DONALDSON COAL

Part of Gloucester Coal

Abel Mine
Subsidence Management Plan
End of Year Report 2011

31 March 2012

Approved by

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TABLES

ATTACHMENTS

1 INTRODUCTION

This Subsidence Management Plan End of Year Report fulfils the requirements of Condition 19 of the Abel Subsidence Management Plan (SMP) Approval Conditions dated 27 May 2010.

A summary of monitoring results for the period January to December 2011 are presented in this report. Pillar extraction was completed in Panels 3, 4, and 5 and commenced in Panels 6 and 7 during this reporting period.

Subsidence surveys, photographic monitoring and visual inspections were conducted over all pillar extraction areas in accordance with the approved Subsidence Monitoring Programs with the exception of a period where access was unable to be obtained, with environmental monitoring conducted in accordance with the approved Environmental Management Plan.

2 PURPOSE AND SCOPE

The purpose of this document is to comply with the relevant approval condition which states:

"The Leaseholder shall prepare an end of year report. This report shall be submitted to the Director Environmental Sustainability, within the first three months of the subsequent year. The end of year report must:

(a) include a summary of the subsidence and environmental results for the year;

(b) include an analysis of these monitoring results against the relevant;

- *impact assessment criteria;*
- *monitoring results from previous years; and*
- *predictions in the SMP.*

(c) identify any trends in the monitoring results over the life of the activity; and

(d) describe what actions were taken to ensure adequate management of any potential subsidence impacts due to mining."

3 SMP PILLAR EXTRACTION DURING REPORTING PERIOD

SMP Approval was granted for Abel Area 1 (Panels 1 to 14 inclusive plus East Mains) on 27 May 2010. Pillar extraction has been conducted in the following order during 2011, completion of Panels 3, 4, and 5, currently extracting Panels 6 and 7. A Variation application for SMP Area 1 was submitted on the 8 August 2011 and was approved on the 29 September 2011. This variation was related to Panels 9 – 13 being removed from the SMP area.

SMP Approval was granted for Abel Area 2 (Panels 14 – 26) on 7 December 2011. A variation was submitted on 19 December 2011 relating to the removal of Panel 14 and the shortening of Panels 15 – 19.

Table 1 below provides approval, plus mining commencement and completion dates for the Panels extracted since approval was granted.

Table 1 – Approval and Extraction Dates

Panel	Approval Date	Extraction Commenced	Extraction Completed
Panel 1	27 May 2010	12 July 2010	22 December 2010
Panel 2	27 May 2010	17 September 2010	12 November 2010
Panel 3	27 May 2010	7 January 2011	19 April 2011
Panel 4	27 May 2010	14 March 2011	20 July 2011
Panel 5	27 May 2010	30 May 2011	24 September 2011
Panel 6	27 May 2010	22 September 2011	
Panel 7	27 May 2010	19 November 2011	

4 SUBSIDENCE AND ENVIRONMENTAL PROGRAMS AND MANAGEMENT PLANS

Subsidence and Underground Monitoring Programs consisting of a combination of subsidence surveys, visual inspections and photographic monitoring have been developed in consultation with and approved by the Principal Subsidence Engineer, DTIRIS for all Panels extracted to date. All required subsidence monitoring lines have been installed and subsidence surveys completed in accordance with the agreed Subsidence Monitoring Program with the exception of a period where access was unable to be obtained.

An Ausgrid Power Line Management Plan for Panels 5 - 8 in SMP Area 1 was prepared and was approved by the Director of Mine Safety Operations on the 18th July 2011.

Draft Management Plans were prepared for, and provided for comment to Black Hill Land and Transgrid. Consultation is continuing towards finalisation of these plans.

5 SUMMARY OF SUBSIDENCE IMPACTS

Mining operations have been completed in Panels 3, 4 & 5 during 2011 and the following visible effects or impacts on either the general surface or specific surface features.

Visual inspections and photographic monitoring of various surface features were conducted throughout the year.

Survey results for subsidence, tilt and strain during the year were general in accordance with predicted levels. Mining has occurred in Panels 3, 4 and 5 and commenced in 6 and 7. One minor exceedance has occurred relating to cracking during this period and is detailed in **Section 5.4**

5.1 Impacts on General Surface and Roads / Tracks

Surface cracking has occurred generally as predicted at the surface above Panels 3, 4, 5 and 6 in both the vegetated areas and sealed access road and access tracks.

Remedial works have been carried out in consultation and agreement with the landholder (Catholic Diocese).

5.2 Impacts on Hunter Water Corporation Waterline

Subsidence Impacts

Nil impacts during 2011.

5.3 Impacts on Ausgrid Powerlines

Subsidence Impacts

Nil impacts during 2011.

5.4 Notification Under SMP Approval Conditions 13, 16 and 17

Notification to an irregular result / minor impact relation to surface cracking in clay capped area above Panel 4 was provided on 6 May 2011. Cracking increased to a maximum of 375mm at approximately 55m coverage exceeding predictions of 260mm at less than 80m cover. A full report was included in the May 2011 Status Report.

6 SUBSIDENCE SURVEY SUMMARY AND ANALYSIS

A record of all completed subsidence surveys is shown in **Table 2**. All subsidence, tilt and strain results are within the predicted range.

Additional surveys have also been conducted on areas within the Catholic Diocese of Maitland – Newcastle land.

A summary of subsidence, strain and tilt results are detailed in **Table 3** with comparison to the SMP predictions.

All required subsidence monitoring lines have been installed and all pre-mining subsidence surveys completed in accordance with the agreed Subsidence Monitoring Programs.

Additional inspections have been carried out over the Catholic Diocese land.

Table 2 – Subsidence Monitoring Survey Dates

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
Panel 1	Subsidence survey	Installation and pre-mining survey 7/07/2010	Weekly Surveys	11/02/2011 24/06/2011
Panel 2	Subsidence Survey			22/12/2010 21/06/2011
Panel 3	Subsidence survey	23/12/2010	Weekly Surveys	10/06/2011 25/10/2011
	Visual inspection		Weekly Surveys	
Panel 4	Subsidence survey	4/03/2011	Weekly Surveys	24/08/2011
	Visual inspection		Weekly Surveys	
Panel 5	Subsidence survey	27/05/2011		2/11/2011
	Visual inspection		Weekly Surveys	
Panel 6	Subsidence survey	14/09/2011		
	Visual inspection		Weekly Surveys	
Panel 7	Subsidence survey	Refer to Attachment 3		
	Visual inspection			
Hunter Water Corporation pipeline	Subsidence survey	7/07/2010 over P1 8/09/2010 over P2	Weekly Surveys	11/02/2011 & 24/06/2011 Over P1 22/12/2010 & 21/06/2011 Over P2
	Visual inspection		Weekly Surveys	
Ausgrid Power Poles	Subsidence survey	7/07/2010 over P1 8/09/2010 over P2	Weekly Surveys	
	Visual inspection		Weekly Surveys	

Table 3 – Comparison of Subsidence Monitoring Results to SMP Predictions

PANEL 1 (W = 120 m; T = 2.35 - 3.0m) Last Survey: 24/06/2011			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	0.95 - 1.25m	1.228m	Measured subsidence < predictions
Tensile Strain	10 - 18 mm/m	18 mm/m	Measured tensile strains < predictions.
Compressive Strain	13 - 23 mm/m	14 mm/m	Measured compressive strains < predictions
Tilt	22 - 40 mm/m	22 - **46** mm/m	Measured tilts < predictions. One exceedance of 15%.
Cracking	<180mm	180mm	Cracking is in line with predictions after review of SMP Predictions. All necessary repairs have been carried out.
Other		Cracked Joint to Hunter Water Pipeline Repaired 11kv Power Line	All necessary repairs have been carried out.

PANEL 2 (W= 150m ; T = 2.5 m) Last Survey: 21/06/2011			
< 75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.30 - 1.38m	1.041 m	Measured subsidence < predictions
Tensile Strain	18 - 31 mm/m	6 mm/m	Measured tensile strains < predictions
Compressive Strain	23 - 40 mm/m	4 - 7 mm/m	Measured compressive strains < predictions
Tilt	40 - 67 mm/m	32 mm/m	Measured tilts < predictions
Cracking	<310mm	50mm	Cracking is in line with predictions. All necessary repairs have been carried out.
Other			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.20 - 1.32m	0.966m	Measured subsidence < predictions
Tensile Strain	13 - 20 mm/m	15 mm/m	Measured tensile strains < predictions
Compressive Strain	17 - 25 mm/m	6 mm/m	Measured compressive strains < predictions
Tilt	30 - 45 mm/m	27 mm/m	Measured tilts < predictions
Cracking	<200mm	150 mm	Cracking is in line with predictions. All necessary repairs have been carried out.
Other			

PANEL 3 (W=160.5 m; T = 2.5 m) Last Survey: 25/10/2011			
< 75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.33 - 1.34 m	0.79 m	Measured subsidence < predictions
Tensile Strain	19 - 31 mm/m	26 mm/m	Measured tensile strains < predictions
Compressive Strain	24 - 40 mm/m	7 mm/m	Measured compressive strains < predictions
Tilt	42 - 67 mm/m	39 mm/m	Measured tilts < predictions
Cracking	<310mm	260 mm	Measured subsidence < predictions
Other			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.26 - 1.27 m	0.982 m	Measured subsidence < predictions
Tensile Strain	14 - 21mm/m	10 mm/m	Measured tensile strains < predictions
Compressive Strain	18 - 27 mm/m	4 mm/m	Measured compressive strains < predictions
Tilt	33 - 49 mm/m	30 mm/m	Measured tilts < predictions
Cracking	<320mm	100 mm	Cracking is in line with predictions. All necessary repairs have been carried out.
Other			

PANEL 4 (W= 160.5 m; T = 2.5 m) Last Survey: 24/08/2011			
< 75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.27-1.29m	1.065m	Measured subsidence < predictions
Tensile Strain	19 - 31 mm/m	10 mm/m (37.5 mm/m)	Measured tensile strains < predictions with 1 exceedance of 20% at clay cap.
Compressive Strain	24 - 40 mm/m	18 mm/m	Measured compressive strains < predictions
Tilt	42 - 67 mm/m	60 mm/m	Measured tilts < predictions
Cracking	<310 mm	375 mm	Cracking exceeded predictions over clay capped area at the inbye end of the Panel. All necessary repairs have been carried out.
Other			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.29 - 1.32m	1.013 m	Measured subsidence < predictions
Tensile Strain	14 - 21mm/m	5 mm/m	Measured tensile strains < predictions
Compressive Strain	18 - 27 mm/m	5 mm/m	Measured compressive strains < predictions
Tilt	42 - 67 mm/m	36 mm/m	Measured tilts < predictions
Cracking	<210mm	50mm	Cracking is in line with predictions
Other			

7 PHOTOGRAPIC MONITORING AND VISUAL INSPECTION SUMMARY AND ANALYSIS

Dates of photographic monitoring and visual inspections are shown in **Table 4.** No impacts or changes have been noted in either photographic monitoring or visual inspections and these results have been detailed in the Subsidence Management Status Reports submitted in January, May and September 2010 and January 2011.

No evidence of impacts has been observed or noted during these inspections and monitoring.

Comparison of pre and post mining photographic monitoring did not reveal any evidence of impact.

Table 4 – Surface Inspection and Photographic Monitoring Dates

Monitoring / Inspection	Monitoring / Inspection Description	Pre Mining Inspections / Monitoring	Mining Period Inspections / Monitoring	Post Mining Inspections / Monitoring
Panel 3				
General Surface	Visual inspection	23/12/2010	Weekly	10/06/2011 25/10/2011
Roads / tracks	Visual inspection	23/12/2010	Weekly in active zone	10/06/2011 25/10/2011
	Photographic monitoring	23/12/2010	-	
Panel 4				
General surface	Visual inspection	4/03/2011	Weekly	24/08/2011
Roads / tracks	Visual inspection	4/03/2011	Weekly in active zone	24/08/2011
	Photographic monitoring	4/03/2011	-	
Panel 5				
General surface–	Visual inspection	27/05/2011	Weekly	2/11/2011
Roads / tracks	Visual inspection	27/05/2011	Weekly in active zone	2/11/2011
	Photographic monitoring	27/05/2011	-	
Panel 6				
General surface–	Visual inspection	14/09/2011	Weekly	
Roads / tracks	Visual inspection	14/09/2011	Weekly in active zone	
	Photographic monitoring	14/09/2011	-	

8 ENVIRONMENTAL MONITORING SUMMARY AND ANALYSIS

Groundwater

Monthly monitoring of regional groundwater levels and quality was undertaken throughout the year in accordance with the Site Water Management Plan and Integrated Monitoring Plan.

A summary of groundwater and surface water quality is provided in **Tables 5** and **6.**

Table 5 – Summary of Groundwater Quality Monitoring Results

Sampling Site	pH	EC (µS/cm)	TSS (mg/L)
6	6.47 – 7.36	1090 – 4140	84 – 708
7	6.31 – 7.69	1540 – 2870	15 – 258
12	6.01 – 7.46	1080 – 14200	12 – 210
13	6.6 – 7.54	3770 – 14300	5 – 66
JRD1	7.87 – 8.38	4460 – 4990	18 – 229
JRD2	6.21 – 7.77	313 – 2520	32 - 222

Table 6 – Summary of Surface Water Quality Monitoring Results

Sampling Site	pH	EC (µS/cm)	Turbidity (NTU)	TSS (mg/L)
1	6.55 – 7.05	227 – 781	12.2 – 280	< 5- 173
8	6.6 – 7.49	151 – 943	4 – 66.4	5 – 49
9	No site access			
10	6.65 – 7.41	248 – 1680	4.3 – 449	5 – 342
11	6.54 – 7.44	200 – 1570	9.2 – 1680	14 - 624
FMCU	6.52 – 7.74	270 – 639	-	8 – 51
FMCD	6.73 – 7.48	120 – 248	-	5 - 132

Flora and Fauna

- **Dams**

Frog species diversity was similar across the dams between the 2011 and 2010 surveys. In 2009, a much lower overall diversity of frog species was noted across the dams. Only a few dams recorded more species in 2009 than what was recorded in 2008. However, in 2010 and 2011 there has been an increase in frog diversity across a number of dams to levels comparable or greater than the 2008 survey results. Bird diversity increased slightly in 2011 in comparison to the 2010 results. There was a considerable decline in 2010 in comparison to the 2008 and 2009 results; however, bird diversity has rebounded slightly to a total of 13 species in 2011. The greatest increase in bird species diversity and abundance compared with the 2010 results was observed at Dam 14.

- **Rainforest**

The results of the 2011 flora survey were similar to those of the baseline survey, representing no substantial change in floral diversity. The transition between dry and moist forest has expanded slightly in 2011, a slight increase in the width of the rainforest within the gully. This is likely to be due to natural changes in species richness occurring within the subject site. A slight retraction of the shrub layer also occurred, which can be explained by the dieback of the exotic species *Lantana camara*. These changes are identified as minor and are consistent with what is expected to occur in rainforest systems. iv Ref: 101- 904 Abel Underground Coal Mine – 2011 Sub-tropical Rainforest Monitoring Plan

In total, 48 fauna species were recorded during the survey period, comprising three arboreal mammal species, four terrestrial mammal species, four bat species, 34 bird species, two amphibian species

and one reptile species. Two of these species, the Little Bentwing-bat *Miniopterus australis* and the Powerful Owl *Ninox strenua* are listed as threatened under the NSW *Threatened Species Conservation Act* 1995. Almost all arboreal and terrestrial mammal species recorded during baseline monitoring in 2008 were also recorded during the 2011 survey effort. Compared to 2010 data, bird species diversity at each transect showed signs of an increase, however, overall diversity was similar to species counts from 2008 and 2009. A relatively low number of bat species were identified (four species in 2011 compared to three species in 2010, six species in 2008 and eight species in 2009). Reasons for the decline in bat species numbers is not certain, but may be due to a combination of sporadic occurrence (varying frequency of detection) and weather conditions around the time of survey.

- **Pambalong Nature Reserve**

Monitoring of Pambalong Nature Reserve has been undertaken in 2010/11 in accordance with the Flora and Fauna Management Plan for Abel Underground Coalmine (ecobiological 2007). This third annual monitoring report continues the data collection that will build a picture of what constitutes normal variation so that any impacts from subsidence can be identified and appropriate management actions taken.
In all there were 102 flora (within the flora survey quadrats and transect) and 97 fauna species comprising one fish, seven frog, three terrestrial mammal, one reptile, ten bat and 75 bird species recorded by **ecobiological** within Pambalong Nature Reserve during the survey period.

No significant changes to the vegetation community extent were recorded in the 2010 surveys. Weed management has been conducted by OEH in 2010 - 11, aimed predominantly at restricting the spread of Water Hyacinth and Blackberry. Water Hyacinth is still a major issue in the North Swamp; however, the barrier installed during 2009 is working well to block the spread of this weed into the Main and South Swamps. The area of Blackberry previously sprayed (in the Main Swamp) requires ongoing monitoring and follow up treatment to eradicate/suppress regrowth. Other weed species controlled on an opportunistic basis included Pampas Grass and Moth Vine (Kathleen Straw, OEH pers comm.). A minor outbreak of Alligator Weed was also treated in the main swamp. A positive development for the Reserve is that a Bush Regeneration Coordinator has been appointed to develop and implement a long-term weed strategy for the park (Kathleen Straw, OEH pers comm.). Another significant weed in the reserve is Lantana. Active control of this species should occur is the Coastal Foothills Spotted Gum – Ironbark Forest to enhance the natural regeneration of this community. Kikuyu grass continues to cover significant areas and any treatment over these areas would require follow up regeneration and rehabilitation of the preferred community type and species. All other significant weed species identified in the Pambalong Nature Reserve should continue to be monitored and managed.

9 TRENDS IN MONITORING RESULTS

As noted previously monitoring results in subsidence and environmental areas displayed no discernable trends.

Routine and scheduled monitoring will continue as outlined in the

10 MANAGEMENT ACTIONS

Actions taken to ensure adequate management of any potential subsidence impacts due to mining include:

- Various monitoring programs, subsidence surveys, visual inspections, photographic monitoring to detect any impact;

- TARPs (Trigger, Action, Response Plans) forming part of approved Public Safety Management Plans and Environmental Monitoring Programs which include mitigation/remediation options and notification procedures relating to subsidence monitoring, surface cracking on both roads / fire trails and vegetated areas and impacts on rock mass / steep slopes and Aboriginal sites.