DONALDSONCOAL
Part of the Yancoal Australia Group

Abel Mine
Subsidence Management Plan
End of Year Report 2017

Approved by

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Operations Manager
Donaldson Coal

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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 for Area 1 and Condition 18 of the Approval Conditions for Area 2, 3 and 4.

A summary of monitoring results for the period January to December 2017 is presented in this report. Mining activities were suspended on 28th April 2016 due to the Mine being placed on Care and Maintenance. Therefore no pillar extraction was undertaken 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 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

Area 1

SMP Approval was granted for Abel Area 1 (Panels 1 to 14 inclusive plus East Mains) on 27 May 2010. Pillar extraction has continued in East Mains during 2014. 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 approved area. No extraction took place in this area during this period.

Area 2

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. The second variation submitted, relating to partial pillar extraction Panel 20 – 22, was approved on the 3 September 2012. A third variation submitted, relating to Panels 19 & 19A, was approved on the 21 December 2012. A fourth variation submitted relating to Panel 22, was approved on the 16 April 2013. No extraction took place in this area during this period.

Area 3

SMP Approval was granted for Abel Area 3 (Panels 23 – 26 and part East Install Headings) on 16 July 2013. A variation was submitted to increase the width to part of Panel 24 and was approved on the 23 December 2013. No extraction took place in this area during this period.

Area 4

SMP/EP Approval was granted for Abel Area 4 (Panels 27 – 35) on the 19th September 2014. A variation was submitted to remove the Subsidence Control Zones around the protected farm dams and was approved on the 11th November 2014. The second variation submitted, relating to Panel 28 panel layout, was approved on 1 April 2015. The third variation submitted, relating to modifying the layout of Panels 29, 31, 33 and 35 which is now to be extracted in the Lower Donaldson Seam, was approved on 13 August 2015. The fourth variation submitted, relating to the removal of the Subsidence Control Zones beneath a principal residence. No extraction took place in this area during this period.

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	2 February 2012
Panel 7	27 May 2010	19 November 2011	31 May 2012
Panel 8	7 December 2011	31 March 2012	17 July 2012
Panel 15	7 December 2011	20 February 2012	26 March 2012
Panel 20	3 September 2012	12 September 2012	3 December 2012
Panel 21	3 September 2012	8 November 2012	18 April 2013
East Mains	27 May 2010	18 July 2012	5 July 2014
East Install Headings	7 December 2011	4 December 2012	17 September 2014
Tailgate Headings	7 December 2011	5 June 2012	10 September 2012
Panel 19A	21 December 2012	20 January 2013	25 May 2013
Panel 19	21 December 2012	25 May 2013	7 August 2013
Panel 22	16 April 2013	19 April 2013	19 July 2013
Panel 23	16 July 2013	22 July 2013	10 March 2014
Panel 24	16 July 2013	16 September 2013	10 July 2014
Panel 25	16 July 2013	11 May 2014	8 May 2015
Panel 26	16 July 2013	11 August 2014	17 June 2015
Panel 27	19 September 2014	30 September 2014	12 August 2015
Panel 28	19 September 2014	11 May 2015	3 February 2016
Panel 30	19 September 2014	22 June 2015	28 April 2016
Panel 31	19 September 2014	25 February 2016	28 April 2016

4 SUBSIDENCE AND ENVIRONMENTAL PROGRAMS AND MANAGEMENT PLANS

Subsidence 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, DPE 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 Programs.

Management Plans have been prepared for the following infrastructure outlined in **Table 2** and have been approved by the Director of Mine Safety Operations.

Table 2 – Approved Management Plans

Infrastructure Owners	Management Plans	Approved
Ausgrid	Ausgrid Powerline Management Plan SMP Area 2 – Tailgate Headings	21 June 2012
	Ausgrid Powerline Management Plan SMP Area 2 - Panels 20 - 22	2 November 2012
	Ausgrid Powerline Management Plan SMP Area 1 – East Mains	12 July 2013
	Ausgrid Powerline Management Plan SMP Area 3	17 July 2013
	Ausgrid Powerline Management Plan EP / SMP Area 4	1 October 2014
Telstra	Telstra Corporation Management Plan SMP Area 2 (Panels 21 & 22)	21 December 2012
	Telstra Corporation Management Plan SMP Area 3 (Panels 23 & 24)	17 July 2013
	Telstra Corporation Management Plan SMP Area 3 Optic Fibre (Panels 23 & 24)	6 December 2013
	Telstra Corporation Management Plan SMP Area 3 (Panels 25)	11 April 2014
	Telstra Corporation Management Plan SMP Area 3 (Panels 26)	3 September 2014
Telstra	Telstra Corporation Management Plan EP / SMP Area 4 (Panels 27, 28, 29)	1 October 2014

Infrastructure Owners	Management Plans	Approved
TransGrid	TransGrid Towers Management Plan SMP Area 1	22 March 2012
	TransGrid Towers Management Plan SMP Area 2	16 January 2013
Cessnock City Council	Blackhill Road and Taylors Road Management Plan SMP Area 2	7 December 2012
	Blackhill Road Management Plan SMP Area 3	11 September 2013
	Public Roads Management Plan	23 December 2014
Hunter Water	Hunter Water Corporation Water Pipeline Management Plan SMP Area 2	21 June 2012
	Hunter Water Corporation Water Pipeline Management Plan SMP Area 1 – East Mains	12 December 2012

5 SUMMARY OF SUBSIDENCE IMPACTS

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.

5.1 Impacts on General Surface and Roads / Tracks

Surface cracking has occurred generally as predicted on the surface above Panels 28, 30 & 31 in the both the cleared and vegetated areas, private access tracks, and sealed private access road, and sealed local government road.

Remedial works have been carried out in consultation and agreement with the landholders and infrastructure owners.

5.2 Impacts on Hunter Water Corporation Waterline

Subsidence Impacts

Impacts were within predictions and infrastructure remained in a safe and serviceable condition.

5.3 Impacts on Ausgrid Powerlines

Subsidence Impacts

Impacts were within predictions and infrastructure remained in a safe and serviceable condition.

5.4 Impacts on TransGrid Transmission Towers

Subsidence Impacts

Impacts were within predictions and infrastructure remained in a safe and serviceable condition.

5.5 Impacts on Blackhill Road

Subsidence Impacts

Impacts were within predictions and infrastructure remained in a safe and serviceable condition.

5.6 Notification under SMP Approval Conditions

There have been no observed and/or reported subsidence impacts, incidents, service difficulties, community complaints, or any other relevant information, that would require notification under the approval conditions.

6 SUBSIDENCE SURVEY SUMMARY AND ANALYSIS

A record of all completed subsidence surveys is shown in **Table 3**.

A summary of subsidence, strain and tilt results are detailed in **Table 4** 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.

Table 3 – 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 1/08/2012
Panel 2	*Subsidence Survey*			22/12/2010 21/06/2011 20/06/2012

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
				9/10/2013
Panel 3	*Subsidence survey*	*23/12/2010*	Weekly Surveys	*10/06/2011* *25/10/2011* *9/05/2012*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*23/12/2010*		
Panel 4	*Subsidence survey*	*4/03/2011*	Weekly Surveys	*24/08/2011* *9/05/2011* *3/09/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*4/03/2011*		
Panel 5	*Subsidence survey*	*27/05/2011*		*4/11/2011* *2/05/2012* *18/02/2013* *14/09/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*27/05/2011*		
Panel 6	*Subsidence survey*	*14/09/2011*		*1/05/2012* *4/09/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*14/09/2011*		
Panel 7	*Subsidence survey*	*8/02/2012*		*2/08/2012* *28/05/2013* *13/09/2013*
	Visual inspection		Weekly Surveys	

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
	Photographic monitoring	*8/02/2012*		
Panel 8	*Subsidence survey*	*13/02/2012*		*31/10/2012* *17/05/2013* *6/09/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*13/02/2012*		
Panel 15	*Subsidence survey*	*9/02/2012*		*27/04/2012* *14/01/2013* *17/05/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*9/02/2012*		
Panel 20	*Subsidence survey*	*29/08/2012*		*10/01/2013* *8/01/2014* *9/07/2014*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*29/08/2012*		
Panel 19	*Subsidence survey*	*1/05/2013*		*14/09/2013* *9/07/2014*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*1/05/2013*		
Panel 19A	*Subsidence survey*	*7/01/2013*		*4/06/2013* *14/09/2013* *5/11/2013* *7/01/2014*

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
				7/07/2014
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*7/01/2013*		
Panel 21	*Subsidence survey*	*7/11/2012*		*16/05/2013* *24/01/2014* *1/09/2014*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*7/11/2012*		
Panel 22	*Subsidence survey*	*11/04/2013*		*30/07/2013* *28/01/2014* *19/02/2015*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*11/04/2013*		
Panel 23	*Subsidence survey*	*12/07/2013*		*8/04/2014* *3/03/2015* *28/10/2015*
	Visual inspection		Daily	
	Photographic monitoring	*12/07/2013*		
Panel 24	*Subsidence survey*	*19/02/2013*		*1/10/2014* *3/03/2015* *22/10/2015*
	Visual inspection		Daily	
	Photographic monitoring	*19/02/2013*		
	Subsidence survey	*13/03/2014*		*3/12/2015*

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
Panel 25				*22/09/2015*
	Visual inspection		Daily	
	Photographic monitoring	*13/03/2014*		
Panel 26	*Subsidence survey*	*9/05/2014*		*6/08/2015* *31/01/2017*
	Visual inspection		Daily	
	Photographic monitoring	*9/05/2014*		
Panel 27	*Subsidence survey*	*16/10/2014*		*3/09/2015* *31/01/2017*
	Visual inspection		Daily	
	Photographic monitoring	*22/09/2014*		
Panel 28	*Subsidence survey*	*6/05/2014*		*20/12/2016* *28/11/2017*
	Visual inspection		*3 times a week*	
	Photographic monitoring	*6/05/2014*		
Panel 30	*Subsidence survey*	*30/11/2015*		*20/12/2016*
	Visual inspection		*3 times a week*	
	Photographic monitoring	*30/11/2015*		
Panel 31	*Subsidence survey*	*25/02/2016*		*5/12/2016*
	Visual inspection		*3 times a week*	
	Photographic monitoring	*25/02/2016*		
East Install Headings	*Subsidence survey*	*14/11/2012*		*23/01/2013* *8/01/2014*
	Visual inspection		Weekly Surveys	

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
	Photographic monitoring	*14/11/2012*		
Tailgate Headings	*Subsidence survey*	*18/05/2012*		*19/12/2012* *13/06/2013* *14/01/2014*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*18/05/2012*		
East Mains Headings	*Subsidence survey*	*9/07/2012*		*14/01/2013* *30/05/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*9/07/2012*		
Blackhill Road	*Subsidence survey*	*19/02/2013*	*As detailed in Management Plan*	Same date as Panel surveys
	Visual inspection		*Daily Surveys*	
	Photographic monitoring	*19/02/2013*		
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		*As detailed in Management Plan*	
	Photographic monitoring			
Ausgrid Power Poles	*Subsidence survey*	Same date as Panel surveys	Weekly Surveys	Same date as Panel surveys
	Visual inspection		Weekly Surveys	

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
	Photographic monitoring	Same date as Panel surveys		
TransGrid Transmission Towers	*Subsidence survey*	28/03/2012	*As detailed in Management Plan*	Same date as Panel surveys
	Visual inspection		Daily Surveys	
	Photographic monitoring	28/03/2012		

Table 4 – Comparison of Subsidence Monitoring Results to SMP Predictions

PANEL 1 (W = 120 m; T = 2.35 - 3.0m)			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	0.95 - 1.25m	0.72 - 1.228m	Measured subsidence < predictions
Tensile Strain	10 - 18 mm/m	4 - 12 mm/m (18 mm/m)	Measured tensile strains < predictions.
Compressive Strain	13 - 23 mm/m	5 - 14 mm/m	Measured compressive strains < predictions
Tilt	22 - 40 mm/m	22 - 46 mm/m	Measured tilts < predictions. One exceedance of 15%.
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)			
< 75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.30 - 1.38m	0.977 - 1.041 m	Measured subsidence < predictions
Tensile Strain	18 - 31 mm/m	4 - 6 mm/m (5 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	22 - 32 mm/m	Measured tilts < predictions
Other			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.20 - 1.32m	0.94 - 0.966m	Measured subsidence < predictions
Tensile Strain	13 - 20 mm/m	9 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
Other			

PANEL 3 (W=160.5 m; T = 2.5 m)			
< 75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.33 - 1.34 m	1.003 m	Measured subsidence < predictions
Tensile Strain	19 - 31 mm/m	8 - 9 mm/m (26 mm/m)	Measured tensile strains < predictions
Compressive Strain	24 - 40 mm/m	5 - 7 mm/m	Measured compressive strains < predictions
Tilt	42 - 67 mm/m	28 - 39 mm/m	Measured tilts < predictions
Other			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.26 - 1.27 m	0.884 - 0.982 m	Measured subsidence < predictions
Tensile Strain	14 - 21mm/m	8 mm/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
Other			

PANEL 4 (W= 160.5 m; T = 2.5 m)			
< 75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.27-1.29m	1.065m	Measured subsidence < predictions
Tensile Strain	19 - 31 mm/m	6 - 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	6 - 18 mm/m	Measured compressive strains < predictions
Tilt	42 - 67 mm/m	36 - 60 mm/m	Measured tilts < predictions
Other			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.29 - 1.32m	1.054 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	25 - 36 mm/m	Measured tilts < predictions
Other			

PANEL 5 (W= 160.5 m; T = 2.5 m)			
< 75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.27-1.43	1.154m	Measured subsidence < predictions
Tensile Strain	14 - 15 mm/m	10 mm/m	Measured tensile strains < predictions
Compressive Strain	15 - 19 mm/m	4 mm/m	Measured compressive strains < predictions
Tilt	41 - 46 mm/m	68 mm/m	Measured tilts < predictions with 1 minor exceedance
Other			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.42 - 1.43m	1.002 m	Measured subsidence < predictions
Tensile Strain	11 - 15 mm/m	2 mm/m	Measured tensile strains < predictions
Compressive Strain	15 - 18 mm/m	13 mm/m	Measured compressive strains < predictions
Tilt	38 - 46 mm/m	29.8 mm/m	Measured tilts < predictions
Other			

PANEL 6 (W= 160.5 m; T = 2.5 m)			
< 75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.21 - 1.32m	1.215m	Measured subsidence < predictions
Tensile Strain	14 mm/m	8 mm/m	Measured tensile strains < predictions
Compressive Strain	17 - 18 mm/m	21 mm/m	Measured compressive strains < predictions with 1 minor exceedance
Tilt	39 - 41 mm/m	89.6 mm/m	Measured tilts < predictions with 1 minor exceedance
Other			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.32 - 1.42m	1.066 m	Measured subsidence < predictions
Tensile Strain	11 - 14mm/m	9 mm/m	Measured tensile strains < predictions
Compressive Strain	14 - 17 mm/m	7 mm/m	Measured compressive strains < predictions
Tilt	38 - 41 mm/m	30 mm/m	Measured tilts < predictions
Other			

PANEL 7 (W= 160.5 m; T = 2.5 m)			
< 75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.27 - 1.32m	0.771m	Measured subsidence < predictions
Tensile Strain	11 - 14 mm/m	5 mm/m	Measured tensile strains < predictions
Compressive Strain	14 - 18 mm/m	2 mm/m	Measured compressive strains < predictions
Tilt	41 mm/m	12 mm/m	Measured tilts < predictions
Other			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.32 - 1.43m	1.336 m	Measured subsidence < predictions
Tensile Strain	11 - 15mm/m	23 mm/m	Measured tensile strains < predictions with 1 minor exceedance
Compressive Strain	14 - 18 mm/m	36 mm/m	Measured compressive strains < predictions with 1 minor exceedance
Tilt	41 mm/m	42.5 mm/m	Measured tilts < predictions with 1 minor exceedance
Other			

PANEL 8 (W= 160.5 m; T = 2.5 m)			
< 75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	< 1.32m	0.830m	Measured subsidence < predictions
Tensile Strain	14 - 15 mm/m	2 mm/m	Measured tensile strains < predictions
Compressive Strain	17 - 19 mm/m	3 mm/m	Measured compressive strains < predictions
Tilt	42 mm/m	11.4 mm/m	Measured tilts < predictions
Other			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.25 - 1.32m	0.845 m	Measured subsidence < predictions
Tensile Strain	10 - 14mm/m	11 mm/m	Measured tensile strains < predictions with 1 minor exceedance
Compressive Strain	13 - 17 mm/m	6 mm/m	Measured compressive strains < predictions with 1 minor exceedance
Tilt	41 mm/m	33.8 mm/m	Measured tilts < predictions
Other			

PANEL 15 (W= 160.5 m; T = 2.5 m)			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.17 - 1.23m	1.164m	Measured subsidence < predictions
Tensile Strain	7 - 12mm/m	15 mm/m	Measured tensile strains < predictions
Compressive Strain	9 - 15 mm/m	13 mm/m	Measured compressive strains < predictions
Tilt	19 - 32 mm/m	49 mm/m	Measured tilts < predictions with 2 minor exceedance
Other			

PANEL 20 (W= 128 m; T = 2.7 m)			
>75m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	150 mm	62 mm	Measured subsidence < predictions
Tensile Strain	2 mm/m	1 mm/m	Measured tensile strains < predictions
Compressive Strain	2 mm/m	2 mm/m	Measured compressive strains < predictions
Tilt	3 mm/m	2.5 mm/m	Measured tilts < predictions
Other			

PANEL 21 (W= 212 m; T = 2.7 m)			
125m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	150 mm	96 mm	Measured subsidence < predictions
Tensile Strain	2 mm/m	1 mm/m	Measured tensile strains < predictions
Compressive Strain	2 mm/m	1 mm/m	Measured compressive strains < predictions
Tilt	3 mm/m	2.1 mm/m	Measured tilts < predictions
Other			

TAILGATE HEADINGS (W= 80.5 m; T = 2.8 m)			
<110mCover	**Predicted**	**Final Measured**	**Comment**
Subsidence	0.88 – 0.99m	0.250m	Measured subsidence < predictions
Tensile Strain	8 - 9mm/m	2 mm/m	Measured tensile strains < predictions
Compressive Strain	8 - 9 mm/m	2 mm/m	Measured compressive strains < predictions
Tilt	18 - 33 mm/m	7 mm/m	Measured tilts < predictions
Other			

EAST INSTALL HEADINGS (W= 105m; T = 2.7 m)			
100m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	0.9m	1.286m	Measured subsidence > predictions
Tensile Strain	13 – 19 mm/m	12 mm/m	Measured tensile strains < predictions
Compressive Strain	16 - 24 mm/m	9 mm/m	Measured compressive strains < predictions
Tilt	24 - 35 mm/m	44 mm/m	Measured tilts > predictions
Other			

EAST MAINS HEADINGS (W= 125m; T = 2.7 m)			
100m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.59m	1.408m	Measured subsidence < predictions
Tensile Strain	10 - 16 mm/m	11 mm/m	Measured tensile strains < predictions
Compressive Strain	13 - 20 mm/m	15 mm/m	Measured compressive strains < predictions
Tilt	49 mm/m	48.6 mm/m	Measured tilts < predictions
Other			

Panel 19A (W= 227.9m; T = 2.6 m)			
100m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.42m	1.261m	Measured subsidence < predictions
Tensile Strain	8 - 14 mm/m	3 - 12 mm/m	Measured tensile strains < predictions
Compressive Strain	11 - 18 mm/m	4 - 13 mm/m	Measured compressive strains < predictions
Tilt	40 mm/m	29 - 48 mm/m	Measured tilts < predictions with only a minor exceedance
Other			

PANEL 22 (W= 180.3 m; T = 2.8 m)			
125m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	150 mm	44 mm	Measured subsidence < predictions
Tensile Strain	2 mm/m	1 mm/m	Measured tensile strains < predictions
Compressive Strain	2 mm/m	1 mm/m	Measured compressive strains < predictions
Other			

PANEL 23 (W= 215 m; T = 2.5 m)			
<130m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.30m	0.983m	Measured subsidence < predictions
Tensile Strain	30 mm/m	13 mm/m	Measured tensile strains < predictions
Compressive Strain	30 mm/m	13 mm/m	Measured compressive strains < predictions
Other			

PANEL 24 (W= 220 m; T = 2.5 m)			
<130m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.30m	1.061m	Measured subsidence < predictions
Tensile Strain	30 mm/m	7 mm/m	Measured tensile strains < predictions
Compressive Strain	30 mm/m	9 mm/m	Measured compressive strains < predictions
Other			

PANEL 25 (W= 220 m; T = 2.5 m)			
<130m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.30m	1.087m	Measured subsidence < predictions
Tensile Strain	30 mm/m	21 mm/m	Measured tensile strains < predictions
Compressive Strain	30 mm/m	9 mm/m	Measured compressive strains < predictions
Other			

PANEL 26 (W= 220 m; T = 2.5 m)			
<130m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.30m	1.130m	Measured subsidence < predictions
Tensile Strain	30 mm/m	9 mm/m	Measured tensile strains < predictions
Compressive Strain	30 mm/m	13 mm/m	Measured compressive strains < predictions
Other			

PANEL 27 (W= 190 m; T = 2.5 m)			
<170m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.40m	1.005m	Measured subsidence < predictions
Tensile Strain	30 mm/m	2 mm/m	Measured tensile strains < predictions
Compressive Strain	30 mm/m	8 mm/m	Measured compressive strains < predictions
Other			

PANEL 28 (W= 190 m; T = 2.5 m)			
<190m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.40m	1.319m	Measured subsidence < predictions
Tensile Strain	30 mm/m	1 mm/m	Measured tensile strains < predictions
Compressive Strain	30 mm/m	10 mm/m	Measured compressive strains < predictions
Other			

PANEL 30 (W= 190 m; T = 2.5 m)			
<200m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.40m	1.131m	Measured subsidence < predictions
Tensile Strain	30 mm/m	11 mm/m	Measured tensile strains < predictions
Compressive Strain	30 mm/m	11 mm/m	Measured compressive strains < predictions
Other			

PANEL 31 (W= 170 m; T = 2.5 m)			
<200m Cover	**Predicted**	**Final Measured**	**Comment**
Subsidence	1.40m	0.307 m	Measured subsidence < predictions
Tensile Strain	30 mm/m	6 mm/m	Measured tensile strains < predictions
Compressive Strain	30 mm/m	7 mm/m	Measured compressive strains < predictions
Other			

7 PHOTOGRAPHIC MONITORING AND VISUAL INSPECTION SUMMARY AND ANALYSIS

Dates of photographic monitoring and visual inspections are shown in **Table 3.** 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 2017 and January 2018.

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.

8 ENVIRONMENTAL MONITORING SUMMARY AND ANALYSIS

Water

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 1 January to 31 December 2017.

Sampling Site	pH	EC (µS/cm)	TSS (mg/L)
6	5.93 – 6.93 (6.58)	1,720 – 2,470 (2,201)	30– 611 (172)
13	6.87 – 7.02 (6.94)	4,250 – 4,560 (4,357)	22- 46 (36.6)
JRD2	5.76 – 7.26 (6.66)	304 – 2,522 (1,357)	11 – 252 (70.6)

Table 6 – Summary of Surface Water Quality Monitoring Results 1 January to 31 December 2017

Sampling Site	pH	EC (µS/cm)	Turbidity (NTU)	TSS (mg/L)
1	6.34 - 8.06 (7.06)	202 - 603 (440)	10.5 – 321 (48)	<5 – 113 (32)
8	5.89 – 7.33 (6.68)	348 – 685 (527)	3.1 – 37.5 (22.9)	<5 – 28 (9.3)
10	6.43 – 7.34 (6.93)	456 – 2,240 (1,319)	4.4 – 78.4 (23.2)	<5 – 111 (26.5)
11	5.88 - 7.64	142 - 1,278	3.7 - 119	9 -176
FMCU	6.09 - 7.50	164 - 468	14 - 32	<5 - 122
FMCD	6.83 – 8.24	110 - 241	3.8 – 5.6	<5 - 86

9 TRENDS IN MONITORING RESULTS

Surface Water

The pH values at all sites were slightly acidic to slightly alkaline. All results were within the upper and lower water quality trigger values for Lowland Rivers in NSW (8.5) outlined in the Guidelines for Fresh and Marine Water Quality (ANZECC 2000). Previously there have been short term declines in pH following significant rainfall events such as in November 2013 (261.8mm rainfall), April 2015 (412mm rainfall) and. January 2016 (430.8mm). Overall, during the reporting period there were no significant differences in pH between the upstream and downstream sites.

The electrical conductivity (EC) results range between 83µS/cm and 2,240µS/cm for all sites. On two occasions, electrical conductivity was recorded outside of water quality trigger values for Lowland Rivers in NSW (125 to 2,200µS/cm) (ANZECC 2000). Four Mile Creek Downstream, Site 3 and Site 5 all recorded EC values below the 125µS/cm trigger during the period. Site 10 recorded an elevated level of 2,240µS/cm in October 2017. This result was recorded during an extended dry period when there was no flow and low water levels in the sampling pool.

Whilst it is expected that rainfall will influence EC results, EC does not appear to be strongly correlated with the monthly rainfall. The average EC values upstream are higher than the corresponding downstream values. No other long-term trends in EC are apparent.

Turbidity and total suspended solids (TSS) levels at upstream Sites 1 during January 2017 exceeded the water quality trigger values for Lowland Rivers in NSW (6 to 50 NTU) outlined in the Guidelines for Fresh and Marine Water Quality (ANZECC 2000) and industry standard TSS criteria (50mg/L). This exceedance did not correspond to a high rainfall event. Given that Site 1 is upstream of the Abel Mine, it is not considered that the mine activities contributed to these levels but rather localised conditions.

No long-term trends are apparent within the monitoring data with widely varying results with spikes in turbidity and TSS not necessarily correlated with monthly rainfall. Baseline monitoring results for both upstream and downstream sites have previously recorded significantly elevated TSS which are considered to form part of the natural variation.

Groundwater Levels

Piezometers located within and to the south of the Abel mine area are behaving predictably, with drawdown in the Donaldson Seams and by a lesser amount in most overburden piezometers responding as expected to mining activities. Piezometers to the west of the Abel mine area appear to likely be influences by mining activity at Bloomfield.

Monitoring confirms that there is no evidence of any drawdown response in the alluvium or regolith groundwater. In particular Piezometers 81A and 81B are located adjacent the Pambalong Nature Reserve.

Monitoring results from 81A (single vibrating wire transducer placed within the Lower Donaldson Seam) showed a drawdown response to mining the Donaldson Seam within the Abel Mine. However, Piezometer 81B is screened within overlying shallow Permian strata with water levels remaining stable. The lack of response in the shallow piezometer indicates there has been no mining impact on the Pambalong Nature Reserve.

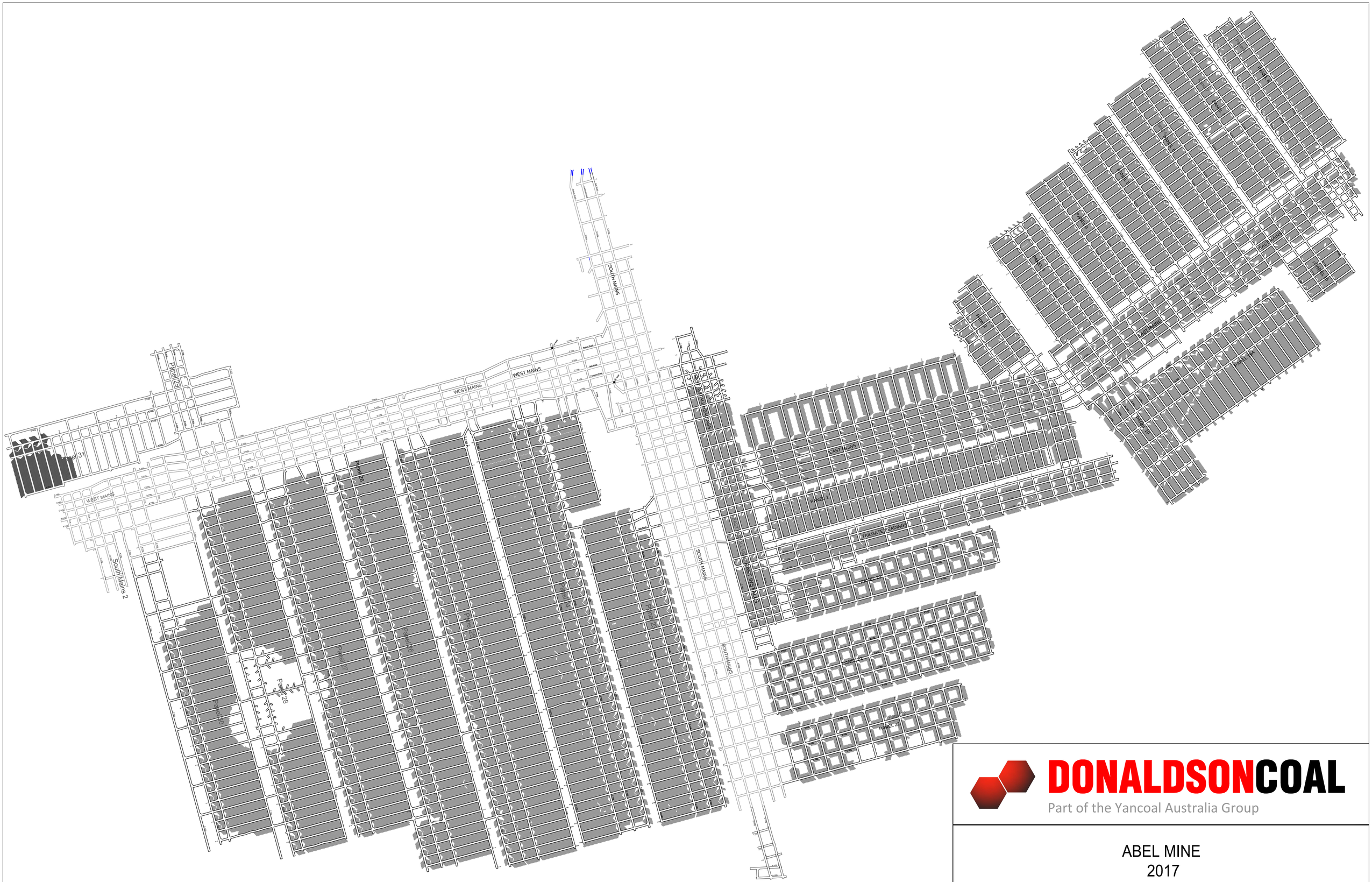
Piezometers 63A and B are located to the east of the Abel Mine adjacent to the F3 Freeway and near the Hexham Swamp. However, it appears that the shallow Piezometer 63B has failed or the bore has collapsed. Notwithstanding this, review of the responses from other shallow alluvium and regolith bores is still consistent with there being no impact on the Hexham Swamp.

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.



DONALDSONCOAL

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ABEL MINE
2017

SCALE	: N.T.S.	DWG No.	: a6p0222.dwg
DRAWN	: R. Tubridy	REVISION	: