BAAL BONE COLLIERY
OPERATED BY THE WALLERAWANG COLLIERIES LIMITED

BAAL BONE COLLIERY
LW29-31 SMP Area

Subsidence Management Status Report No.14

for the period

8th April 2012 to 7th August 2012

December 2012

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1 INTRODUCTION

This Subsidence Management Status Report fulfils the requirements of Condition 19 of the Baal Bone Subsidence Management Plan (SMP) Longwalls 29 to 31 Approval Conditions. This is the fourteenth four monthly status report and covers the period 8 April 2012 to 7 August 2012.

Extraction of Longwall 31 (LW31) was completed on 3 September 2011.

Summaries of monitoring results post completion of LW 31 are presented in this report. Subsidence surveys, photographic monitoring and visual inspections were conducted in accordance with the approved Subsidence Monitoring Programs with environmental monitoring conducted in accordance with the approved Environmental Monitoring Programs.

2 PURPOSE AND SCOPE

The purpose of this document is to provide a summary of environmental and subsidence monitoring results, impacts, trends, analysis, the implemented management processes and consultation with relevant stakeholders following completion of mining in the LW 29-31 area. It also provides the opportunity for relevant stakeholders to provide feedback as required under the relevant approval Condition 19.

3 SUMMARY OF SUBSIDENCE MANAGEMENT ACTIONS

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

1. Continuation of regular surface inspections.
2. Continuation of ongoing groundwater quality monitoring programs.
3. Routine monitoring of groundwater piezometer levels.
4. A risk assessment to determine appropriate remediation methods for subsidence cracking above LW 29-31 was conducted.

4 CONSULTATION WITH STAKEHOLDERS

Consultation has been conducted with the following stakeholders during this reporting period:

- An inspection of subsidence cracking above LW 29-31 was carried out with Chris Rudens from the Department of Trade and Investment, Resources and Energy (DTIRE) – Environmental Sustainability Unit on 4 May 2012. A risk assessment to determine appropriate remediation methods for the identified subsidence cracking was held on 5 June 2012 with representatives from Baal Bone Colliery, Forests NSW, Soil Conservation Service, and SCT Operations. Subsequently a Review of Environmental Factors for the repair of the subsidence cracking was submitted to DTIRE.
- On 22 May 2012 Baal Bone held a Community Consultative Committee onsite.
- On 5 June 2012 Baal Bone held an Annual Environmental Management Report meeting, and End of Panel meeting for regulatory authorities. Representatives from DTIRE – Environmental Sustainability Unit, Forests NSW. Lithgow City Council, NSW Office of Water and Environment Protection Authority attended the meeting and site inspection.
- Representatives from community and cultural groups were invited to attend an End of Panel meeting to be held at Baal Bone Colliery on 20 June 2012.
- On 2 August 2012 representatives from Baal Bone Colliery, Lithgow City Council, Environment Protection Authority, the Principal Subsidence Engineer and a local landowner inspected a landslip event which had occurred on private property to the east of Baal Bone's Longwall 31.

5 SUMMARY OF SUBSIDENCE IMPACTS

Mining operations for LW 31 were completed in September 2011. Mining height was nominally 2.5m while seam thickness varies between 2.1m to 2.3m. Overburden ranges in thickness generally from 190m to 220m. The full extraction void is 220m wide (which includes the 5m width of development drivage both sides of the longwall block).

The only visible impacts associated with LW 31 observed was some tension cracking, as predicted, parallel to the gate roads and across the centre of the panel. Notification was provided, as required.

An Inspection Plan was developed, approved and implemented to identify, confirm and classify all cracking over the LW 29-31 area. Inspections were conducted and all cracking identified. A Risk Assessment was then conducted, including all relevant parties.

Following this, a Review of Environmental (REF) has been prepared, including flora and fauna studies and remediation program. The REF was accepted by DTIRE and Forests NSW on 8 November 2012. Baal Bone Colliery is currently organising the repair of the subsidence cracks.

Monitoring of groundwater bores for both levels and quality has continued with no observable major impact on groundwater levels due to mining. Exceedances in the following analytes, zinc and iron were registered during 2011 and reported. Notification was provided as required. Studies were conducted and a report from Aurecon provided. These analyte levels returned to “below trigger” values. This is further detailed in **Section 7.9**. Exceedances in zinc and copper have been noted in late 2012, and initial notification was provided to the Principal Subsidence Engineer and Department of Planning and Infrastructure on 16 November 2012. Investigations are currently being carried out, and further notification will be provided upon completion. Refer to **Section 7.9** for further detail.

All required pre-mining, during-mining and post-mining subsidence surveys were completed in accordance with the Subsidence Monitoring Program. Survey results for subsidence, tilt and strain were generally below predicted levels. Some minor exceedances were noted and are detailed in **Section 6**.

No subsidence impacts were observed outside the nominated angle of draw on LW31.

Visual inspections and photographic monitoring of various surface features, including cliffs, roads, tracks and swamp vegetation were also completed, with no adverse or unpredicted impacts observed.

No subsidence impacts were noted generally in relation to flora and fauna.

6 SUBSIDENCE SURVEY SUMMARY, MONITORING AND ANALYSIS

All subsidence surveys and data monitoring as required by Baal Bone Colliery LW 29-31 SMP - Subsidence Monitoring Program (May 2009) have now been completed.

A record of all completed subsidence surveys during and post LW31 extraction period is shown in **Table 1**. Subsidence, tilt and strain results for the LW31 area were generally within the predicted range. A summary of subsidence, strain and tilt results are also detailed with comparison to the SMP predictions.

The minor exceedance on E Line over LW30 has previously been reported. The survey conducted on 23 September 2011 noted that this exceedance had increased to 126mm. The post mining survey conducted on 8 May 2012 noted a further increase of 14mm to a total of 142mm. The distance where this occurred is limited to a length of less than 50 metres.

Table 1 – Summary of Subsidence Survey Results

Line	Survey Date	SMP Prediction Subsidence (mm)	Measured Subsidence (mm)	SMP Prediction Strain (mm/m)	Measured Strain (mm/m)	SMP Prediction Tilt (mm/m)	Measured Tilt (mm/m)	SMP Prediction Horizontal Movement (mm)	Measured Horizontal Movement (mm)
E Line	10-03-2011	1400 – 1600	1638 (LW30)	9 – 21	14.2	32 – 52	27.1	400	216
E Line (LW 31)	12-07-2011		34		9.6		1.0		67
	14-07-2011		32		9.6		1.0		68
	21-07-2011		36		9.6		1.1		68
	26-07-2011		40		9.5		1.0		66
	28-07-2011		44		9.6		1.1		69
	02-08-2011		54		9.8		1.0		66
	05-08-2011		74		9.7		1.0		65
	08-08-2011		84		10.1		1.0		66
	10-08-2011		232		10.4		4.3		123
	12-08-2011		514		9.8		11.2		170
	17-08-2011		1245		9.5		37.5		
	19-08-2011		1340		11.9		42.4		234
	23-08-2011		1397		12.3		43.7		229
	25-08-2011		1415		12.3		43.7		244
	29-08-2011		1436		12.3		43.7		222
	23-09-2011		1726 (LW30)		13.8		43.2		242
	08-05-2012		1742 (LW30)		13.3		43.2		280

Line	Survey Date	SMP Prediction Subsidence (mm)	Measured Subsidence (mm)	SMP Prediction Strain (mm/m)	Measured Strain (mm/m)	SMP Prediction Tilt (mm/m)	Measured Tilt (mm/m)	SMP Prediction Horizontal Movement (mm)	Measured Horizontal Movement (mm)
F Line	21-01-2011	1400 – 1600	1418	9 – 21	12.0	32 – 52	26.1	400	333
	26-09-2011		1434		13.8		26.3		538 (LW29)
G Line	09-03-2011	1400 – 1600	50	9 - 21	2.3	32 – 52	0.9	400	61
	23-09-2011		58		2.5		0.9		44
H Line	21-01-2011	1300 – 1400	5	8 - 14	1.1	27 - 34	0.4	400	24
	06-04-2011		162		1.4		1.8		49
	08-04-2011		199		1.9		2.0		58
	12-04-2011		207		2.5		2.1		64
	15-04-2011		217		3.0		2.1		102
	29-04-2011		234		3.6		2.3		116
	12-05-2011		207		3.7		2.1		94
	26-05-2011		244		3.8		2.4		162
	23-09-2011		251		3.7		2.5		136

Line	Survey Date	SMP Prediction Subsidence (mm)	Measured Subsidence (mm)	SMP Prediction Strain (mm/m)	Measured Strain (mm/m)	SMP Prediction Tilt (mm/m)	Measured Tilt (mm/m)	SMP Prediction Horizontal Movement (mm)	Measured Horizontal Movement (mm)
I Line	21-01-2011	1300 - 1400	5	8 - 14	0.7	27 - 34	0.2		16
	06-04-2011		7		0.9		0.4		13
	08-04-2011		1		0.9		0.3		23
	12-04-2011		4		1.0		0.3		8
	15-04-2011		3		1.0		0.3		16
	29-04-2011		5		1.1		0,2		10
	12-05-2011		4		1.1		0.3		15
	26-05-2011		6		1.1		0.4		30
	23-09-2011		9		0.9		0.2		11

Line	Survey Date	SMP Prediction Subsidence (mm)	Measured Subsidence (mm)	SMP Prediction Strain (mm/m)	Measured Strain (mm/m)	SMP Prediction Tilt (mm/m)	Measured Tilt (mm/m)	SMP Prediction Horizontal Movement (mm)	Measured Horizontal Movement (mm)
J Line	12-07-2011	1300 - 1400	7		0.8		0.5		18
	14-07-2011		4		0.9		0.5		16
	21-07-2011		5		0.9		0.2		27
	26-07-2011		5		0.9		0.3		23
	28-07-2011		8		0.9		0.5		20
	02-08-2011		8		0.9		0.3		38
	05-08-2011		7		0.8		0.3		16
	08-08-2011		7		0.7		0.5		25
	10-08-2011		7		0.8		0.3		120
	12-08-2011		8		0.8		0.3		23
	17-8-2011		12		0.8		0.3		
	19-08-2011		9		0.7		0.4		32
	23-08-2011		8		0.7		0.2		40
	25-08-2011		12		0.9		0.3		17
	29-08-2011		13		0.7		0.3		34
	23-09-2011		15		0.7		0.3		23

Line Northern Pinch Point Reflectors	**Survey Date**	**SMP Prediction Subsidence (mm)**	**Measured Subsidence (mm)**	**SMP Prediction Strain (mm/m)**	**Measured Strain (mm/m)**	**SMP Prediction Tilt (mm/m)**	**Measured Tilt (mm/m)**	**SMP Prediction Horizontal Movement (mm)**	**Measured Horizontal Movement (mm)**
	04-04-2011		+6						12
	12-07-2011		+15						21
	14-07-2011		+14						16
	21-07-2011		+17						17
	26-07-2011		+14						25
	28-07-2011		+19						33
	02-08-2011		+14						43
	05-08-2011		+14						34
	08-08-2011		+17						38
	10-08-2011		+13						34
	12-08-2011		+12						36
	19-08-2011		+14						41
	23-08-2011		+13						39
	25-80-2011		+15						35
	29-08-2011		+14						35
	22-09-2011		+4						45
	08-05-2012		+9						33

Line Northern Pinch Point Prisms	**Survey Date**	**SMP Prediction Subsidence (mm)**	**Measured Subsidence (mm)**	**SMP Prediction Strain (mm/m)**	**Measured Strain (mm/m)**	**SMP Prediction Tilt (mm/m)**	**Measured Tilt (mm/m)**	**SMP Prediction Horizontal Movement (mm)**	**Measured Horizontal Movement (mm)**
	14-07-2011		1						6
	21-07-2011		8						8
	26-07-2011		5						21
	28-07-2011		2						25
	02-08-2011		6						34
	05-08-2011		7						27
	08-08-2011		6						26
	10-08-2011		9						29
	12-08-2011		9						24
	19-08-2011		6						29
	23-08-2011		9						27
	25-08-2011		2						22
	29-08-2011		6						21
	22-09-2011		10						33
	08-05-2012		13						24

Line Southern Pinch Point	Survey Date	SMP Prediction Subsidence (mm)	Measured Subsidence (mm)	SMP Prediction Strain (mm/m)	Measured Strain (mm/m)	SMP Prediction Tilt (mm/m)	Measured Tilt (mm/m)	SMP Prediction Horizontal Movement (mm)	Measured Horizontal Movement (mm)
Reflectors	06-04-2011		14						10
	08-04-2011		14						9
	12-04-2011		14						8
	15-04-2011		17						9
	29-04-2011		14						7
	12-05-2011		12						10
	26-05-2011		15						10
	22-09-2011		14						10
	08-05-2012		14						9
Prisms	06-04-2011		1						8
	08-04-2011		1						7
	12-04-2011		1						6
	15-04-2011		2						7
	29-04-2011		1						4
	12-05-2011		2						5
	26-05-2011		3						9
	22-09-2011		2						9
	08-05-2012		2						8

7 ENVIRONMENTAL MONITORING SUMMARY AND ANALYSIS

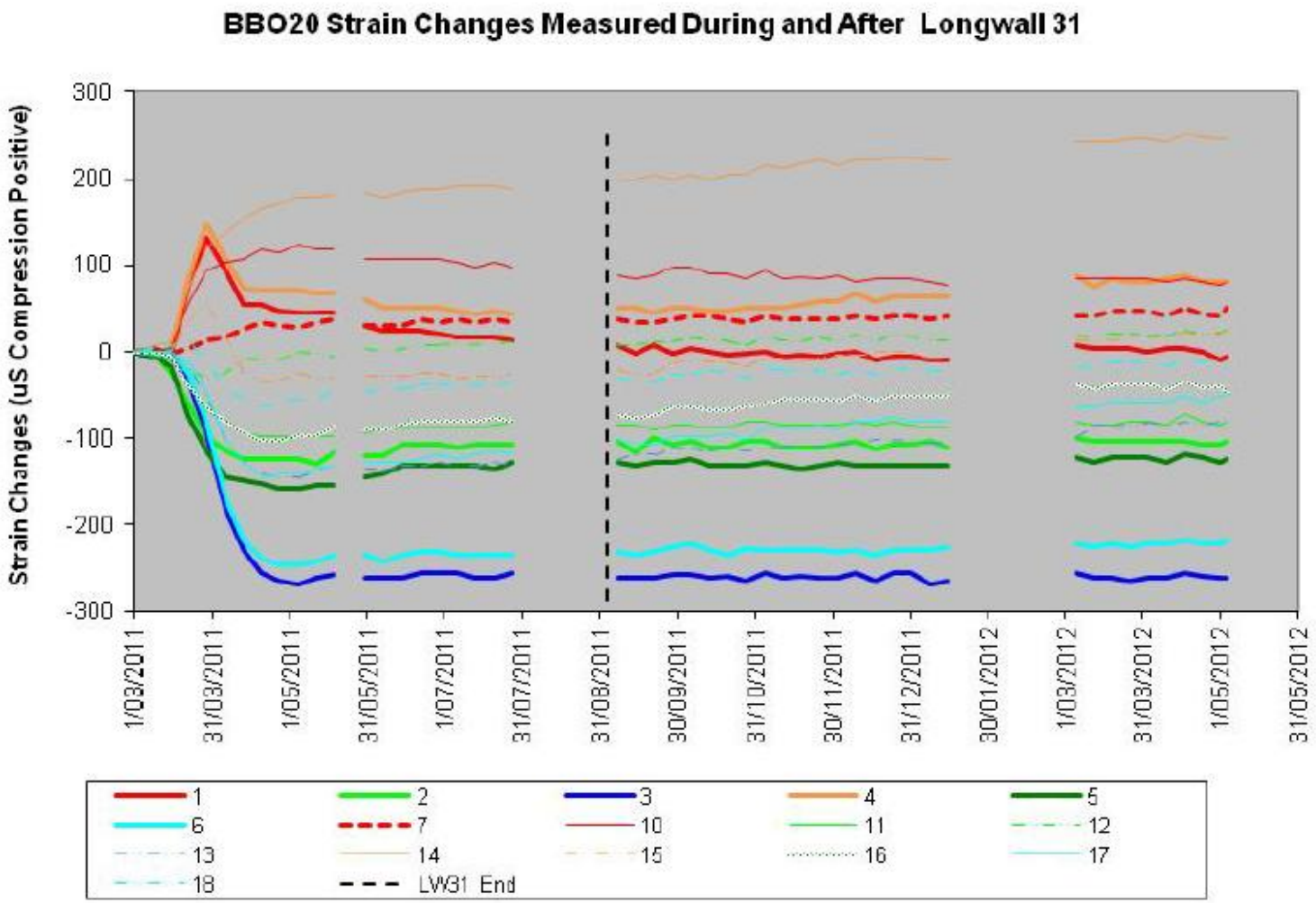
7.1 Wolgan Escarpment – Stress Cell Monitoring

Stress cell monitoring as required by Baal Bone Colliery LW 29-31 SMP - Subsidence Monitoring Program (May 2009) has now been completed.

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 were monitored using a remote logger as Longwalls 29, 30 and 31 were progressively extracted. Stress cells are logged on a twice daily cycle and the information is downloaded periodically.

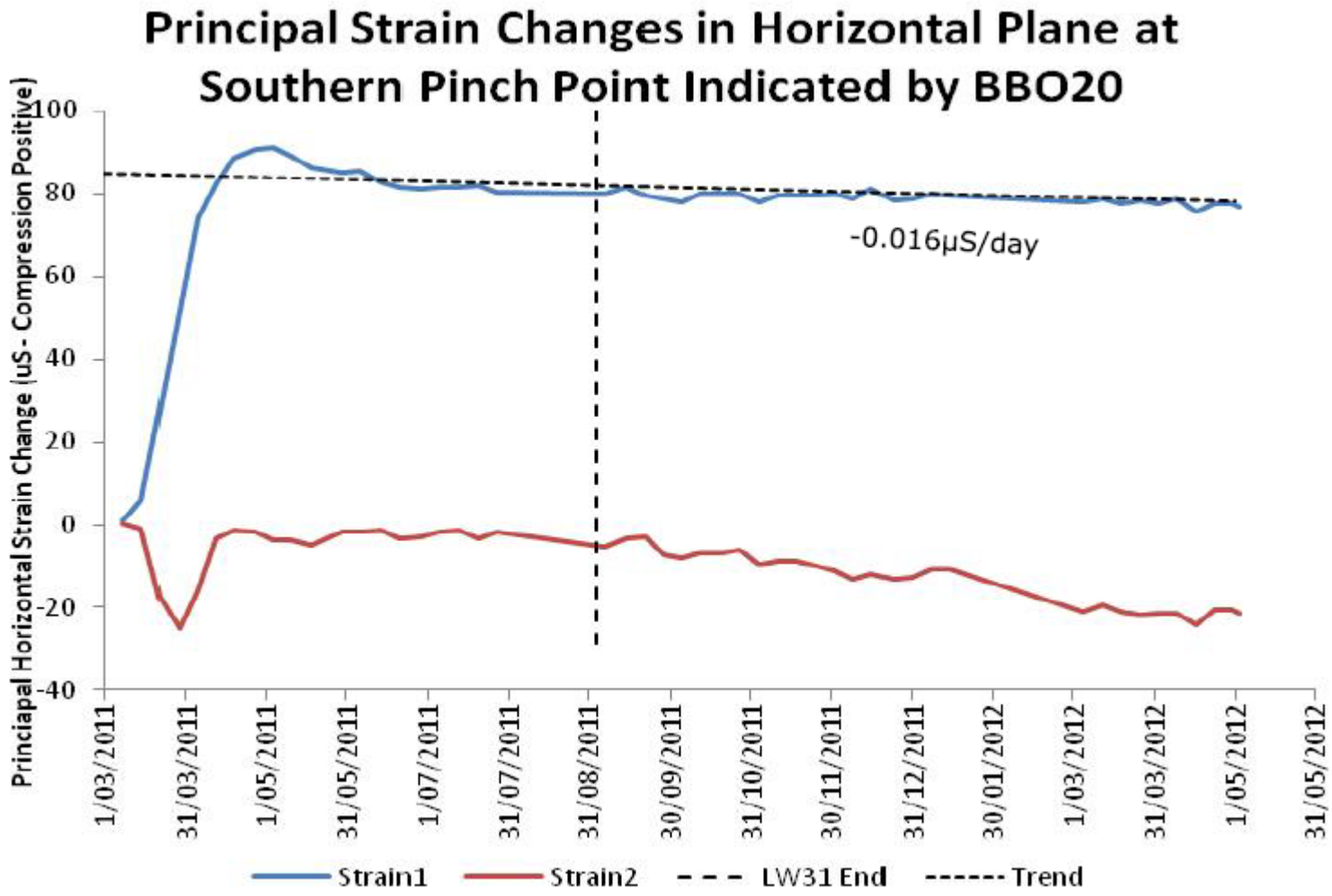
A summary of observations from completed stress cell monitoring can be found in **Figure 1** through to **Figure 8**.

Figure 1 - BBO20 Strain Changes Measured During and After Longwall 31



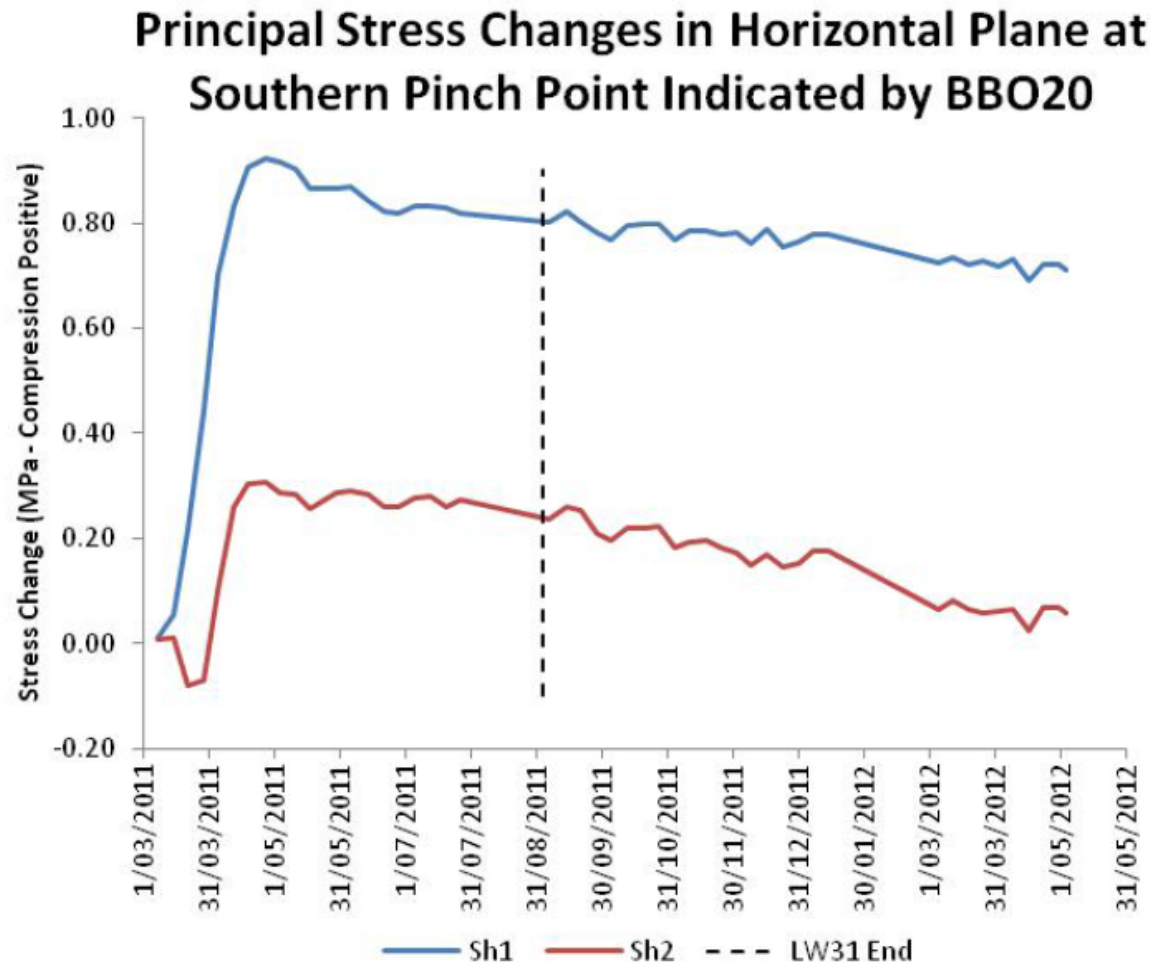
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 2 – Principal Strain Changes in Horizontal Plane at Southern Pinch Point Indicated by BBO20



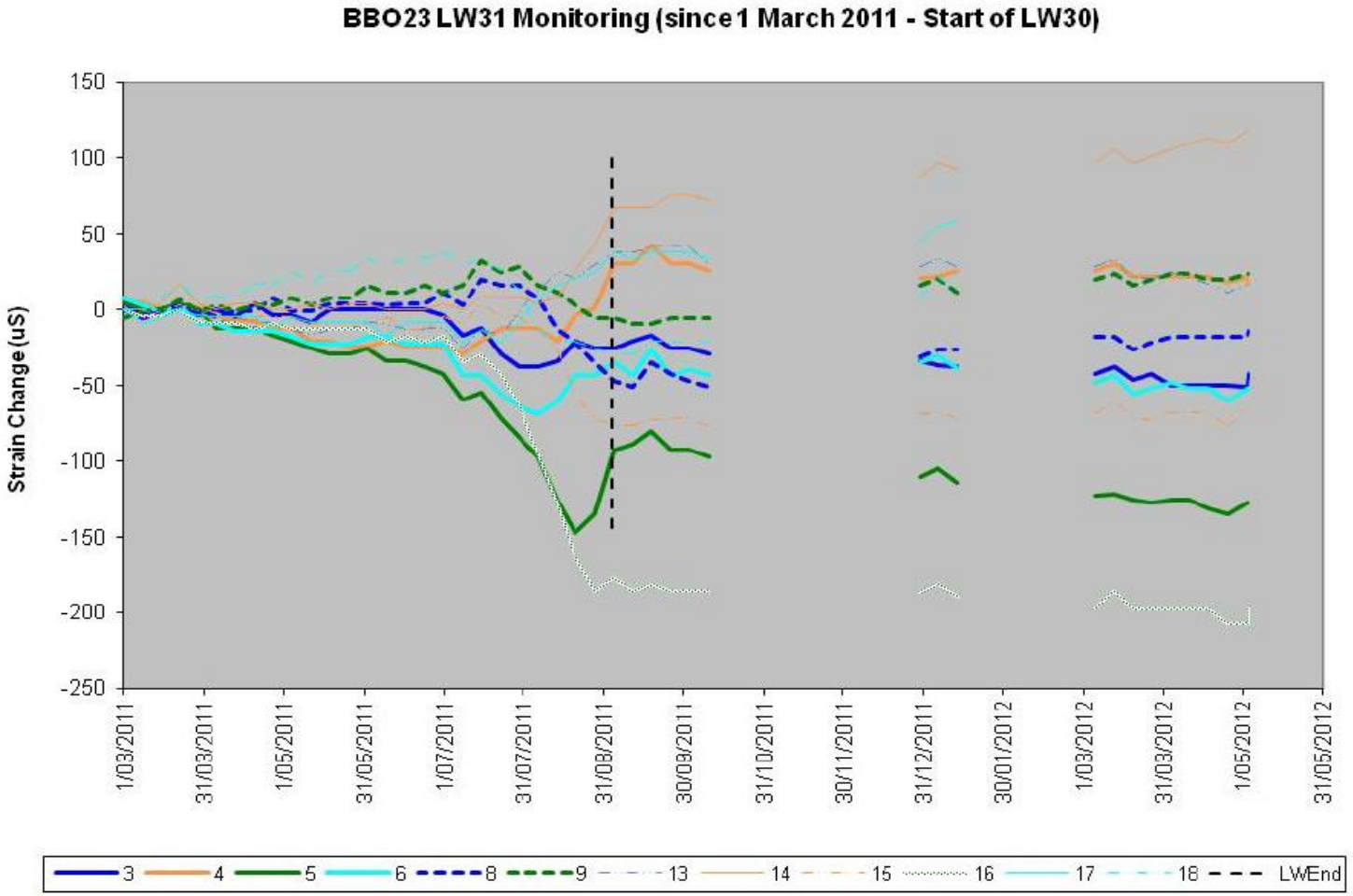
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 3 – Principal Stress Changes in Horizontal Plane at Southern Pinch Point Indicated by BBO20



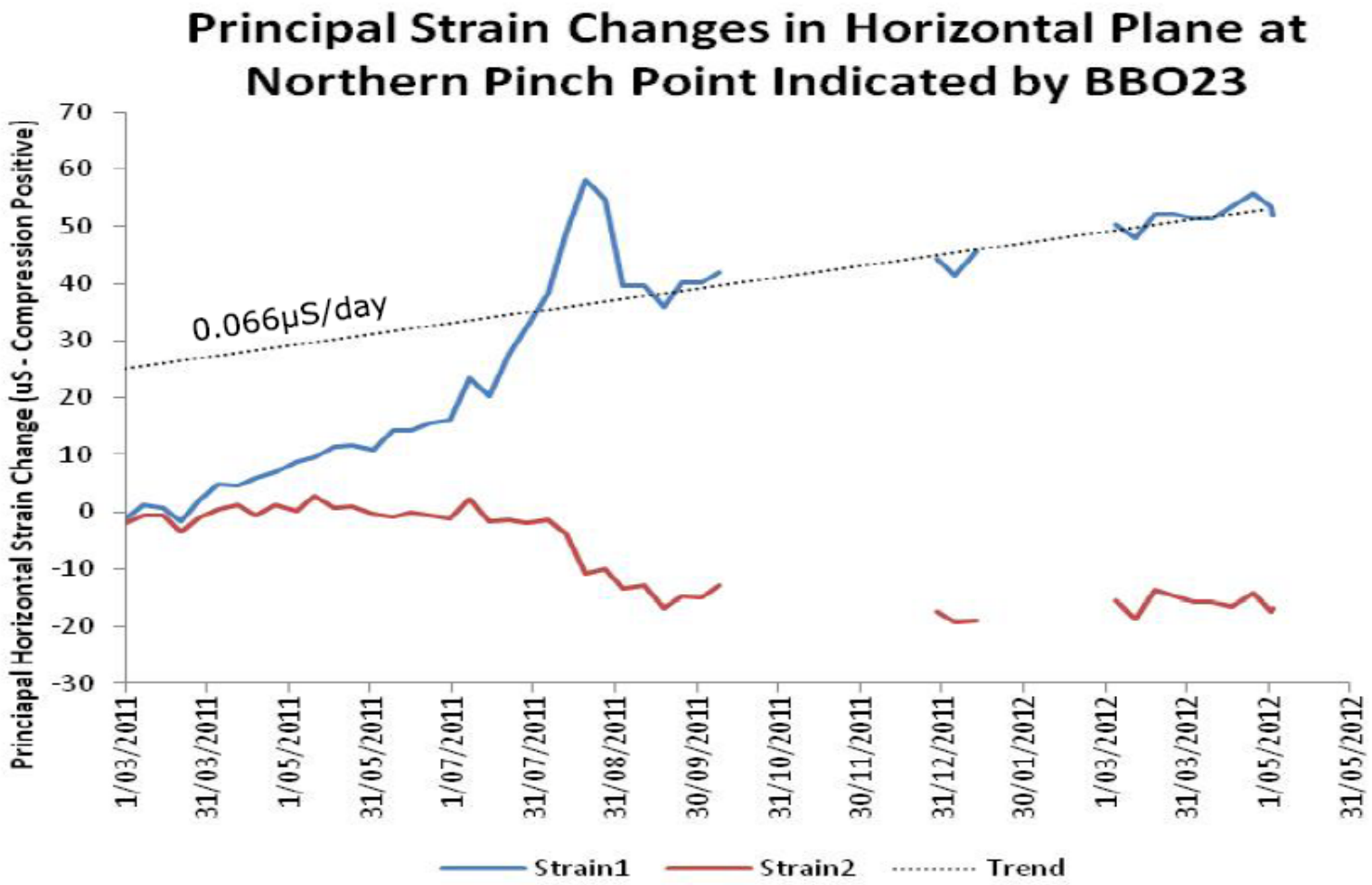
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 4 – BBO23 LW31 Monitoring Since 1 March 2011



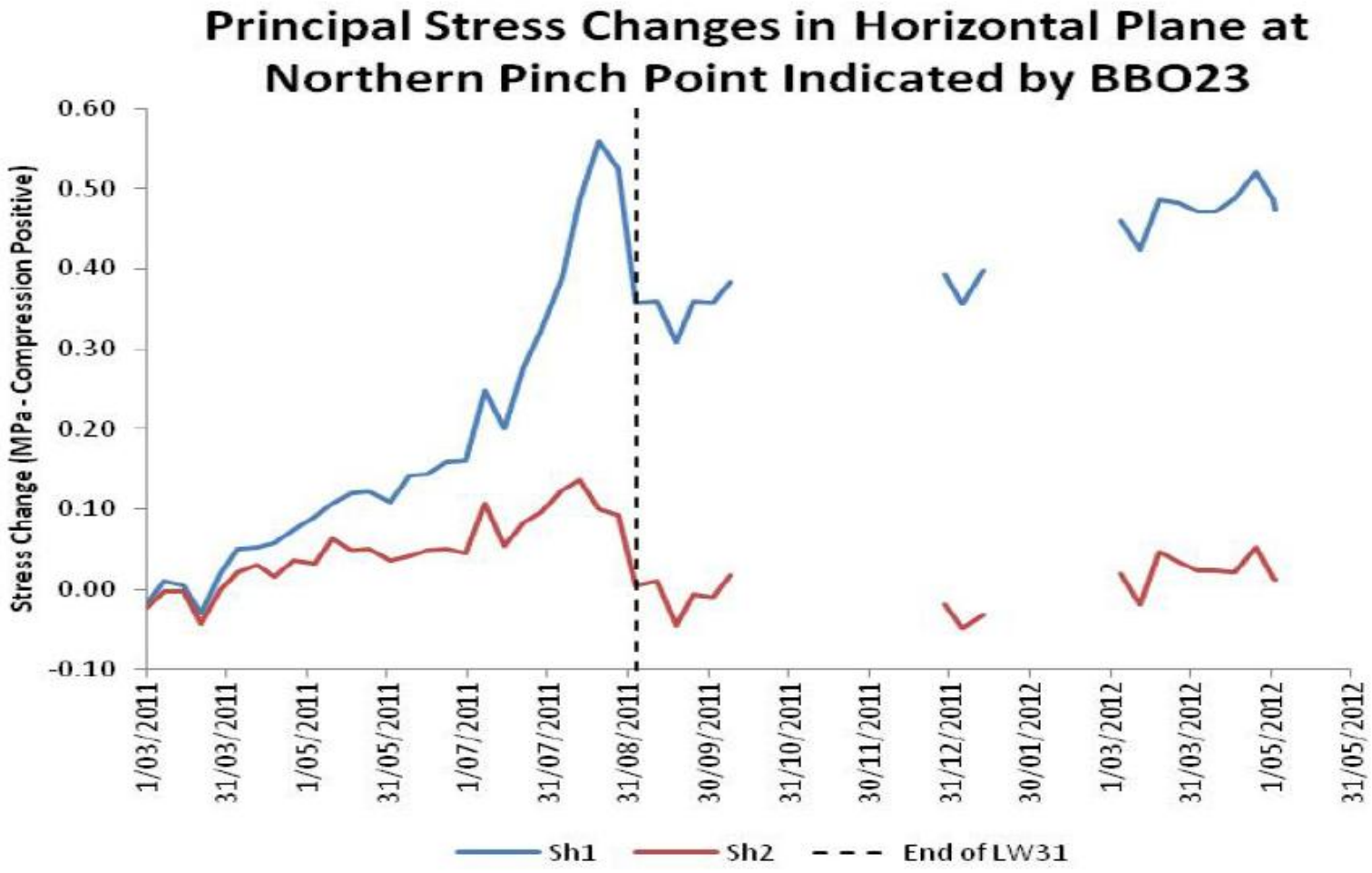
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 5 – Principal Strain Changes in Horizontal Plane at Northern Pinch Point Indicated by BBO23



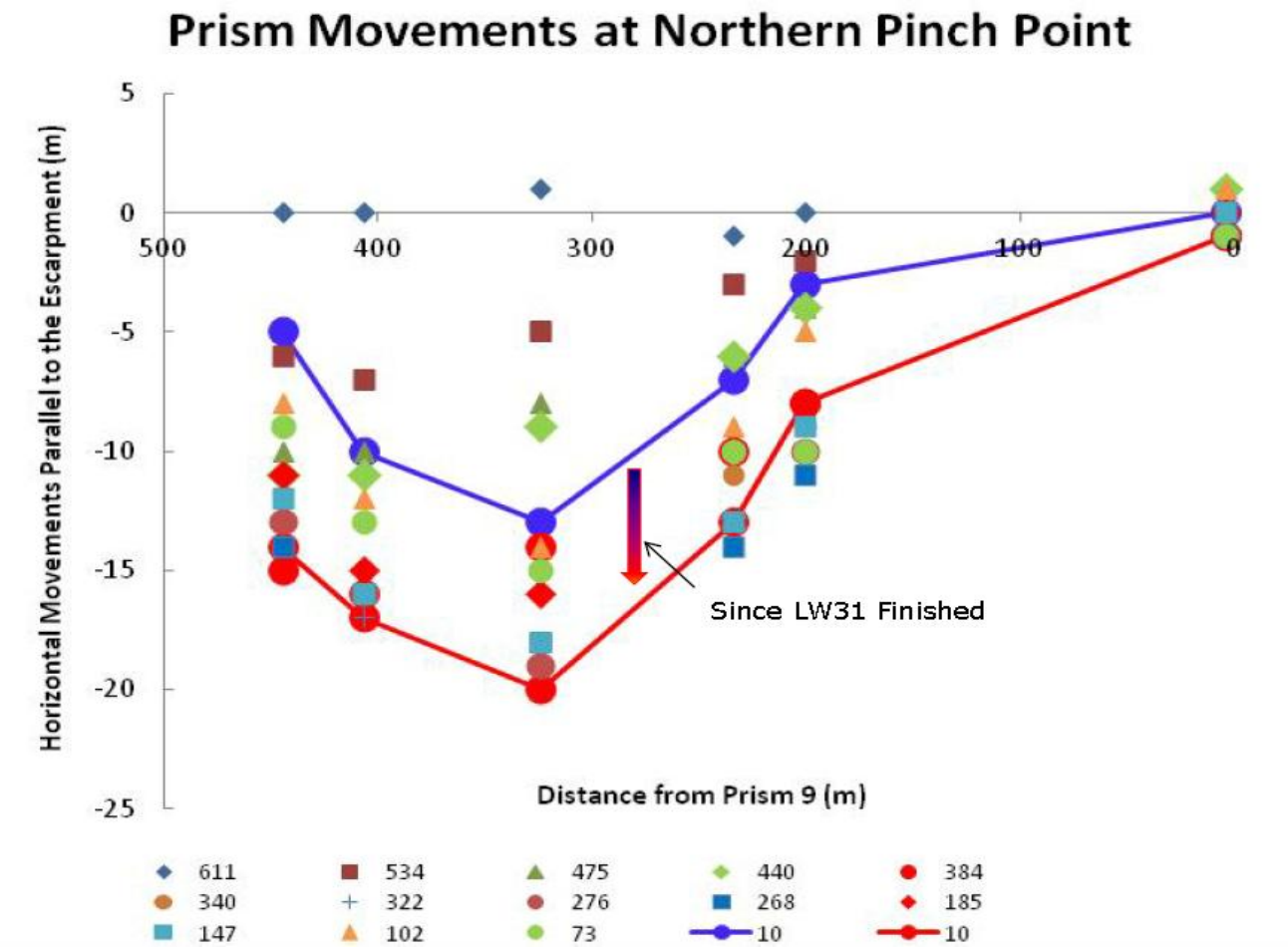
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 6 – Principal Stress Changes in Horizontal Plane at Northern Pinch Point Indicated by BBO23



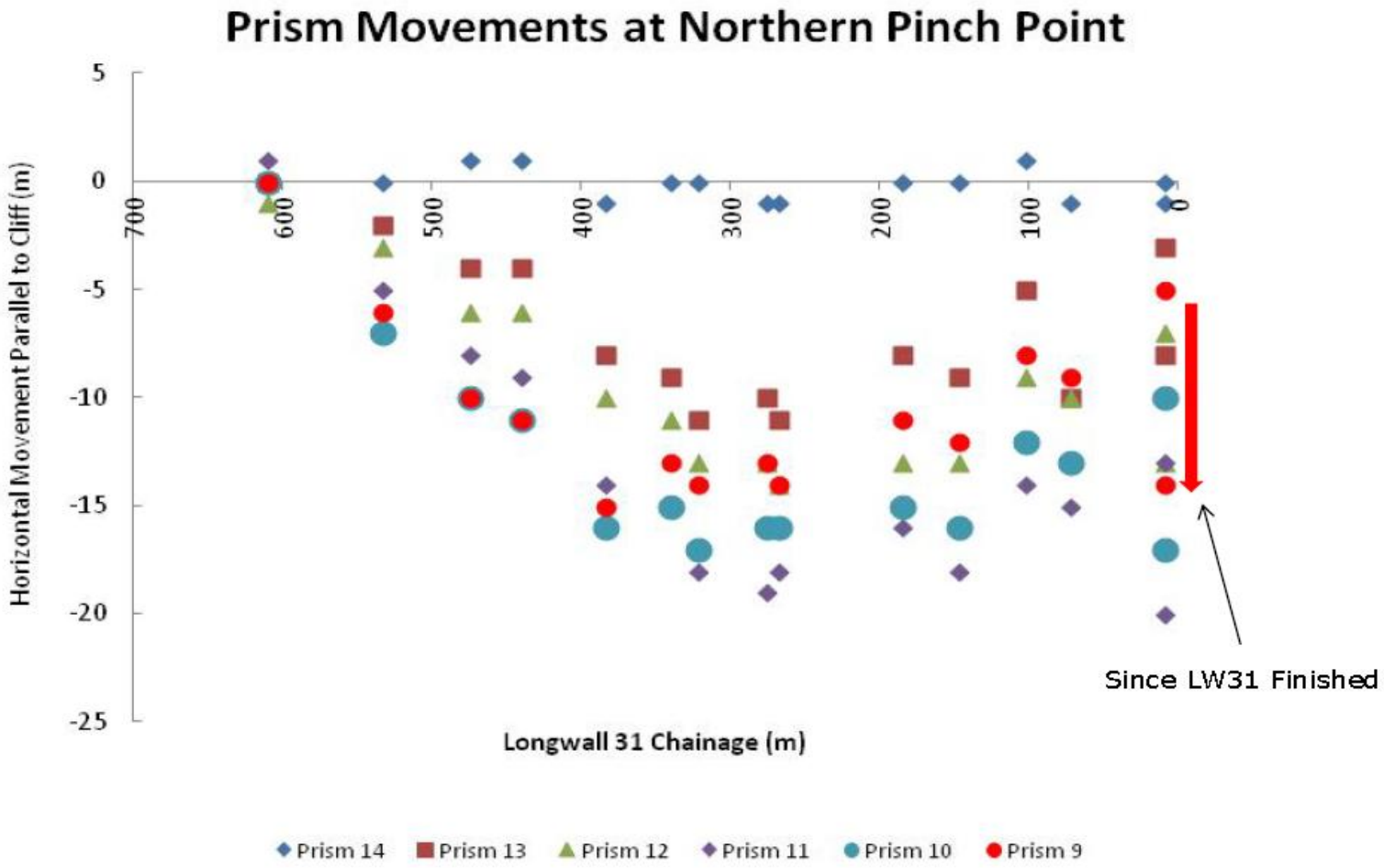
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 7 – Prism Movements at Northern Pinch Point



Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 8 – Prism Movements at Northern Pinch Point



Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

7.2 Rock Features

All rock feature and subsidence surveys as required by Baal Bone Colliery LW 29-31 SMP -Subsidence Monitoring Program (May 2009) and Land Management Plan (June 2009) have now been completed.

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

7.3 Surface Drainage Depressions

To date there has been one unpredicted subsidence impact observed on surface drainage depressions within the SMP area, in LW 30, details of which were included in previous Status and End of Panel Report**.** 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 (i.e. 25mm / 24 hour period) continued during longwall mining; there has been no observable change to pre-mining flow characteristics and/or stream morphology during this reporting period.

Monitoring will continue now LW 31 is complete and any subsidence / upsidence impacts and/or required remediation on the stream will be reassessed.

7.4 Fire Trails and Tracks

All fire trails and track surveys as required by Baal Bone Colliery LW 29-31 SMP - Land Management Plan (June 2009) have now been completed.

To date there have been no subsidence impacts on any fire trails or tracks in the SMP area.

7.5 Swamp

As scheduled in the Baal Bone Colliery LW 29-31 SMP - Environmental Monitoring Program (May 2009), seasonal photographic monitoring of the Coxs River Swamp has been discontinued since the cessation of mining.

Monitoring completed to date indicate that seasonal variations in swamp appearance are consistent with those observed during pre-mining assessments, particularly when antecedent ground moisture levels are taken into consideration. These observations are confirmed by the results of the seasonal flora and fauna monitoring programs.

7.6 Fauna

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

No survey was conducted during the reporting period. Listed below is a summary of the 2011 fauna monitoring.

A total of 20 native mammal (plus three introduced), 58 bird, five reptile and three amphibian species have been located within or near Longwall 29-31 SMP Area at Baal Bone Colliery during 2011. The list of fauna species located during the 2011 surveys in the SMP Area provides a total assemblage of species located within Baal Bone Colliery and LW29-31 SMP Area over the years. At present, 30 native mammal, 95 bird, 14 reptile and six amphibian species are known to occur within the LW29-31 SMP Area.

The number of birds, native mammals, reptile and amphibian species located in 2011 was similar to that located in earlier years. As expected with continued surveys, the number of species located within the SMP area has increased over the years. It is expected that the number of new species located each year will continue to increase and finally level out. Then the final overall species richness can be calculated from the final slope of the asymptote.

New species located during 2011 are the Eastern Pygmy-possum, House Mouse, Large Forest Bat, White-necked Heron, Buff-banded Rail, Golden-headed Cisticola, Beautiful Firetail, White's Rock-skink, Bibron's Toadlet and the Giant Dragonfly.

Overall there have been 11 threatened species located within the LW29-31 SMP Application Area at Baal Bone Colliery as a result of surveys since 2005. In 2011, the following threatened species were located: Gang-gang Cockatoo, Scarlet Robin, Varied Sittella, Eastern Pygmy-possum, Little Pied Bat, Eastern False Pipistrelle, Eastern Bent-wing Bat, Greater Broad-nosed Bat. The first three species are part of a suite of threatened species that are listed partly because of their declining population status within the western slopes of NSW. This area (called the sheep-wheat belt) has undergone extensive clearing and much of the woodland habitat preferred by these species has been lost. However, in the Newnes Plateau region woodland habitat has been retained (albeit logged), and such bird species are still to be located. None of these threatened bird species would be directly affected by subsidence-induced changes to their preferred habitat.

Two new threatened species were located during the 2011 surveys, the Eastern Pygmy-possum and the Giant Dragonfly. Both were associated with Long Swamp, with the Eastern Pygmy-possum pit-trapped in a stand of banksia close to the swamp and at least five Giant Dragonflies were observed flying over Long Swamp close to piezometer BBP5.

The Giant Dragonfly is listed as Endangered under the NSW TSC Act.

Table 2: Result from Analysis of Data from 2006 to 2011

BIODIVERSITY INDICES	SIGNIFICANT DIFFERENCES BETWEEN PRE AND POST MINING
Species richness of faunal groups	NO
Diversity indices of faunal groups	NO
Capture rates of individual species	NO
Contribution to the faunal assemblages by species dependant upon woodland	NO
Contribution to the faunal assemblages by species declining in the Central West	NO
Habitat complexity scores	NO

Conclusions

The configuration of survey sites established in previous years adequately samples the three major environments within Baal Bone SMP Application Area i.e. woodland, swamp and creekline. These sites will provide the best possible data for the long-term monitoring of terrestrial vertebrates. The survey techniques used have been successful in locating a wide range of species, including new records for the Newnes Plateau region.

The accumulation of data from the on-going surveys makes it possible to track changes to the terrestrial vertebrate fauna within the Baal Bone Colliery SMP Application Area during and after mining activities. At present, there appears to be no evidence of any significant effects from subsidence upon the fauna diversity at Baal Bone Colliery.

It should be noted that a number of Giant Dragonflies were located at Long Swamp during the 2011 surveys. The combination of wet weather and warm conditions during this year's summer would have encouraged the breeding of this endangered species. Long Swamp and the adjoining littoral vegetation can be considered to be of importance in terms of the number of threatened species located there (six in 2011).

7.7 Flora

Systematic vegetation monitoring quadrats were established within the SMP area in January 2007.

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.

No survey was conducted during this reporting period. A summary of the 2011 results is included.

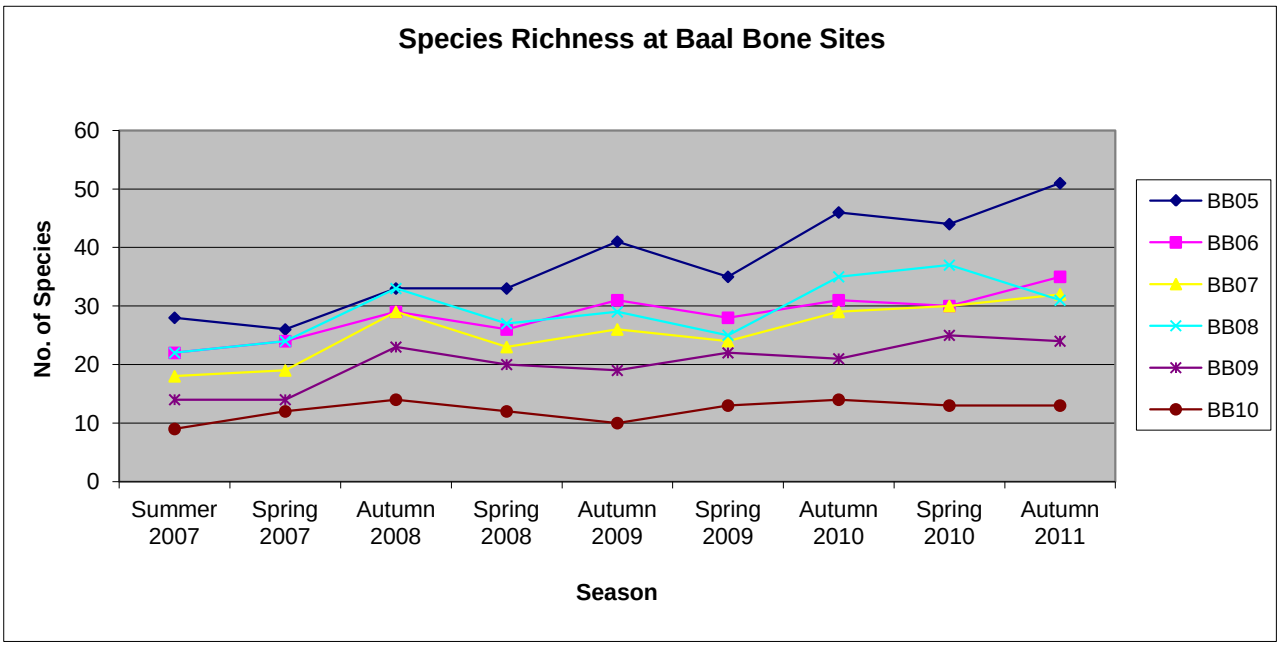
Each seasonal survey involves recording of vegetation structure, dominant species, estimated cover and height for each stratum, full floristics, an estimated cover abundance for each species using the modified Braun-Blanquet scale and condition of common species using the condition scale. Observations of general condition of the surface environment, stream water flow and quality are also made where relevant.

Results

Plant Species Diversity

Species diversity results show that levels of species diversity recorded in 2011 were at the higher end or above the previously recorded range at each site. **Figure 9** shows species richness recorded across all sites during spring and autumn since the baseline data was obtained.

Figure 9 - Species Richness at Baal Bone Vegetation Monitoring Sites



Discussion

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. These indicators are:

- a decline in diversity and abundance of plant species which typically are associated with wet, sheltered areas
- an increase in diversity and abundance of plant species which typically occur in forests or woodlands in locations initially supporting species characteristic of more sheltered communities
- an increase in diversity and abundance of exotic species or native species favoured by disturbance
- unusual variation in species diversity
- decline in condition of plant species known to be sensitive to changes in water availability.

Changes in these indicators may also result from prevailing climatic conditions and other disturbances independent of mining such as bushfires, logging operations, recreational activities and feral animals.

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.

The levels of species richness and weed growth are all consistent with a response to rainfall. There has been no evidence which would indicate an effect of subsidence on vegetation distribution and abundance at the monitoring sites.

7.8 Groundwater - Levels

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.

Rainfall over the April and May period was slightly below average for the time of year, with 44 mm in April and 31 mm in May. Rainfall for the June and July period was virtually on average for the time of year – with 82 mm falling in June and 51 mm in July.

Groundwater levels have remained reasonably level over the current period (**Figure 10**). Piezometers P1, P5 and P6 have all remained stable, while some slight variances were observed in P2, P3 and P4, generally corresponding with rainfall patterns.

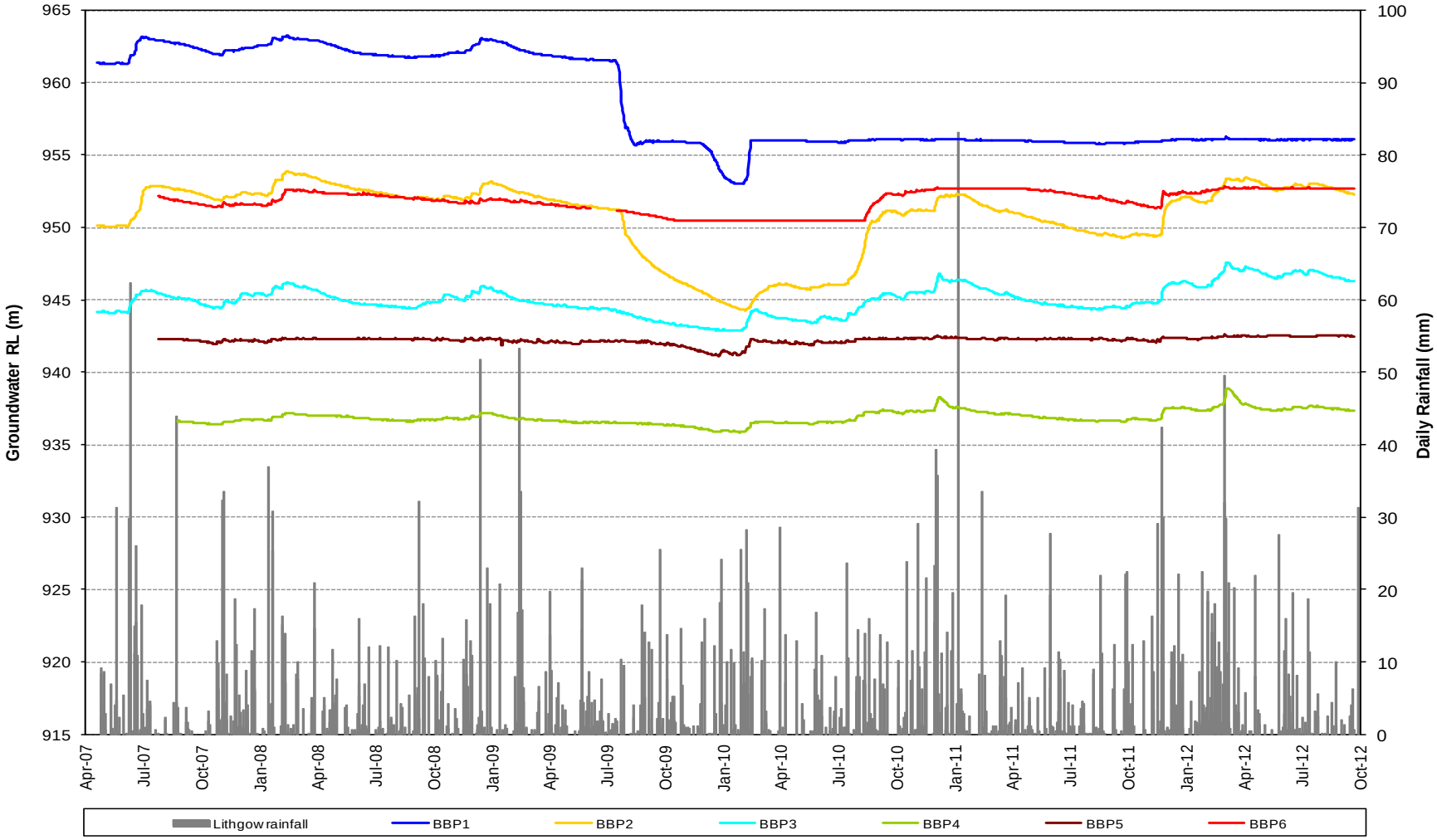
Piezometers P5 and P6, which are installed within bores in the centre of the swamp, have maintained their long-term groundwater level approximately at ground level.

The north to south downstream groundwater gradient has been maintained over the current period (highest level observed in P1 and lowest level observed in P4), indicating that flow has been maintained down through the swamp.

All groundwater levels appear to be approximately at (or above) pre-mining levels, with the only exception being at piezometer P1, where a groundwater has re-stabilised at RL956 (approximately 5 m below pre-mining level).

There is no observable impact on groundwater due to mining for the reporting period.

Figure 10 – Coxs River Swamp Groundwater Levels



7.9 Groundwater – Quality

ALS Environmental collects groundwater samples for quality analysis from the six bores on a monthly basis (**Figures 11 through 15**).

During the reporting period (April to August) all analytes remained within Trigger Action Response Plan (TARP) levels with the exception of minor increases of zinc at BBPB3 and copper at BBPB4. At that time, the increases were classified (according to the TARP) as Minor Impact.

Groundwater quality results obtained outside of the current reporting period show that zinc levels at BBPB3 and copper levels at BBPB4 continued to exceeded TARP trigger levels in September and October 2012, and are now classified as a Major Impact.

It should be noted that BBPB4 is a background bore and its purpose is to provide a benchmark for comparison with the other potentially affected monitoring bores (BBPB1 to 3 and BBPB5 and 6). BBPB4 is an aquifer groundwater bore and is not located within the Cox's River Swamp. BBPB4 is located approximately 70 metres to the west of the wetland in an area where no subsidence was expected to occur (refer to **Figure 17**). BBPB3 is also not located within Cox's River Swamp, but is located approximately 140 metres to the east of the Swamp, and is outside of the subsidence zone for LW 29-31.

In February 2012 Baal Bone Colliery commissioned a report by Aurecon which investigated groundwater quality and the TARP trigger levels:

> *Groundwater Level and Water Quality Changes compared to TARP Trigger Values in and around the Coxs River Swamp from 2009 to 2011 for SMP Area LW29-31 (Aurecon, March 2012).*

A copy of the Aurecon report was provided to the Principal Subsidence Engineer, Subsidence Executive Officer and NSW Office of Water in March 2012.

The findings of the Aurecon report include:

- Minor impact increases in zinc levels at BBPB3 could have occurred due to variable conditions of rainfall and the resulting groundwater level changes.
- Major impact increases of copper at BBPB4 occurred during spring of each year, and are likely due to the release of the metal into the groundwater from the nearby wetland by natural processes.

On 16 November 2012, an initial notification regarding the elevated levels of zinc and copper in BBPB3 and BBPB4 respectively was provided to the Principal Subsidence Engineer and Department of Planning and Infrastructure via email.

A notification will be provided to the Interagency Committee following the completion of further investigations, and data collection.

Figure 11 – Cox's Swamp Piezometer Reading - Copper (filterable)

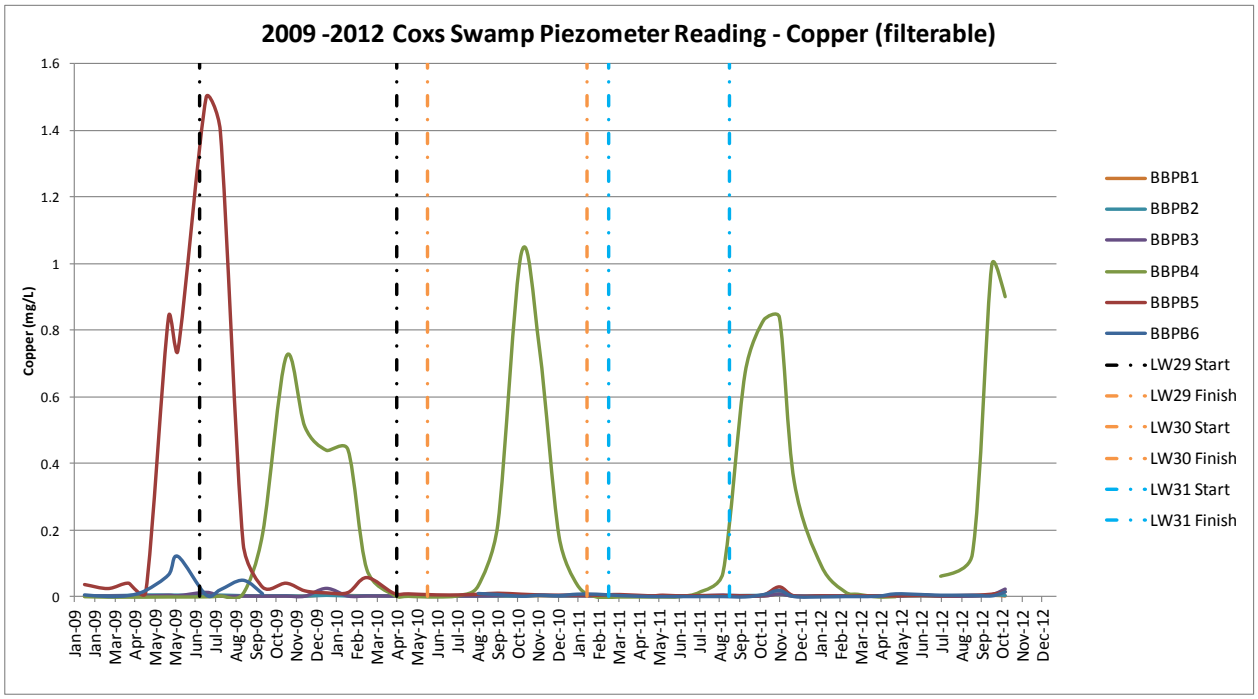


Figure 12 – Cox's Swamp Piezometer Reading – Electrical Conductivity

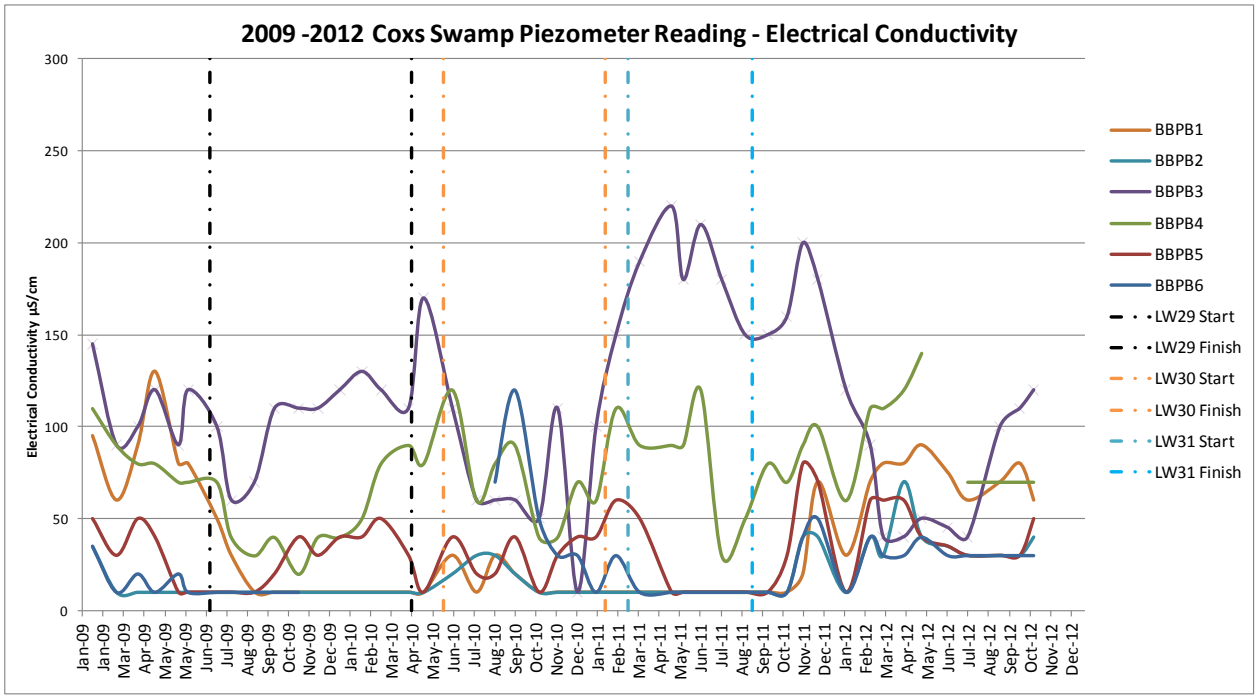


Figure 13 – Cox's Swamp Piezometer Reading – pH

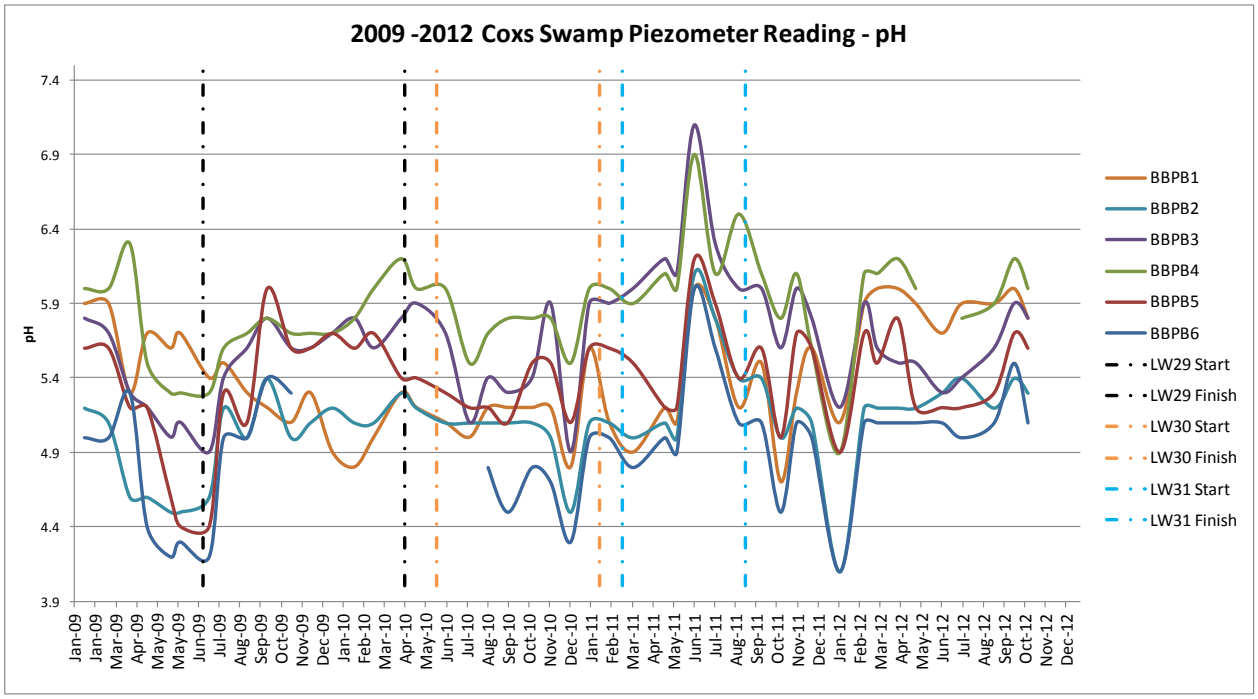


Figure 14 – Cox's Swamp Piezometer Reading - Iron (filterable)

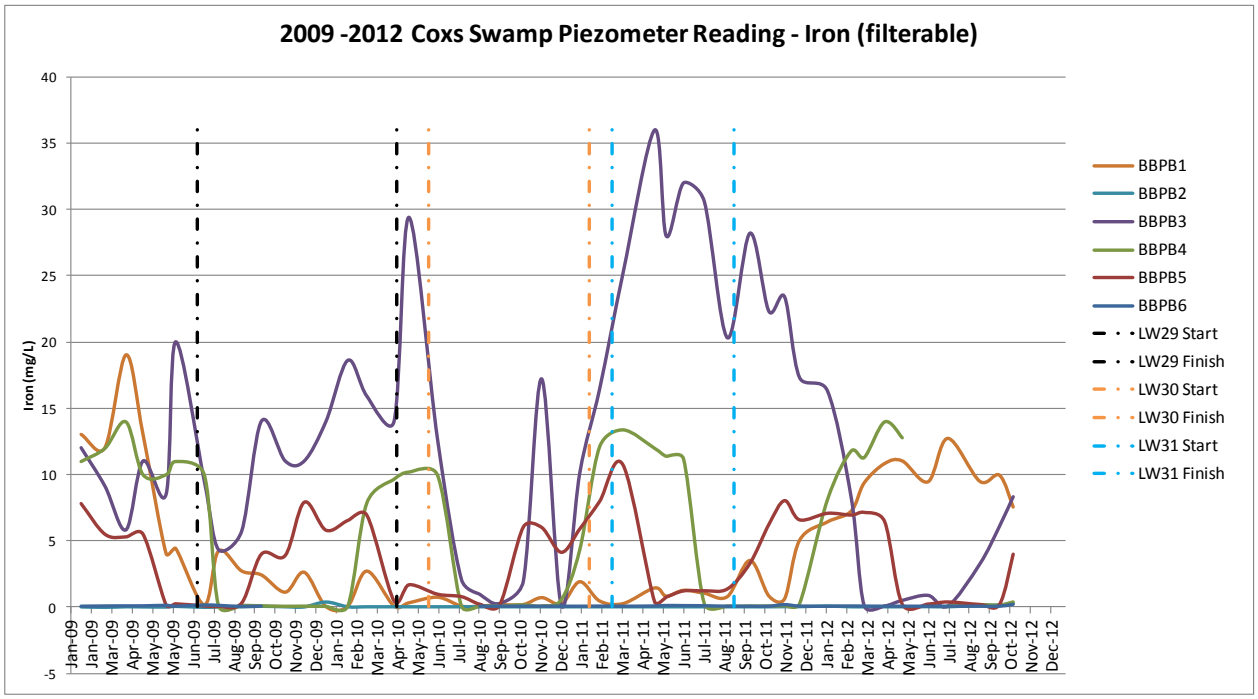
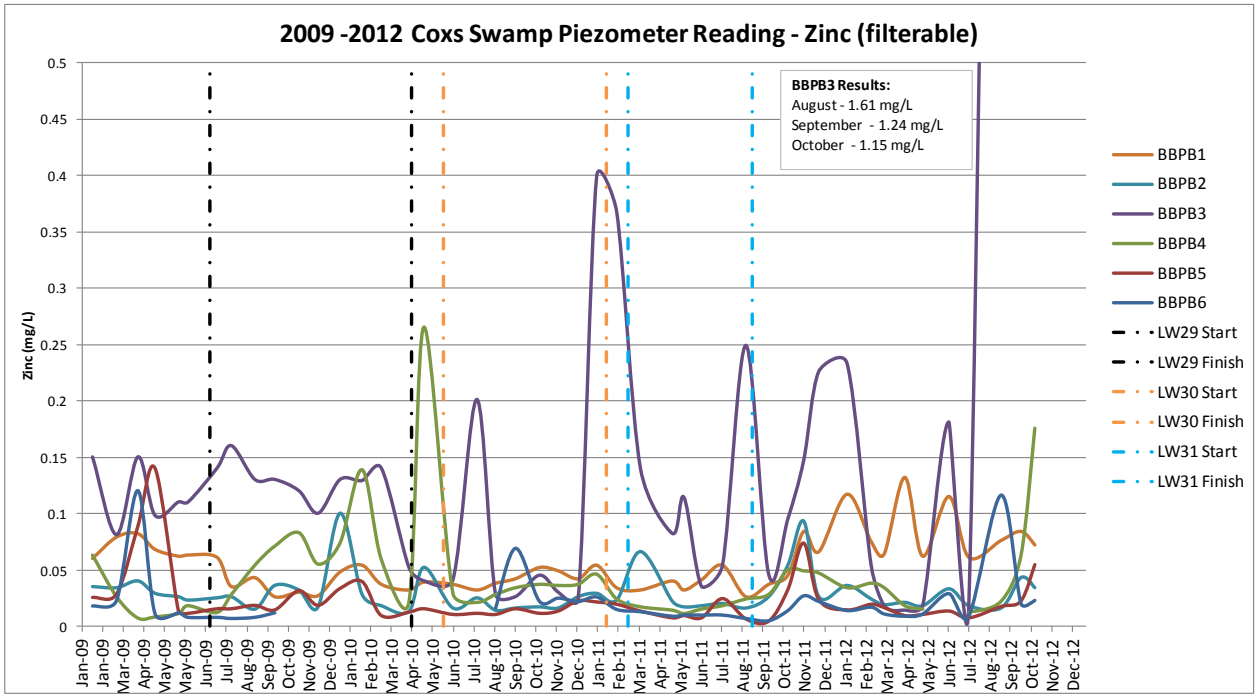


Figure 15 – Cox's Swamp Piezometer Reading - Zinc (filterable)



8 TRENDS IN MONITORING RESULTS

Pre, during and post Longwall 31 extraction, routine scientific and survey monitoring of impacts on rock features and escarpments have been completed. Monitoring of surface and groundwater regimes continued. Though there have been two minor exceedances relating to subsidence and horizontal movement, these have been located over LWs 29 and 30. Monitoring results over LW31 were within expected / predicted parameters and displayed no discernable trends.

9 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 an inspection program and remediation program with regard to the surface cracking are also considered to be appropriate and effective.

10 PROPOSED ADDITIONAL / OUTSTANDING MANAGEMENT ACTIONS

Repairs to surface cracking above LW 29-31 area to be carried out in accordance with Review of Environmental Factors, and the requirements of Forests NSW.

11 CONCLUSIONS

During the reporting period (April to August):

Routine scientific and survey monitoring of impacts on rock features, and escarpments have been completed as per the requirements of the Baal Bone Colliery LW 29-31 SMP.

Monitoring of groundwater bores for both levels and quality has continued with no observable major impact on groundwater levels due to mining. Exceedances in the following analytes, zinc and iron were registered during 2011 and reported. Notification was provided as required. Studies were conducted and a report from Aurecon provided. These analyte levels then returned to "below trigger" values. Exceedances in zinc and copper have been noted in late 2012, and initial notification was provided to the Principal Subsidence Engineer and Department of Planning and Infrastructure on 16 November 2012. Investigations are currently being carried out, and further notification will be provided upon completion.

An Inspection Plan was developed, approved and implemented to identify, confirm and classify all cracking over the LW 29-31 area. Inspections were conducted and all cracking identified. A Risk Assessment was then conducted, including all relevant parties.

Following this, a REF has been prepared, including flora and fauna studies and remediation program. The REF was accepted by DTIRE and Forests NSW on 8 November 2012. Baal Bone Colliery is currently organising the repair of the subsidence cracks.

All other monitoring results are within expected / predicted parameters and displayed no discernable trends.

The following routine and scheduled seasonal monitoring is proposed:

- Visual inspections in general surface area with particular emphasis on the subsidence cracking areas to be remediated, and the effectiveness of public safety measures, and
- Groundwater monitoring to continue until analytes return to below trigger levels – after which the monitoring program is to be reviewed in consultation with the Environmental Branch of DTIRIS.

Figure 16 - Subsidence Survey and Data Monitoring Locations (Source: *Baal Bone Colliery LW29-31 SMP Subsidence Monitoring Program*)

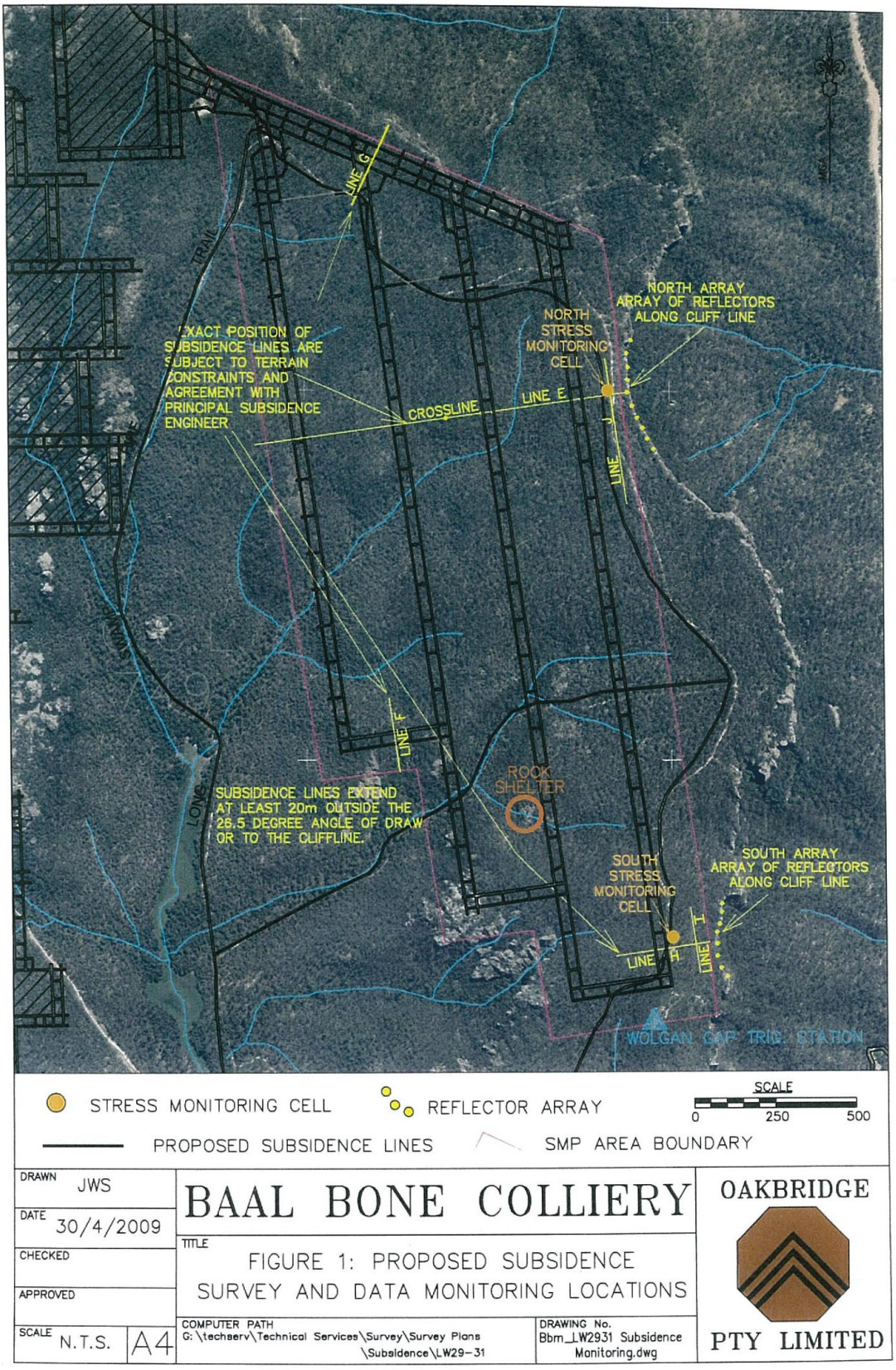
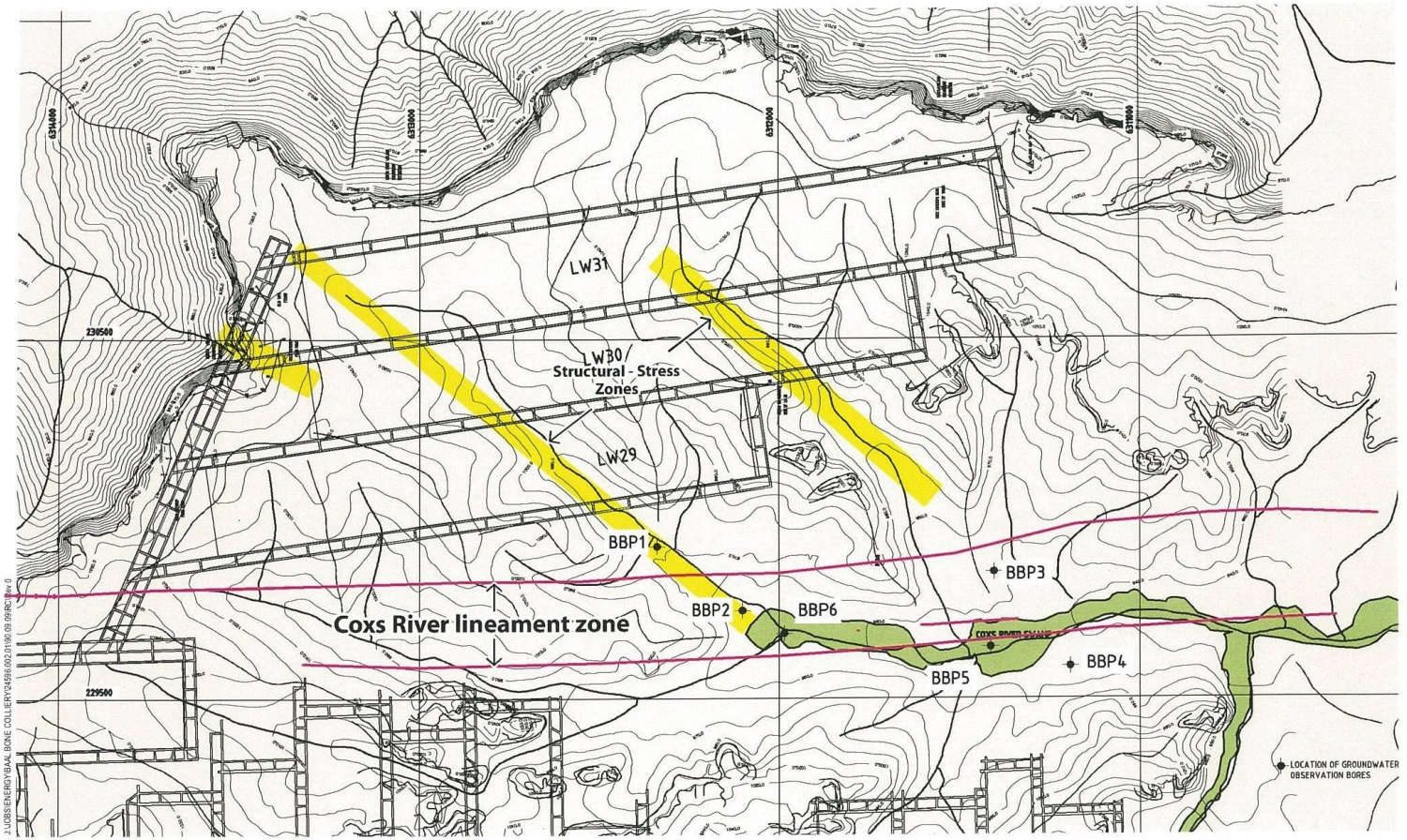


Figure 17 - Location of Groundwater Observation Bores and Geological Structures

aurecon



Baal Bone Colliery Groundwater Response Strategy

FIGURE: Location of Groundwater Observation Bores and Geological Structures

Figure 18 - Survey Monitoring and Stress Cell Location North Pinch Point Area

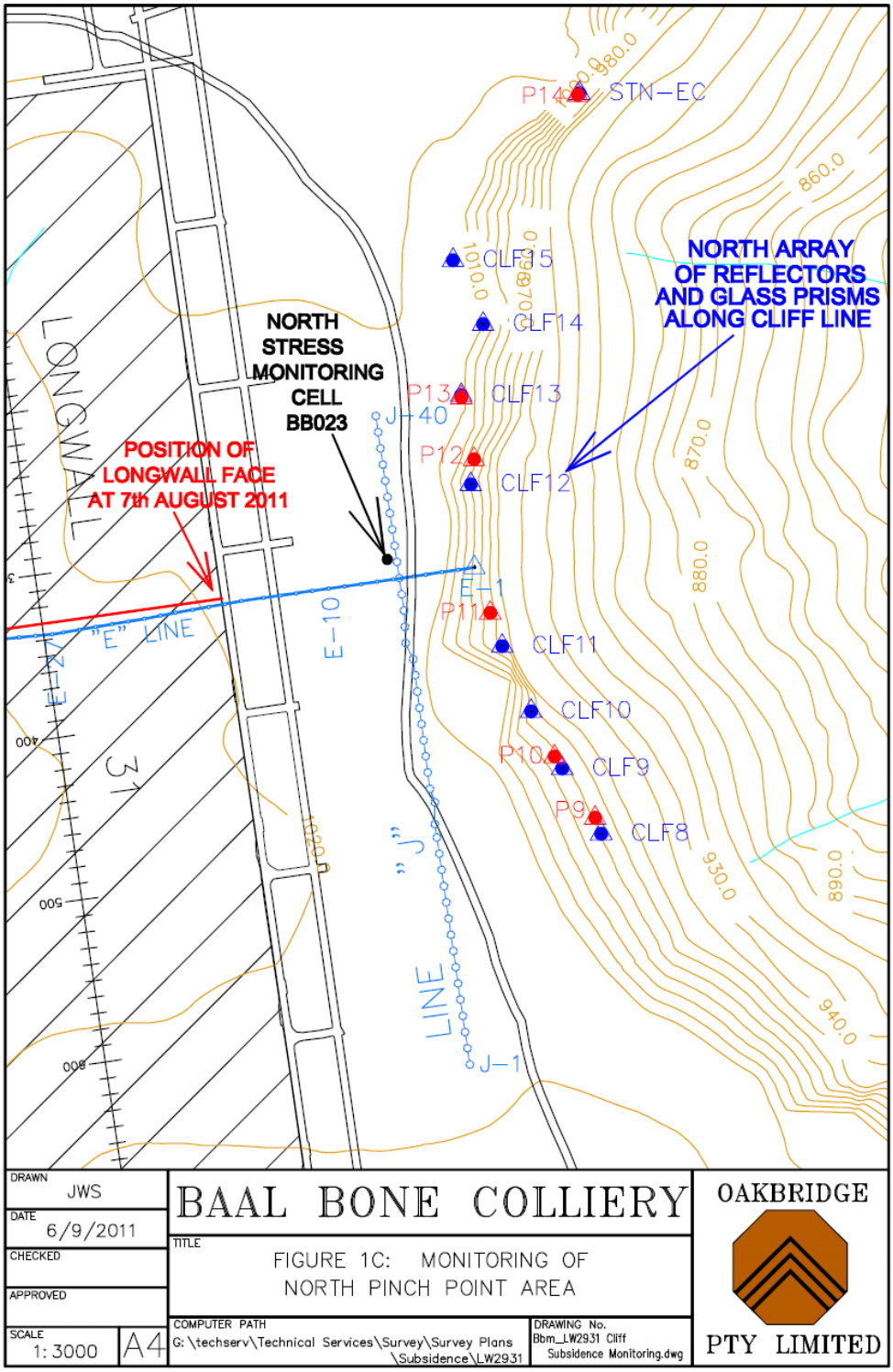


Figure 19 - Survey Monitoring and Stress Cell Location South Pinch Point Area

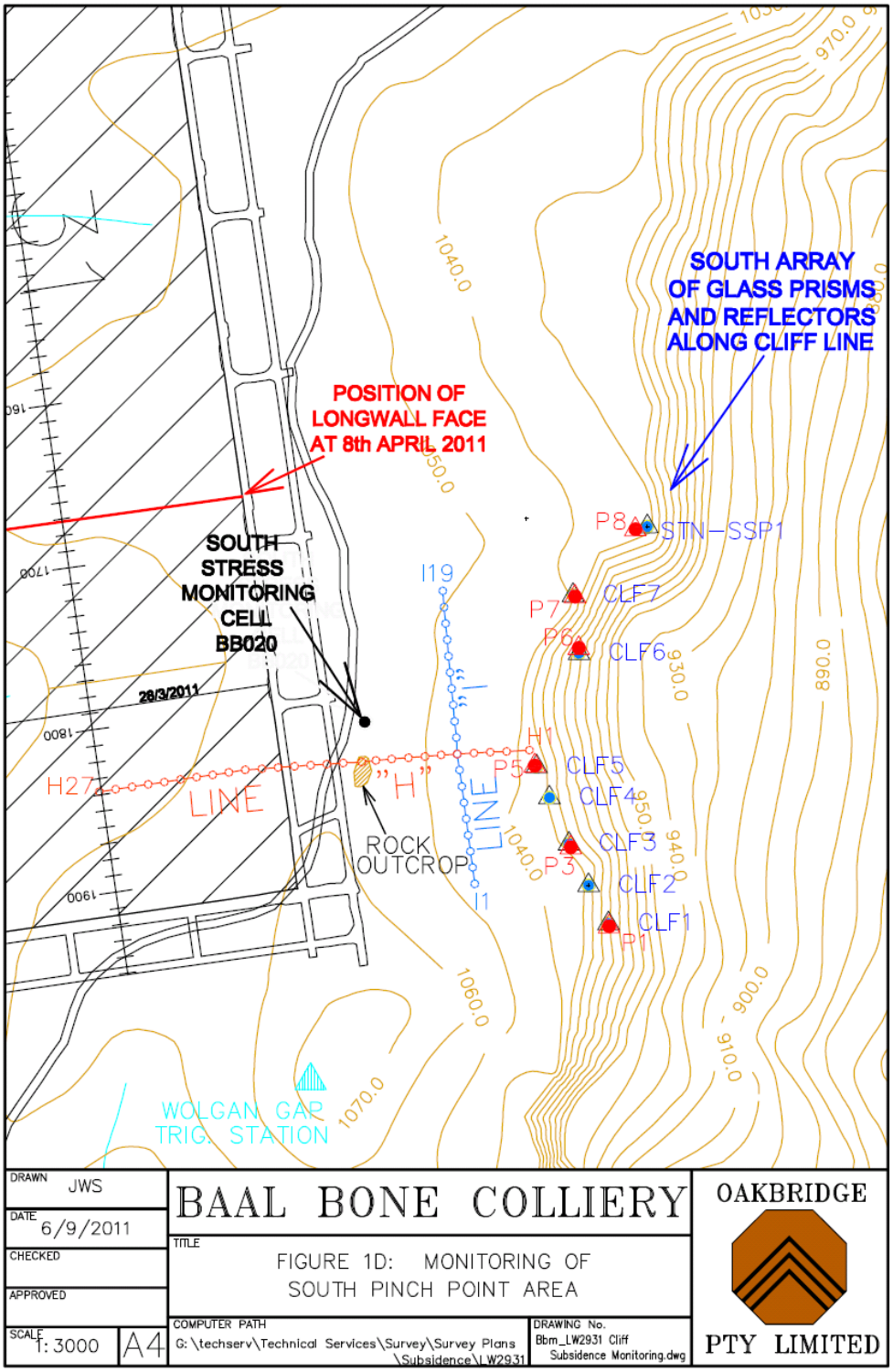


Figure 20 – Longwall Extraction Timing