BAAL BONE COLLIERY
OPERATED BY THE WALLERAWANG COLLIERIES LIMITED

BAAL BONE COLLIERY
Subsidence Management Status Report
LW 29 - 31

Four Monthly Update

REPORT No. 9

For the period:
8th August 2010 to 7th December 2010

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1 INTRODUCTION

This Subsidence Status Management Report fulfils the requirements of Condition 19 of the Baal Bone Subsidence Management Plan (SMP) Longwalls 29 to 31 Approval Conditions. This is the ninth report and covers the period 8th August 2010 to 7th December 2010.

2 PURPOSE AND SCOPE

The purpose of this document is to report the progress of mining, provide a summary of subsidence impacts, the implemented management processes and consultation with relevant stakeholders. It also provides the opportunity for relevant stakeholders to provide feedback as required under Condition 19.

3 FACE POSITION OF THE LONGWALL

Longwall production in the second panel (LW30) of the SMP area commenced on 11 June 2010 and retreated 401m at 7 August 2010.

During the reporting period the faceline has retreated 1006m, from chainage 1217m to chainage 211m. As of 7 December 2010, the faceline of LW30 has retreated a total of 1407m.

4 SUMMARY OF SUBSIDENCE MANAGEMENT ACTIONS

Subsidence management actions undertaken throughout this reporting period are outlined below.

1. Continuation of weekly surface inspections.
2. Continuation of ongoing flora, fauna and groundwater quality monitoring programs.
3. Routine monitoring of groundwater piezometer levels.
4. Continuation of stress cell monitoring adjacent to Wolgan Escarpment.
5. Survey conducted on monitoring points adjacent to rock shelter.
6. Subsidence survey conducted on Line E.
7. Notification under Condition 18(a) of surface cracking associated with the extraction of LW 30 and also under Condition 18(b) relating to impact of minor cracking in the bed of a small ephemeral watercourse. Continued inspections, various meetings, advice and consultation with the landowner and appropriate departments to develop an acceptable and approved remediation program.
8. Erection of additional warning signs and barrier tape associated with the above cracking and also around the perimeter of the mining area and at strategic points along the various forest tracks that traverse the SMP area; due to loss of signs by theft.

5 CONSULTATION WITH STAKEHOLDERS

Consultation has been conducted with the following stakeholders during this reporting period in relation to the notification under Condition 18(a) and (b).

Dr Gang Li – Principal Subsidence Engineer, Industry & Investment NSW - Notification

Chris Rudens – Environmental Sustainability Branch, Industry & Investment NSW - Notification, inspections and meetings.

Dan Kirby – Environment Compliance Officer and Gavin Jeffries – Regional Manager, Forests NSW - - Notification, inspections and meetings.

Mark Mignanelli – Manager, Major Projects and Mining Assessments – NSW Office of Water – Notification

Andrew Helms – Regional Operations Manager, Department of Environment, Climate Change and Water - Notification

Ian Landon-Jones – Executive Director Dam Safety – Sydney Catchment Authority - Notification,

Bruce Hundy – Senior Operations Manager, Soil Conservation Service of NSW – Notification, inspection and meeting.

Additionally correspondence received from Blue Mountains Conservation Society Inc, Dr Brian Marshall, relating to requests for additional information and providing comments on Subsidence Management Reports 6-8 and End of Panel Report – Longwall 29. Several of these comments are addressed in this report with the remainder currently being reviewed and response prepared.

6 SUBSIDENCE DEVELOPMENT, OBSERVED SUBSIDENCE IMPACTS & MONITORING RESULTS

6.1 Surface Subsidence Impacts

At the end of the reporting period the LW30 face has retreated a total of 1407m and was approximately 211m from the end of the panel. Some tension cracking, as predicted, has appeared parallel to the gateroads and across the centre of the panel, including one crack that exceeded predictions.

In accordance with Condition 18, Incident and Ongoing Management Reporting, of the Baal Bone Colliery Longwalls 29-31 Approval Conditions, notification was provided for the following impacts

Condition 18(a) requires notification of *any significant unpredicted and/or higher-than-predicted subsidence and/or abnormalities in the development of subsidence.*

The first exceedance reported related to the width of a tension crack around the start of Longwall 30 at Baal Bone Colliery. The Trigger Action Response Plan (TARP), contained within Baal Bone's LW29-31 SMP Land Management Plan (Revision 2, June 2009), states that surface cracking > 200mm in width constitutes a major impact and initially requires notification to the Interagency Committee, the PSE and other appropriate parties under SMP Approval Condition 18.

Condition 18(b) requires notification of *any exceedance of predicted impacts on surface and groundwater resources and/or natural environment that may have been caused (whether partly or wholly) by subsidence*.

The second exceedance reported concerned a minor impact on surface watercourses as defined by the TARP contained with Baal Bone's LW29-31 SMP Environmental Monitoring Program

(Revision 1, May 2009). This impact relates to potential bed damage in a watercourse where water is seen to disappear and initially requires notification to the appropriate parties under SMP Approval Condition 18.

It should be noted that both of the subsidence impacts as notified above are related to the same set of circumstances at the start of Longwall 30 (LW30).

Routine inspections of the surface above LW30 first identified initial cracking around the start area on of the 9th of July 2010. At that time the width of the crack was within the predicted range, however a file note was made to recheck the area regularly as there was a relatively steep slope below the crack, which also ran in roughly the same direction as the longwall retreat.

Weekly visual monitoring was continued and during the inspection of 23 July 2010 it was confirmed that the width of the crack had developed to a point where it was more than likely going to trigger the TARP. A verbal notification of the situation was subsequently made to the Acting Subsidence Executive Officer (I&I NSW) and a commitment given to lodge a formal written notification in the event that the situation developed further.

Concurrent with an inspection on 30 July 2010, Baal Bone erected additional warning signs in the vicinity and barrier tape was placed along several sections of the crack.

Pre-emptive discussions and a site inspection were conducted with the Soil Conservation Service (Lithgow) to evaluate the most suitable remediation procedure and initial contact was made with Forests NSW (Macquarie Region) to confirm specific approval and/or other requirements they may have in regards to the undertaking of site works.

Dr Ken Mills of SCT Operations Pty Ltd was also contacted and asked to review the location and magnitude of this subsidence crack in the context of experience of subsidence movements and other cracks observed at the mine and elsewhere. Dr Mills provided a report dated 25 August 2010 and in this he noted that:

Our assessment indicates that the location and opening of the subsidence crack at the commencement of Longwall 30 is consistent with the subsidence behaviour expected at the start of a longwall panel in sloping terrain.

At the start of each longwall panel, the two components of horizontal movement occur in the same direction because movement toward the goaf is also the direction of the retreating longwall panel. As a result of the superposition of these horizontal movements, subsidence cracks at the start of each panel are commonly larger than anywhere else in the panel.

Horizontal subsidence movements in sloping terrain are typically observed to occur in a direction toward the valley floor (i.e. a downslope direction). These movements are caused by lateral strata dilation that occurs as the ground subsides vertically. In sloping terrain, this lateral dilation is unopposed on the valley side with the result that the ground moves laterally toward the valley. The magnitude of downslope movements varies with the geological setting and the steepness of the slope but movements of up to 30% of vertical subsidence or 500mm are typical in moderately steep terrain such as that at the beginning of Longwall 30. The mechanism that causes downslope horizontal movements also causes stretching or tensile cracking at the top of slopes and compression, valley closure, and upsidence in the bottom of valleys.

At the start of Longwall 30, the coincidence of a slope in the direction of mining and the start of the panel has led to coincidence of systematic horizontal movements and downslope movements. The observed subsidence cracking is the culmination of these two horizontal movements.

Baal Bone's routine inspection of 27 August 2010 confirmed that the magnitude and extent of impact had increased significantly, and that a major impact, as defined by the TARP in the LW29-31 Land Management Plan, had occurred.

Even though additional signs and barrier tape were installed, due to the location of the area, inspection frequency was increased to three times weekly for a period.

Further, as part of the surface inspection conducted on 27 August 2010, it was confirmed that the same subsidence event(s) has potentially caused a degree of damage to the bed of a small, unnamed ephemeral drainage channel nearby. Water was observed disappearing into a small area of the bed of the channel.

Further responses and action as defined in the TARP, include a site inspection with specialist soil conservationist, Forests NSW and other relevant Government Departments with the view to discussing and confirming an appropriate level of action/remediation.

Following various meetings, site inspections and consultation a remediation plan, including a review of Environmental Factors was developed and approved in conjunction with officers of Industry and Investment NSW and Forests NSW.

These remediation works will be conducted once appropriate weather and ground conditions prevail.

There have been no subsidence impacts observed outside the nominated angle of draw.

6.1.1 Wolgan Escarpment

Stress change monitoring instruments have been installed and commissioned in the vicinity of the two pinch points on LW31. Stress changes in the rock strata are being monitored using a remote logger as Longwalls 29, 30 and 31 are progressively extracted. Stress cells are logged on a twice daily cycle and information downloaded periodically for analysis by SCT Operations.

A review of installations and monitoring data is currently being prepared as LW30 approaches completion and will be included in the End of Panel report for Longwall 30.

A paper “In situ stress measurements using the ANZI stress cell” is attached as Appendix A to assist in understanding the measurements previously reported and the details in the review once completed.

The gauges on the instrument are numbered 1 to 18, with 1 to 6 being the circumferential gauges, 7 to 9 being axial and 10 to 18 being 45 to 135 degrees to the borehole axis.

Gauge orientation is described by two angles. The Alpha angle is the orientation relativ eto the north measured clockwise around the hole looking into the hole. The Beta angle is the angle of the gauge relative to the axis of the borehole.) degrees is and axial gauge, 90 degrees is a circumferential gauge.

Gauge	Alpha	Beta
1	0	90
2	60	90
3	120	90
4	180	90
5	240	90
6	300	90
7	0	0
8	120	0
9	240	0
10	0	135
11	60	45
12	60	135
13	120	135
14	180	45
15	180	135

16	240	135
17	300	45
18	300	135

Two plots showing the recent data are included below. There are several periods with no data due to logger failure.

Table 1 – Southern Stress Cell (BBO20) Monitoring

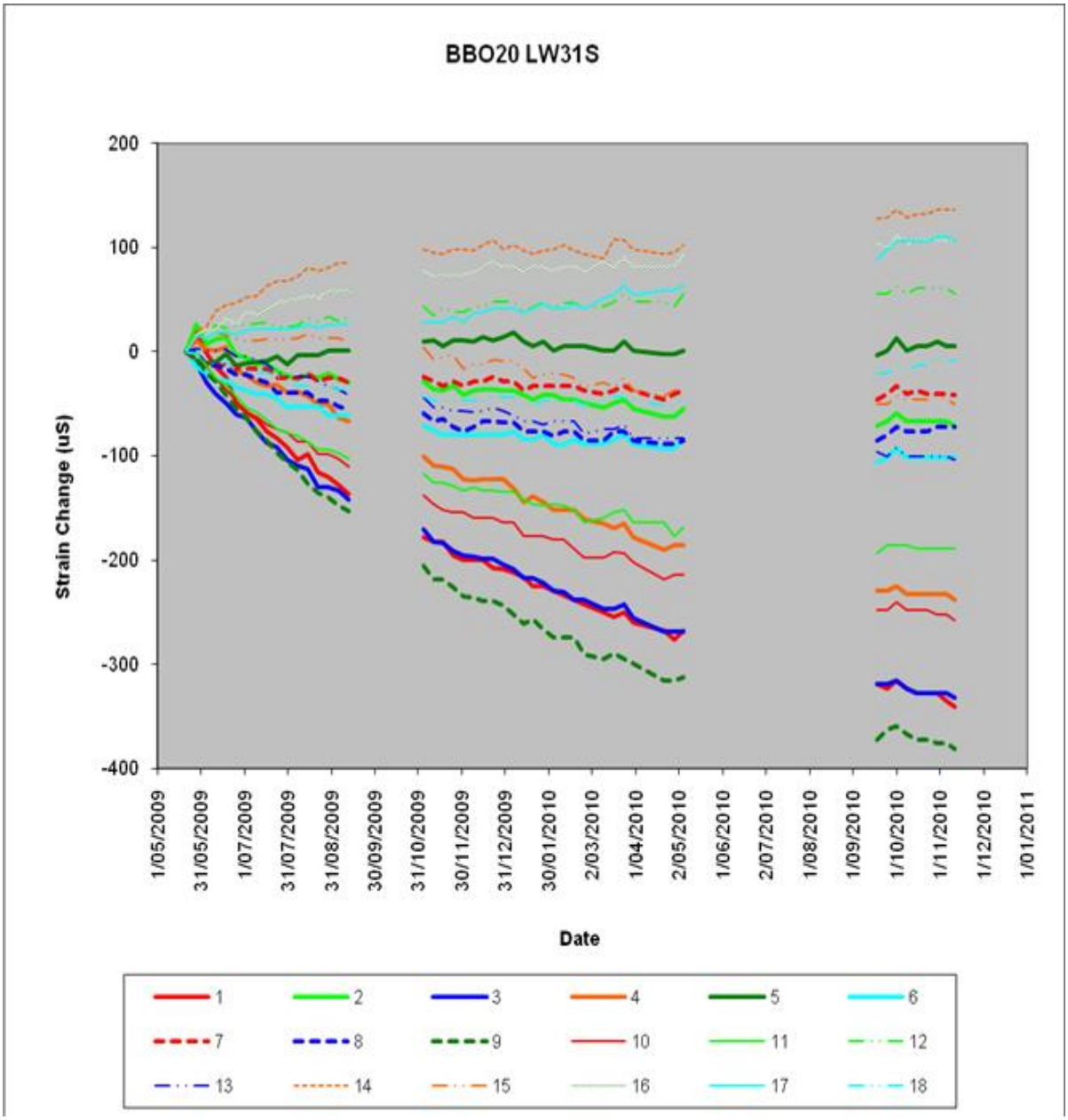
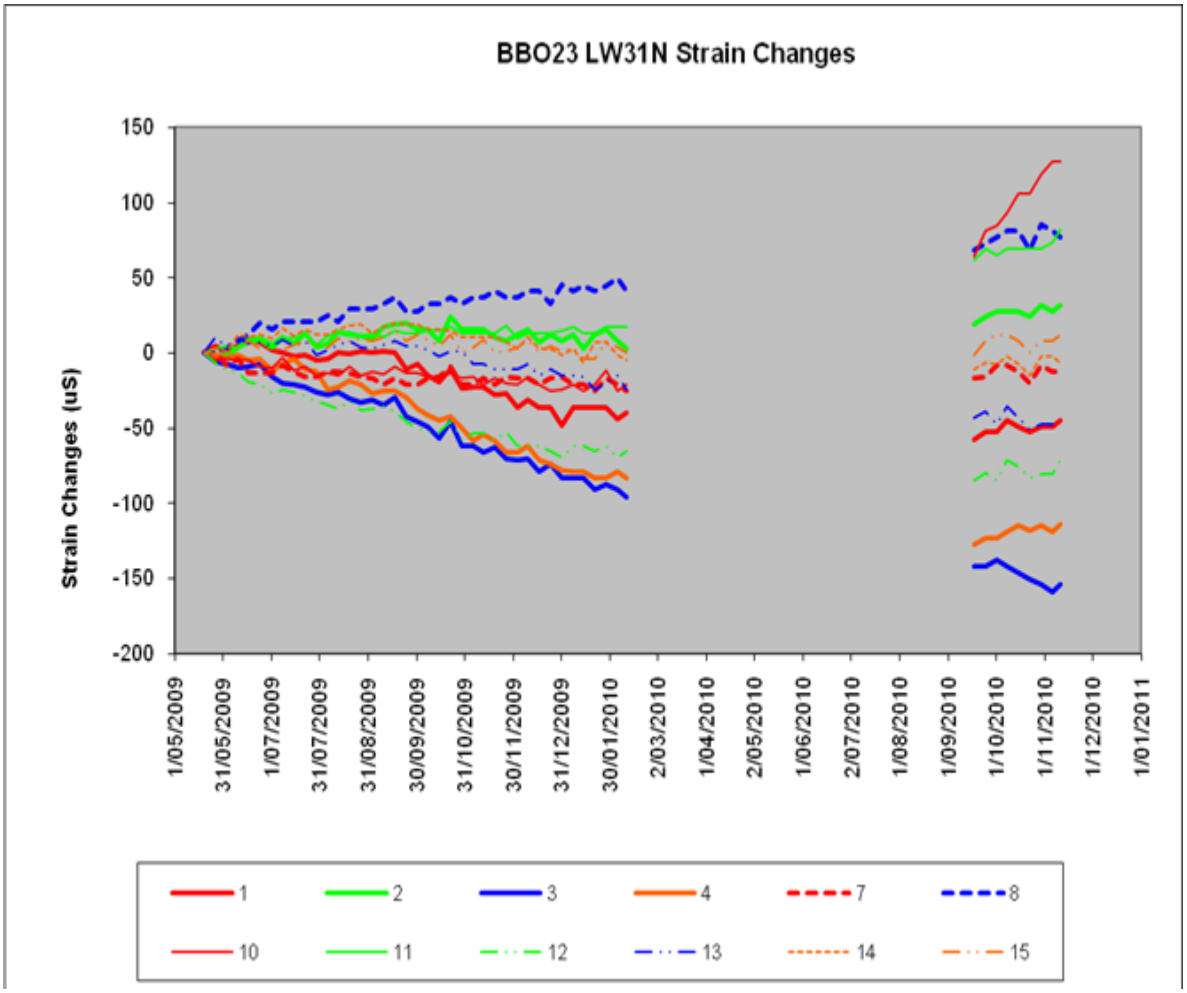


Table 2 – Northern Stress Cell (BBO23) Monitoring



6.1.2 Rock Features

To date there has been no adverse or unpredicted subsidence impacts on identified rock features in the vicinity of the SMP area.

6.1.3 Surface Drainage Depressions

To date there has been one unpredicted subsidence impacts observed on surface drainage depressions within the SMP area, details of which are included in **Section 6.1.** Apart from this incident some minor fractures, within predicted ranges and below TARP trigger values, as identified in the SMP Environmental Monitoring Program, have been identified.

Inspections of the area during or immediately following runoff producing rainfall events (ie. 25mm / 24 hour period) has continued during longwall mining; there has been no observable change to pre-mining flow characteristics and/or stream morphology apart from the area noted in **Section 6.1**.

6.1.4 Fire Trails and Tracks

To date there have been no subsidence impacts on any fire trails or tracks in the SMP area; ongoing weekly inspections are continuing.

6.1.5 Swamp

Seasonal photographic monitoring of the Coxs River Swamp has continued as scheduled.

6.1.6 Fauna

Four sites within and near the Baal Bone Colliery Longwall 29-31 SMP Area were surveyed for fauna by Biodiversity Monitoring Services during December 2010 and January 2011. Three of these sites have been surveyed since 2005.

Seven native mammal (plus two introduced), 50 bird, six reptile and three amphibian species were recorded from within or near the SMP area. Calculations of diversity indices were undertaken and are provided in **Table 3.**

Table 3 - Biodiversity Indices for Fauna in Baal Bone SMP Area During Spring

Diversity Index	Birds 2005	Birds 2006	Birds 2007	Birds 2008	Birds 2009	Birds 2010
Evenness	0.872	0.871	0.876	0.880	0.833	0.864
Simpson (1-D)	0.93	0.94	0.927	0.934	0.945	0.955
Total Numbers	117	187	145	209	549	433
Species Richness	30	36	35	34	51	50

Diversity Index	Native Mammals 2005	Native Mammals 2006	Native Mammals 2007	Native Mammals 2008	Native Mammals 2009	Native Mammals 2010
Evenness	0.911	0.733	0.753	0.890	0.807	0.920
Simpson (1-D)	0.806	0.707	0.683	0.789	0.764	0.817
Total Numbers	14	52	41	17	69	48
Species Richness	7	7	7	7	9	7

Table 4 – Evenness and Simpson (1-D) Diversity Birds

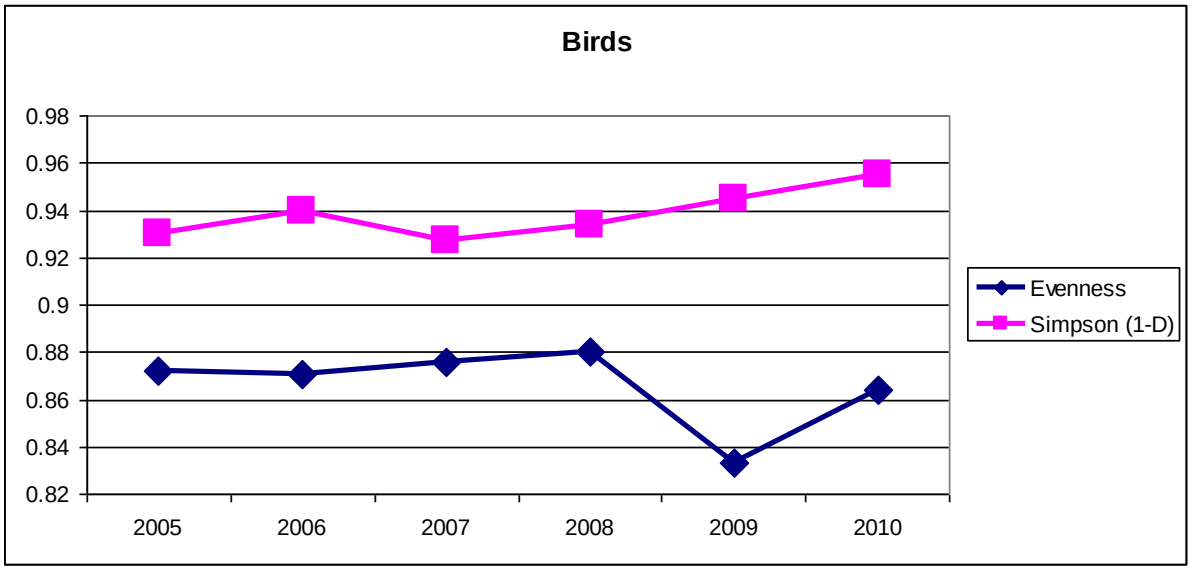
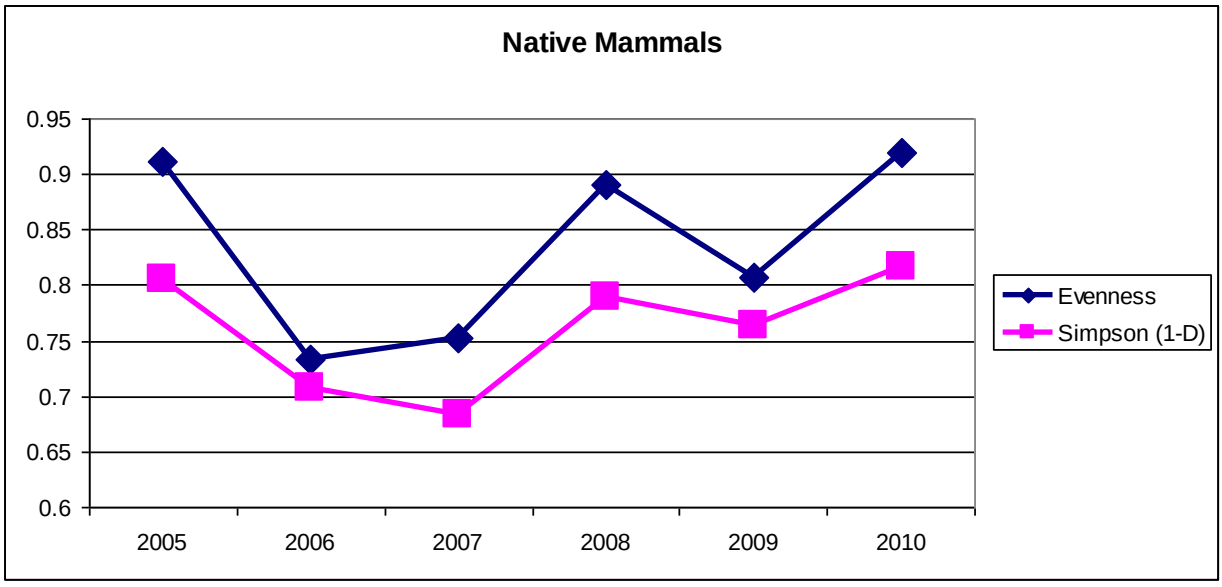


Table 5 – Evenness and Simpson (1-D) Diversity Native Mammals



Statistical analysis (non-parametric Kruskal-Wallis One Way Analysis of Variance on Ranks) of these results shows no significant differences for the biodiversity indices over the years. However, over the years there has been a slight upward trend in most biodiversity indices.

The total numbers of individuals located this year are less than that recorded during the 2009 spring survey. This is probably due to the extreme weather conditions experienced in 2010.

Estimation of Diversity

Because of the accumulation of data under formal survey conditions (consistent survey effort and techniques at each survey site) it is possible to calculate some comparisons and relationships from the results of the survey.

Total numbers and species richness (number of species per site) are the simplest measures used to determine biodiversity of a site. However, these indices miss the information that some species may be rare and others common. The Simpson's Index of Dominance (D) takes into account both the abundance patterns and the species richness of a community. This index measures the probability that two individuals randomly selected from a sample will belong to the same species (or some category other than species). Simpson's Index is either expressed as D or as 1-D (Simpson's Index of Diversity). When using D alone, 0 represents infinite diversity and 1, no diversity. When using 1-D, the opposite is true i.e. the higher the score the greater the diversity. It was possible to calculate Simpson's Index of Diversity for mammal, bird and reptile populations from each survey site for most survey periods.

An evenness score was also calculated. Evenness is a measure of the relative abundance of different species making up the richness of an area. A low value for evenness means that the sample is dominated by a large number of one or two species. A high evenness value means that most species in the sample have a similar abundance.

There are now sufficient numbers and diversities of the fauna groups monitored to be able to calculate a set of diversity indices that form part of the baseline monitoring database. In addition, these factors can now be tracked over a number of years (2005 to 2010) and seasons to provide useful monitoring data to assess any changes in biodiversity values in the LW29-31 SMP Area.

Three threatened species were recorded within the area during the spring surveys. These were the Gang-gang Cockatoo, Flame Robin and Scarlet Robin. In addition, many woodland dependant bird species were located. Although small numbers, the trapping results gave larger densities of small ground mammals than in previous years. Several young male antechinus were captured in addition to a female captured in autumn 2010.

It is now possible to assess any differences in the biodiversity and habitat condition of those sites sampling an area that has been subject to underground mining and shows signs of subsidence activity. This comparison showed that there are no significant differences in the biodiversity and habitat complexity over the years. It is concluded that, at present, there are no discernable impacts from underground mining of LW29-31 at Baal Bone Colliery upon the fauna on the surface. A full analysis of the year's data will be undertaken after the summer survey.

6.1.7 Flora

Gingra Ecological Surveys submitted their Spring 2010 survey on 8 December 2010; the results of which are reported below.

Prior to the establishment of monitoring sites the SMP area was the subject of a flora survey conducted over a 3 day period in October 2005.

Systematic vegetation monitoring quadrats were established within the SMP area in January 2007. The spring survey took place on 29th October and 17th November 2010.

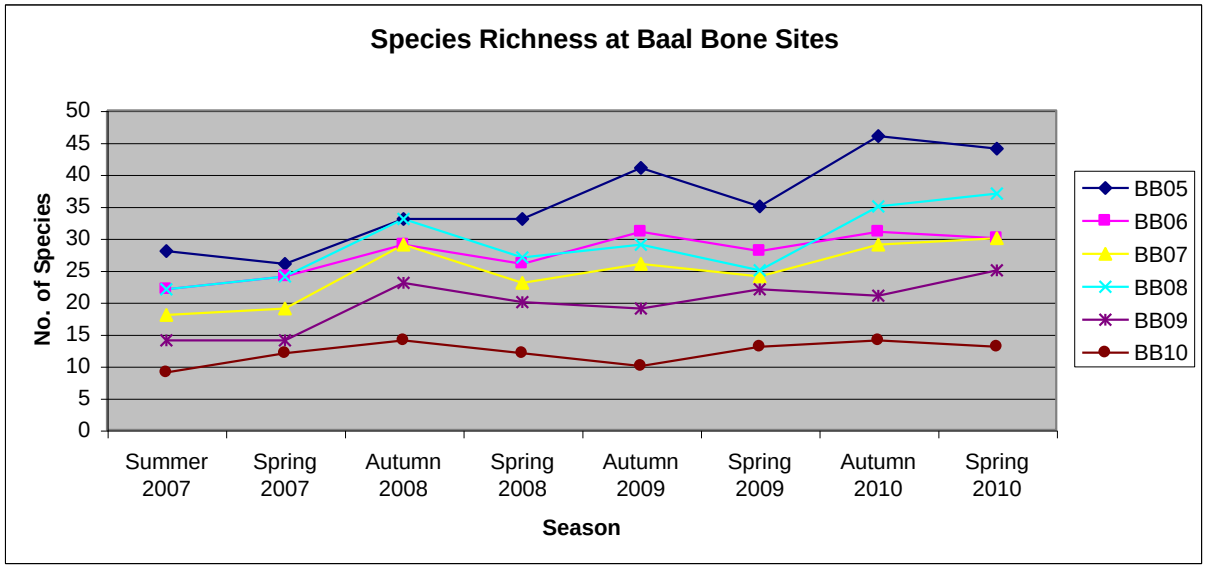
Plant Species Diversity

Species diversity records for the Baal Bone Colliery sites are presented graphically in **Table 6** below. The results show that levels of species diversity recorded in 2010 were at or above the previously recorded range at each site. Figure 1 shows total number of species recorded across all sites during spring and autumn monitoring since the baseline data was obtained.

At the woodlands sites BB07 and BB08, and the swamp site, BB09, species diversity in spring 2010 was higher than at any other sampling over the monitoring period.

The species count for the Tablelands Sheltered Valley Woodland at BB05 is consistently higher than for other sites reflecting higher productivity at that site related to soil fertility and water availability.

Table 6 - Species Richness at Baal Bone Vegetation Monitoring Sites



Weed Species

Four exotic species, Yorkshire Fog (*Holcus lanatus*), Catsear (*Hypochaeris radicata*), Fleabane (*Conyza* sp.) and Spear Thistle (*Cirsium vulgare*) have been recorded over a total of five sites.

Yorkshire Fog has increased in abundance at Long Swamp over the monitoring period (2007 to 2010). This appears to be related to improved seasonal conditions. Catsear has now been recorded at five sites. This also is related to improved seasonal conditions, in particular the break from the long term drought in south-eastern Australia. Similar observations have been recorded at other sites in the Great Lithgow area.

No exotic species were recorded at BB06 over the monitoring period.

Changes in Plant Species Distribution and Abundance

A number of species were recorded for the first time from individual quadrats in 2010. Many of these were orchids and other herbaceous species which are difficult to detect when not flowering. Rainfall during 2009 and 2010 is believed to have triggered growth and flowering of these species. They include the following species in woodland quadrats; Mosquito Orchid (*Acianthus* sp.), Fairy Orchid (*Caladenia* sp.), Hyacinth Orchid (*Dipodium punctatum*), a pennywort (*Hydrocotyle peduncularis*), *Nertera granadensis*, *Pratia surrepans*, Spreading Fan-fern (*Sticherus lobatus*), Button Everlasting (*Coronidium scorpioides*), a bluebell (*Wahlenbergia luteola*) and *Senecio prenanthoides,* and the swamp species; *Euchiton involucratus*, *Dichelachne parva*, Gunn's Willow-herb (*Epilobium gunnianum*) and *Galium gaudichaudii*.

The vegetation monitoring being undertaken is conducted in a manner which allows assessment against a number of indicators which may provide evidence of an effect of subsidence.

Gross species diversity records do not necessarily provide a clear indication of an effect of mining. Experience from other mines in the Lithgow area indicates that there is a seasonal response, with grasses, orchids and other ground layer plants being detected in spring, summer and autumn, but not winter. Periods of relatively low rainfall, such as that experienced in 2006 and for periods in 2007, including July to October, may result in a seasonal failure in growth of these groups of plants, leading to lower rates of species diversity than in seasons of average or above average rainfall. The return to average or above average rainfall during 2009 and 2010 has facilitated growth of these species. This is reflected in species richness at the woodland and swamp sites with higher levels recorded during 2010 in comparison to those recorded in 2007 and 2008.

There has an increase in the detection of weed species, with Yorkshire Fog being more abundant in 2009 and 2010, than recorded in 2007 and Catsear recorded at more sites (but with low abundance at each of these sites). In the case of the study area the response related to increased rainfall rather than an impact of subsidence.

The results from sampling of vegetation at Long Swamp survey sites in autumn and spring 2010 do not indicate any effect of subsidence on plant species diversity, plant species composition or weed invasion. The swamp was wetter in spring 2010 than at any time during the monitoring period (2007-2010).

6.1.8 Underground Water Make

Data continues to be collected from the mines dewatering bores, flow meters and data loggers regarding mines water discharges and underground water storage levels. Review of this data is continuing and the mine water model is currently being reviewed along with the post-closure mine water make model for inclusion in Baal Bone's Detailed Mine Closure Plan.

6.1.9 Ground Water

Aurecon monitors data loggers in the six piezometers on a regular basis to gather baseline data regarding groundwater level fluctuations in the vicinity of the Coxs River Swamp. Baseline data obtained prior to commencement of mining confirms a strong correlation between groundwater levels and prevailing climatic conditions, most particularly the relationship to rainfall.

Groundwater levels earlier in 2009 had not reached pre-mining levels, part of the reason was considered to be the below average rainfalls. More importantly it was observed that the pattern of groundwater response to rainfall had returned to normal in BBP2 and BBP3. The latest data has confirmed this contention.

In October and November the rainfall in this area was above average. In October the 70mm at Lithgow was only just above average, while the 99mm in November was well above the average of 69mm.

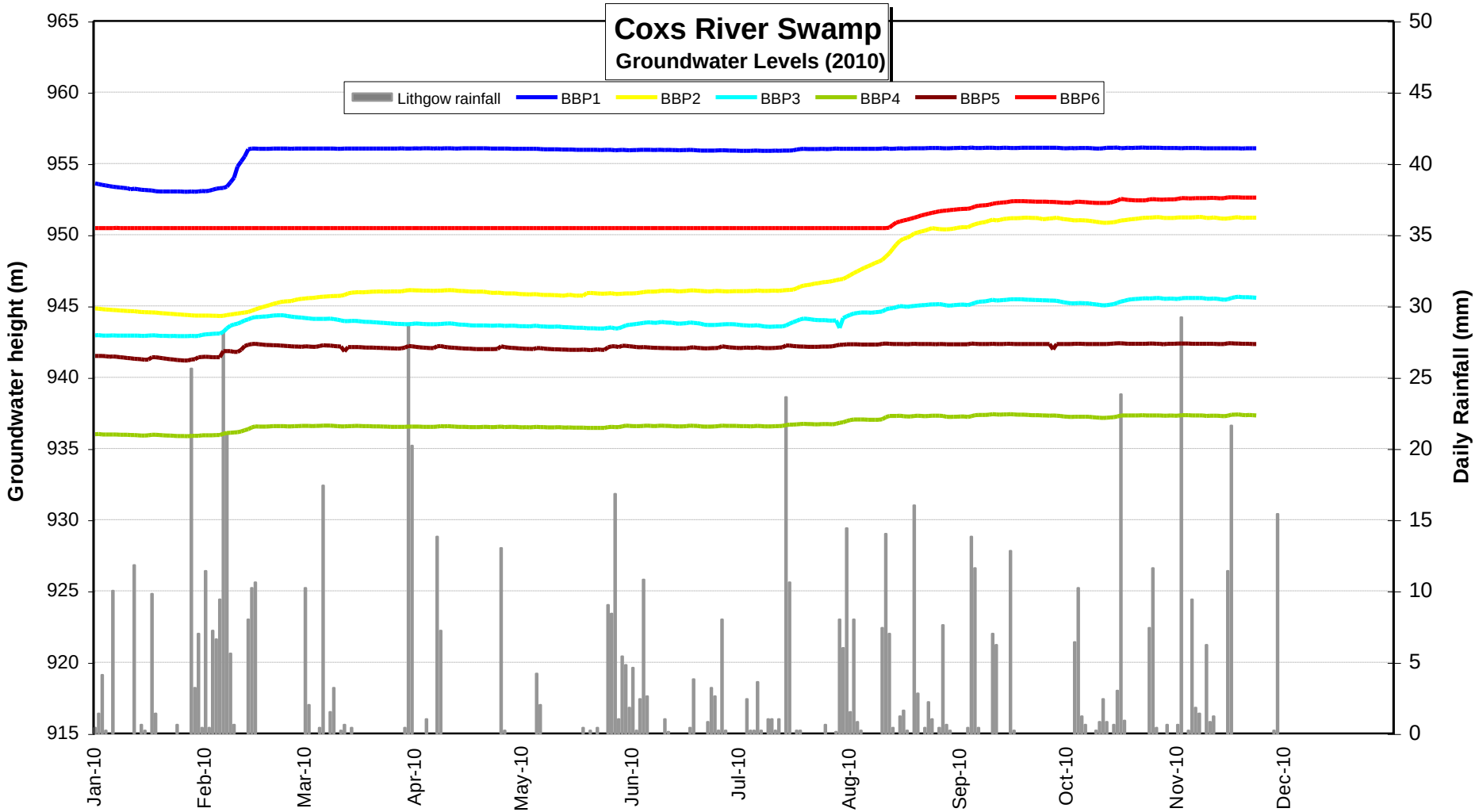
This rainfall has produced rising groundwater levels in all of the bores except BBP1, which has shown a stable groundwater level since February 2010. There is obviously still some influence from the fault zone at this site as the groundwater level is below pre-mining levels. The fault zone lies between the BBP1 and the swamp, so there is unlikely to be any hydraulic connection between the zone of depleted groundwater and the swamp. The groundwater level at BBP1 is still higher than the groundwater level in the swamp so that even if there is a connection across the fault, groundwater flow would still be towards the swamp.

The groundwater level in BBP2 has recovered significantly since February 2010 and is now at the same level a sit was just before mining commenced. Above average rainfall in August 2010 has raised the groundwater level more than would be normally expected, which indicates that the excess infiltration appears to have replaced the groundwater drained. More importantly the pattern of groundwater response to rainfall is still normal and any remaining deficiency in the groundwater caused by the activity on the fault will be replaced by excess infiltration from future rainfall events. The groundwater level behaviour also indicates that clearly that there has been negligible drainage of groundwater into the goaf. If a connection between the goaf and the aquifer was responsible for the initial drop in groundwater level there would have been no recovery in the groundwater level in this bore.

BBP3 shows a groundwater level that is above its pre-mining level and responds to rainfall event in an identical fashion to that displayed before mining. There is no evidence of any mining impact sat this site. BBP4 is well downstream and was not impacted by mining. It continues to show normal groundwater behaviour.

Both of the bores in the swamp (BBP5 and BBP6) now have groundwater levels that are higher than previously measured in the period since monitoring commenced, and are responding normally to the climatic conditions. This is due to the consistent rainfall conditions over the past 6 months. The monitoring data confirms that there has been no measurable impact from mining on the swamp.

Table 7- Coxs River Swamp Groundwater Levels



6.2 Subsidence Development (Summary of Survey Results)

A post mining survey of the rock shelter marks was conducted on 29 October 2010 with subsidence and westward movement measured but no impacts.

A further survey of the Subsidence E Line was conducted on 10 December 2010. Results of this survey is within the predicted ranges as presented in **Table 8** below.

Table 8 - Comparison of Subsidence Monitoring Results to SMP Predictions – E Line

Monitoring Item	SMP Prediction	Survey 13/05/09	Survey10/12/10
Subsidence	1400 – 1600mm	1400mm	1538mm
Strain	9 – 21mm/m	5.7mm/m	13.7mm/m
Tilt	32 – 52mm/m	22.3mm/m	23.2mm/m
Horizontal Movement	400mm	121mm	188mm

7 ADEQUACY, QUALITY AND EFFECTIVENESS

The adequacy, quality and effectiveness of the implemented management response processes, based on compliance with approval conditions, are considered to be satisfactory to date. Notification, consultation and development of a remediation program with regard to the surface cracking are also considered to be appropriate.

8 PROPOSED ADDITIONAL / OUTSTANDING MANAGEMENT ACTIONS

As discussed above in Section 6.1 additional management actions and response procedures have been implemented in accordance with the approved Management Plans and Approval conditions. The approved remediation will be implemented when weather and surface conditions permit. While ongoing monitoring and review of the groundwater and stress cell information is continuing, there is no proposal at this stage to implement any additional management actions.

9 CONCLUSIONS

During the reporting period the faceline of LW30 has retreated 1006m, from chainage 1217m to chainage 211m. As of 7 December 2010, the faceline of LW30 has retreated a total of 1407m.

Routine scientific and survey monitoring of impacts on rock features, escarpments, and surface and groundwater regimes continued, as did seasonal monitoring of flora and fauna.

Anomalous groundwater behaviour in several monitoring bores as reported previously appears to have stabilised and is showing signs of normalising.

All other monitoring results are within expected / predicted parameters with the exception of the cracking noted in **Section 6.1**. Routine and scheduled seasonal monitoring will continue.

FIGURE 1: Proposed Subsidence Survey and Data Monitoring Locations (Source: *Baal Bone Colliery LW29-31 SMP Subsidence Monitoring Program*)

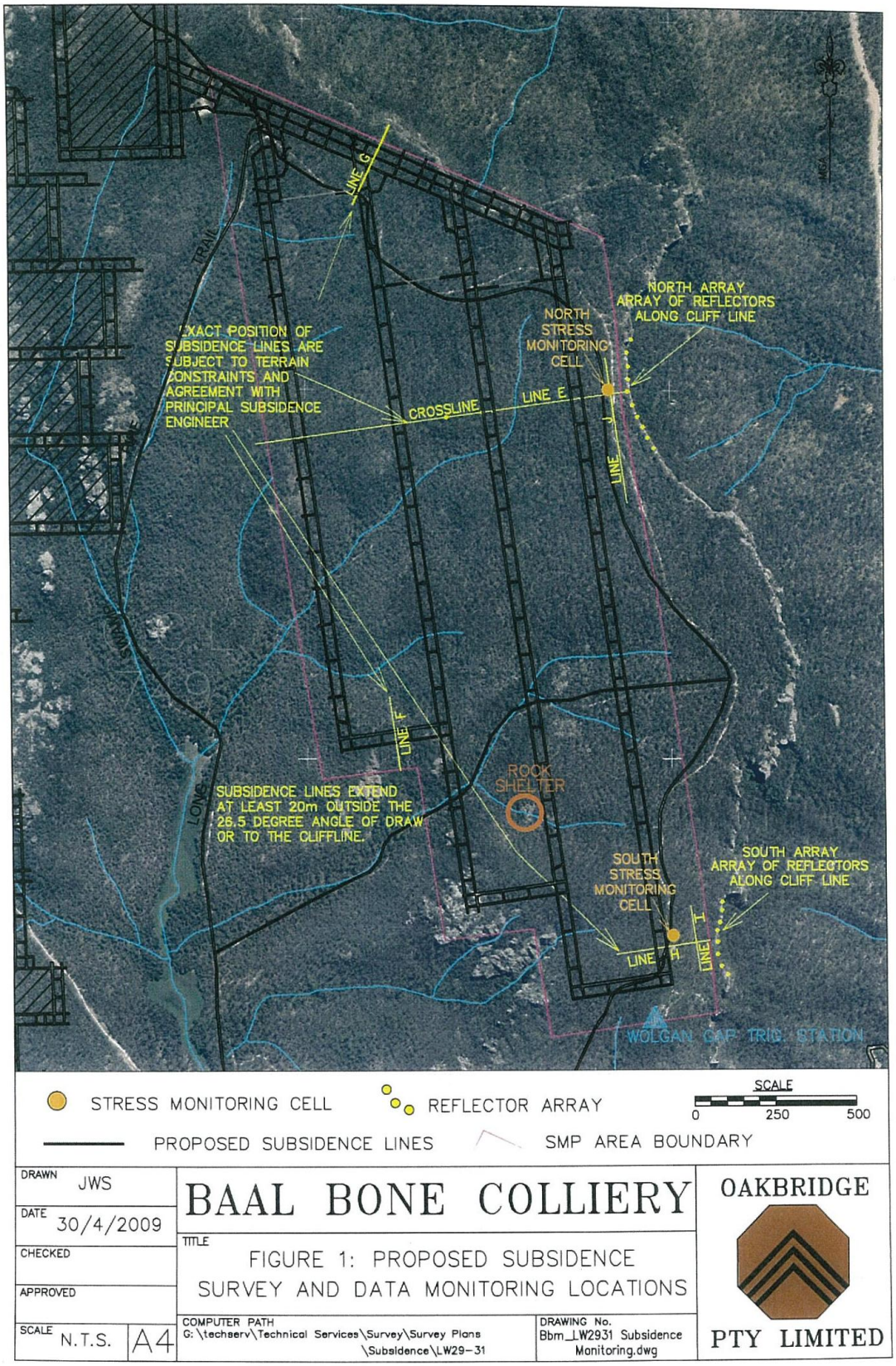


FIGURE 1B: Location of Groundwater Observation Bores and Geological Structures

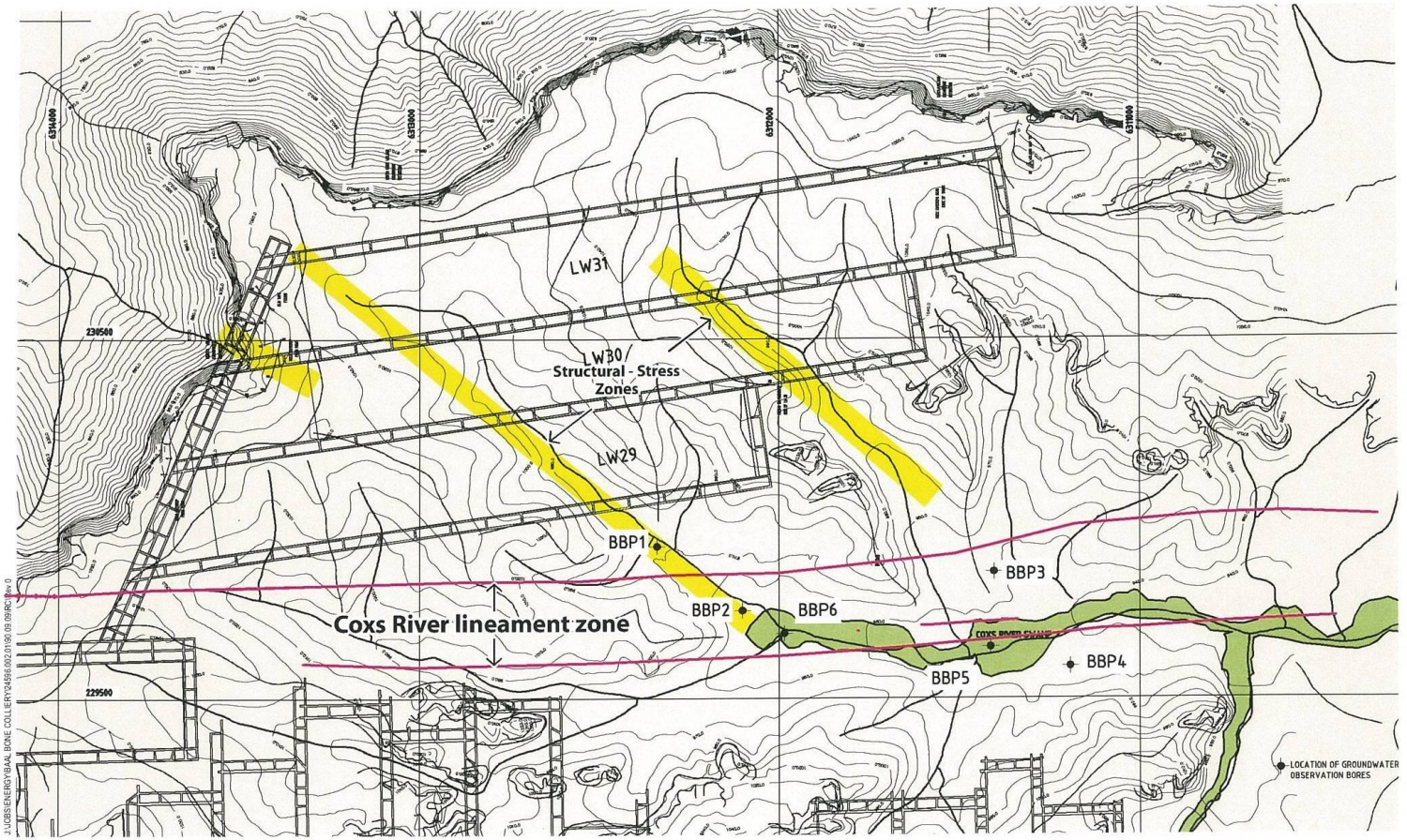


FIGURE 1C: Survey Monitoring and Stress Cell Location of North Pinch Point Area

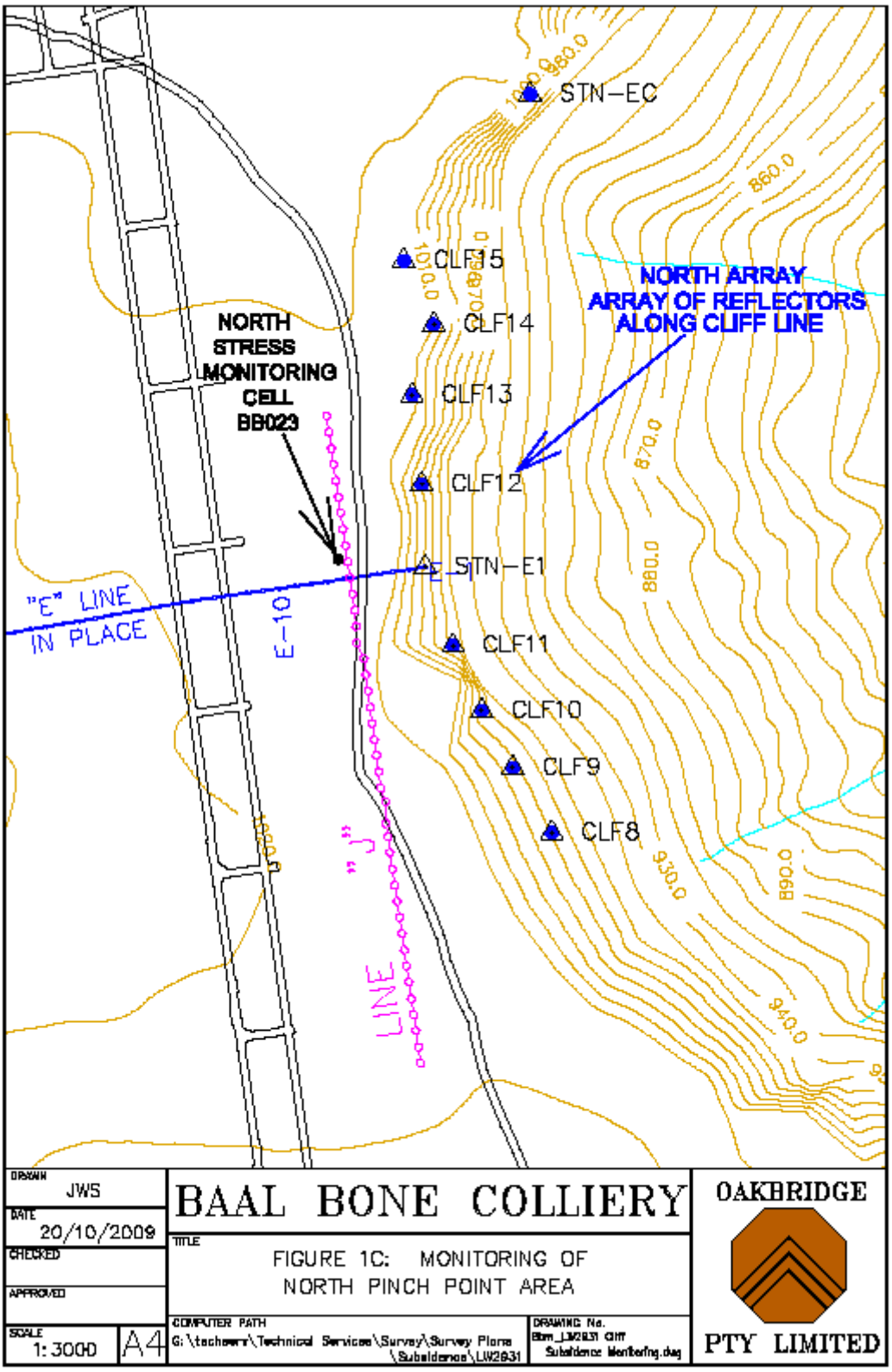


FIGURE 1D: Survey Monitoring and Stress Cell Location of South Pinch Point Area

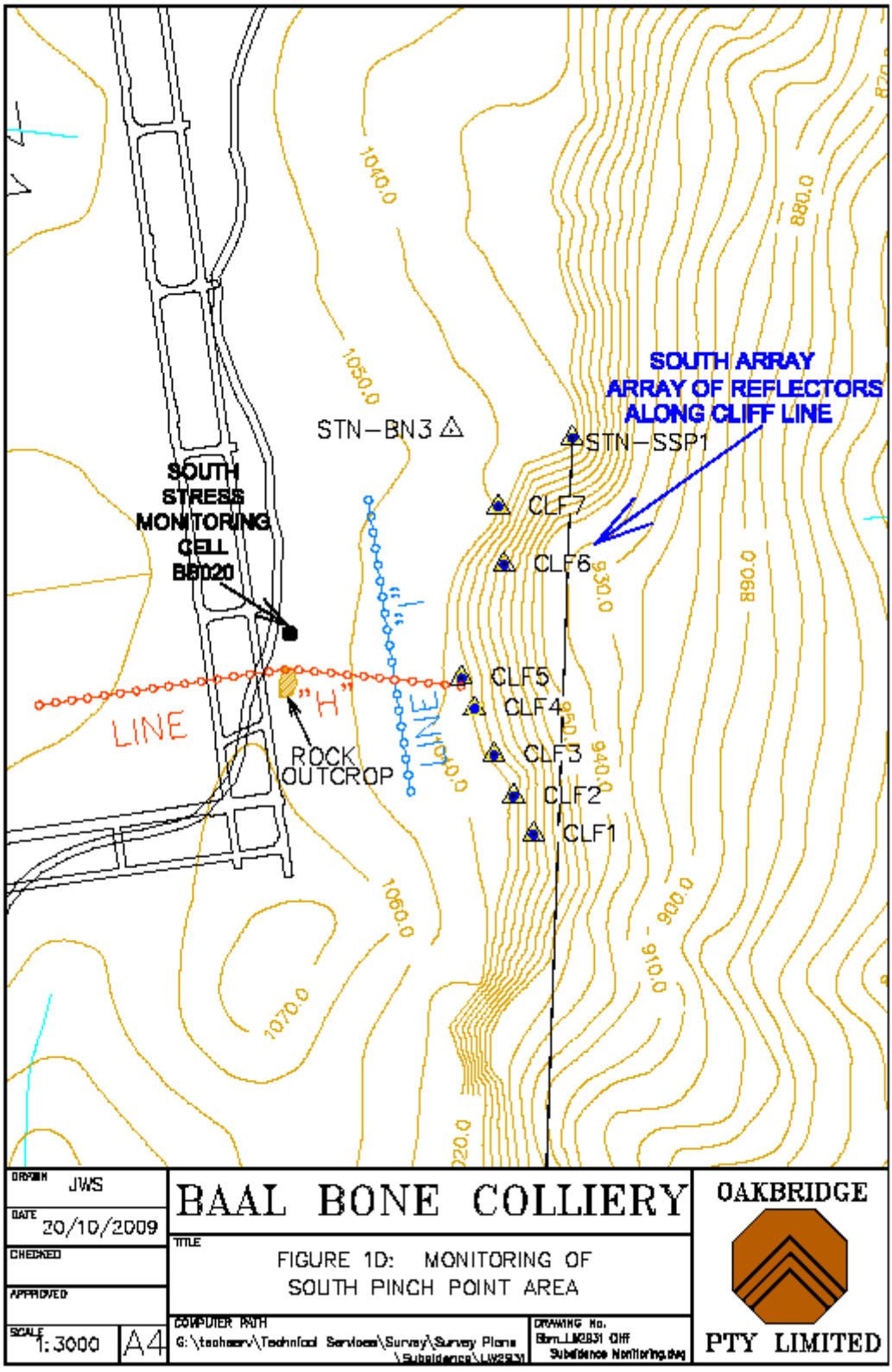


FIGURE 2 – Longwall Extraction Timing