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DPE46890

Dear Gabrielle

AIRLY MINE EXTRACTION PLAN MODIFICATION (MOD2): REVIEW OF SUBSIDENCE MONITORING TO END OF MW10 AND SURFACE CRACKING

Centennial Airly Pty Ltd (CAPL) owns and operates Airly Mine 40km northwest of Lithgow in New South Wales. The Department of Planning, Industry and Environment (DPIE) gave conditional approval for an Extraction Plan Modification (referred to as MOD2) but required CAPL to demonstrate the subsidence at the completion of MW10 was within predicted levels and the subsidence impact performance measures are expected to be met. In an email dated 6 September 2021, DPIE commissioned the Independent Expert Panel (IEP) for Airly Mine, Professor Ismet Canbulat (University of NSW) and Dr Ken Mills (SCT Operations Pty Ltd), to review the monitoring data and provide the following advice:

- In the panel's opinion, is the cracking observed over the MW10 chain pillar consistent with anticipated subsidence movements?
- Taking into consideration the additional information provided by Centennial, does the panel agree that:
 - subsidence levels have returned to within predicted levels and are likely to be maintained within predictions for MW11 and 12; and
 - the subsidence impact performance measures established under the consent are likely to be achieved over MW11 and MW12?

This letter report provides the IEP's advice in respect of these matters.

The IEP has reviewed the subsidence monitoring information and considers that the subsidence behaviour observed is consistent with the subsidence behaviour observed over previous longwall panels and subsidence at the completion of MW10 is less than recent numerical modelling studies indicate. The cracking observed to the east of MW10 is consistent with cracking observed to the east of the six previous panels.

The subsidence levels above MW10 are currently within expectation. They are greater than 125mm on the western side of the panel and are expected to increase further as MW11 and MW12 are mined. Modelling indicates the maximum subsidence over MW10 at the completion of MW12 is likely to be somewhere in the range 200-250mm.

The panel does not agree that subsidence has returned to predicted levels – assuming predicted levels means less than 125mm – because no change has yet been made to the geometry of extracted panels that would cause any reduction in subsidence from the greater than 125mm levels observed over previous panels. The effects of the larger chain pillar between MW10 and MW11 will only become evident once MW11 is mined.

The panel does accept that numerical modelling indicates that subsidence above MW11 and MW12 will be less than 125mm. If subsidence remains consistent with the recent numerical modelling, the performance measures are likely to be achieved.

1. ANALYSIS OF SUBSIDENCE MONITORING

The subsidence observations from A and B Lines at Airly Mine have been reviewed and analysed. The results of the analysis are presented in this section. The survey data has been offset where necessary to remove minor inconsistencies that are common when monitoring subsidence in a bushland environment.

Figure 1 shows the location of the miniwall panels (extracted in red and proposed in blue), the A and B subsidence lines, and the cracks that have been observed/recorded or indicated ahead of mining by subsidence monitoring.

The approximate locations of cracks observed on rock features are shown in Figure 1 as thick yellow lines. The eastern edge of extracted panels when the cracks were observed is shown by the western end of the thin yellow line perpendicular to crack. The cracks indicated by subsidence monitoring along the length of A and B subsidence lines are shown in a lighter shade of yellow. These cracks are not necessarily apparent at the surface because they are disguised by surface soils and leaf litter. Their presence is indicated by the differential horizontal movements between adjacent survey pegs. The crack width indicated by this differential movement is typically 40-60mm.

The observed cracks are concentrated close to areas that are readily accessible, below subsidence lines, or that have been specifically inspected (for instance by the IEP site visit in January 2021). On this basis, there may be additional cracks elsewhere around the periphery of the miniwall panels that have yet to be identified because of the steep nature of the terrain and difficulties of access.

The overburden depth to the mining horizon is approximately 240m over the central part of the mining area and decreases to the east by up to 80m above MW11.

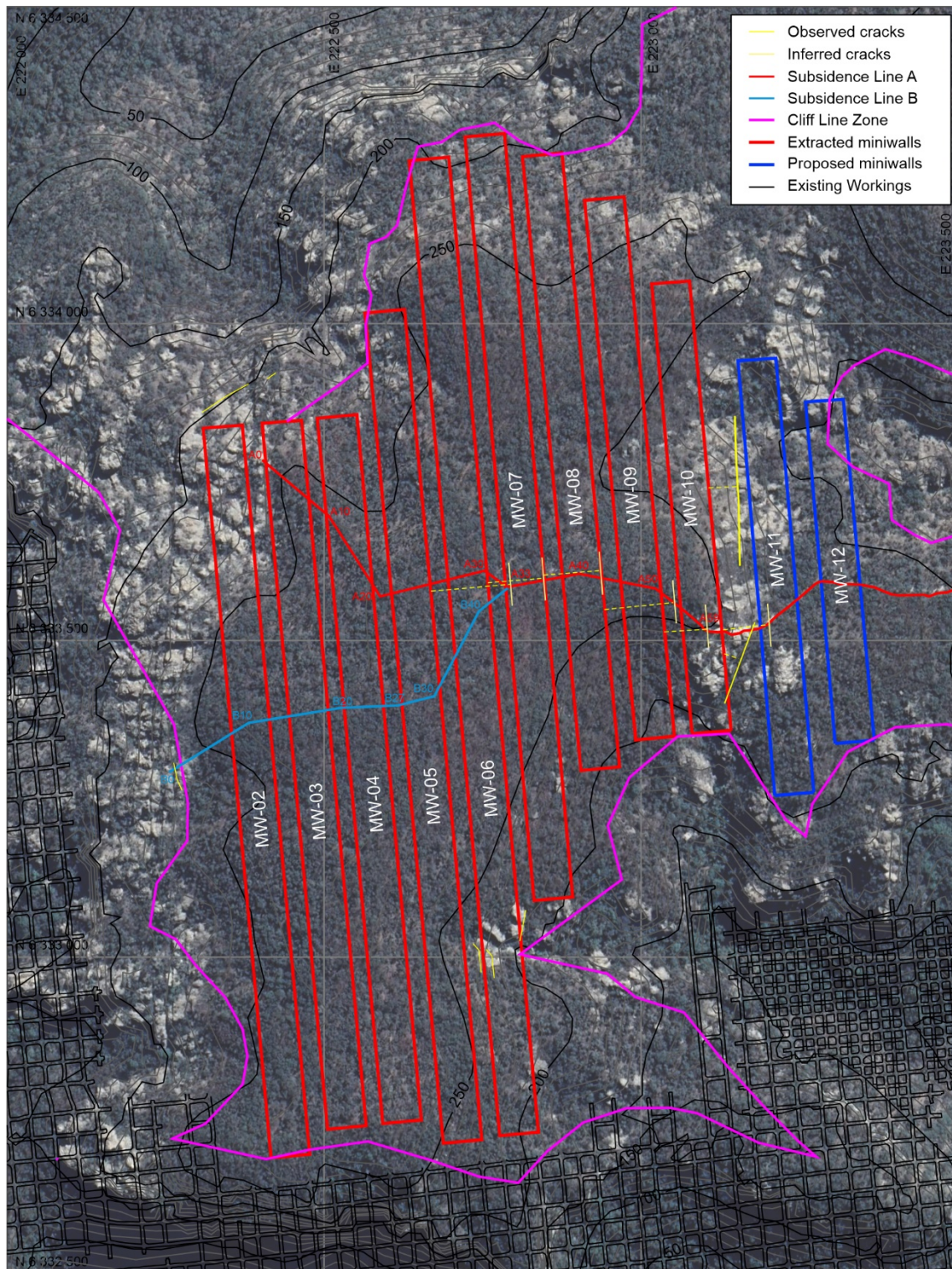
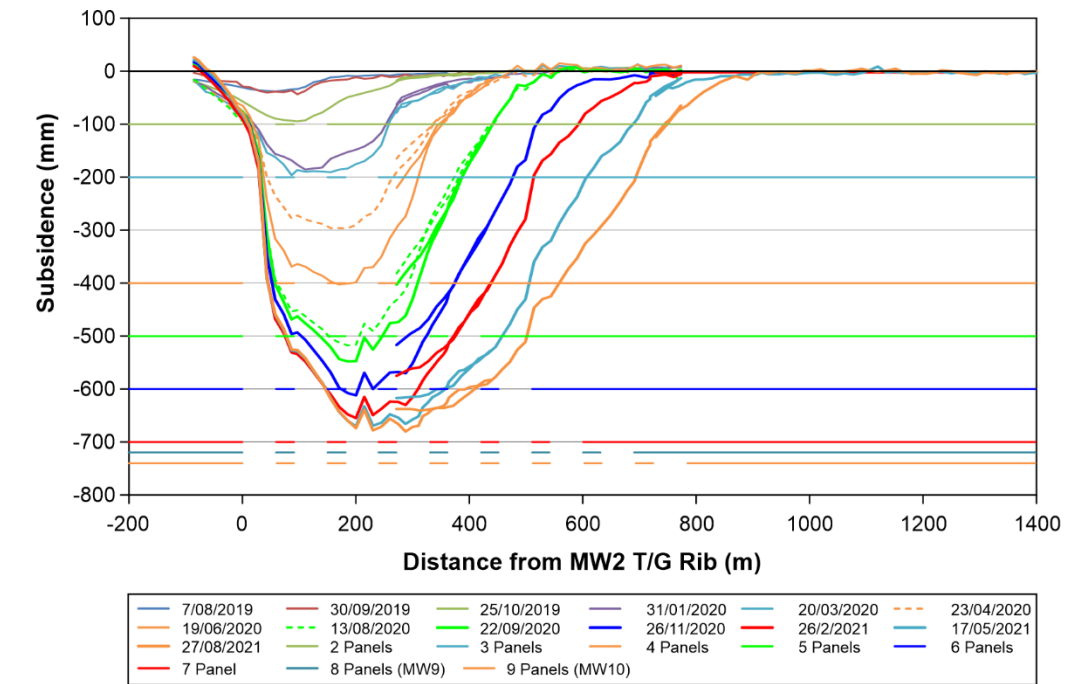
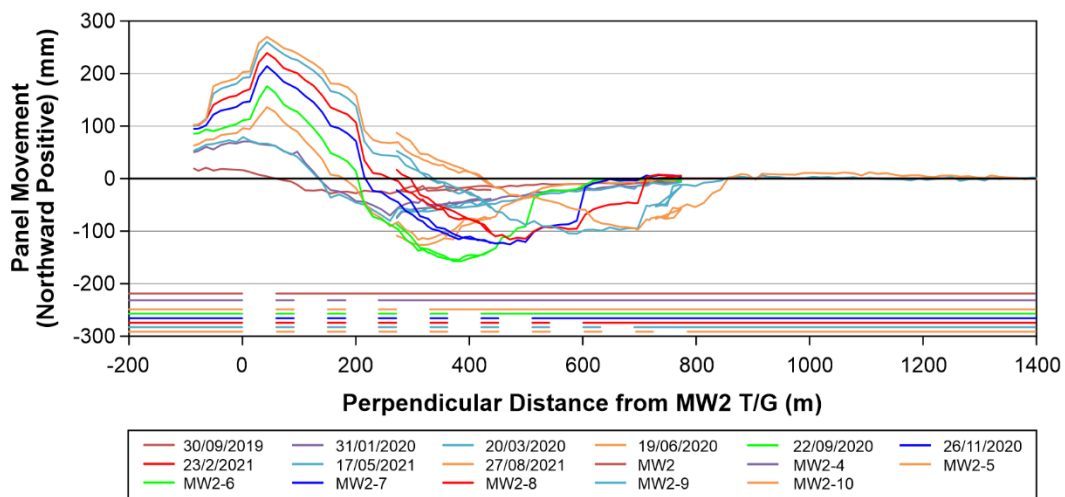


Figure 1: Site plan showing location of miniwall panels, subsidence lines and surface cracks observed and inferred.

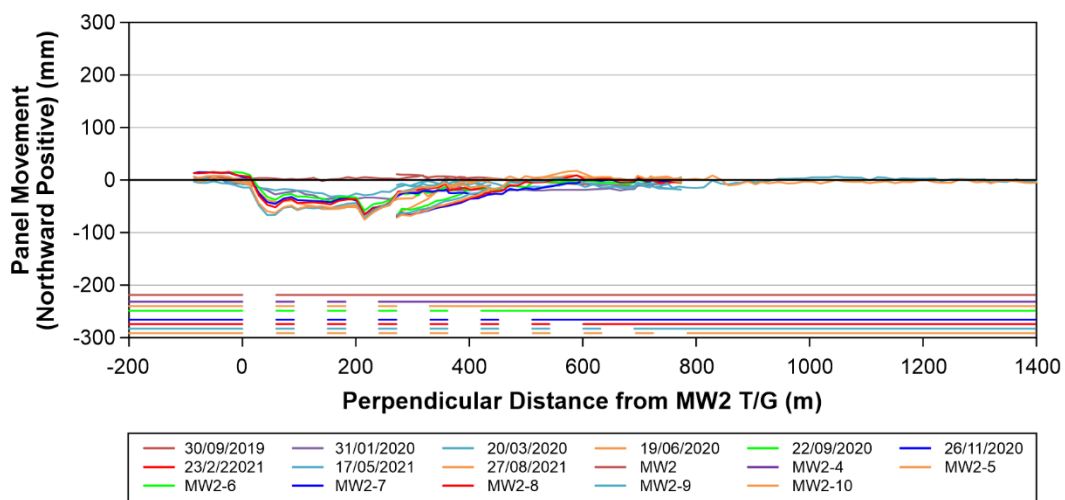
Figure 2 shows the subsidence movements observed on A and B Lines following the completion of each miniwall panel. The extracted panel geometry is shown at the level of maximum subsidence in the colour that corresponds to the subsidence profile. For the horizontal movements, the panel geometries are shown at the bottom of each plot. The three components of movement are shown at approximately the same vertical scale.



a) Subsidence.



b) Cross-Panel Horizontal.



c) Long-Panel Horizontal.

Figure 2: Subsidence movements observed on A and B Lines.

Subsidence in the central part of the mining area has reached a maximum of approximately 680mm that is now only increasing slightly with each additional panel mined. Observed cross-panel horizontal movements indicate the overburden strata above the entire mining area is continuing to increment to the east with each panel mined. The increment of movement is approximately 40mm across most of the area.

Figure 3 shows a comparison of the goaf edge subsidence measured at the completion of MW10 and expected movements based on numerical modelling for MW10, MW11 and MW12.

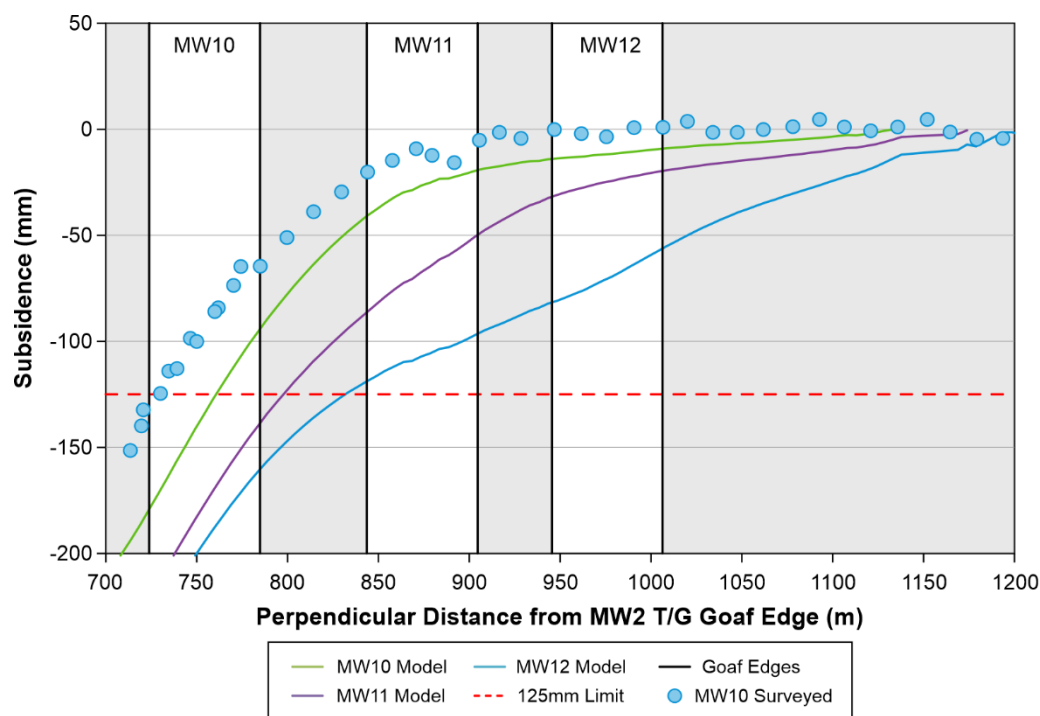


Figure 3: Comparison of measured and expected movements based on numerical modelling.

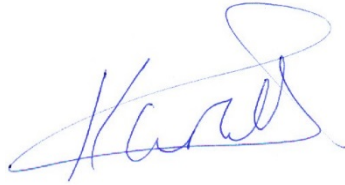
The measured subsidence is less than modelling indicates. If that trend continues when MW11 and MW12 are mined, vertical subsidence would be less than 125mm over MW11 and MW12 and compliance with performance measures would be expected.

2. RECOMMENDATIONS

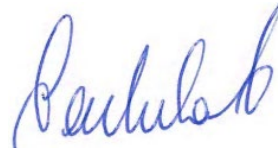
Consistent with the conditional approvals for MOD2, the IEP recommends a three-dimensional survey of A and B Lines is conducted at the completion of MW11 and analysed to confirm that the subsidence observed is consistent with the results of numerical modelling prior to the commencement of MW12.

If you have any queries or require further clarification of any of these issues, please don't hesitate to get back to either of us.

Yours sincerely



Ken Mills
SCT Operations Pty Ltd



Ismet Canbulat
University of New South Wales

Disclaimer

Ismet Canbulat is employed as Professor, Head of School and Kenneth Finlay Chair of Rock Mechanics at The University of New South Wales (UNSW) Sydney. In accordance with policy regulations of UNSW regarding external private consulting, it is recorded that this report has been prepared by the author in his private capacity as an independent consultant, and not as an employee of UNSW. The report does not necessarily reflect the views of UNSW, and has not relied upon any resources of UNSW.
