Appendix K

Subsidence Monitoring Program

DONALDSON COAL PTY LIMITED

ABEL MINE

Appendix K

Subsidence Monitoring Program

Panels 27 - 35

May 2014

Document Control

Description

Document No.	
Title	Subsidence Monitoring Program – Panels 27 - 35
General Description	Provides a program for the management of subsidence monitoring on the surface in the area potentially influenced by mining in Panels 27 - 35 at Abel Mine.
Key Support Documents	Abel Mine Extraction Plan Panels 27 - 35

Approvals

ORIGINATOR	Matthew Wright	Position Registered Mine Surveyor	Signed	Date
REVIEWED	Daniel Lee	Position Registered Surveyor	Signed	Date
APPROVED	Tony Sutherland	Position Technical Services Manager	Signed	Date
CONFIRMED **(DTIRIS if Applicable)**		Position	Signed	Date

Revisions

					Approved	
Version #	**Date**	**Description**	**By**	**Checked**	**Name**	**Signed**

Consultation

Version#	Date	Name	Position

The nominated Coordinator for this document is	Technical Services Manager

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1. PURPOSE AND SCOPE

The purpose of this Monitoring Program is to provide a subsidence monitoring and reporting program to measure and monitor both subsidence and any effects relating to mining (pillar extraction) in the Extraction Plan area. The program includes monitoring both pre and post mining for Panels 27 - 35 within EP Area 4. The proposed subsidence mark locations and the relevant surface features are shown on **Figure 1**. Individual monitoring programs and details are listed in **Section 6 – Monitoring Details**. Monitoring specific to individual built features (e.g. power lines, telecommunications, and public roads will be detailed in individual Built Features Management Plans prepared in consultation with the relevant owners.

This Monitoring Program has been developed as part of the Abel Extraction Plan for Area 4.

2. RESPONSIBILITIES AND RESOURCES

The Abel Mine Surveyor is responsible for the implementation of the subsidence monitoring component and the visual and photographic monitoring and inspection component of this Program.

The Abel Manager of Mining Engineering is responsible for ensuring that sufficient resources are available to implement the requirements of this Program.

3. CONSULTATION

This program has been developed considering recommendations contained within reports provided by MSEC, in consultation with officers of the Department of Trade and Investment and is submitted to the Principal Subsidence Engineer for approval.

4. BACKGROUND

Abel Mine is an underground coal mine operated by Donaldson Coal Pty Limited. The mine access, entries and primary surface facilities are located approximately 23km north-west of Newcastle on John Renshaw Drive at Blackhill. Abel commenced mining operations in May 2008, and commenced pillar extraction during June 2010. Abel uses the bord and pillar method to develop mining panels which will support secondary extraction.

This Subsidence Monitoring Program includes the monitoring of:

- Longitudinal and transverse monitoring lines above extraction panel
- Public Roads
- Principal Residence / Other Structures / Access roads
- Dams
- Photographic monitoring and visual inspections of the general, roads, tracks and fences.

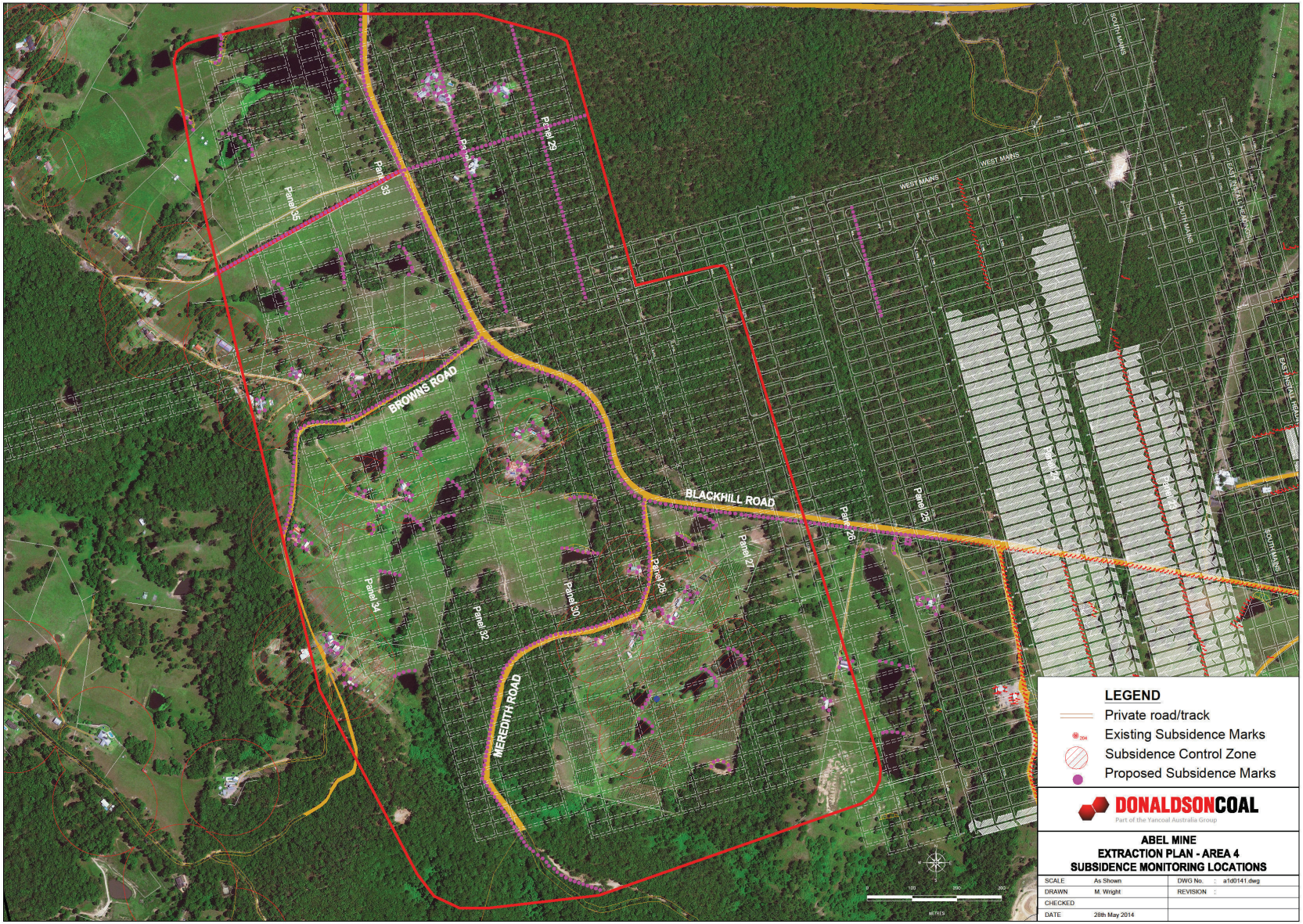

FIGURE 1: LOCATION PLAN

5. APPROACH TO SUBSIDENCE MONITORING

The Mine's overall strategy for monitoring and management is:

1. **Measure baseline information** - Established background data for the surface above the mining area.

2. **Monitor the effects of mining** - Continue monitoring of identified parameters at key positions relating to the mining position.

3. **Regularly assess and interpret monitoring** – Monitoring data is analysed to identify any variations from predictions or unexpected anomalies.

4. **Subsidence Management Status Reports** - Regular reports will be supplied to the relevant Stakeholders, along with periodic consultation meetings. Such updates will review the monitoring results, review the requirement to reassess subsidence effects and identify/implement remedial actions (see below).

5. **Reporting of monitoring results** – as described in **Section 7.**

6. **Re-assess any impacts** – where variations are greater than predictions made in the Extraction Plan, additional assessment/investigation of impacts will be undertaken. This will be carried out by specialist consultants and Abel personnel where required.

6. MONITORING DETAILS

6.1 Subsidence Monitoring

6.1.1 Longitudinal and Monitoring Lines

Stable marks to be established as shown in "**Figure 1"**. These lines will extend beyond the 26.5 degree angle of draw. Stations to be placed at generally 10 metre spacing's along the lines. Monitoring by precise level and steel band to provide level, strain and tilt information.

6.1.2 Principal Residence / Other Structures / Dams / Access Roads

Stable marks to be established around Principal Residences, other structures and dams. These marks will be monitored by either precise level and steel band to provide level, strain and tilt information or total station to provided x, y and z to establish movement. See **"Figure 1"** for proposed monitoring point locations.

6.1.3 Public Road Lines

Stable marks to be established along the edge of roads. These lines will extend beyond the 26.5 degree angle of draw. Stations to be placed at generally 10 metre spacing's along the line. Monitoring will consist of precise level and steel band to provide level, strain and tilt information. See **"Figure 1"** for proposed monitoring point locations. Further information regarding monitoring of Public Roads will be outline in the individual Built Features Management Plan.

6.2 Monitoring Schedule

Survey Line	Survey Stations	Station Spacing	Monitoring Frequency	Survey Standards
Centre Line / Cross Lines	Stable Marks	Generally 10m apart	Pre & post mining 6 months post 12 months post	Standard B
Public Roads	Stable Marks	Generally 10m apart	Pre & post mining 6 months post 12 months post Also Weekly surveys while in active mining area	Standard B
Principal Residence / Other Structures / Dams / Access Road	Stable Marks	Adjacent to Structure	Pre & post mining 6 months post 12 months post	Standard A & B

6.3 Surface Features – Surface Inspections and Photographic Monitoring

Surface features above Area 4 include paddocks used for cattle grazing interspersed with areas of medium density tree cover, private access roads and public roads (Blackhill Road, Meredith Road and Brown's Road). A pre-mining inspection of the area will identify existing condition of the surface area.

6.3.1 Surface Inspections, Parameters, Monitoring and Frequency

A pre-mining inspection of the panels shall be undertaken prior to commencement of pillar extraction. The purpose of this inspection is to gain a baseline record of the surface before carrying out pillar extraction beneath an area. Visual inspections will then be conducted of any sensitive surface features at regular intervals during undermining by the panel plus post mining. If any change is noted photographs will be taken and used as a comparison against the baseline photographs.

Mine personnel will conducted surface inspection of the area on a routine basis as outline the in the Public Safety Management Plan. Regular inspections will be conducted in the zone defined as being 200m behind and 100metres inform of the current face position will include inspections of:

- Surface cracking particularly around edges of extraction void, travelling abutments and steep slopes
- Surface humps near centre of extraction panel, travelling abutments and topographic lows adjacent steep slopes
- Step changes in land surface
- Serviceability of access tracks

- Slope, boulder and tree instability
- General vegetation condition observation

The proposed surface condition monitoring from is included in **Appendix A**.

6.3.2 Photographic Monitoring, Parameters, Methods and Frequency

Where sensitive surface features are located during the pre-mining visual inspection, photographic monitoring sites will be established (with GPS location). Photographic inspections of the panel shall be undertaken prior to commencement of pillar extraction and at completion of mining. Additional photography will be undertaken if visual inspections, conducted during mining, reveal any changes.

A summary of results will be reported to the Principal Subsidence Engineer. An annual summary will be prepared for the Annual Environment Management Report (AEMR).

6.4 Monitoring – General Information

Monitoring or inspections shall not be discontinued or the approved monitoring program modified without the agreement of the Principal Subsidence Engineer.

Table 1. Surface Inspections and Photographic Monitoring Methods and Parameters

Item	Monitoring Type	Monitoring Frequency	Responsibility
Surface features	Photographic	• Pre mining • Additonal if visual inspections identify impact • Post mining	Abel Mine Surveyor
Surface features	Visual inspections	• Pre mining • Daily during undermining • Post mining	Abel Mine Surveyor
Principal Residence / Other Structures / Dams / Access Roads	Visual inspections	• Pre mining • As detailed in the individual built feature management plans • Post mining	Abel Mine Surveyor
Surface Infrastructure	Visual Inspection	As detailed in the individual built feature management plans	Abel Mine Surveyor

6.5 Increase in Monitoring Frequency

The Extraction Plan Subsidence Monitoring and Management TARP indicated scenarios where frequency of monitoring may be increased to more frequent intervals than that presented in **Appendix A.** This may occur where greater than predicted subsidence parameters are measured, or abnormal surface conditions are observed.

7. SURVEY STANDARDS

GENERAL

- Control survey information datum for both coordinates and level to be either from State Survey Grid or confirmed unaffected station installed from State Survey Grid.

STANDARD A

- Location of marks by Total station coordination (x,y) and level (z).
- Expected accuracy +/-10mm
- Traverse accuracy to be ICSM SP1 Class D or better.

STANDARD B

- Precision leveling with an expected accuracy of +/-5mm
- Strain measurements with an expected accuracy of +/-3mm

8. REPORTING

Information generated as a result of monitoring surveys conducted over subsidence marks shall be supplied to the Principal Subsidence Engineer in Excel format via e-mail.

Results of each survey, in Excel format, shall be forwarded promptly following completion.

9. REVIEW

This plan will be reviewed as necessary including:

- In the event that relevant stakeholders raise issues that necessitate a review;
- Monitoring demonstrates that the subsidence results are such that a review is warranted.

Appendix A

Subsidence Inspection Checklist

SUBSIDENCE INSPECTION CHECKLIST		
Date		
Abel Panel Number		
Face Position (Pillar No / Panel row)		
Inspection Zone Start (Face Chainage -200m)		
Inspection Zone End (Face Chainage + 100m)		
Area Inspected		
INSPECTION ITEM	**CHECKED**	**COMMENTS**
Surface cracking		
Surface humps (compression)		
Step change in land surface		
Unstable slopes, boulders or trees		
Surface slumping, erosion		
Changes to streams, ponding, sediment load		
General vegetation condition (in particular, dieback of vegetation		
Other		

SUBSIDENCE INSPECTION CHECKLIST

Where to Inspect

200 metres behind and 100 metres in front of the current face position.

Cover the full subsidence bowl out to the 26.5° angle of draw.

What to look for

- Surface cracking - edges of extraction void and start and travelling abutments particularly in rock outcrop areas.
- Surface humps (compression) - near centre of extracted panels and travelling abutment
- Step change in land surface - associated with cracking
- Slope, boulder and tree instability
- Surface slumping, erosion
- Serviceability of access tracks
- Changes to streams, ponding, sediment load
- General vegetation conditions
- Any effect that may cause a safety risk. – If unsure report immediately.

Actions if there is a public safety risk

- Implement the **Public Safety Management Plan**; including
- Immediately notify the Landholder or Stakeholder (or responsible person) of the issue.
- Take action to remediate the issue (If possible)
- Erect 'NO ACCESS' tape and warning signs if remediation is not possible and
- Notify the Technical Services Manager of the issue.