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14 September 2011

Steve Barry
Acting- Director Environmental Sustainability
Department of Industry and Investment- Mineral Resources
PO Box 344
Hunter Regional Mail Centre NSW 2310

Dear Steve,

Re: End of Panel Report- Stage 2 Longwall A4

Austar Coal Mine Pty Ltd (Austar) completed extraction of Longwall A4 on 18 May 2011. Austar submits this End of Panel report for Longwall A4 in accordance with Condition 18 of Subsidence Management Plan (SMP) Approval for Longwall A4-A5 (File No.08/2956, approved on 24 December 2009).

This report encompasses the monitoring undertaken during the extraction of Longwall A4. There has been no abnormal behaviour that has required particular review. The report consists of the analysis from:

Appendix 1: Surface subsidence monitoring program;
Appendix 2: Public safety monitoring and management plan;
Appendix 3: Vibration monitoring plan
Appendix 4: Groundwater monitoring as per the Site Water Management Plan (SWMP)
Appendix 5: Surface water monitoring per the SWMP
Appendix 6: Ecological monitoring per the Stage 2 Ecological Monitoring Program

In summary, surface subsidence was of the order of 850mm and at its maximum over the chain pillar as predicted. No perceptible impacts to the environment or increase in public safety risk have occurred. Ground and groundwater behaviour indicated by the monitoring is as predicted by the assessment reports.

Please contact myself on (02) 4993 7293 if you require further information regarding any of the data or interpretations summarised in this report.

Yours faithfully,
AUSTAR COAL MINE

Adrian Moodie
TECHNICAL SERVICES MANAGER

Appendix 1: Surface Subsidence Monitoring

1.1 Monitoring Results Summary

Subsidence monitoring has been undertaken in accordance with Subsidence Monitoring Programme. Summary results are displayed below and compared against maximum predicted and upper bound subsidence from MSEC Report MSEC275 which supported the SMP application. Included in **Table 1 and 2** are the Maximum Predicted and Upper Bound subsidence parameters. Whereby the Maximum Predicted case was determined using the calibrated Incremental Profile Method and the Upper Bound case was determined by scaling up the predicted systematic subsidence parameters such that the maximum subsidence of 65% of effective extracted seam thickness is achieved above the longwalls.

Table 1: Actual vs Maximum Predicted Subsidence Parameters

LW	Maximum Predicted Cumulative Subsidence (mm)	Actual Cumulative Subsidence	Maximum Predicted Cumulative Tilt (mm/m)	Actual Cumulative Tilt (mm/m)	Maximum Predicted Cumulative Tensile Strain (mm/m)	Actual Cumulative Tensile Strain (mm/m)	Maximum Predicted Cumulative Compressive Strain (mm/m)	Actual Cumulative Compressive Strain (mm/m)
After A3	295	157	1.5	0.7	0.2	0.2	0.4	0.4
After A4	1130	850	5.1	5.4	0.7	<1.0	1.7	<1.0

Table 2: Actual vs Upper Bound Subsidence Parameters

LW	Upper Bound Cumulative Subsidence (mm)	Actual Cumulative Subsidence	Upper Bound Cumulative Tilt (mm/m)	Actual Cumulative Tilt (mm/m)	Upper Bound Cumulative Tensile Strain (mm/m)	Actual Cumulative Tensile Strain (mm/m)	Upper Bound Cumulative Compressive Strain (mm/m)	Actual Cumulative Compressive Strain (mm/m)
After A3	630	157	2.9	0.7	0.4	0.2	0.8	0.4
After A4	2335	850	9.4	5.4	1.1	<1.0	3.1	<1.0

Further detailed analysis of the individual monitoring lines can be found in the attached report '*MSEC512 Longwall A4 End of Panel Subsidence Monitoring Review Report'*.

1.2 Analysis of Monitoring Results

See attached report *MSEC512 Longwall A4 End of Panel Subsidence Monitoring Review Report*.

1.2.1 Comparison to Impact Assessment Criteria

Chapter 5 of the subsidence prediction report (MSEC275) details the anticipated impacts on natural features and surface infrastructure. The following table summaries these impacts and makes comment as to the level of impact created by A4 subsidence.

Table 3- Impact Assessment Criteria Post Longwall A4 Mining

Item	Subsidence Impact Assessment	Actual Observation/Occurrence	Action
Cracking of alluvial creek beds	Quorrobolong Creek strains 0.7 to 1.5mm/m with minor cracking possible around perimeters of the longwalls. Cracks only shallow and would infill with material.	Strains <1.0mm/m. No observed cracking.	Nil
Drainage lines	Potential for shallow cracking around tensile zones of perimeter of longwalls	None observed.	Nil
Steep slopes (south-eastern side A3 and above A4)	Tilts 4.0mm/m, Strains <0.5mm/m after A4. Potential for minor cracking and unlikely to cause and slippage event after full subsidence.	Tilt <2.0mm/m, Strain <1.0mm/m potentially as a result of downward slope. No observed cracking or physical signs of movement.	Continue to monitor
Nash Lane	After A4 955mm, Tilt 3.7mm/m, Strains 0.3-1.0mm/m. No impact on serviceability due to A4 subsidence	Nearby <0.4mm/m strain, Tilt <2.0mm/m No impact. Road serviceable. No cracking	Nil
Services	Unlikely to create and significant impact even under full subsidence.	No impact	Nil
Rural building structures	All Category A to B for Tilt and Category to 4 for Strain after A4 (Max Predicted)	Tilt less than Category A and Strain less than Category 2	Nil
Other structures	Minimal impact	No impact	Nil

In summary impacts are mostly less than expected or as expected due to combined A3 and A4 extraction.

1.2.2 Comparison to Previous Panels

Monitoring of subsidence parameters and impacts for the mining of two Top Coal Caving panels in Stage 1 confirmed Maximum Predicted Subsidence to be an accurate prediction of actual subsidence. The same observation has been recorded for extraction of A3 and A4 in the Stage 2 mining area. Minimal physical impacts were observed in Stage 1 which is the same for the extraction to date in Stage 2. In summary parameters and impacts for A3 and A4 combined are in line with previous mining.

1.2.3 Comparisons to Predictions in SMP

See sections 1.2 and 1.2.1 above.

1.3 Trends in Monitoring Results

Monitoring data is revealing trends as expected, with subsidence parameters around maximum predicted and subsidence being controlled by compression of the chain pillars. The final survey conducted for A4 was shortly after completion of mining, with the next survey not due prior to completion of this report. However the trends in the monitoring data and overall levels of subsidence still indicate that final subsidence parameters due to A4 will be less than maximum predicted with only a minor excedence in tilt (1mm/m) observed along the A3 cross line.

1.4 Subsidence Management Actions

No immediate actions were required during or post extraction of A4. Subsidence monitoring should continue per the Subsidence Monitoring Strategy.

Appendix 2: Public Safety Monitoring and Management Plan

2.0 Summary

During routine subsidence monitoring and on occasions the area was being accessed for other purposes the following items were inspected for as per the Public Safety Management Plan:

- Surface Cracking;
- Surface humps;
- Step changes in landform;
- Serviceability of access tracks;
- Slope or boulder instability;
- Other sign of subsidence.

Of all the inspection occasions no evidence of any of the above could be observed (Also refer to **Table 3**). Correspondence with the landholders in the area surrounding longwall A3 and A4 also confirmed that no safety issues manifested and no physical signs of subsidence were observed other than some minor plasterboard cracking around an archway.

Appendix 3: Vibration Monitoring

3.1 Monitoring Results Summary

Vibration monitoring has been undertaken in accordance with the Vibration Monitoring Plan for Longwall Panels A3, A4, and A5. Monitoring was undertaken at locations V5 and V6 during extraction of LWA4 (refer to **Figure 3.1**).

Monitors were set to monitor vibration continuously, and also to record a waveform when vibration in exceeded 1mm/sec in any axis. Results of vibration monitoring greater than 1mm/sec are shown in **Figures 3.2 and 3.3**. Periods which recorded vibration less than 1mm/sec are not shown on the graphs.

Guideline values for annoyance (*Assessing Vibration: a technical guideline, DECC February 2006*), and for minimal risk of cosmetic damage (*BS7385:1993*) are included with the graphed results.

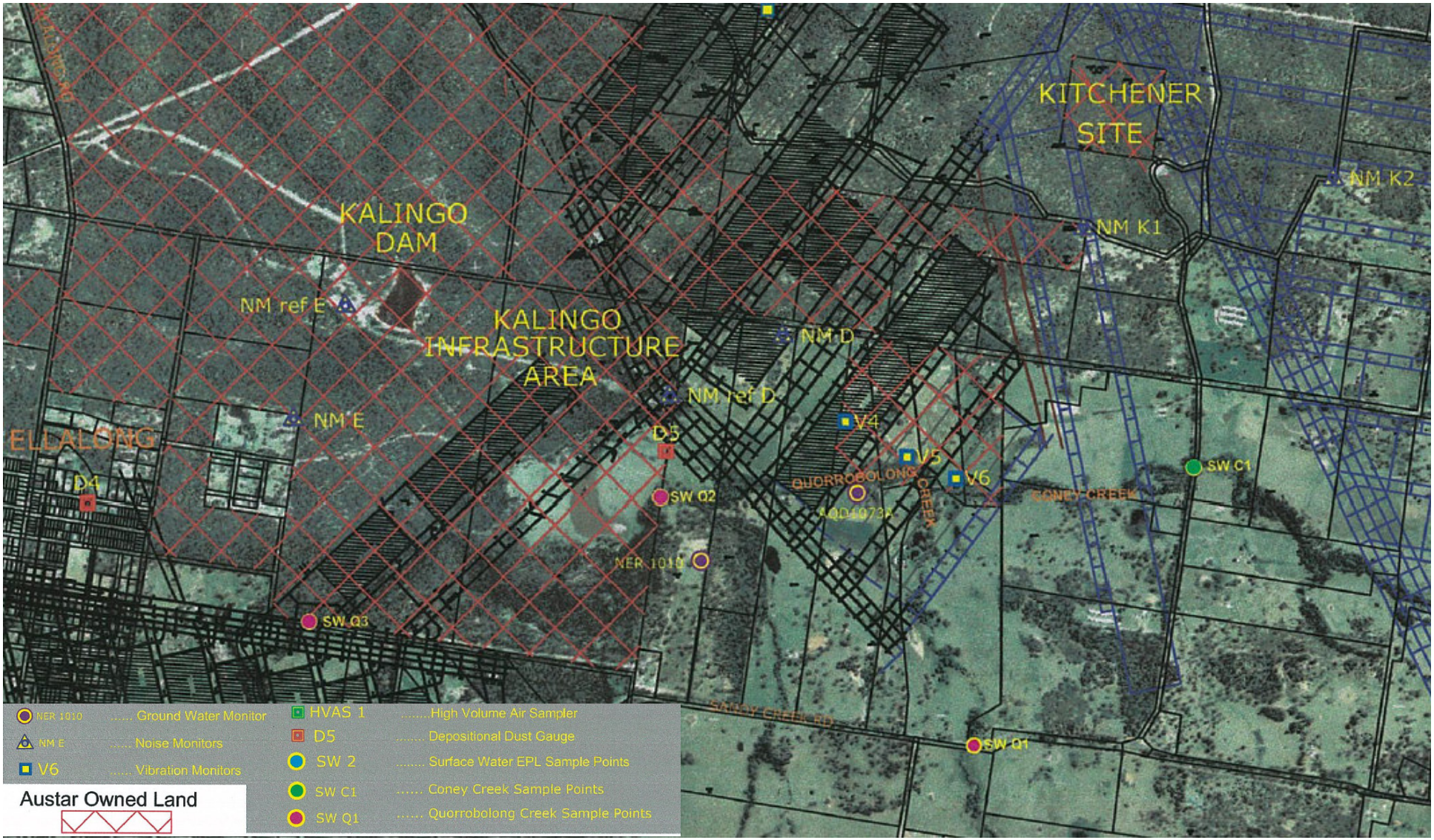

Figure 3.1 Austar Environmental Monitoring Network

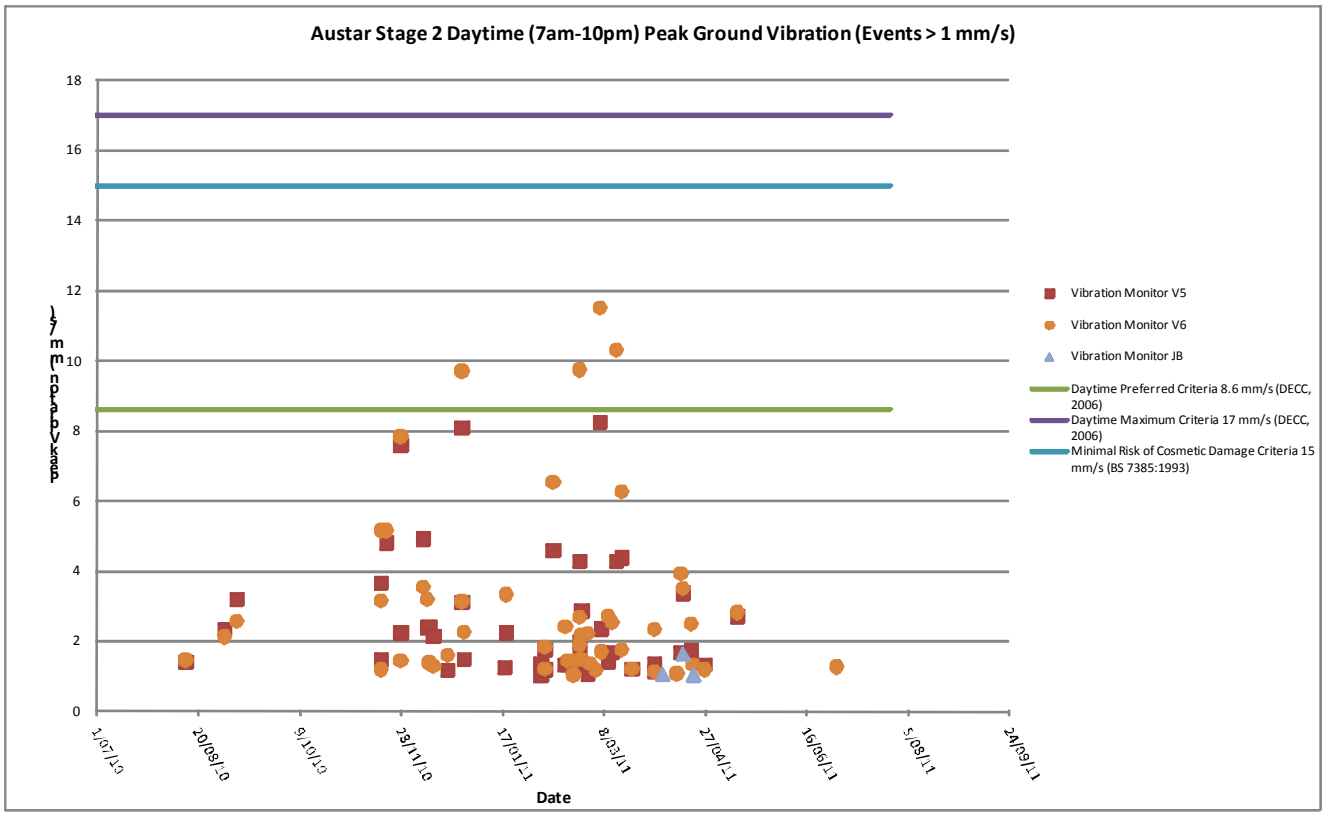

Figure 3.2 Vibration Monitoring Results – Daytime

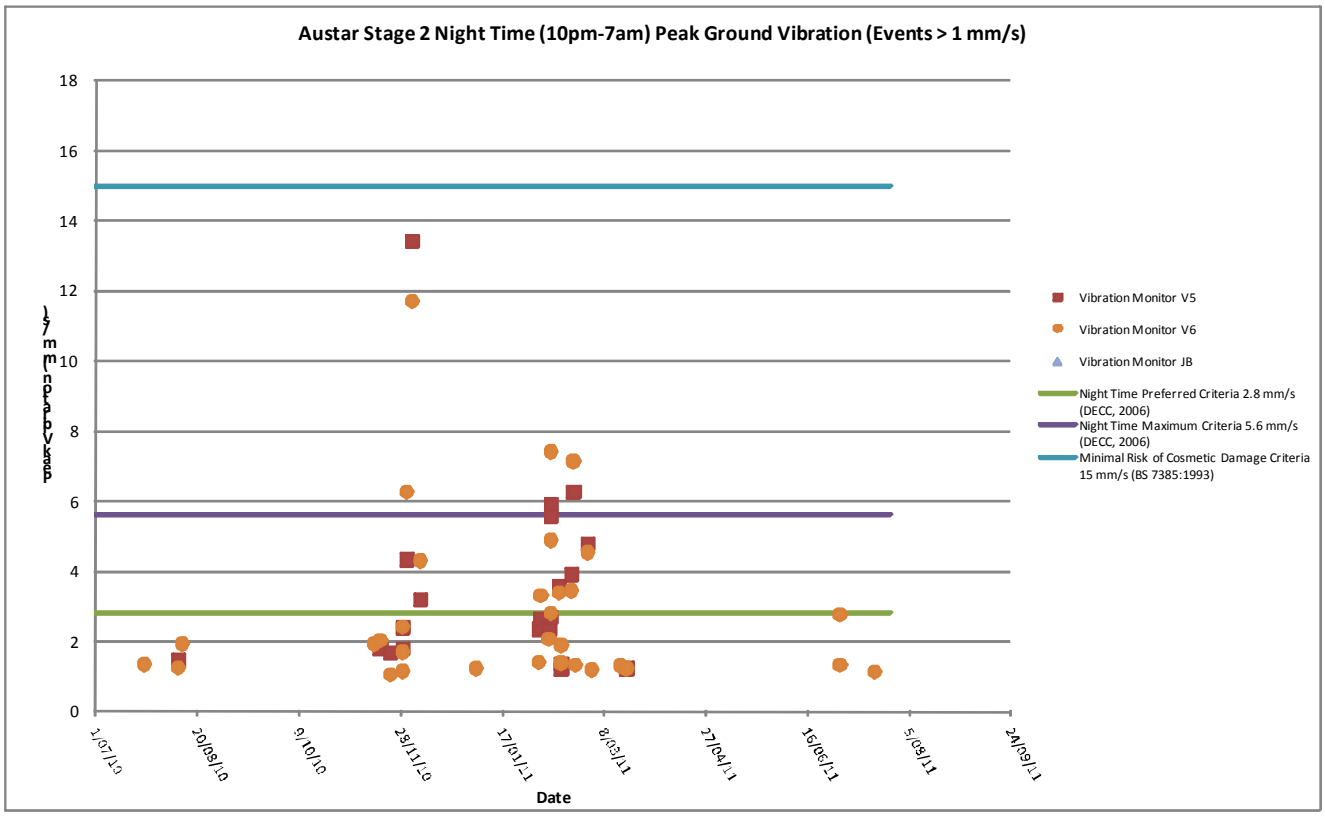

Figure 3.3 Vibration Monitoring Results – Night

3.2 Analysis of Monitoring Results

Results indicate that vibration from extraction of Longwall A4 has been event based in nature, typically generated by strata failures from material overlying the mining area. The majority of vibration events are less than 4 mm/sec, with 16 events greater than 4 mm/sec over the period of extraction of A4. There was one event greater than 12 mm/sec.

Over the period of monitoring (July 2010 to June 2011), 4 events exceeded the maximum criteria for human response to vibration during the night period. These exceedances have been infrequent in nature, and given the number of events over the duration which mining occurred, are not considered to be significant. It is important to note that the vibration criteria are non-mandatory (*DECC 2006*) so are used as a monitoring tool to assess possible annoyance. Also, due to the vibration being strata generated, the timing of vibration events cannot be controlled, as would be the case in say pile driving, so operational controls are not feasible in this case.

No events exceeded the guideline value where a minimal risk of cosmetic damage may occur (15mm/sec).

3.3 Trends in Monitoring Results

There was no vibration measured at >1mm/sec between completion of Longwall A3 and commencement of Longwall A4, and vibration ceased after completion of extraction of Longwall A4. This indicates that vibration is coincidental with operational of longwall extraction.

Results are similar in magnitude to those from previous Longwall A3, however the frequency of events has increased from that observed during extraction of Longwall A4. A trend of grouping of vibration events was observed during extraction of A4, with more events observed in November 2010 and February 2011, followed by periods of lesser frequency of vibration. This trend may be explained as releases of tensile stress in the overlying strata within the caving or fracture zone, which are observable as vibration, followed by periods of building tension where fewer events are recorded. This trend will continue to be monitored.

3.4 Management Actions

No management actions relating to vibration have been necessary. Vibration monitoring should continue.

Appendix 4: Ground Water Monitoring

4.1 Monitoring Results Summary

Groundwater monitoring continued in established alluvial monitoring well AQD1073a, and in the sandstone water bearing zone in the Branxton formation in monitoring well NER1010 during longwall extraction of A4. The location of AQD1073 and NER1010 are shown in **Figure 3.1**. Water level monitoring results are presented with rainfall data in **Figure 4.1.**

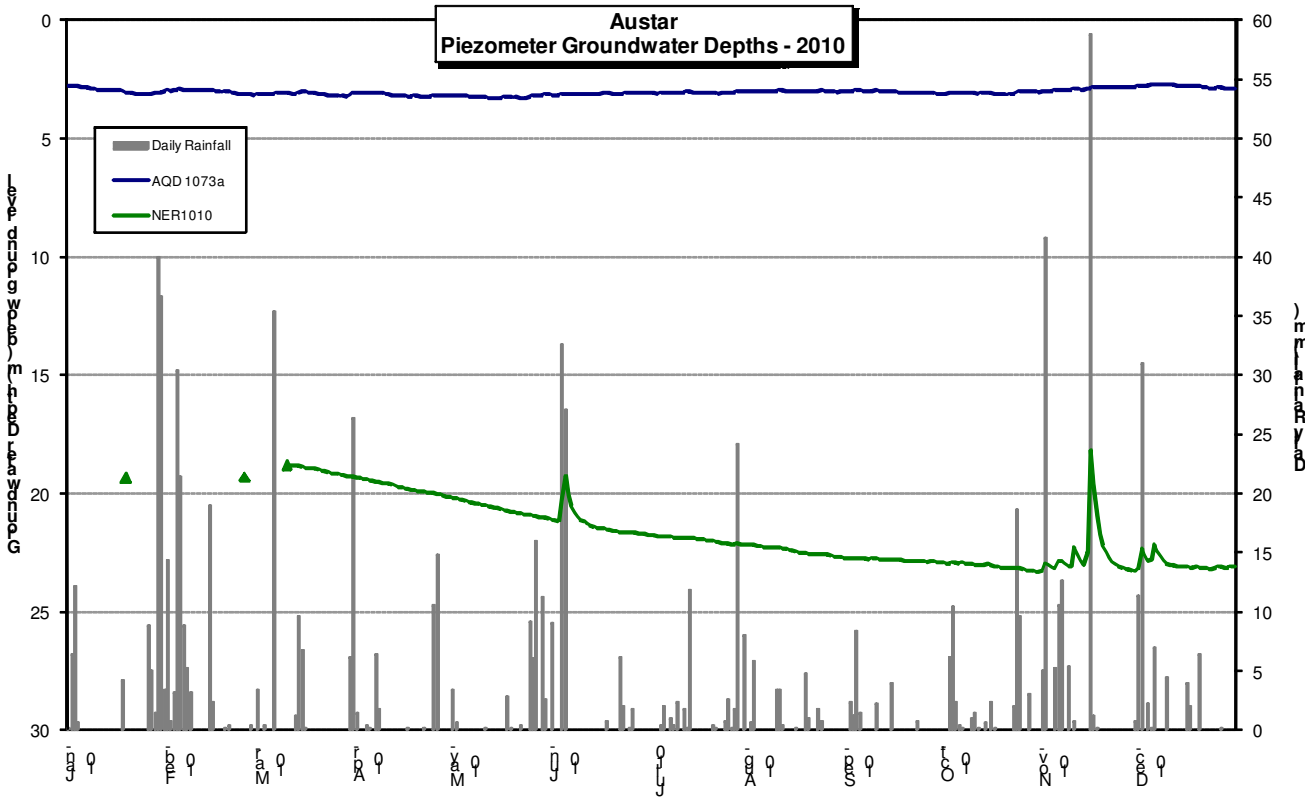

Figure 4.1 – Groundwater monitoring results 2010

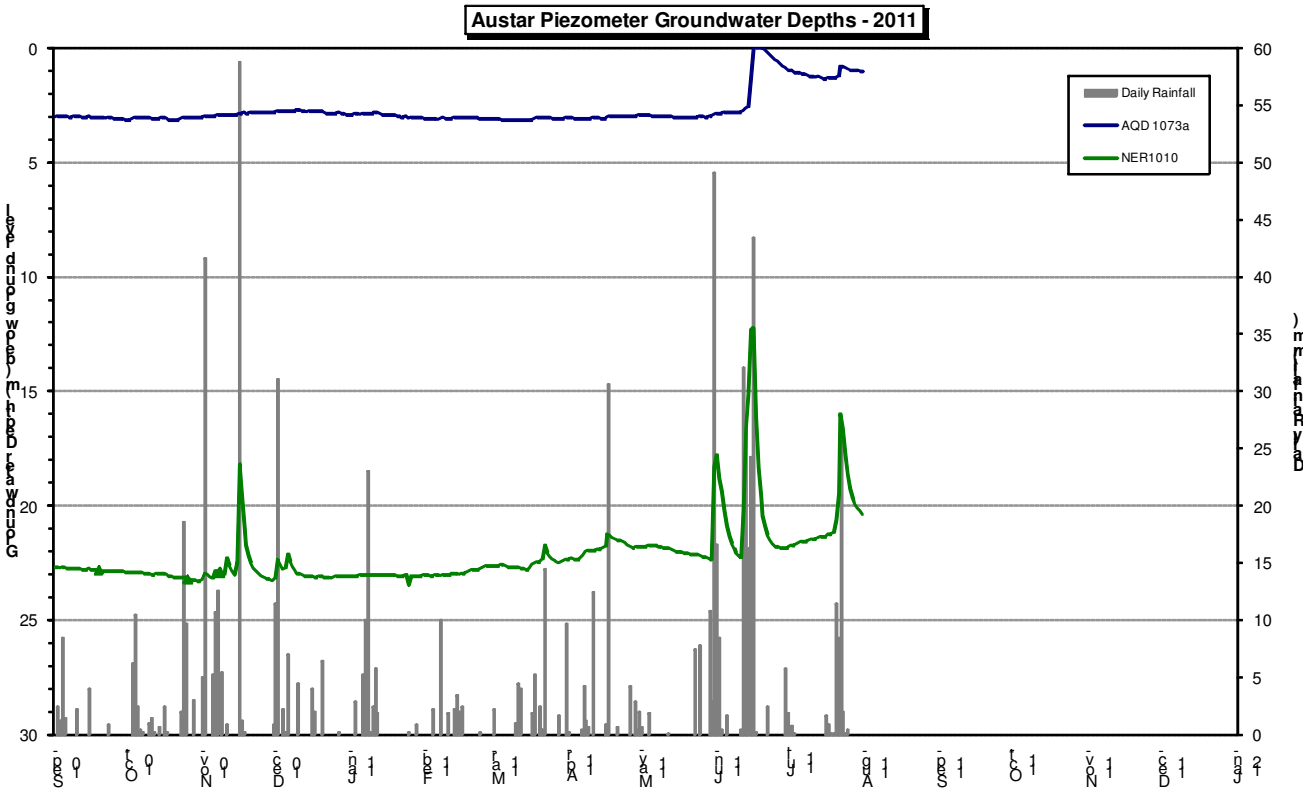

Figure 4.2 – Groundwater monitoring results 2011

4.2 Analysis of Monitoring Results

There are no criteria for groundwater monitoring results in the Site Water Management Plan. Trends are discussed below.

4.3 Trends in Monitoring Results

A relatively static water level has been observed in the alluvial aquifer at AQD1073a throughout 2010-2011, which has generally been at 3m below ground level (m bgl). A relatively wet three month period with higher than average rainfalls was experienced from May-July 2011. May falls were 81 mm (compared to a 54 mm long-term average), June falls of 180 mm (compared to a 60 mm long-term average), and July falls of 51 mm (compared to a 33 mm long-term average). The alluvial groundwater level responded accordingly, briefly rising to the surface when 143 mm of rain fell over the period 12th to 16th June. This is only the second time that at surface levels have been observed since the installation of the piezometer, with the other occurrence in September 2008, which saw an equally intense period of rainfall of 90 mm over a three day period. Alluvial groundwater levels have fallen to approximately 1m bgl by August 2011.

The water level in the Branxton formation in NER1010 showed a general gradual decline in water level during 2010 from approximately 18m bgl to 23m gbl. Since December 2010 however, there has been a general trend of increasing water level to approximately 22m bgl in June 2011. The rain events in May – July 2011 caused groundwater levels to briefly spike to approximately 12m bgl and 16 m bgl before falling to meet the general increasing trend line.

4.4 Management Actions

No management actions relating to groundwater level have been necessary. Groundwater monitoring should continue.

Appendix 5: Surface Water Monitoring

5.1 Monitoring Results Summary

Surface water monitoring was conducted in Quorrobolong Creek (locations and SWQ1, SWQ2, and SWQ3) and Coney Creek (SW C1) in accordance with the Site Water Management Plan. Monitoring in these water courses is undertaken upstream and downstream of the Stage 2 longwall mining area. The confluence of these creeks resides above the Stage 2 mining area. Longwall A4 was extracted beneath Quorrobolong and Coney Creeks between February and April 2011. Monitoring locations are presented in **Figure 3.1.**

Water samples are analysed for pH, electrical conductivity (EC), total suspended solids (TSS) and iron (Fe). Results of monitoring are presented in **Figures 5.1 to 5.8**.

Where the creek was dry at the time of sampling, no sample results appear in the relevant graph.

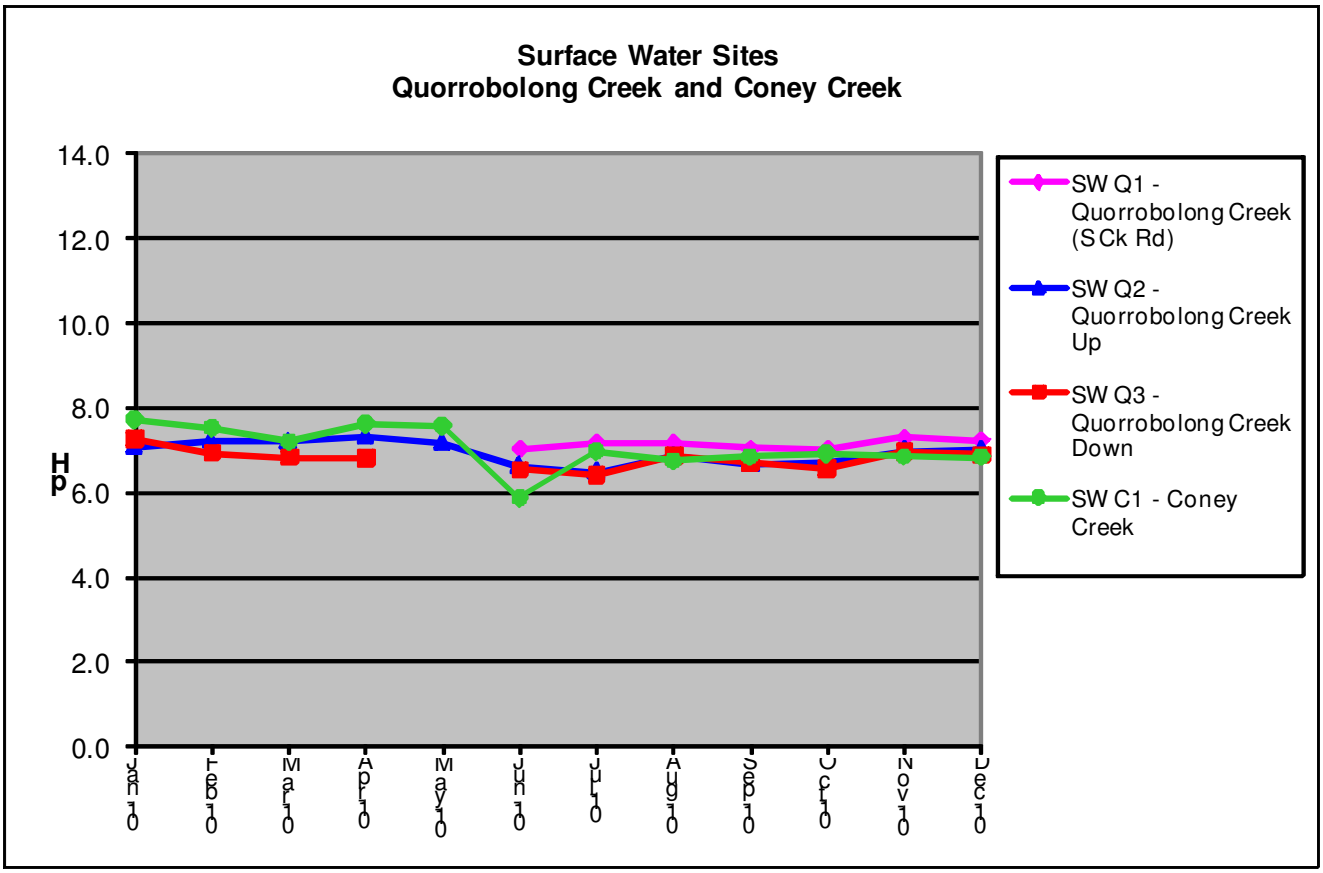

Figure 5.1 – 2010 Surface water results – pH

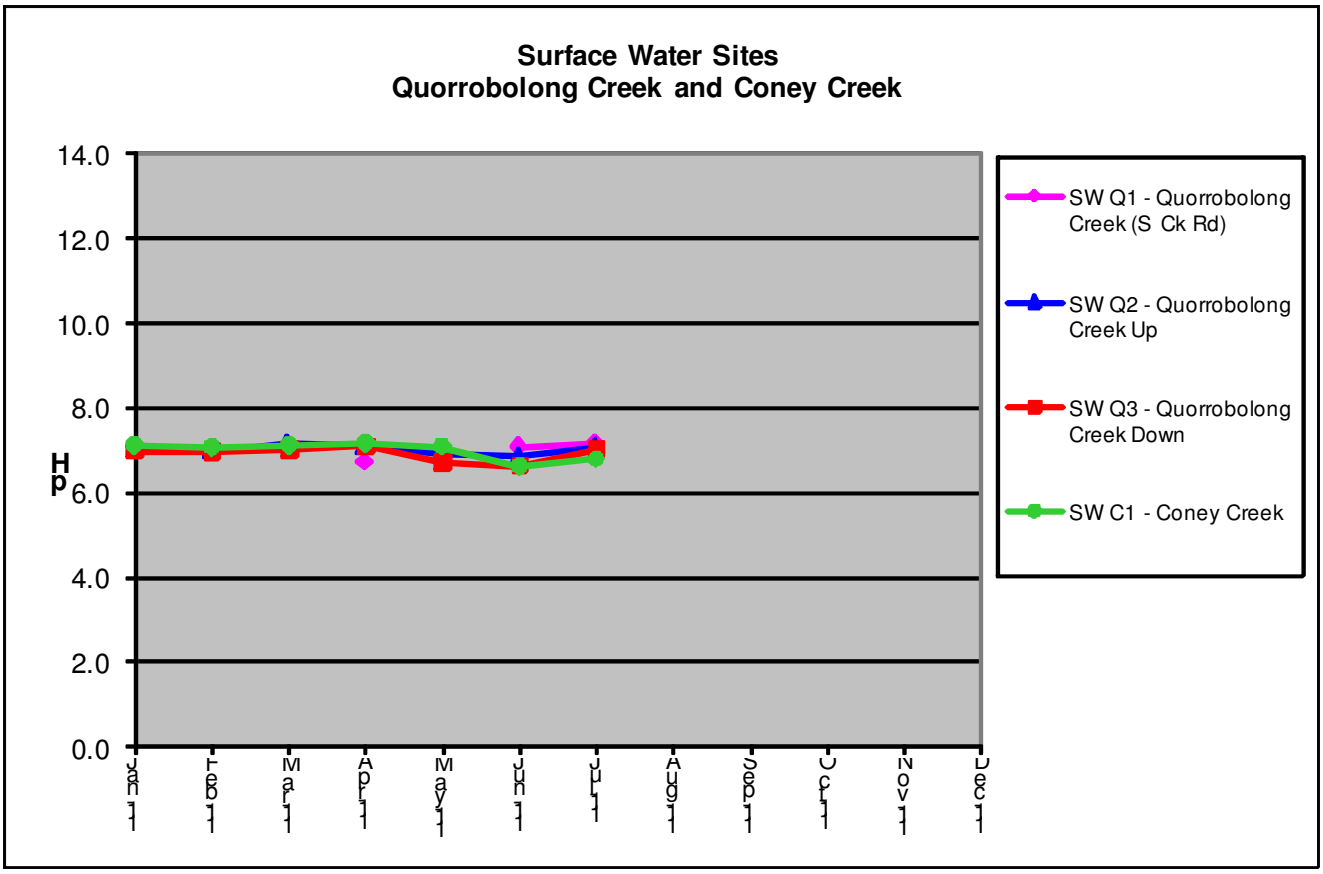

Figure 5.2 – 2011 Surface water results – pH

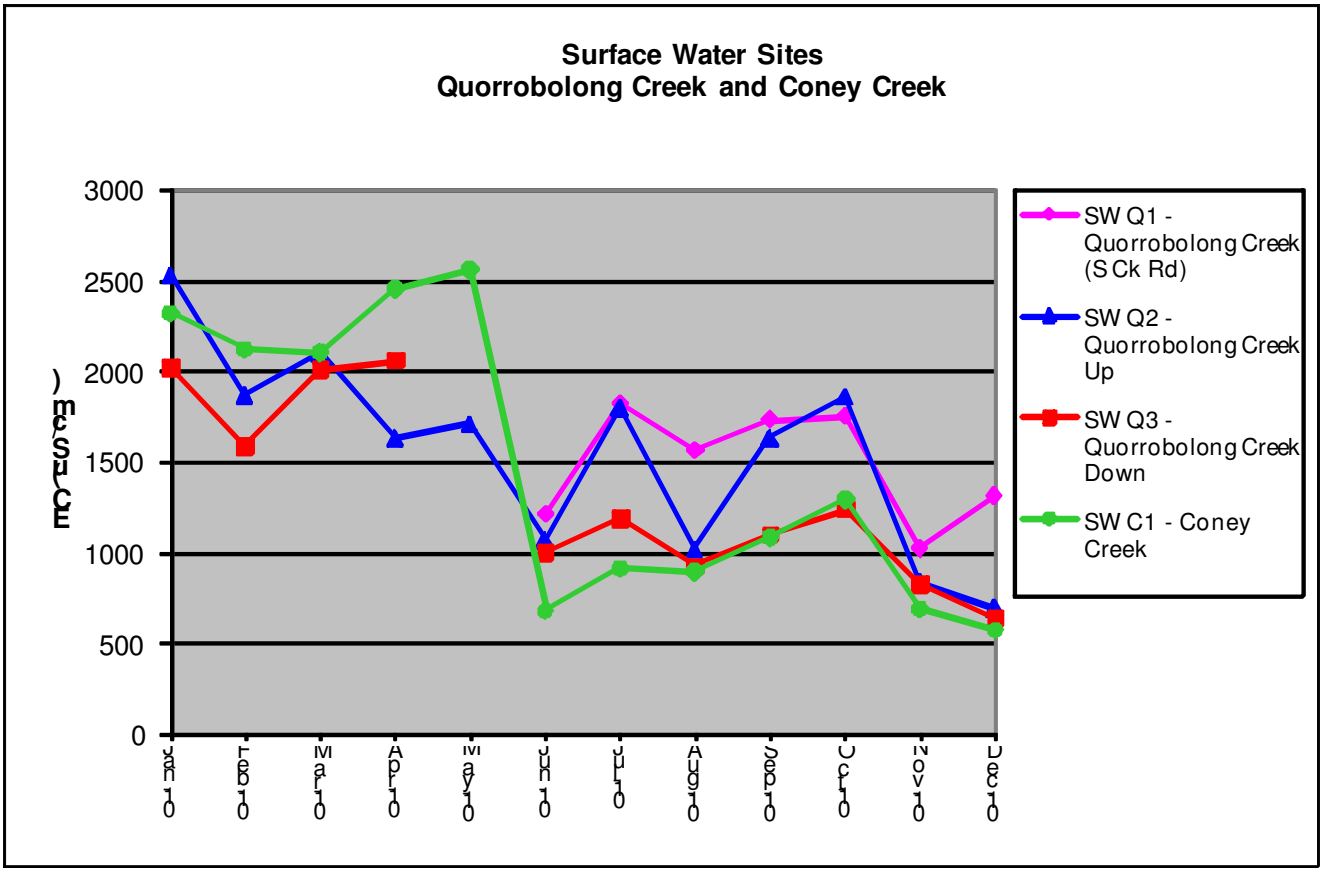

Figure 5.3 – 2010 Surface water results - EC

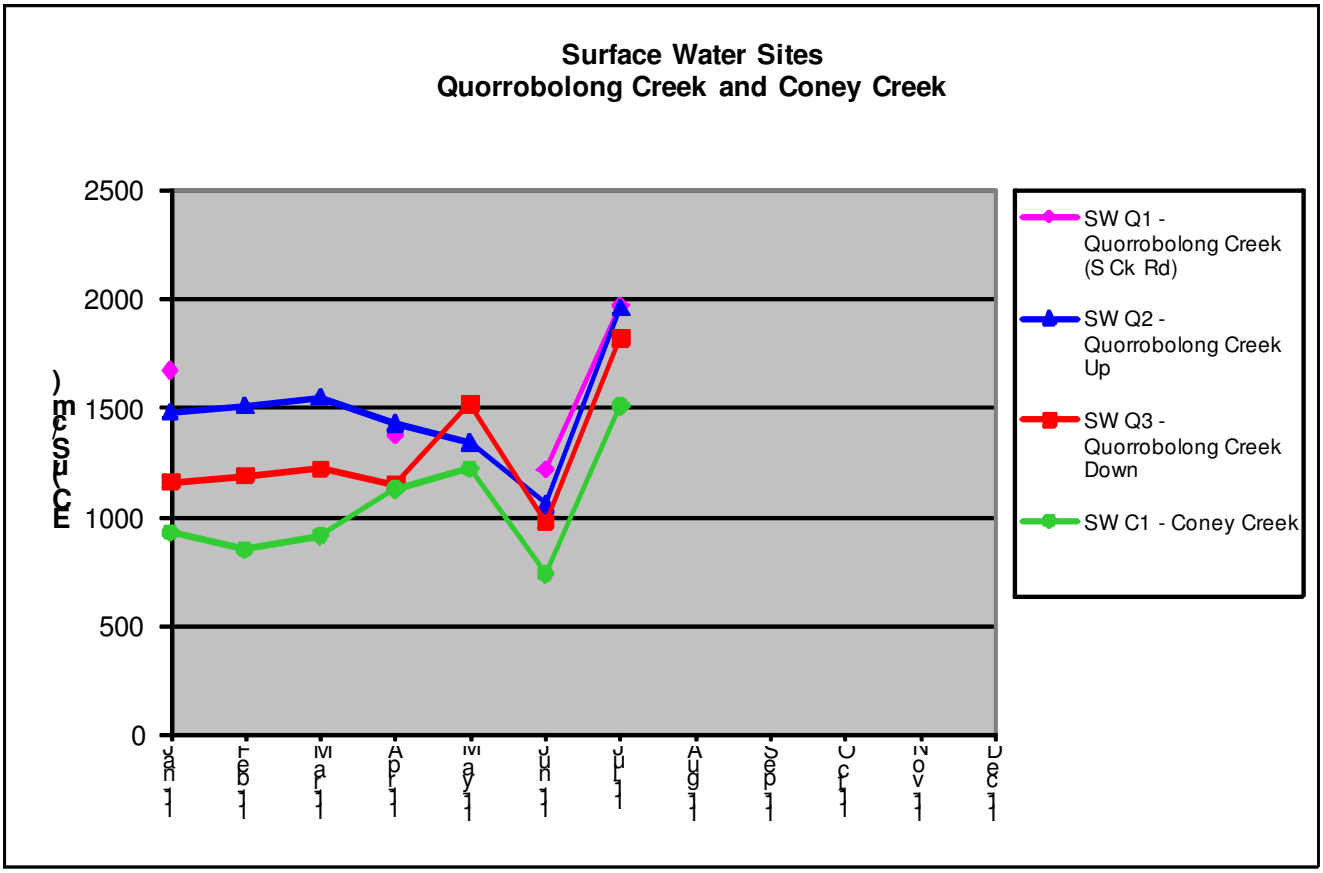

Figure 5.4 – 2011 Surface water results - EC

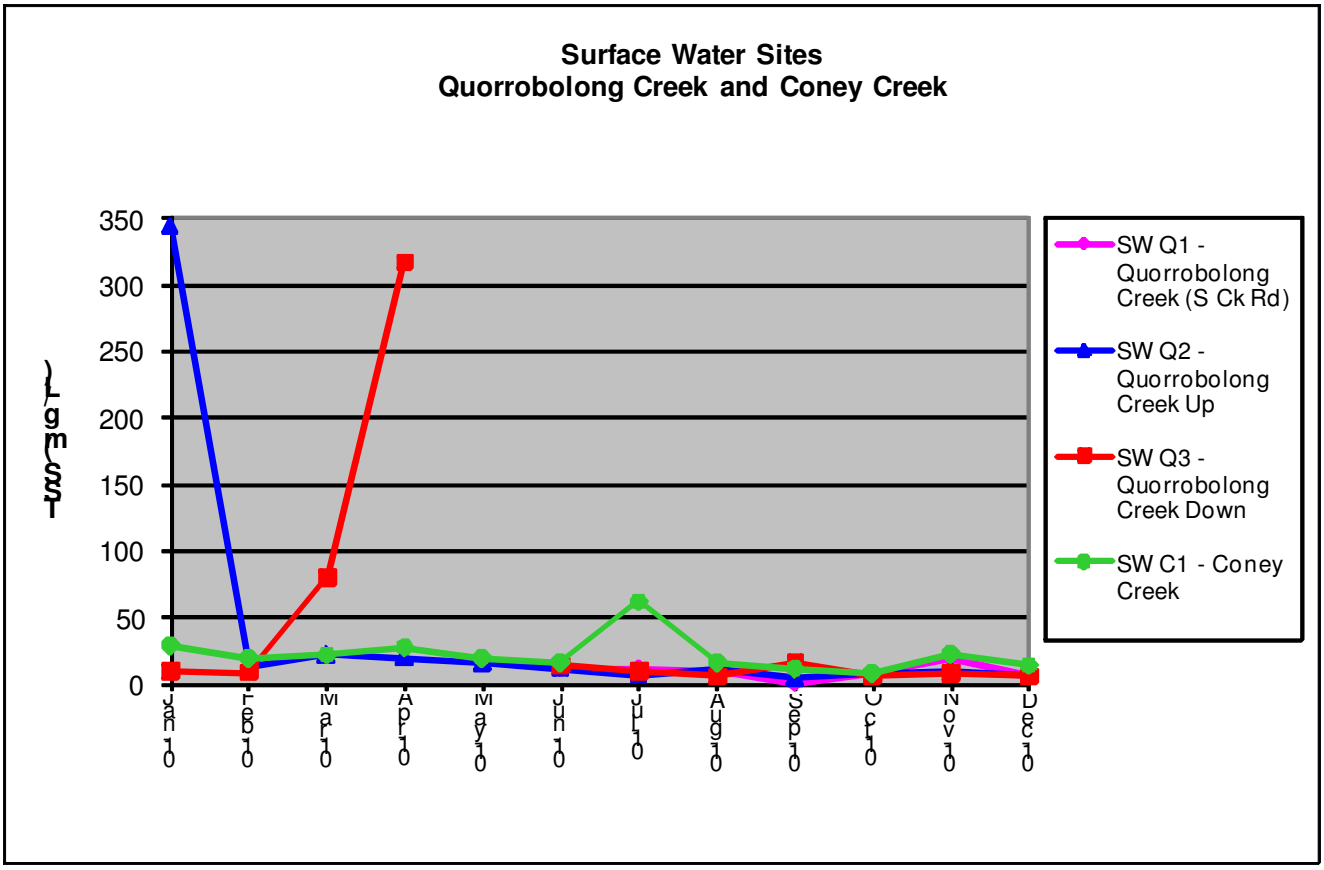

Figure 5.5 – 2010 Surface water results - TSS

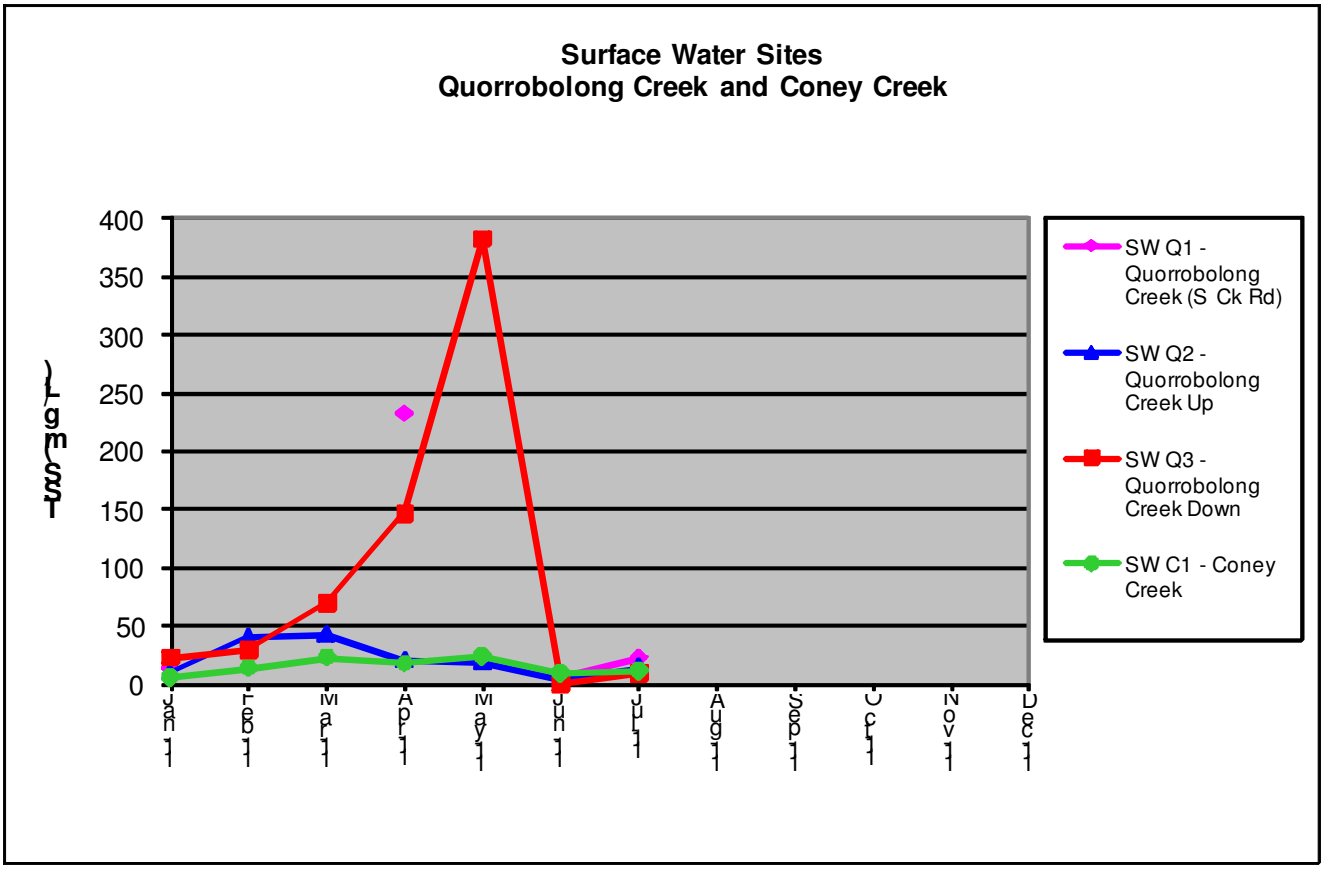

Figure 5.6 – 2011 Surface water results - TSS

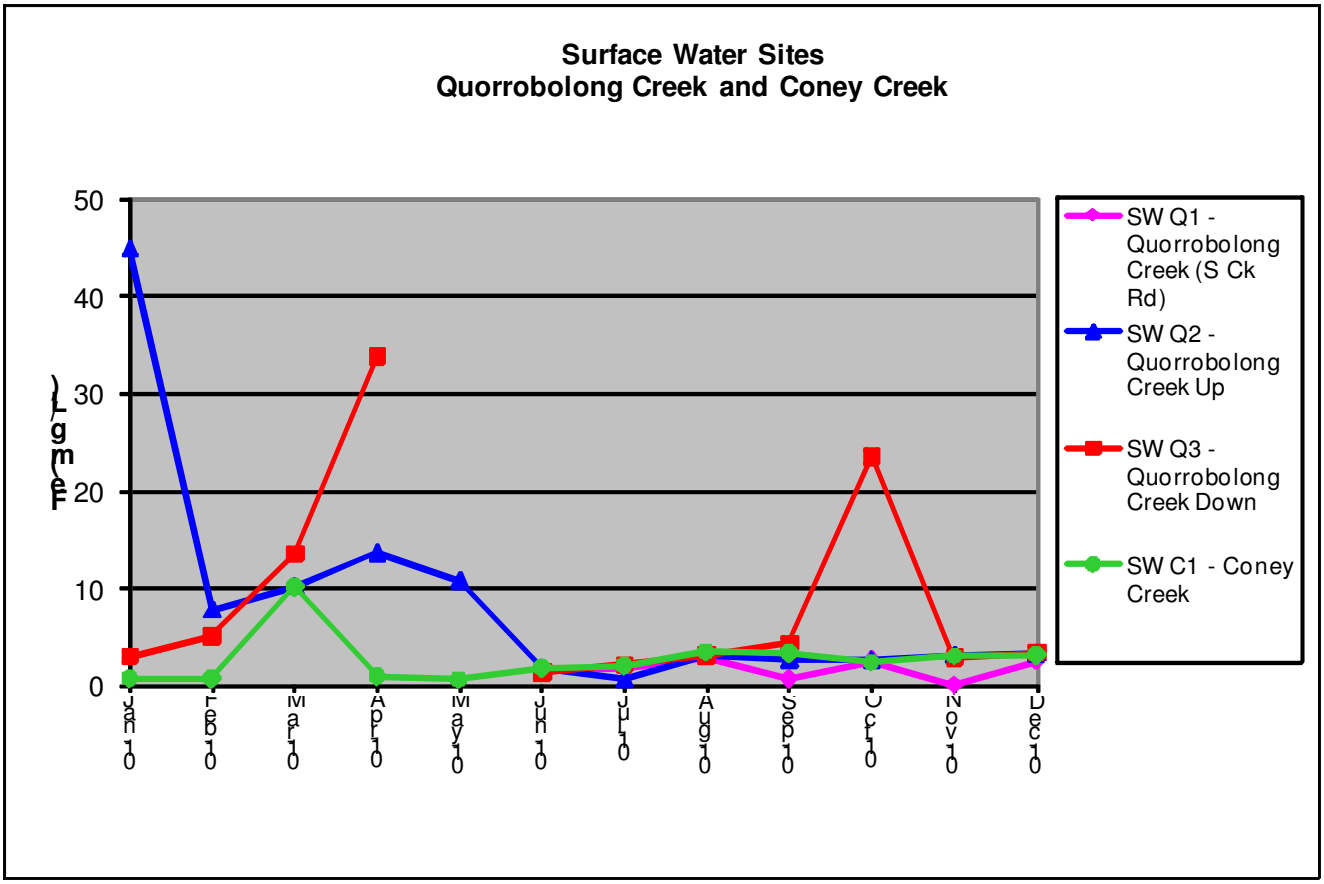

Figure 5.7 – 2010 Surface water results - Fe

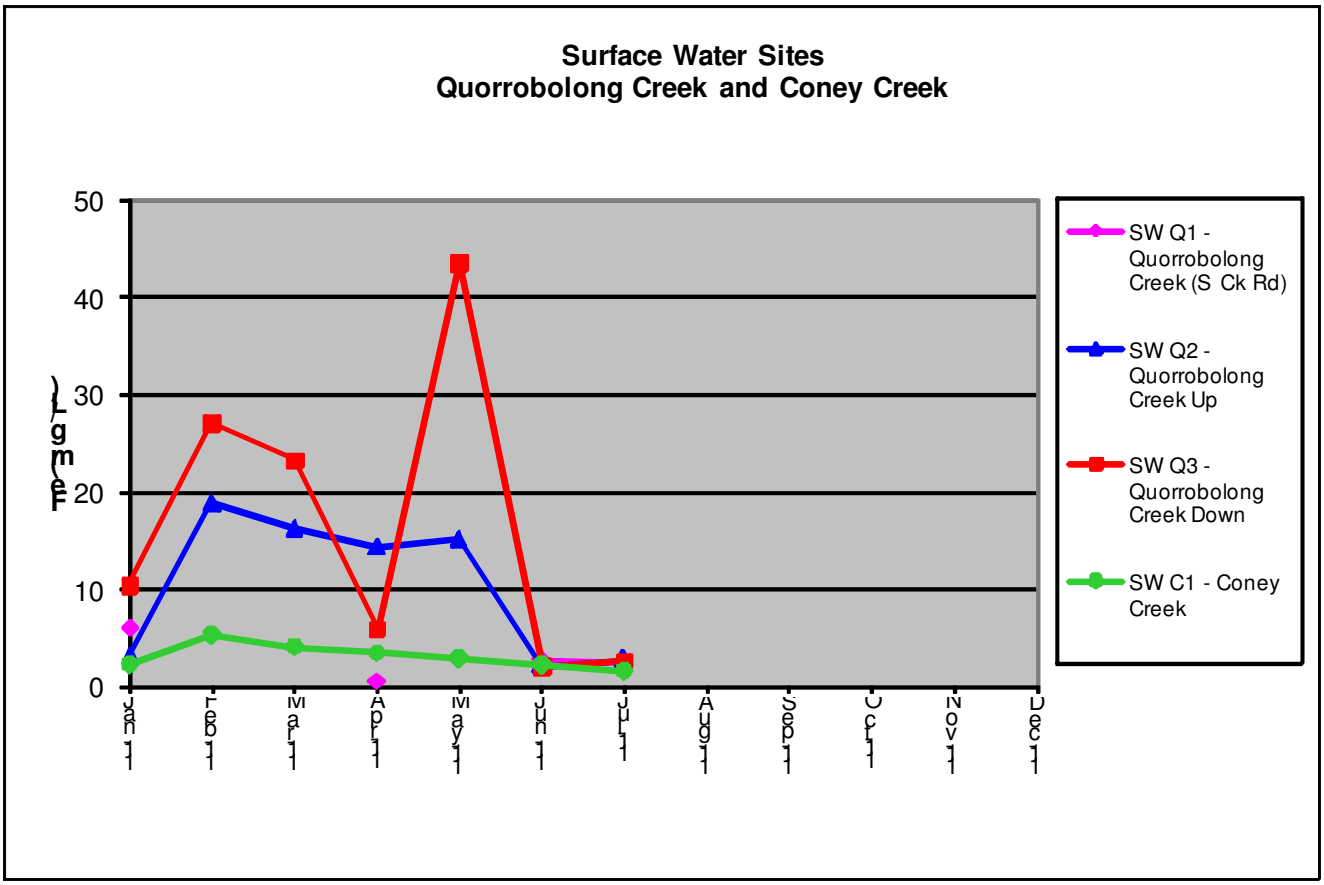

Figure 5.8 – 2011 Surface water results - Fe

5.2 Analysis of Monitoring Results

There are no criteria or predictions for surface water results. Apart from some anomalous TSS and Fe results in January, April, and October 2010 and May 2011, the results from Coney Creek, and Quorrobolong Creek both upstream and downstream of the longwall LWA4 extraction area have been similar. There appears to be no effect from longwall extraction in LWA4.

5.3. Trends in Monitoring Results

pH has remained relatively steady. EC decreased during 2010 before increasing again in 2011. TSS and Fe have remained relatively stable, apart from anomalous results in January, April, and October 2010 and May 2011.

5.4 Management Actions

No management actions relating to surface water have been necessary. The monitoring program should continue.

Appendix 6: Ecological Monitoring

6.1 Monitoring Results Summary

An ecological monitoring program has been implemented both prior to and during Stage 2 longwall mining. Six ecological monitoring sites are monitored on a bi-annual basis in the season of spring and autumn, with a baseline monitoring survey undertaken in 2008, and ongoing monitoring being undertaken during mining of Longwall A3 and A4.

The monitoring program incorporates three key survey methods:

- permanent vegetation sampling quadrats;
- ecological condition assessment and
- photo monitoring.

Over three years of monitoring, four permanent 400 m2 quadrats were set up for semi-quantitative vegetation sampling. These are sites 1, 2, 3 and 6. Site 6 was established during the spring 2009 monitoring period; site 3 was established initially in a different location in spring 2008 and was moved in spring 2009 due to access constraints. Vegetation quadrat sampling, ecological condition assessment and photo monitoring were carried out at each of these sites. Two permanent sites (4 and 5) were set up for condition assessment and photo monitoring only. Monitoring locations are presented in **Figure 6.1**.

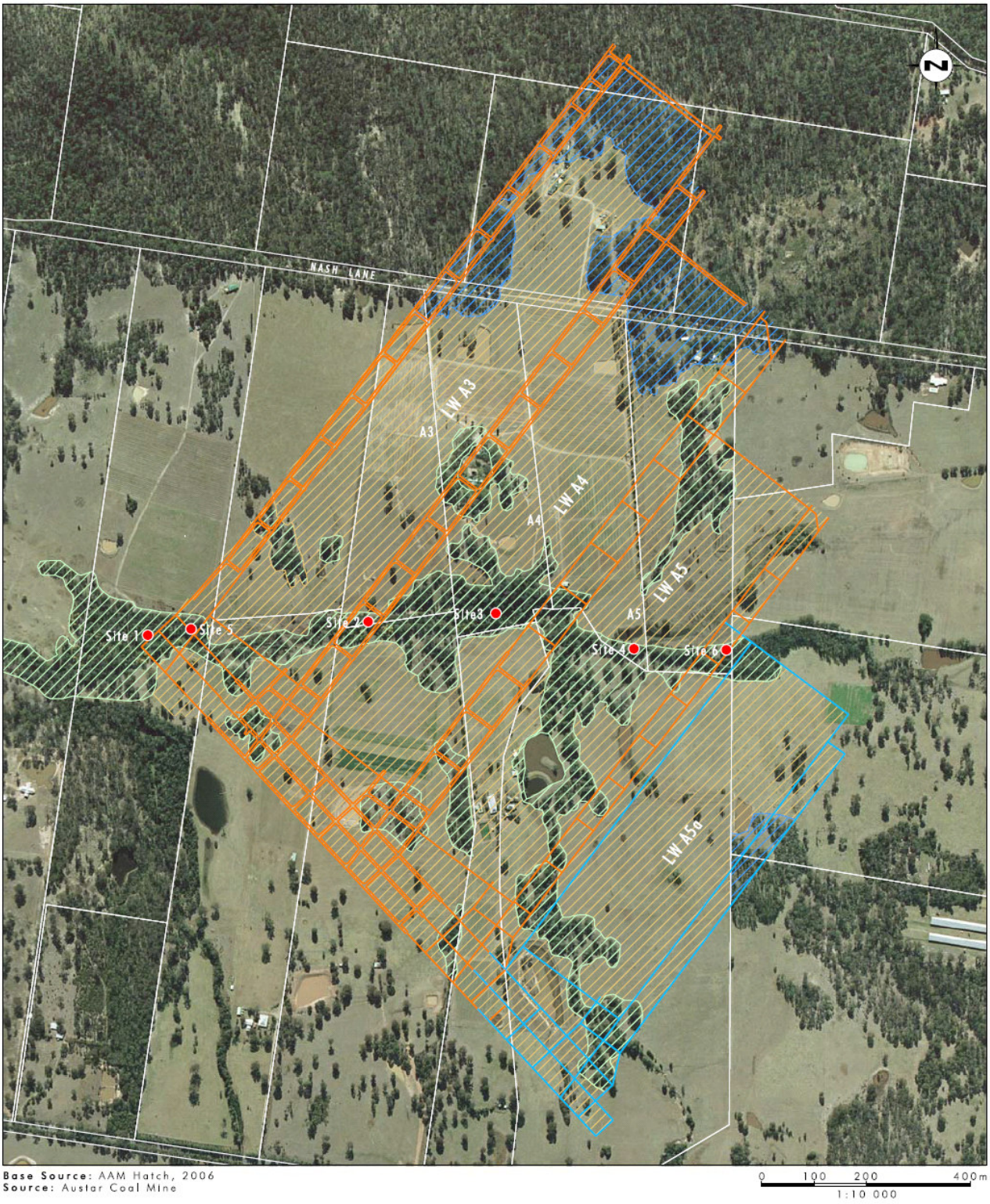

Figure 6.1 – Ecological Monitoring Locations

6.2 Analysis of Monitoring Results

Ecological monitoring has revealed the following:

- There is no evidence to date that any of the fluctuations in species numbers observed (native and introduced) could be associated with underground mining operations.
- No obvious increase in erosion or bank instability has been recorded at any of the sites monitored, or elsewhere in the Study Area.
- No obvious increase in dieback has been recorded at any of the sites monitored (although baseline levels of mild dieback have persisted).
- The photo monitoring indicates there have been no obvious visual changes to the vegetation since the baseline photos were taken.
- High threat weed species observed at all sites were blackberry (Rubus fruticosus sp. agg.) and wandering Jew (Tradescantia fluminensis).
- Longwall mining under site 1 and site 5 (panel A3) occurred in February–March 2010, and therefore both 2010 monitoring surveys and all subsequent surveys would detect any impacts resulting from mining under these sites. It is possible that site 2 could also be affected by panel A3. The 2010 surveys did not reveal any evidence of impacts on riparian vegetation at these sites as a result of subsidence.
- Longwall mining passed under site 2 and site 3 (panel A4) in February 2011 and there has been one post-mining survey for these sites to date. Site 2 could possibly also be affected by panel A3 – see above.
- There is no evidence of any impacts on ecological features as a result of longwall mining.

6.3 Trends in Monitoring Results

None identified with monitoring undertaken to date.

6.4 Management Actions

Spring monitoring for 2011 had not yet occurred at the date of this report.

Biannual monitoring will continue to be undertaken in autumn and in spring. Two monitoring events per year will sample seasonal variation in vegetation, enabling patterns of change to be more accurately attributed to cause.

Biannual monitoring will be conducted for a period of five years after the commencement of mining. The need for and frequency of subsequent monitoring surveys will be reviewed after five years based on the results obtained up to that time.

Despite the fact there are no discernable impacts on the ecological values of the Study Area that could be associated with the underground mining, there are existing threats that require appropriate management. In particular, weed management for Austar owned properties will be addressed to help conserve and enhance the ecological values of the riparian vegetation which comprises the River-flat Eucalypt Forest EEC.