0.002	713	1164	1.1	906.0	0.083
Maximum	19.00	0.010	140	0.050	0.001	6.3	0.002	810	1400	1.2	906.0	0.100
Minimum	4.20	0.005	43	0.010	0.001	5.1	0.001	250	500	1.1	905.9	0.050
50th Percentile	18.00	0.010	120	0.050	0.001	5.8	0.002	770	1200	1.1	906.0	0.080

4. Water Quality Data and Summary for Background Groundwater Bore WGM1/D2

WGM1/D2 Pre-Dry Ash Placement Background Summary 1988- April, 2003 (mg/L)																		
Date	**Ag**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.007	14	0.001	0.05	0.173		1.6	0.001	36	0.017	25534	0.013	0.007	0.17	1.1	0.0003	2	5.2
Maximum	0.020	138	0.002	0.30	3.000		13.0	0.001	104	0.021	44536	0.048	0.080	0.75	13.0	0.0009	5	16.0
Minimum	0.001	0.00	0.001	0.005	0.010		0.0	0.001	9.00	0.014	9720	0.001	0.001	0.001	0.03	0.0001	0	0.0
90th Percentile	0.016	24	0.001	0.10	0.114		5.0	0.001	48	0.020	31000	0.041	0.010	0.28	1.7	0.0007	4	9.0

Continued…………………WGM1/D2 Pre-Dry Ash Placement Background Data 1988-April, 2003 (mg/L)											
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.301		32	0.027	0.008	4.6	0.001	45	160	5.9	914.3	0.067
Maximum	0.800		66	0.032	0.074	5.6	0.001	102	345	8.7	917.6	0.180
Minimum	0.035		11	0.023	0.001	2.9	0.001	6	10	2.7	911.5	0.012
90th Percentile	0.442		42	0.031	0.010	5.4	0.001	61	258	7.3	917.2	0.114

WGM1/D2 Post-Dry Ash Placement Data April, 2010 onward
(data from August, 2007 to March, 2010 in Aurecon, 2010)

Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg
16-Apr-10	0.0005	10		0.0005	0.1	0.039	0.001	1.7	0.0001	38		419	0.0005	0.003	0.05	4	0.000025	3		13
27-May-10	<0.001	<20		<0.001	0.12	0.043		1.7	<0.0002	41		412	<0.001	0.001	<0.1	4.9	<0.00005	2		13
10-Jun-10	<0.001	<20		<0.001	0.03	0.046		1.2	<0.0002	13		308	<0.001	<0.001	<0.1	0.03	<0.00005	4		22
1-Jul-10	<0.001	<20	0.28	<0.001	0.01	0.047		1.1	<0.0002	17		315	<0.001	0.001	<0.1	0.05	<0.00005	4		21
26-Aug-10	<0.001	<20	0.36	<0.001	0.01	0.042		1.4	<0.0002	12		307	<0.001	<0.001	<0.1	0.04	<0.00005	4		25
24-Sep-10	<0.001	<20	0.33	<0.001	<0.01	0.043		1.3	<0.0002	13		312	<0.001	0.001	<0.1	0.03	<0.00005	4		25
28-Oct-10	<0.001	<20		<0.001	<0.01	0.043		1.4	<0.0002	13		312	<0.001	<0.001	<0.1	0.04	<0.00005	4		25
19-Nov-10	<0.001	<20		<0.001	<0.01	0.042		1.3	<0.0002	14		305	<0.001	0.001	<0.1	0.03	<0.00005	5		25
10-Dec-10	<0.001	<20	0.26	<0.001	0.02	0.04		1.6	<0.0002	14		309	<0.001	<0.001	<0.1	0.02	<0.00005	5		24
13-Jan-11	<0.001	<20	0.24	<0.001	0.02	0.044		1.5	<0.0002	17		298	<0.001	<0.001	<0.1	0.03	0.00008	5		26
25-Feb-11	<0.001	<20	0.29	<0.001	0.05	0.043		1.7	<0.0002	24		355	<0.001	<0.001	<0.1	0.02	<0.00005	4		21
24-Mar-11	<0.001	<20	0.32	<0.001	<0.01	0.051		1.2	<0.0002	20		310	<0.001	0.001	<0.1	0.02	<0.00005	5		22
8-Apr-11	<0.001	<20	0.2	<0.001	0.04	0.041		1.2	<0.0002	32		320	<0.001	0.001	<0.1	0.56	<0.00005	4		16
12-May-11	<0.001	<20	0.35	<0.001	0.14	0.041		2.7	<0.0002	27		490	<0.001	0.002	<0.1	2.7	<0.00005	4		23
10-Jun-11	<0.001	<20	0.3	<0.001	0.1	0.044		2.1	<0.0002	24		400	<0.001	0.002	<0.1	0.03	<0.00005	4		23
21-Jul-11	<0.001	<20	0.2	<0.001	<0.01	0.045		1.1	<0.0002	33		320	0.001	0.001	<0.1	0.04	<0.00005	3		19
31-Aug-11	<0.001	<20	0.26	<0.001	0.01	0.042		1.5	<0.0002	21		340	<0.001	<0.001	<0.1	0.07	<0.00005	4		23
22-Sep-11	<0.001	<20	0.28	<0.001	0.09	0.04		2.4	<0.0002	27		480	<0.001	0.001	<0.1	0.3	<0.00005	4		23
26-Oct-11	0.0005	10		0.0005	0.03	0.043		1.9	0.0001	24		380	0.001	0.0005	0.05	0.98	0.000025	4		23
16-Nov-11	0.0005	10		0.0005	0.09	0.042		2.9	0.0001	32		510	0.0005	0.002	0.05	0.17	0.000025	4		25
14-Dec-11	0.0005	10		0.0005	0.02	0.043		1.2	0.0001	19		300	0.0005	0.0005	0.05	0.02	0.000025	4		22
18-Jan-12	0.001	20	0.34	0.001	0.03	0.038		1.2	0.0002	26		320	0.001	0.006	0.1	0.02	0.00005	4		19

Continued……..WGM1/D2 Post-Dry Ash Placement Data April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
16-Apr-10	0.45	0.005	50	0.05	0.0005	4.4	0.001	120	260	7.2	913.00	0.09
27-May-10	0.42	<0.01	54	0.05	0.001	4.7	<0.002	110	230	7.3	912.90	0.09
10-Jun-10	0.37	<0.01	16	0.05	0.001	4.9	<0.002	110	180	6.4	913.80	0.08
1-Jul-10	0.35	<0.01	21	0.05	0.001	4.6	<0.002	100	210	6.8	913.40	0.07
26-Aug-10	0.42	<0.01	16	0.05	0.001	5	<0.002	110	200			0.08
24-Sep-10	0.45	<0.01	18	0.05	<0.001	5	<0.002	110	250			0.07
28-Oct-10	0.48	<0.01	17	0.05	<0.001	5.3	<0.002	100	210			0.07
19-Nov-10	0.47	<0.01	17	0.05	0.001	5	<0.002	110	210	5	915.20	0.08
10-Dec-10	0.51	<0.01	16	0.06	<0.001	5.2	<0.002	100	230			0.08
13-Jan-11	0.52	<0.01	19	0.05	0.001	5	<0.002	98	230	5.2	915.00	0.09
25-Feb-11	0.53	<0.01	30	0.06	<0.001	4.6	<0.002	120	240			0.09
24-Mar-11	0.43	<0.01	21	0.05	0.001	4.7	<0.002	92	190	5.9	914.30	0.07
8-Apr-11	0.4	<0.01	31	0.04	0.001	4.7	<0.002	86	200	7.6	912.60	0.07
12-May-11	0.8	<0.01	45	0.08	0.004	3.8	<0.002	160	320	7.8	912.40	0.13
10-Jun-11	0.58	<0.01	35	0.06	0.002	4.2	<0.002	130	230	7.3	912.90	0.1
21-Jul-11	0.35	<0.01	29	0.04	<0.001	4.9	<0.002	82	260	7.5	912.70	0.07
31-Aug-11	0.5	<0.01	26	0.06	0.002	4.8	<0.002	100	190	7	913.20	0.08
22-Sep-11	0.74	<0.01	44	0.08	0.002	3.8	<0.002	150	240	7.4	912.80	0.11
26-Oct-11	0.62	0.005	32	0.06	0.001	4.5	0.001	120	240	7.2	913.00	0.1
16-Nov-11	0.78	0.005	50	0.09	0.002	3.8	0.001	160	330	7.5	912.70	0.15
14-Dec-11	0.45	0.005	18	0.05	0.0005	4.7	0.001	92	210	5.5	914.70	0.07
18-Jan-12	0.40	0.01	27	0.04	0.001	4.8	0.002	91	210	7.3	912.90	0.06

WGM1/D2 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																				
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0006	12	0.3	<0.001	0.05	0.043	0.001	2	<0.0002	23		356	0.0008	0.0016	0.06	0.64	0.000038	4	21.73
Maximum	0.0010	20	0.4	<0.001	0.14	0.051	0.001	3	0.0002	41		510	0.0010	0.0060	0.10	4.90	0.000080	5	26.00
Minimum	0.0005	10	0.2	0.0005	0.01	0.038	0.001	1	0.0001	12		298	0.0005	0.0005	0.05	0.02	0.000025	2	13.00
50th Percentile	0.0005	10	0.3	0.0005	0.03	0.043	0.001	1	0.0001	23		320	0.0008	0.0010	0.05	0.04	0.000025	4	23.00

Continued…………………WGM1/D2 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.50	0.006	29	0.055	0.001	4.7	0.001	111	230	6.8	913.4	0.086
Maximum	0.80	0.010	54	0.090	0.004	5.3	0.002	160	330	7.8	915.2	0.150
Minimum	0.35	0.005	16	0.040	0.001	3.8	0.001	82	180	5.0	912.4	0.060
50th Percentile	0.46	0.005	27	0.050	0.001	4.7	0.001	110	230	7.2	913.0	0.080

5. Water Quality Data and Summary for KVAD Dry Ash Placement Area Seepage Detection Groundwater Bores WGM1/D5 and 1/D6

a) Groundwater Bore WGM1/D5

WGM1/D5 Pre-Dry Ash Placement Background Summary 1988-April, 2003 (mg/L)																		
Date	**Ag**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	18	0.004	1.29	0.166	0.006	12.4	0.002	20	0.061	701	0.017	0.019	0.41	6.9	0.0003	16	20.3
Maximum	0.001	90	0.013	2.00	1.700	0.006	23.0	0.005	90	0.075	1050	0.055	0.080	1.02	17.0	0.0007	23	34.0
Minimum	0.001	1	0.001	0.08	0.010	0.006	5.2	0.001	8	0.047	283	0.003	0.001	0.10	0.1	0.0002	7	8.0
90th Percentile	0.001	51	0.008	1.70	0.148	0.006	19.7	0.004	24	0.072	810	0.041	0.058	0.65	14.7	0.0006	19	26.0

Continued………….WGM1/D5 Pre-Dry Ash Placement Background Summary 1988-April, 2003 (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	1.630		61	0.125	0.010	3.8	0.001	259	470	4.8	899.6	0.338
Maximum	3.970		127	0.140	0.050	5.4	0.002	380	1913	8.8	902.0	2.630
Minimum	0.520		7	0.110	0.002	2.8	0.001	92	48	2.3	895.4	0.032
90th Percentile	2.500		70	0.137	0.021	4.5	0.002	328	550	8.3	901.7	0.505

WGM1/D5 Post-Dry Ash Placement Data April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)																				
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
16-Apr-10																				
27-May-10	0.001	20		0.001	0.79	0.013		21	0.0011	4		583	0.001	0.008	0.4	0.14	0.00005	14		24
10-Jun-10	0.001	20		0.003	2.8	0.035		38	0.012	10		1167	0.005	0.044	0.9	0.25	0.00005	28		63
1-Jul-10	0.001	20	38	0.003	3.7	0.038		41	0.011	13		1356	0.005	0.054	0.5	0.41	0.00005	30		76
26-Aug-10	0.001	20	23	0.001	2.2	0.029		39	0.0017	14		1432	0.001	0.005	0.4	2.6	0.00005	30		69
24-Sep-10	0.001	20	23	0.001	1.9	0.027		42	0.0018	15		1394	0.001	0.008	0.4	14	0.00005	32		73
28-Oct-10	0.001	20		0.001	2.9	0.022		40	0.0019	18		1505	0.001	0.004	0.3	6.9	0.00005	31		70
19-Nov-10	0.001	20		0.001	1.7	0.026		31	0.0016	12		1106	0.001	0.004	0.5	1.9	0.00005	22		50
10-Dec-10	0.001	20	13	0.001	0.8	0.045		22	0.0019	6		658	0.0011	0.0061	0.7	0.22	0.00005	10		25
13-Jan-11	0.001	20	18	0.001	2.3	0.029		37	0.002	18		1368	0.001	0.006	0.9	2.1	0.00005	27		63
25-Feb-11	0.001	20	23	0.001	4.6	0.028		49	0.002	27		1823	0.001	0.009	1.1	3.3	0.00005	37		87
24-Mar-11	0.001	20	19	0.001	3.7	0.033		45	0.002	20		1500	0.001	0.011	1	1.6	0.00005	30		70
8-Apr-11	0.001	20	31	0.002	4.7	0.042		49	0.0002	29		1800	0.006	0.03	1	3	0.00005	41		86
12-May-11																				
10-Jun-11	0.001	20	13	0.001	1.7	0.027		31	0.002	13		870	0.001	0.006	0.8	0.29	0.00005	17		38
21-Jul-11	0.001	20	41	0.002	3.6	0.04		51	0.015	28		1400	0.004	0.029	1	0.13	0.00005	28		75
31-Aug-11	0.001	20	15	0.001	1.9	0.026		36	0.002	18		1000	0.002	0.009	0.9	0.65	0.00005	20		45
22-Sep-11																				
26-Oct-11																				
16-Nov-11																				
14-Dec-11	0.0005	10		0.0005	1.4	0.033		31	0.002	15		900	0.0005	0.002	0.7	1.7	0.000025	16		37
18-Jan-12	0.001	20	14	0.001	1.9	0.023		38	0.00095	22		1100	0.001	0.004	0.8	28	0.00005	26		49

Continued………WGM1/D5 Post-Dry Ash Placement Data April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
16-Apr-10												
27-May-10	2.7	0.01	25	0.23	0.004	3.7	0.002	250	390	8	896.19	0.54
10-Jun-10	7.3	0.01	77	0.56	0.0036	4.2	0.002	680	1000	6.1	898.09	2.1
1-Jul-10	8.2	0.01	97	0.63	0.035	4	0.002	800	1200	7	897.19	3.3
26-Aug-10	8.4	0.01	91	0.57	0.009	3.4	0.002	690	990			1.2
24-Sep-10	8.4	0.01	100	0.59	0.007	3.7	0.002	740	1200			1.2
28-Oct-10	8.7	0.01	100	0.57	0.006	3.4	0.002	760	1100			1.1
19-Nov-10	6	0.01	67	0.42	0.005	3.4	0.002	540	780	3	901.19	0.85
10-Dec-10	3.7	0.01	35	0.35	0.0045	3.8	0.002	300	490			0.9
13-Jan-11	7.5	0.01	98	0.54	0.007	3.3	0.002	680	1000	2.9	901.29	1.1
25-Feb-11	10	0.01	140	0.67	0.009	3.2	0.002	970	1400			1.2
24-Mar-11	8.7	0.01	100	0.54	0.008	3.3	0.002	720	1100	3	901.19	0.97
8-Apr-11	11	0.01	140	0.68	0.026	3.4	0.002	960	1400	6.4	897.79	2.2
12-May-11										7.9		
10-Jun-11	5.2	0.01	45	0.33	0.024	3.7	0.002	390	590	4.1	900.09	0.67
21-Jul-11	8.8	0.01	110	0.61	0.029	4	0.002	800	1300	8	896.19	4
31-Aug-11	6.2	0.01	61	0.35	0.018	3.6	0.002	490	720	4	900.19	0.78
22-Sep-11												
26-Oct-11												
16-Nov-11												
14-Dec-11	5.1	0.005	49	0.36	0.003	3.5	0.002	410	620	3.1	901.09	0.89
18-Jan-12	6.1	0.01	77	0.4	0.002	4.2	0.002	530	850	7.2	896.99	0.63

WGM1/D5 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																			
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0010	19	22.6	0.0013	2.51	0.030		38	0.0036	17		1233	0.0020	0.0141	0.72	3.95	0.000049	26	58.82
Maximum	0.0010	20	41.0	0.0030	4.70	0.045		51	0.0150	29		1823	0.0060	0.0540	1.10	28.00	0.000050	41	87.00
Minimum	0.0005	10	13.0	0.0005	0.79	0.013		21	<0.0001	4		583	0.0005	0.0020	0.30	0.13	0.000025	10	24.00
50th Percentile	0.0010	20	21.0	0.0010	2.20	0.029		38	0.0020	15		1356	0.0010	0.0080	0.80	1.70	0.000050	28	63.00

Continued………….WGM1/D5 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)											
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	7.18	0.010	83	0.494	0.012	3.6	0.002	630	949	5.4	899.0	1.390
Maximum	11.00	0.010	140	0.680	0.035	4.2	0.002	970	1400	8.0	901.3	4.000
Minimum	2.70	0.005	25	0.230	0.002	3.2	0.002	250	390	2.9	896.2	0.540
50th Percentile	7.50	0.010	91	0.540	0.007	3.6	0.002	680	1000	6.1	899.1	1.100

b) Groundwater Bore WGM1/D6

WGM1/D6 Pre-Dry Ash Placement Background Summary 1988-April, 2003 (mg/L)																	
	Ag	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	27	0.003	0.78	0.184		22.3	0.002	53	94830	0.011	0.016	0.14	93.3	0.0004	7	25.4
Maximum	0.001	390	0.015	1.10	1.900		33.0	0.009	160	143000	0.032	0.260	0.65	174.2	0.0009	48	34.0
Minimum	0.001	0	0.001	0.27	0.021		14.0	0.001	23	60100	0.001	0.001	0.001	0.1	0.0001	4	17.0
90th Percentile	0.001	39	0.005	0.98	0.210		27.0	0.003	65	110000	0.020	0.021	0.28	123.0	0.0007	9	30.0

Continued……………..WGM1/D6 Pre-Dry Ash Placement Background Summary 1988-April, 2003 (mg/l)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	4.005		45	0.117	0.007	4.5	0.016	340	603	10.8	896.2	0.107
Maximum	5.400		90	0.210	0.023	5.8	0.100	536	902	11.4	896.9	0.566
Minimum	1.390		26	0.023	0.001	1.4	0.001	190	320	10.1	895.6	0.004
90^{th} Percentile	4.810		55	0.191	0.013	5.5	0.043	381	736	11.2	896.6	0.232

WGM1/D6 Post-Dry Ash Placement Data October, 2007 onward
(data from August, 2007 to March, 2010 in Aurecon, 2010)

Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg
16-Apr-10	0.0005	10		0.007	0.6	0.024	0.008	12	0.0004	34		1055	0.005	0.007	0.4	3.5	0.000025	8		44
27-May-10	0.001	20		0.01	0.54	0.021		5.3	0.0011	24		784	0.002	0.005	0.6	0.88	0.00005	8		52
10-Jun-10	0.001	20		0.003	0.56	0.024		2.8	0.0017	25		789	0.001	0.006	0.7	1.2	0.00005	7		53
1-Jul-10	0.001	20	5.4	0.004	0.55	0.026		3.7	0.0019	24		844	0.001	0.005	0.7	0.74	0.00005	7		59
26-Aug-10	0.001	20	6.1	0.007	0.56	0.031		7.3	0.0061	47		1176	0.002	0.011	0.7	2	0.00005	7		72
24-Sep-10	0.001	20	4.1	0.004	0.6	0.03		13	0.0024	48		1194	0.004	0.008	0.6	7.2	0.00005	7		62
28-Oct-10	0.001	20		0.001	0.75	0.027		17	0.002	46		1239	<0.00 1	0.005	0.3	19	0.00005	7		52
19-Nov-10	0.001	20		0.002	0.8	0.027		20	0.0009	50		1231	0.003	0.004	0.3	34	0.00005	8		54
10-Dec-10	0.001	20	3.6	0.0015	0.43	0.025		8.8	0.0012	49		958	0.002 3	0.0047	0.3	1.2	0.00005	7		47
13-Jan-11	0.001	20	3.9	0.001	0.86	0.031		26	0.002	55		1378	0.001	0.006	0.3	10	0.00006	9		55
25-Feb-11	0.001	20	4.6	0.001	0.93	0.028		27	0.003	54		1433	0.001	0.006	0.3	21	0.00005	8		52
24-Mar-11	0.001	20	5	0.001	0.72	0.024		18	0.003	40		1300	0.001	0.007	0.6	4.7	0.00005	8		62
8-Apr-11	0.001	20	2.1	0.001	0.92	0.024		26	0.001	53		1300	0.002	0.004	0.2	81	0.00005	8		45
12-May-11	0.001	20	2.3	0.001	0.85	0.024		24	0.001	48		1200	0.002	0.005	0.3	71	0.00005	9		51
10-Jun-11	0.001	20	3.2	0.001	0.6	0.022		13	0.001	27		1100	0.001	0.006	0.5	3.9	0.00005	7		54
21-Jul-11	0.001	20	3.6	0.001	0.93	0.025		25	0.0007	49		1300	0.002	0.003	0.5	78	0.00005	8		60
31-Aug-11	0.001	20	3.4	0.001	0.61	0.02		17	0.0006	35		1100	0.003	0.004	0.6	9.2	0.00005	7		59
22-Sep-11	0.001	20	2.8	0.001	0.84	0.02		24	0.0004	49		1400	0.003	0.003	0.4	56	0.00005	8		61
26-Oct-11	0.0005	10		0.0005	0.69	0.021		21	0.0006	41		1200	0.003	0.002	0.4	65	0.000025	8		58
16-Nov-11	0.0005	10		0.0005	0.85	0.023		26	0.00056	51		1500	0.001	0.004	0.4	48	0.000025	8		63
14-Dec-11	0.0005	10		0.0005	0.91	0.02		26	0.0004	49		1300	0.002	0.002	0.3	61	0.000025	8		57
18-Jan-12	0.001	20	2.0	0.001	0.91	0.017		27	0.0002	50		1400	0.003	0.003	0.2	120	0.00005	8		55

Continued……………….WGM1/D6 Post-Dry Ash Placement Data October, 2007 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)													
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
16-Apr-10	2.1	0.005	63	0.32	0.013	3.1	0.001	350	520	10.5	896.45	0.67
27-May-10	0.8	0.01	60	0.5	0.012	3.9	0.002	330	510	10.5	896.45	1.1
10-Jun-10	0.32	0.01	59	0.51	0.012	3.8	0.002	350	540	10.2	896.75	1.5
1-Jul-10	0.42	0.01	63	0.54	0.011	3.7	0.002	360	600	10.5	896.45	2
26-Aug-10	1.1	0.01	84	0.55	0.024	3.3	0.002	430	660			1.8
24-Sep-10	2.1	0.01	79	0.44	0.017	3.2	0.002	430	720			1.2
28-Oct-10	3	0.01	69	0.35	0.016	3	0.002	440	700			0.97
19-Nov-10	3.6	0.01	77	0.32	0.011	3.1	0.002	470	710	10.4	896.55	0.84
10-Dec-10	1.3	0.01	72	0.35	0.012	3.3	0.002	320	560			0.87
13-Jan-11	4.5	0.01	83	0.3	0.019	2.9	0.002	490	740	10.3	896.65	0.83
25-Feb-11	5.4	0.01	77	0.35	0.026	2.9	0.002	530	800			0.95
24-Mar-11	3.4	0.01	84	0.4	0.022	3	0.002	480	700	10.4	896.55	1.2
8-Apr-11	5.5	0.01	74	0.24	0.008	3.2	0.002	510	840	10.6	896.35	0.65
12-May-11	5.1	0.01	83	0.29	0.01	3.5	0.002	500	890	10.4	896.55	0.71
10-Jun-11	2.5	0.01	79	0.41	0.011	3.2	0.002	430	610	10.4	896.55	1.1
21-Jul-11	5	0.01	91	0.37	0.008	3.3	0.002	560	1000	10.3	896.65	0.86
31-Aug-11	3	0.01	93	0.41	0.009	3.5	0.002	490	780	10.6	896.35	0.92
22-Sep-11	4.8	0.01	90	0.34	0.012	3.1	0.002	560	800	10.5	896.45	0.7
26-Oct-11	4.3	0.005	81	0.37	0.009	3.7	0.001	490	810	10.5	896.45	0.84
16-Nov-11	4.9	0.005	84	0.35	0.009	3	0.001	520	910	10.5	896.45	0.93
14-Dec-11	5	0.005	86	0.31	0.009	3.2	0.001	540	920	10.5	896.45	0.65
18-Jan-12	5.4	0.01	88	0.26	0.002	3.1	0.002	580	1000	10.4	896.55	0.49

WGM1/D6 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																				
	Ag	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
Average	<0.001	18	3.7	0.0023	0.73	0.024		18	0.0015	43		1190	0.0022	0.0050	0.44	31.75	0.000046	8		55.77
Maximum	0.0010	20	6.1	0.0100	0.93	0.031		27	0.0061	55		1500	0.0050	0.0110	0.70	120.00	0.000060	9		72.00
Minimum	0.0005	10	2.0	0.0005	0.43	0.017		3	<0.0001	24		784	0.0010	0.0020	0.20	0.74	0.000025	7		44.00
50th Percentile	0.0010	20	3.6	0.0010	0.74	0.024		19	0.0010	48		1216	0.0020	0.0050	0.40	14.50	0.000050	8		55.00

Continued…………….WGM1/D6 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)											
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	3.34	0.009	78	0.376	0.013	3.3	0.002	462	742	10.4	896.5	0.990
Maximum	5.50	0.010	93	0.550	0.026	3.9	0.002	580	1000	10.6	896.8	2.000
Minimum	0.32	0.005	59	0.240	0.002	2.9	0.001	320	510	10.2	896.4	0.490
50th Percentile	3.50	0.010	80	0.350	0.012	3.2	0.002	485	730	10.5	896.5	0.895

6. Water Quality Data and Summary for SSCAD Pond

SSCAD Pre-Dry Ash Placement Background Summary 1996-April, 2003 (mg/L)																		
Date	**Ag**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**CrIV**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	18	0.016	4.7	0.128	0.009	56	0.012	18	121893	0.005		0.007	9.3	0.17	0.0002	53	11
Maximum	0.001	53	0.039	8.6	0.152	0.009	140	0.020	74	257800	0.018		0.035	14.0	0.45	0.0002	110	18
Minimum	0.001	5	0.003	2.7	0.110	0.008	33	0.006	8	86000	0.001		0.001	7.2	0.03	0.0001	35	7
90th Percentile	0.001	28.4	0.034	8.0	0.142	0.009	107	0.020	28	200360	0.013		0.016	11.4	0.29	0.0002	88	15

Continued………………..SSCAD Pre-Dry Ash Placement Background Summary 1996-April, 2003 (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	1.2	0.152	137	0.129	0.002	5.4	0.151	553	858	0.426
Maximum	1.7	0.190	380	0.150	0.005	6.5	0.379	1390	2170	0.650
Minimum	0.8	0.113	46	0.108	0.001	4.7	0.029	351	215	0.100
90th Percentile	1.7	0.182	287	0.146	0.005	6.0	0.298	1029	1604	0.580

SSCAD Post-Dry Ash Placement April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)																					
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**CrIV**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
16-Apr-10	0.0005	10		0.0005	2.1	0.07	0.001	83	0.002	40		2,247	0.0005		0.01	2.500	0.03	0.000025	49		19
26-May-10	0.001	20		0.001	2.9	0.041		69	0.0003	27		1,344	0.001		0.003	1.7	0.020	0.00005	42		49
9-Jun-10	0.001	<20		0.001	2.9	0.04		68	0.0003	26		1,285	0.001		0.002	0.4	0.050	0.00005	41		48
1-Jul-10	0.001	<20	3.5	0.001	3.5	0.041		72	0.0004	20		1,458	0.001		0.003	0.7	0.120	0.00005	45		58
25-Aug-10	0.001	40	2.5	0.001	2.1	0.028		53	0.0003	21		1,140	0.001		0.002	1.6	0.030	0.00005	32		38
23-Sep-10	0.001	220	0.9	0.002	0.67	0.022		21	0.0002	12		838	0.001		0.002	1.2	0.120	0.00005	14		14
27-Oct-10	0.001	70		0.001	0.96	0.021		26	0.0002	15		662	0.001		0.001	1.2	0.010	0.00005	17		16
19-Nov-10	0.001	70		0.004	1	0.037		30	0.0008	15		694	0.002		0.006	1.8	0.010	0.00005	19		19
9-Dec-10	0.001	30	0.97	0.001	0.35	0.05		15	0.0002	13		336	0.001		0.0037	0.5	0.020	0.00005	7		9.3
12-Jan-11	0.001	60	16	0.005	0.76	0.073		27	0.0008	16		545	0.002		0.007	1.2	0.020	0.00005	15		15
24-Feb-11	0.001	50	4.9	0.001	1.8	0.047		48	0.0006	21		972	0.001		0.002	2.1	<0.01	0.00005	29		30
24-Mar-11	0.001	30	1.2	0.001	2.1	0.054		55	0.0006	25		1,000	0.001		0.002	2	<0.01	0.00005	36		32
8-Apr-11	0.001	65	2.8	0.001	2.2	0.063		58	0.0010	24		1,100	0.001		0.003	2.1	0.010	0.00005	36		32
12-May-11	0.001	250	53	0.031	2	0.16		56	0.0070	26		1,200	0.005		0.015	2.6	0.020	0.00005	39		31
10-Jun-11	0.001	360	2.2	0.004	0.82	0.022		25	0.0006	12		1,100	0.001		0.002	1.6	0.040	0.00005	18		14
26-Jul-11	0.001	360	2.3	0.002	0.98	0.016		28	0.0006	12		1,100	0.001		0.002	2	0.010	0.00005	22		15
30-Aug-11	0.001	360	21	0.009	0.68	0.051		25	0.0020	12		980	0.003		0.006	2.1	<0.01	0.00005	18		13
21-Sep-11	0.001	420	7.1	0.005	0.83	0.026		28	0.0010	11		1,100	0.002		0.007	2.1	<0.01	0.00005	21		14
12-Oct-11	0.0005	53		0.0005	0.04	0.016		21	0.0001	9		280	0.0005		0.001	0	0.07	0.000025	5		12
10-Nov-11	0.0005	80		0.0005	0.04	0.018		30	0.0001	11		380	0.0005		0.0005	0	0.06	0.000025	5		18
8-Dec-11	0.0005	59		0.0005	0.005	0.014		19	0.0001	7		250	0.0005		0.001	0	0.16	0.000025	4		11
18-Jan-12	<0.001	20	2.6	0.001	1.8	0.079		70	0.003	27		1700	0.001		0.021	2.1	0.09	0.00005	40		15

Continued……..SSCAD Post-Dry Ash Placement April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
16-Apr-10	0.89	0.03	370	0.03	0.0005	4.50	0.003	1000	1600	0.08
26-May-10	4.5	0.01	140	0.3	0.001	6.7	0.002	640	860	0.51
9-Jun-10	4.9	0.01	130	0.33	<0.001	6.3	0.002	640	980	0.56
1-Jul-10	6.5	0.01	130	0.46	<0.001	4.1	0.002	730	1100	0.82
25-Aug-10	4	0.01	120	0.28	0.001	7.2	0.002	470	760	0.5
23-Sep-10	1	0.01	150	0.08	0.001	8.2	0.002	180	510	0.14
27-Oct-10	1.4	0.01	81	0.09	<0.001	7.6	0.002	210	430	0.15
19-Nov-10	1.7	0.01	82	0.17	0.006	7.2	0.002	250	450	0.54
9-Dec-10	0.31	0.01	37	0.04	<0.001	7.3	0.002	99	240	0.09
12-Jan-11	0.09	0.01	63	0.17	0.011	7.3	0.002	190	390	0.7
24-Feb-11	2.9	0.01	96	0.18	0.003	7.1	0.002	410	690	0.36
24-Mar-11	3.4	0.01	100	0.18	<0.001	6.8	0.002	440	710	0.32
8-Apr-11	3.1	0.01	130	0.15	0.002	7.3	0.002	470	800	0.35
12-May-11	2.8	0.01	170	0.48	0.027	7.5	0.002	430	880	
10-Jun-11	1.2	0.02	210	0.08	0.002	8.3	0.002	190	670	0.22
26-Jul-11	1.3	0.02	210	0.1	0.002	8.1	0.002	220	690	0.22
30-Aug-11	0.83	0.01	190	0.11	0.005	8	0.002	180	660	0.74
21-Sep-11	0.98	0.02	240	0.11	0.002	8.3	0.002	200	770	0.43
12-Oct-11	0.130	0.005	20	0.005	0.0005	7.6	0.001	67		0.02
10-Nov-11	0.086	0.005	24	0.005	0.0005	7.9	0.001	82		0.02
8-Dec-11	0.250	0.005	14	0.005	0.0005	7.5	0.001	49		0.02
18-Jan-12	0.96	0.02	280	0.05	<0.001	5	0.014	800	1300	0.16

SSCAD Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																			
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**CrIV**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0009	131	8.6	0.0034	1.39	0.045		42	0.0010	18	987	0.0013		0.0046	1.46	0.05	0.000045	25	23.74
Maximum	0.0010	420	53.0	0.0310	3.50	0.160		83	0.0070	40	2247	0.0050		0.0210	2.60	0.16	0.000050	49	58.00
Minimum	0.0005	<10	0.9	0.0005	0.01	0.014		15	0.0001	7	250	0.0005		0.0005	0.20	0.01	0.000025	4	9.30
50th Percentile	0.0010	63	2.7	0.0010	0.99	0.041		30	0.0006	16	1050	0.0010		0.0025	1.65	0.03	0.000050	22	17.00

Continued………………..SSCAD Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	1.96	0.012	136	0.155	0.004	7.1	0.002	361	763	0.331
Maximum	6.50	0.030	370	0.480	0.027	8.3	0.014	1000	1600	0.820
Minimum	0.09	0.005	14	0.005	0.001	4.1	0.001	49	240	0.020
50th Percentile	1.25	0.010	130	0.110	0.002	7.3	0.002	235	710	0.320

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