Austar Coal Mine Pty Ltd
A.B.N. 67 111 910 822

Mine Office
Middle Road,
Paxton, NSW.
Locked Bag 806,
Cessnock, NSW 2325,
Australia.
PHONE: +61 2 4993 7200
FAX: +61 2 4993 7302

23 July 2010

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

Dear Michael

Re: Stage 2 End of Panel Report- Longwall A3

As per the Subsidence Management Plan (SMP) Approval for Longwall A3 (File No.06/7775) as approved on 30 January 2009, Austar submits the end of Panel report for Longwall A3 which was completed on 30 March 2010, in accordance with condition 18 of the SMP.

This report encompasses the monitoring undertaken during the extraction of Longwall A3 at Austar Coal Mine. 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 160mm and at its maximum over the chain pillar as predicted. No perceptible impacts to the environment or increase in public safety risk has 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. 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 Incremental Subsidence (mm)	Actual Incremental Subsidence	Maximum Predicted Incremental Tilt (mm/m)	Actual Incremental Tilt (mm/m)	Maximum Predicted Incremental Tensile Strain (mm/m)	Actual Incremental Tensile Strain (mm/m)	Maximum Predicted Incremental Compressive Strain (mm/m)	Actual Incremental Compressive Strain (mm/m)
A3	295	157	1.5	0.7	0.2	0.2	0.4	0.4

Table 2: Actual vs Upper Bound Subsidence Parameters

LW	Upper Bound Incremental Subsidence (mm)	Actual Incremental Subsidence	Upper Bound Incremental Tilt (mm/m)	Actual Incremental Tilt (mm/m)	Upper Bound Incremental Tensile Strain (mm/m)	Actual Incremental Tensile Strain (mm/m)	Upper Bound Incremental Compressive Strain (mm/m)	Actual Incremental Compressive Strain (mm/m)
A3	630	157	2.9	0.7	0.4	0.2	0.8	0.4

The below graphs represent the subsidence monitoring results along the A3 centreline and A3 cross line as displayed by **Figure 1.1**. The green lines of each graph represent the maximum predicted subsidence parameter for subsidence, strain and tilt as per report MSEC275.

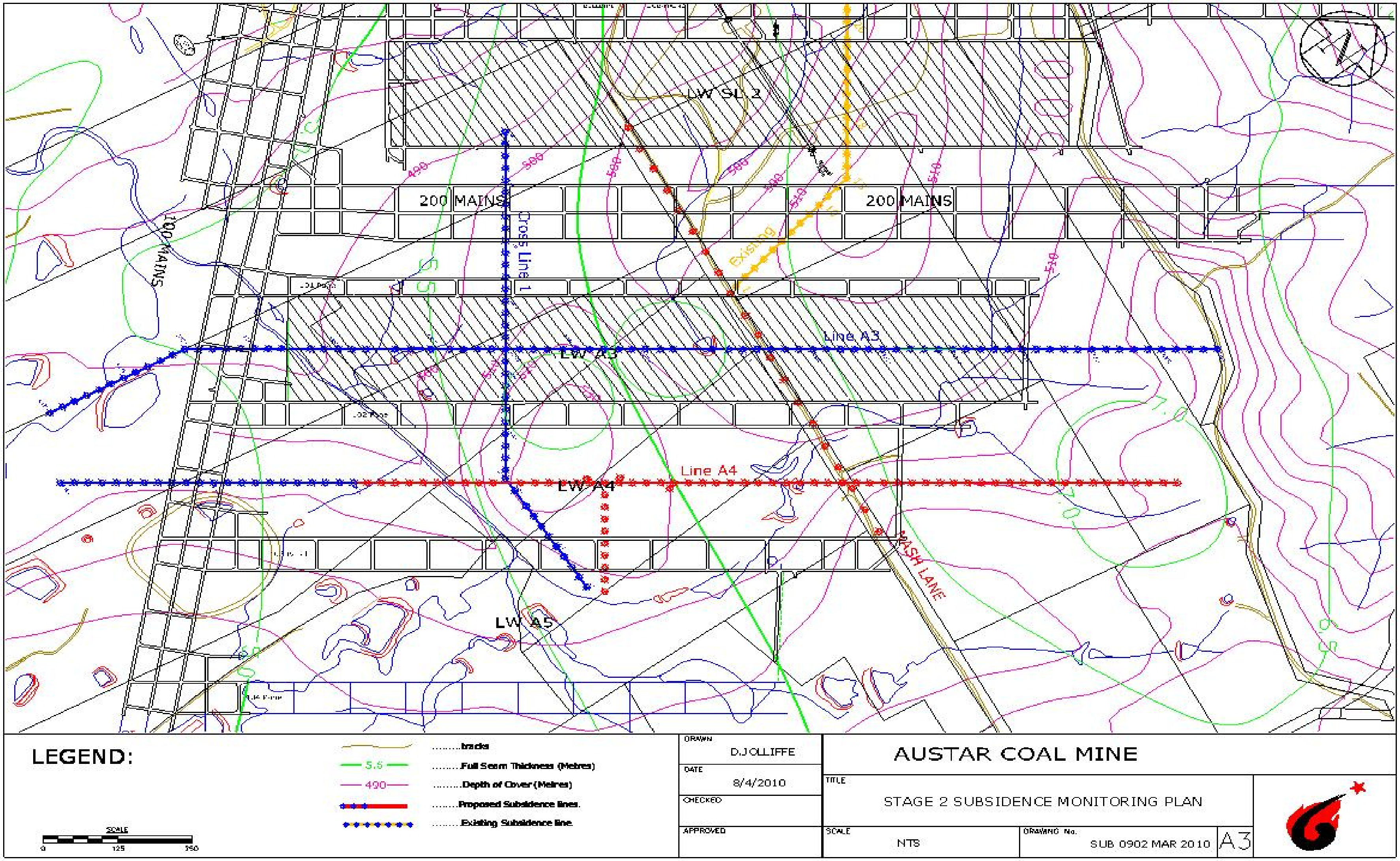

Figure 1.1: A3 Subsidence Monitoring Lines

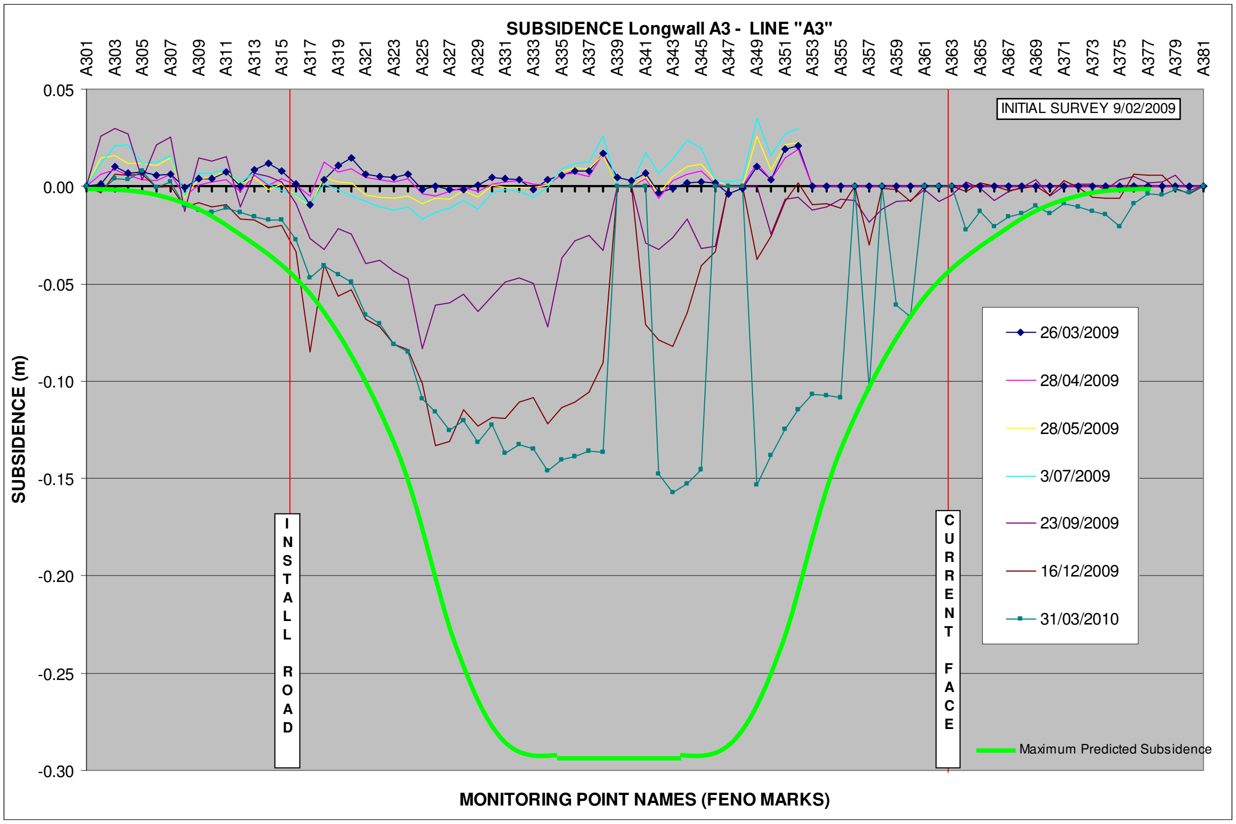

Figure 1.2- A3 Centreline Subsidence

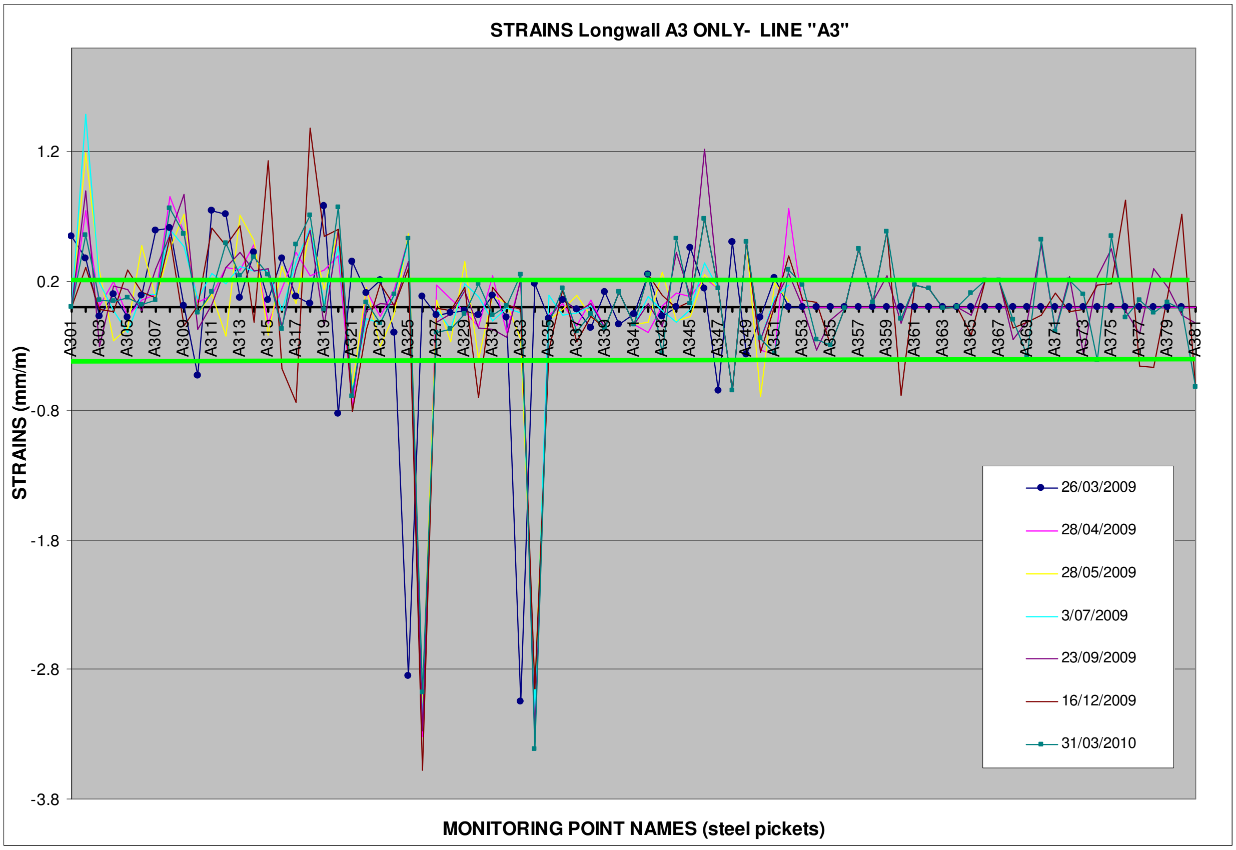

Figure 1.3- A3 Centreline Strains

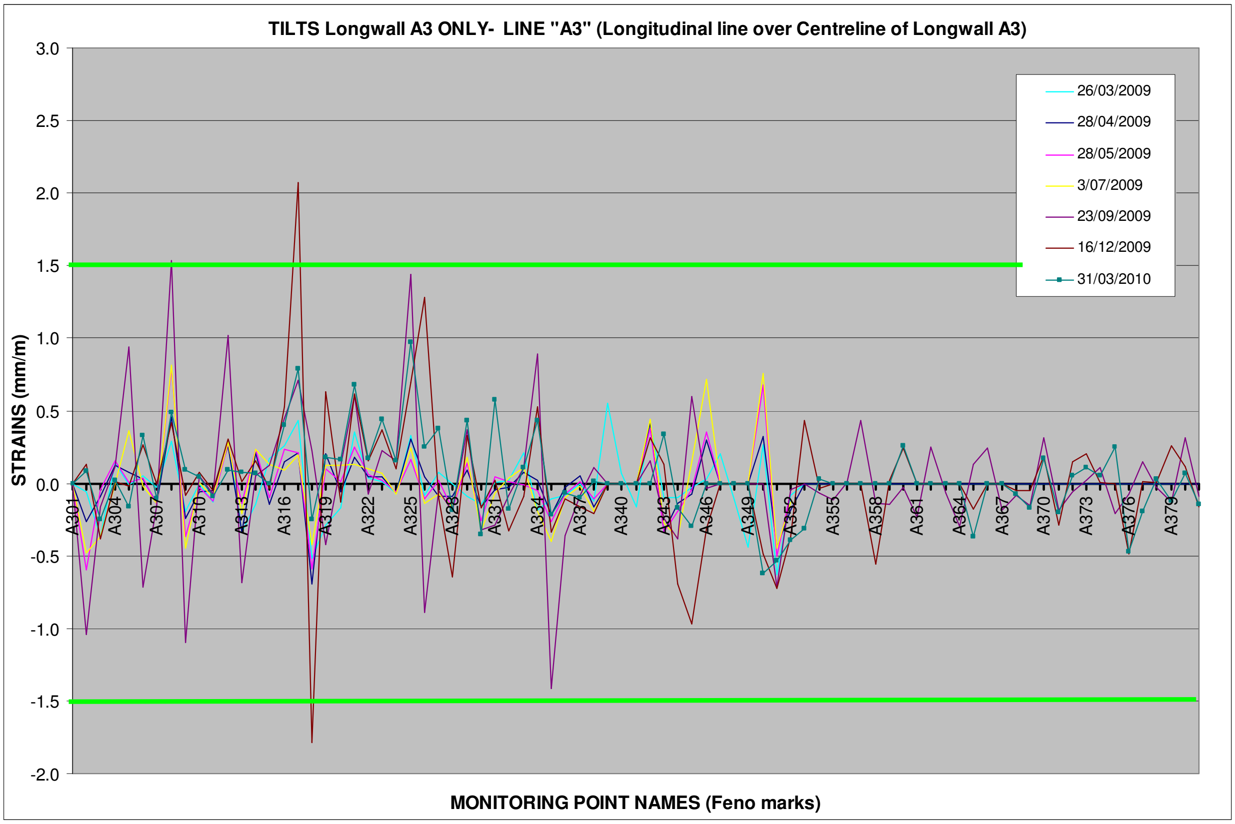

Figure 1.4- A3 Centreline Tilts

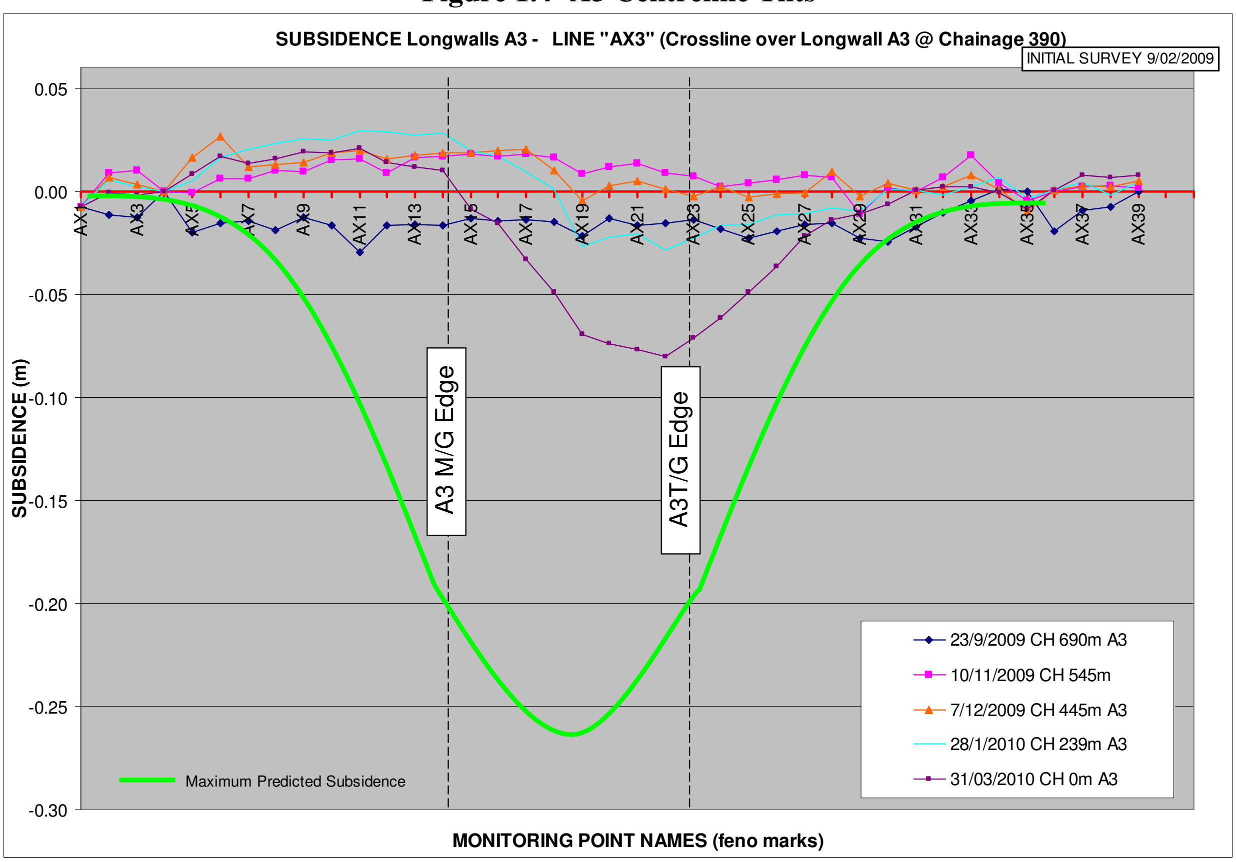

Figure 1.5- A3 Cross Line Subsidence

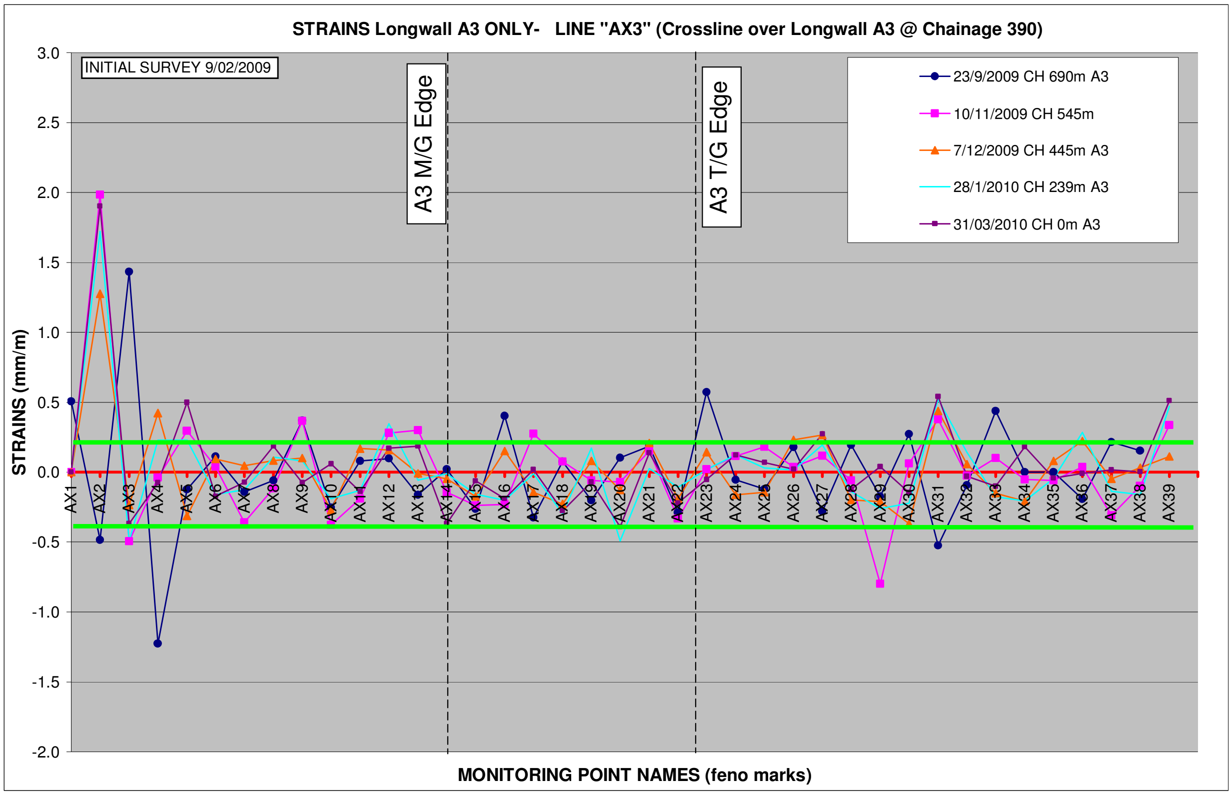

Figure 1.6- A3 Cross Line Strains

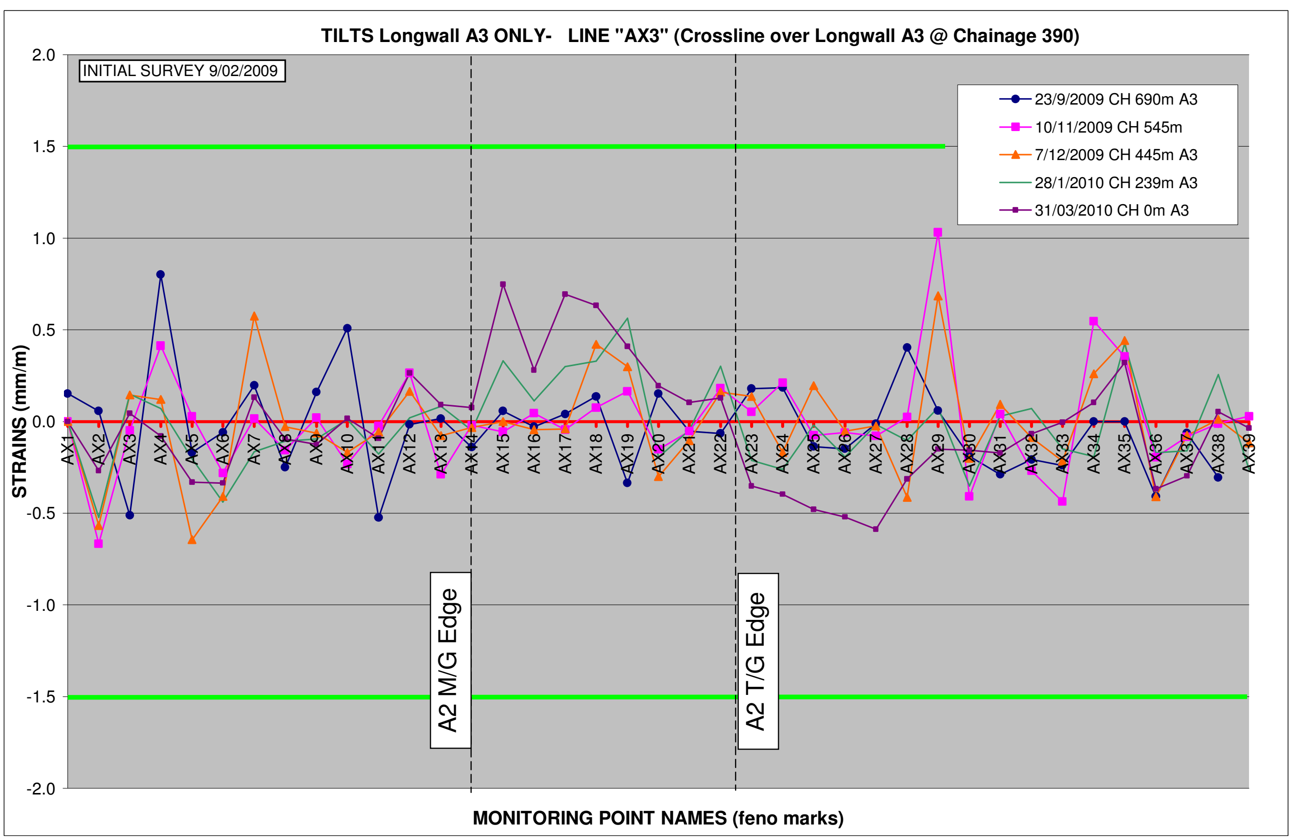

Figure 1.7- A3 Cross Line Tilts

1.2 Analysis of Monitoring Results

Whilst the first quarterly monitoring results after the final shear on the A3 longwall are not available, significant further settlement is not expected as indicated by 31 March 2010 survey, where flattening of the measured subsidence on the A3 centreline (**Figure 1.2**) is observable. This survey was completed a day after the final shear on longwall A3 was taken, and whilst some further settlement can be expected towards the outbye end of the panel, the general flattening of this line and the greatly reduced amount of subsidence to date when compared to the maximum predicted subsidence, suggests near full subsidence for this panel has been reached and will remain well below that which was predicted.

The other subsidence parameters of tilt and strain are also within maximum predicted ranges on both the A3 centreline and cross line. Some scatter can be noted in these results but is expected based on a relative horizontal accuracy of ±3mm to 5mm for each mark. The following comments are made in relation to this:

AX3 cross-line:-

- The measured strains along the AX3 cross-line are generally less than 0.5 mm/m (i.e. in the order of nominal survey tolerance).
- Where the measured strains exceeded the nominal survey tolerance, these first occurred in the surveys dated 23/09/09 and 10/11/09, when the longwall extraction face was still some distance from the monitoring line. Also, these strains occurred as tensile-compressive strain pairs, which is indicative of a horizontally disturbed survey mark.
- From examination of the aerial photograph, it also appears that the elevated strains around Marks AX01 to AX05 and AX29 to AX31 are located near tracks (possible disturbance by vehicles) and vegetation. These marks are also located outside the width of the longwall, where the strains would be expected to be less than those measured directly above the longwall.

A3 line:-

- There is a higher scatter in the strain results when compared with the AX3 cross-line
- The elevated compressive strains between Marks A325 and A326 and between A333 and A334 occurred in the survey dated 26/3/09, when the longwall extraction face was some distance from these locations. Also Marks A325 and A326 are located either side of Nash Lane and Marks A333 and A334 appear to be located around the driveway to the private property. These marks are considered to have been disturbed by vehicle traffic.
- The tensile strain between Marks A301 and A302 grows each survey, so appears to be real, but is located around 350 metres from the longwall end. These marks are located near the top of hill and the tensile strain could be associated with some downslope movements. Although Mark A301 is located next to a track (possible disturbance by vehicles).
- There is a higher scatter in the results between Marks A305 and A320, which being more heavily vegetated is considered to affect the results.
- There is a higher scatter in the results between Marks A345 and A353. Many of these strains occurred as tensile-compressive strain pairs, which is indicative of a horizontally disturbed survey mark.

Importantly all subsidence parameters to date are well below that of the Upper Bound predictions, supporting the fact that Upper Bound predictions serve only for assessing worse case risk and that maximum predicted subsidence estimates provide a much more accurate estimate of the subsidence. This was also the case for Stage 1 where two Top Coal Caving Longwall panels were mined beside several other longwall panels.

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 A3 subsidence.

Table 3- Impact Assessment Criteria

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 <0.2mm/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 0.6mm/m, Strains <0.1mm/m after A3. Potential for minor cracking and unlikely to cause and slippage event after full subsidence.	Strain <1.2mm/m potentially as a result of downward slope movement but also may be due to movement of survey marker located near a track. No observed cracking or physical signs of movement.	Continue to monitor
Nash Lane	After A3 290mm, Tilt 0.9mm/m, Strains 0.1-0.3mm/m. No impact due to A3 subsidence (strains <0.5mm/m).	Survey markers adjacent affected by vehicles. Nearby <0.3mm/m strain 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 for Tilt and Category 0 for Strain after A3 (Max Predicted)	No impacts (Ie Less than Category A or 0)	Nil
Other structures	Minimal impact	No impact	Nil

In summary impacts are mostly less than expected or as expected due to A3 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 also confirmed Maximum Predicted Subsidence to be an accurate prediction of actual subsidence. The same has occurred for extraction of A3 in the Stage 2 mining area. No to minimal physical impacts were observed in Stage 1 which is the same for the extraction of A3. In summary parameters and impacts for A3 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 A3 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 A3 will be less than maximum predicted. Extraction of A4 panel commencing in early July 2010 will increase subsidence along the monitoring lines for A3.

With the currently low levels of tilt and strain there is some scatter in the data due to the surveying tolerances, this will be expected to reduce with extraction of subsequent panels. Errors in the data associated with survey marker movements in locations that are exposed to vehicle traffic in particular will continue to be a problem.

1.4 Subsidence Management Actions

No immediate actions were required during or post extraction of A3. 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.

On the eight (8) 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 also confirmed that no safety issues manifested and no physical signs of subsidence were observed

In Stage 1 despite a larger amount of subsidence occurring there were still no signs of physical subsidence impact to the surface of the land. Thus the results for A3 are to be expected.

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 V4 and V5 during extraction of LWA3 (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.

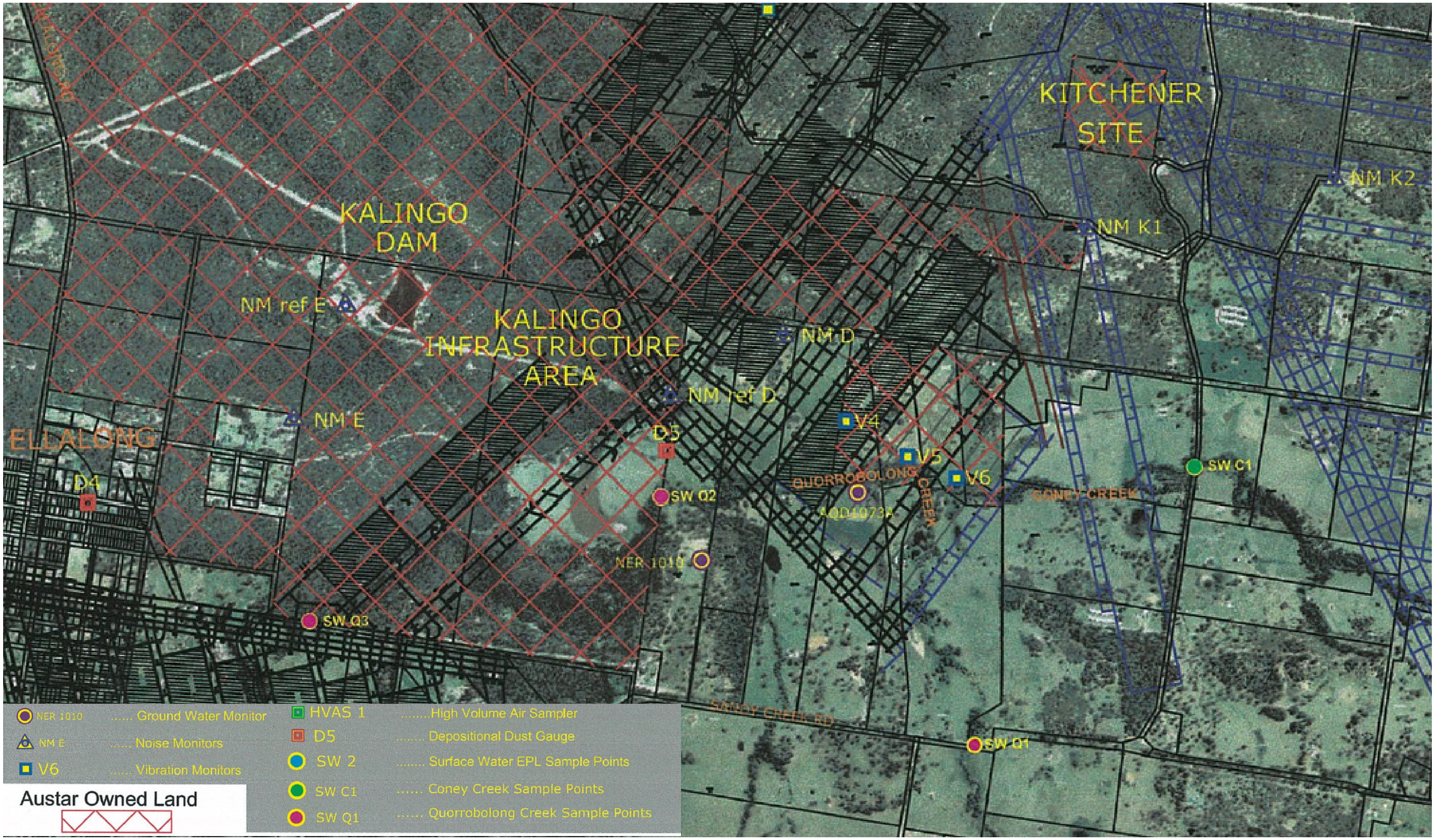

Figure 3.1 Austar Environmental Monitoring Network

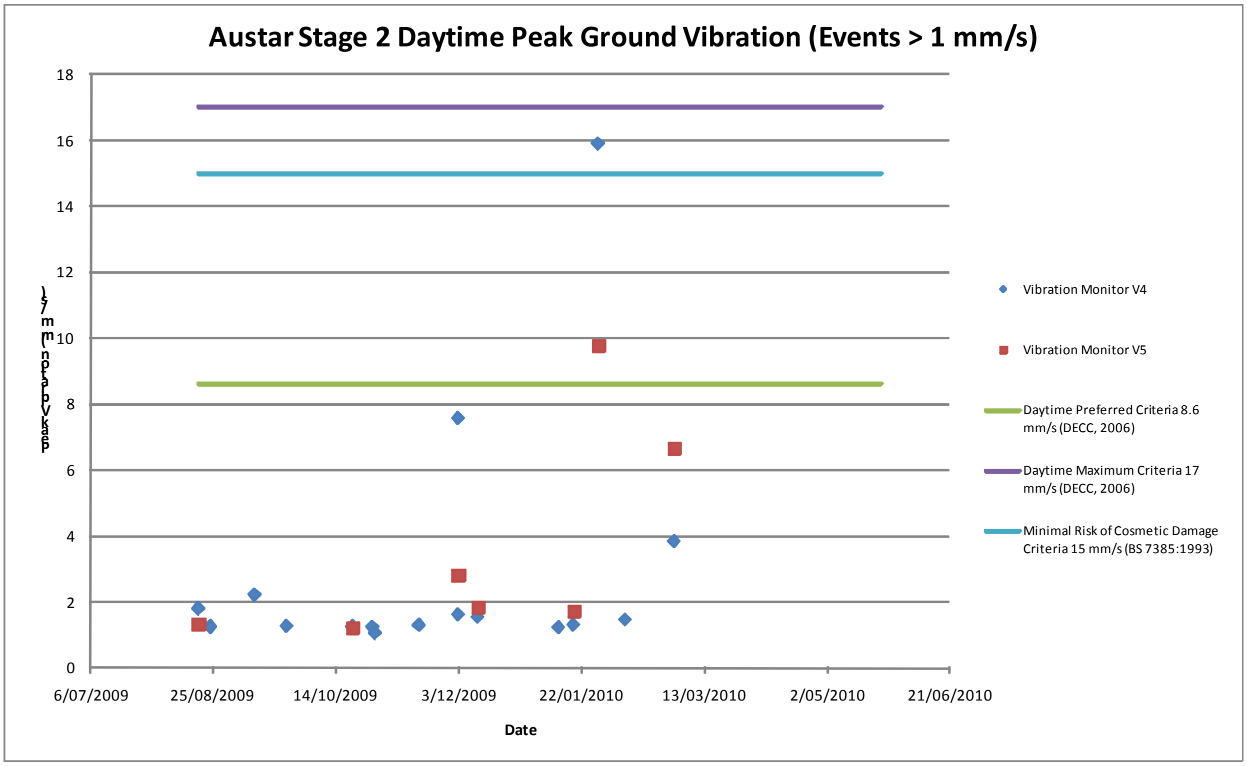

Figure 3.2 Vibration Monitoring Results – Daytime

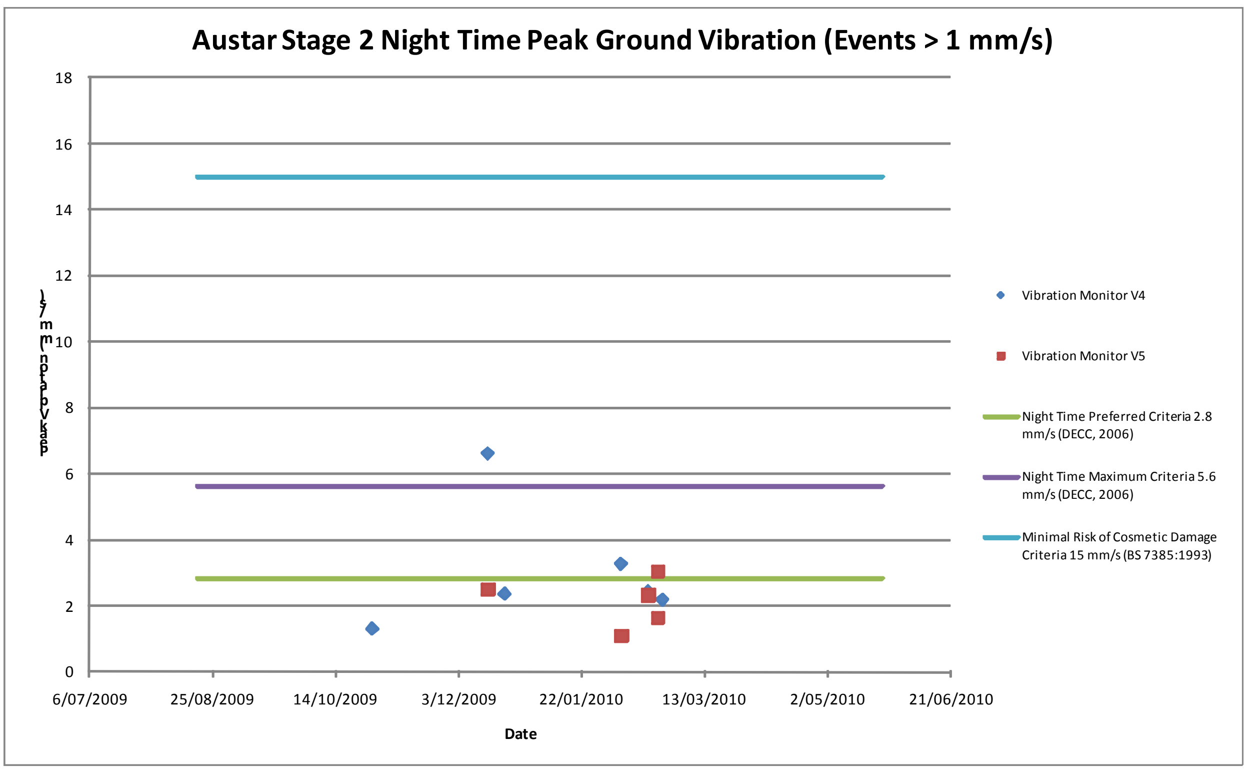

Figure 3.3 Vibration Monitoring Results – Night

3.2 Analysis of Monitoring Results

Results indicate that vibration from extraction of Longwall A3 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 3 mm/sec, with only 6 events greater than 3mm/sec over the period of monitoring.

Over the period of monitoring, 3 events exceeded the preferred criteria for human response to vibration, and 1 event exceeded the maximum criteria for human response to vibration. 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.

One event was measured at 15.9mm/sec, which marginally exceeded the guideline value where a minimal risk of cosmetic damage may occur. This event was the exception, rather than the norm of measured vibration.

3.3 Trends in Monitoring Results

There was no vibration measured at greater than 1mm/sec after completion of Longwall A3, indicating measurable vibration is coincidental with operational longwall extraction.

Results are similar to those from previous longwall panels A1 and A2.

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 during longwall extraction of A3. Groundwater monitoring also commenced in sandstone water bearing zone in the Branxton formation in January 2010 with a monitoring well installation to a depth of 100m in existing exploration borehole NER1010. The location of AQD1073 and NER1010 are shown in **Figure 4.1**.

Water level monitoring results are presented with rainfall data in **Figure 4.1.**

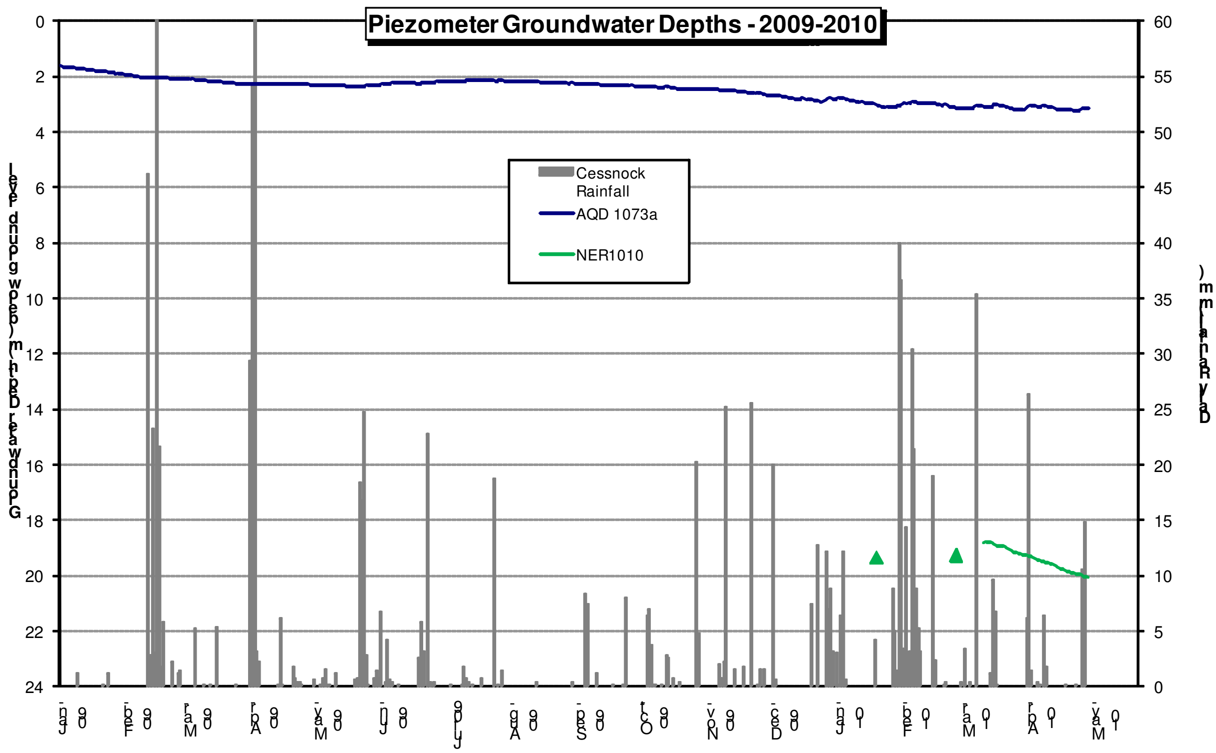

Figure 4.1 – Groundwater monitoring results

The two “triangle” marker locations for NER1010 are manual water level dips prior to water level logger installation.

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 general trend of declining water level has been observed in the alluvial aquifer at AQD1073a, from slightly less than 2m below ground level (m bgl) to slightly greater than 3m bgl. It is considered unlikely that Longwall A3 has had any effect on alluvial groundwater levels, but changes are more reflective of local effects, such as variation in rainfall, as is expected. In 2007-2008 the groundwater level in AQD1073a varied from slightly greater than 2m bgl, up to the ground surface (0m bgl), and was influenced by rainfall events.

There has not been significant record from NER1010 to discern significant trends. Groundwater level has varied between approximately 18.5 to 20m bgl over the period of record, rising after installation of the piezometer in January up to March, and appears to be on a slow decline in April-May 2010. More data is required to assess trending at this location.

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. 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 5.4**.

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

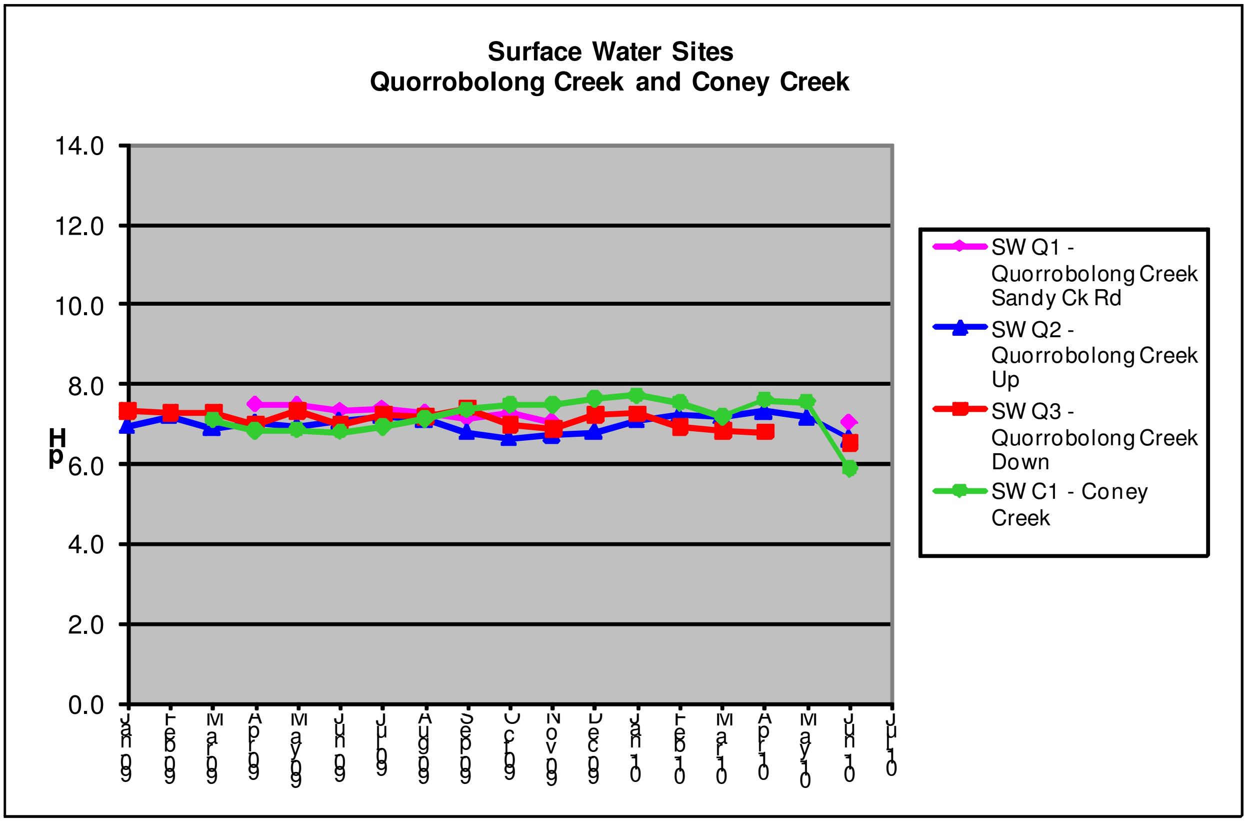

Figure 5.1 – Surface water results - pH

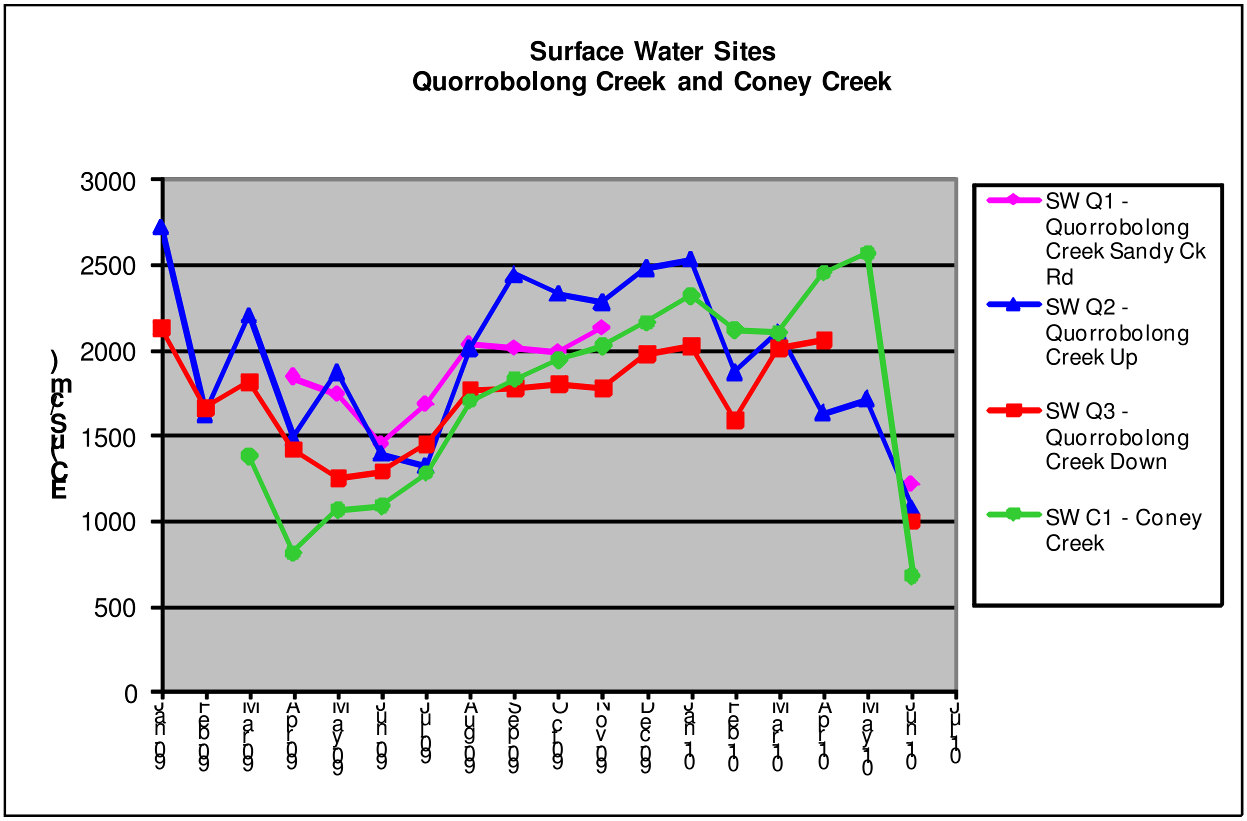

Figure 5.2 – Surface water results - EC

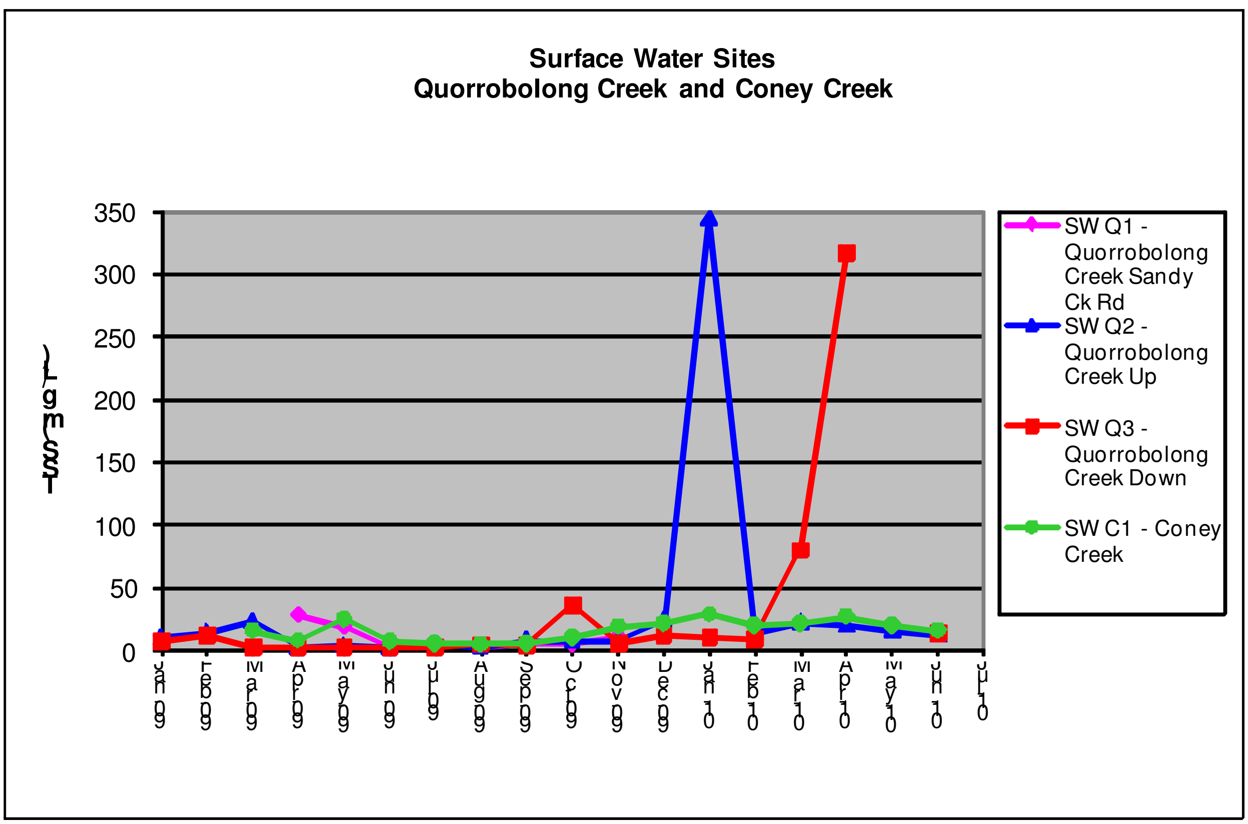

Figure 5.3 – Surface water results - TSS

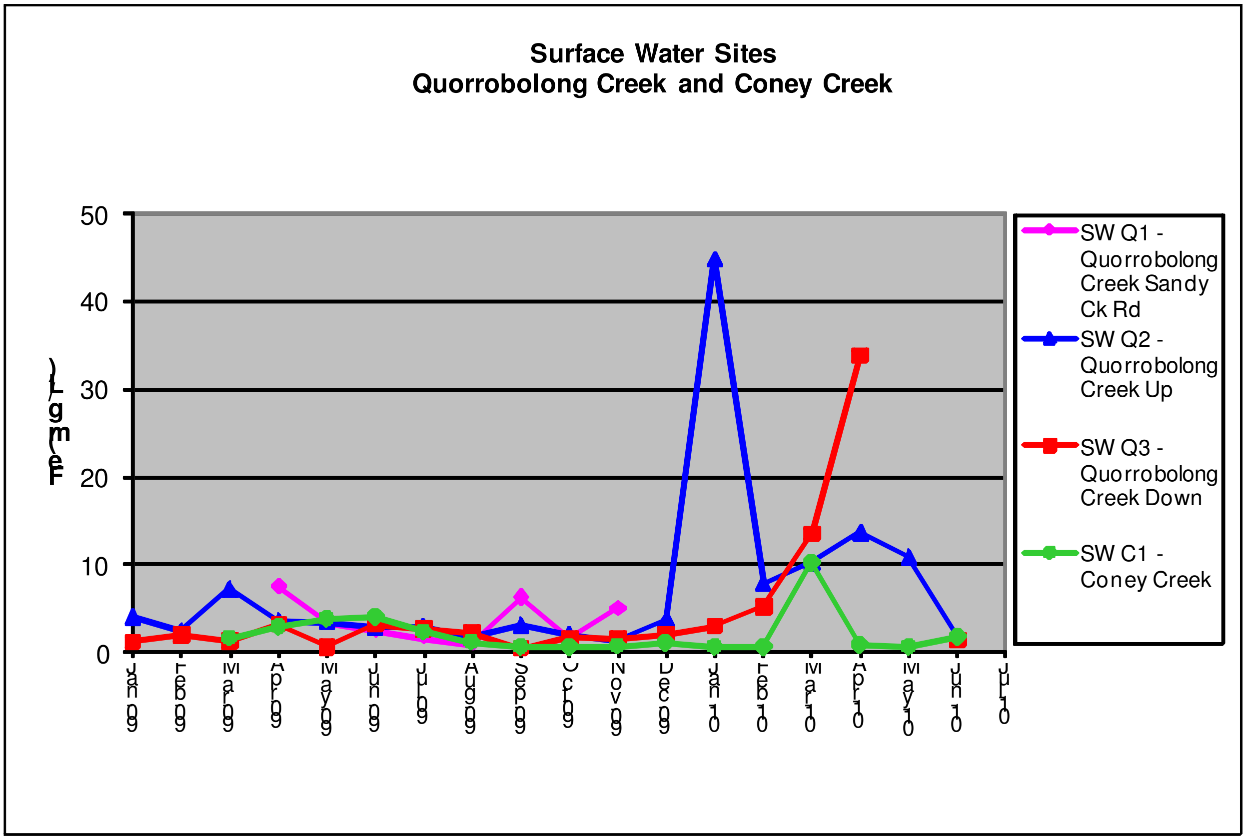

Figure 5.4 – Surface water results - Fe

5.2 Analysis of Monitoring Results

There are no criteria or predictions for surface water results. Apart from some anomalous results in January and April 2010, the results from Coney Creek, and Quorrobolong Creek both upstream and downstream of the longwall LWA3 extraction area have been similar. There appears to be no effect from longwall extraction in LWA3.

5.3. Trends in Monitoring Results

pH has remained relatively steady. EC increased during a prolonged period of low rainfall between July 2009 and February 2010. TSS and Fe have remained relatively stable, apart from anomalous results in January and April 2010.

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 in 2009.

The monitoring program incorporates three key survey methods:

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

Over two 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 were set up for condition assessment and photo monitoring only. These locations, sites 4 and 5, were unsuitable for vegetation sampling as the understorey vegetation was highly disturbed at these locations and not representative of the target community. Monitoring locations are presented in **Figure 6.1**.

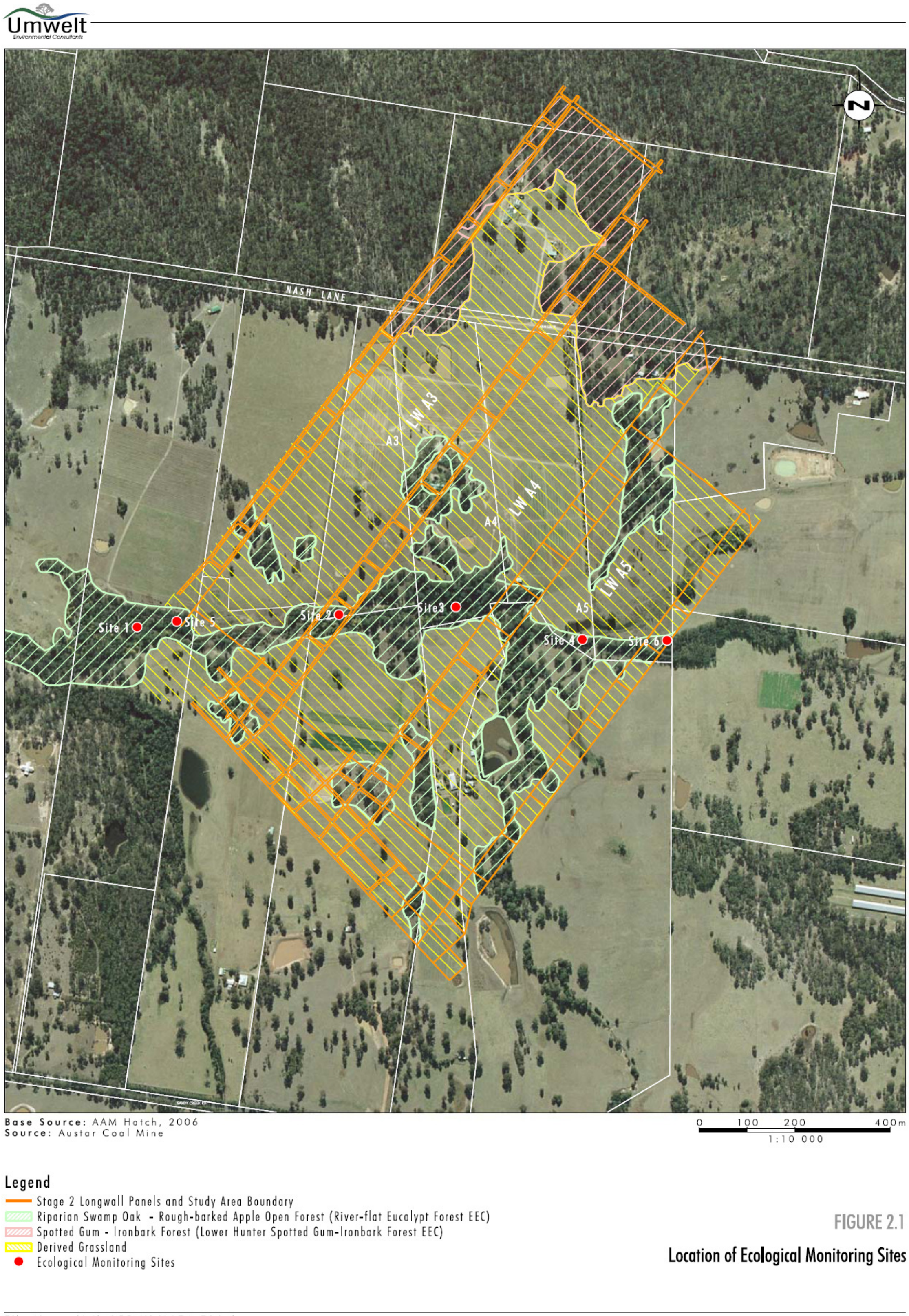

Figure 6.1 – Ecological Monitoring Locations

6.2 Analysis of Monitoring Results

There is no direct evidence of any decline in species diversity as a direct result of mining operations, however all monitoring sites were found to be in varying states of disturbance, mostly from past clearing and grazing practices, as well as a consequence of weed infestation. Potentially problematic weed species were inclusive of noxious weed blackberry (Rubus fruticosus sp. agg.) and the invasive wandering Jew (Tradescantia fluminensis).

The general structural diversity of these monitoring sites was low with very little natural regeneration observed. There is no evidence of impacts on structural diversity as a result of longwall mining.

The photo monitoring undertaken as part of the survey provides a visual reference of the baseline condition of the vegetation and creeklines and indicated no significant changes had occurred to the vegetation.

In conclusion, there is no evidence of any impacts on ecological features as a result of longwall mining. Continued monitoring for at least the next three years will help to determine if any impacts result from longwall mining and if any remediation measures are necessary.

6.3 Trends in Monitoring Results

None identified with monitoring undertaken to date.

6.4 Management Actions

Monitoring undertaken to date documents the baseline results from monitoring Sites 3, 5 and 6; and the results of continued biannual monitoring for Sites 1, 2 and 4 in the Stage 2 underground mining area. Repetition of the monitoring program for the minimum five years has been recommended by the ecological consultant to allow for more detailed comparisons of the data. The ecologists have indicated that few robust comparisons can be drawn of the data after a two year monitoring period, although any minor changes observed are likely to be a consequence of natural fluctuations in flora species over time.

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.