

6 March 2019

Moolarben Coal Operations Pty Ltd
Locked Bag 2003
Mudgee NSW 2850

For the attention of: Graham Chase, Environmental and Community Manager

Dear Graham,

RE: Modified commencing end of LW103 and proposed 103A workings

Moolarben Coal Operations (MCO) has approval for the extraction of Longwalls 101 to 103 (LW101 to LW103) in the Ulan Seam (DA 08_0135, MOD2). The Extraction Plan for these longwalls was approved by the Department of Planning and Environment on the 21 September 2017. At the time of this letter report, MCO had completed LW101 and it was in the process of mining LW102A.

Subsequent to the Extraction Plan approval, an igneous plug and associated dykes were identified near the commencing end of LW103. These intrusions make the extraction of coal uneconomic using longwall mining methods in this location.

MCO therefore proposes to shorten the commencing end of LW103 by 660 m from the extent indicated in the approved Extraction Plan so as to avoid the igneous plug. The extent of LW103 indicated in the Extraction Plan is referred to as the *Previous Layout* and the proposed shortened extent of this longwall is referred to as the *Modified Layout* in this letter report. MCO also proposes to partially extract coal between the previous and modified longwall commencing ends using long run-outs and series of isolated unsupported plunges, referred to as the *103A workings*.

The layout of LW103 and the proposed 103A workings are illustrated in Figure 1.

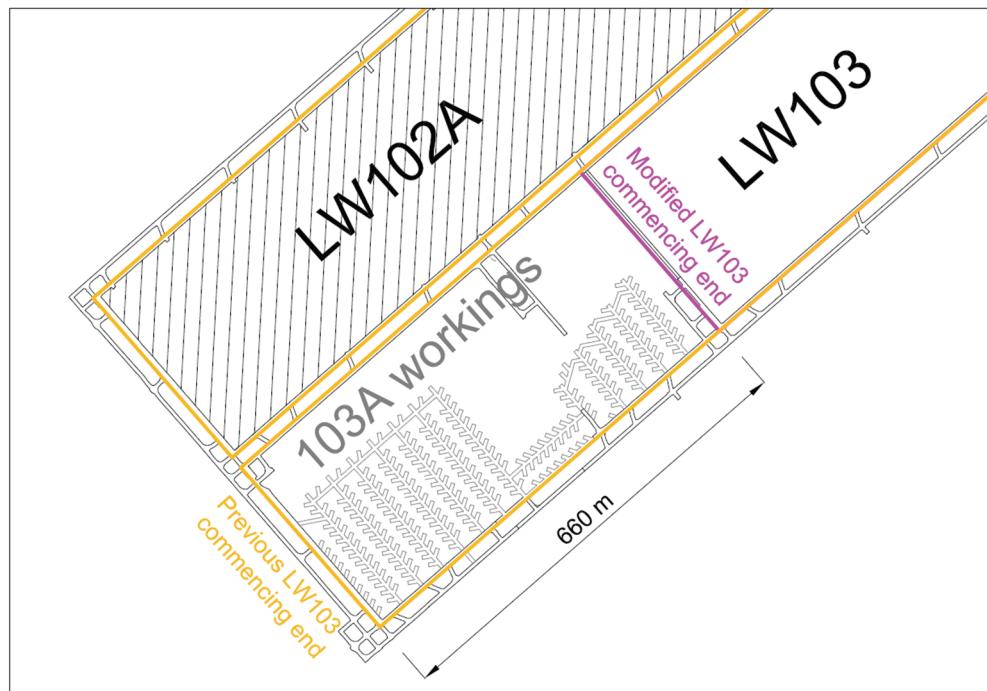


Figure 1 Layout of LW103 and the proposed 103A workings

The overall void length (including the installation heading) of LW103 is 4492 m based on the Previous Layout and is 3832 m based on the Modified Layout. The overall void width of this longwall including the first workings is 311 m and the solid tailgate chain pillar width is 20 m based on both these layouts.

A long-section through the commencing end of LW103 and the proposed 103A workings is provided in Figure 2.

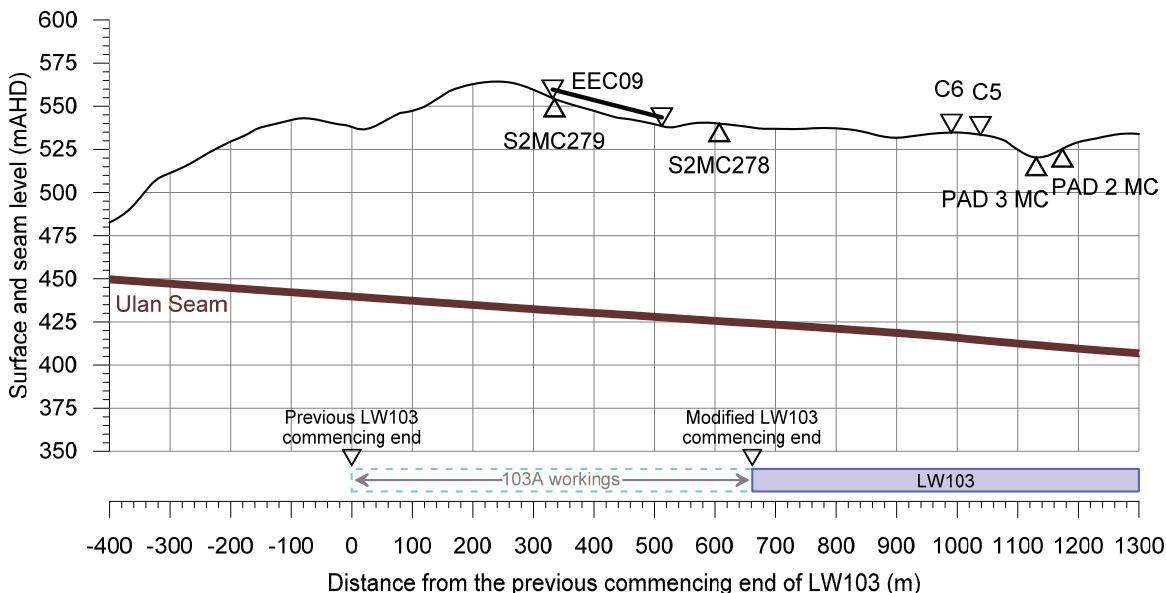


Figure 2 Long-section through the commencing end of LW103 and the proposed 103A workings

LW103 and the proposed 103A workings will be extracted within the Ulan Seam. The seam dips towards the north-east, i.e. approximately in the direction of mining. The average depth of cover along the centreline of LW103 is 95 m above the previous commencing end and is 110 m above the modified commencing end. The minimum depth of cover above the longwall commencing end is approximately 80 m based on both these layouts.

MCO proposes to mine the DWS and DTP plies of the Ulan Seam. The seam thickness varies between 3.2 m and 3.5 m within the longwall mining area and it is approximately 3.3 m between the previous and modified commencing ends of LW103.

The assessment of the proposed 103A workings was carried out by Mine Advice (MA, 2019a and 2019b). The geotechnical evaluation “*has conservatively assessed that the proposed geometry will provide a long-term stable pillar environment, with subsidence limited to less than 20 mm. It is also concluded that heights of fracturing above the formed roadways within the Ulan Seam will be minimal given the first working nature of the mining method and global stability of the plunges and associated formed intersections*” (MA, 2019b).

The predicted surface subsidence movements for LW101 to LW103 were previously provided in Report No. MSEC867 (MSEC, 2017), which supported the Extraction Plan for these longwalls. The subsidence model has been updated based on the proposed modified commencing end of LW103.

The predicted subsidence contours for LW101 to LW103, based on the Modified Layout, are shown in Figure 3. The values of the contours, from the outside to the inside, are 20 mm, 50 mm, 100 mm, 200 mm and then so forth in 200 mm increments. The predicted 20 mm subsidence contour based on the Previous Layout is also shown as the cyan line in this figure for comparison.

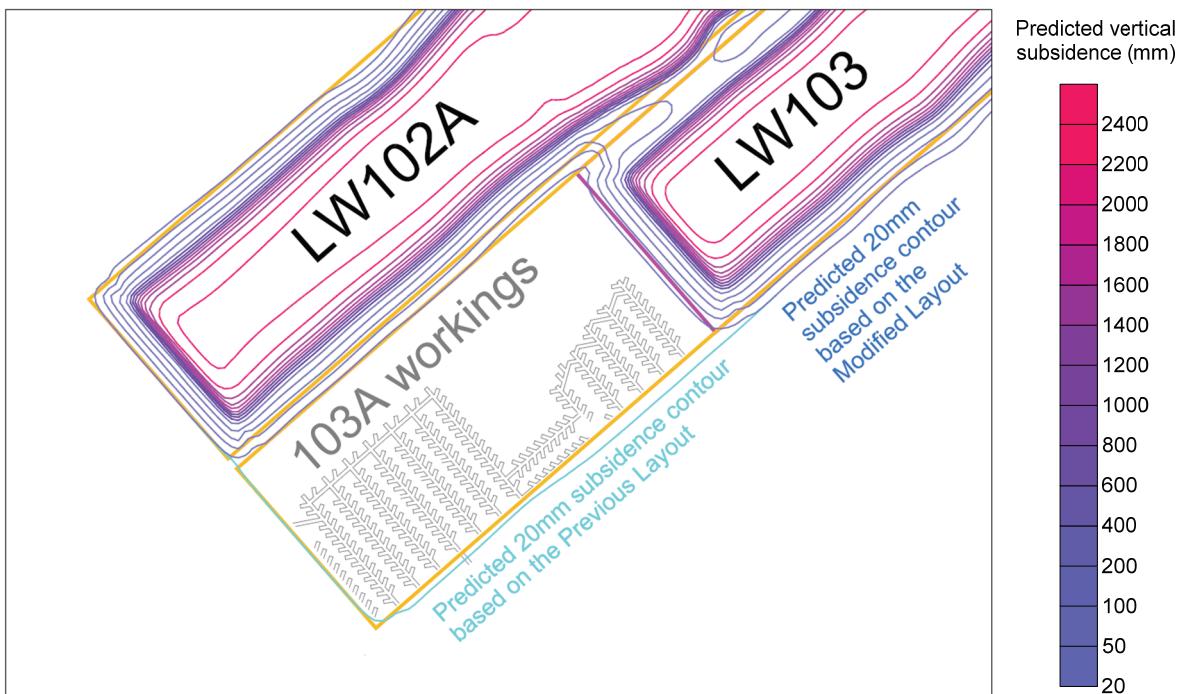


Figure 3 Predicted subsidence contours for LW101 to LW103

The maximum predicted total vertical subsidence is 2400 mm, based on both the Previous and Modified Layouts, and it represents 65 % of the maximum extraction height within the mining area. The maximum predicted vertical subsidence does not change, due to the proposed modification, as the longwalls are supercritical in width.

Whilst the maximum predicted vertical subsidence does not change, the extent of subsidence reduces due to the proposed modification. The surface area within the predicted limit of vertical subsidence (i.e. the predicted 20 mm subsidence contour) decreases by approximately 22 hectares (i.e. 220,000 m²).

Similarly, the maximum predicted total tilt, curvatures and strains do not change due to the proposed modification. However, the locations of the maximum longitudinal components of these parameters (i.e. orientated along the main longwall axis) move approximately 660 m towards the north-east above LW103. This is illustrated in Figure 4 which shows the predicted profiles of total vertical subsidence along the centreline of LW103 based on both the Previous and Modified Layouts.

The maximum predicted total tilt is greater than 100 mm/m (i.e. 10 %, or 1 in 10) based on both the Previous and Modified Layouts. The location of the maximum longitudinal component of tilt (i.e. the steepest part of the subsidence profile shown Figure 4) therefore moves approximately 660 m inbye due to the proposed modification.

Similarly, the maximum predicted total hogging and sagging curvatures are greater than 3 km⁻¹ based on both the Previous and Modified Layouts, and these represent a minimum radius of curvature of less than 0.3 km. Whilst specific values of the maximum predicted curvatures have not been presented, as they are less meaningful at these high magnitudes, the values do not change due to the proposed modification.

The maximum predicted longitudinal components of curvature occur directly above LW103 and immediately adjacent to the longwall commencing end. The locations of the maximum predicted longitudinal components of curvature therefore move approximately 660 m inbye due to the proposed modification.

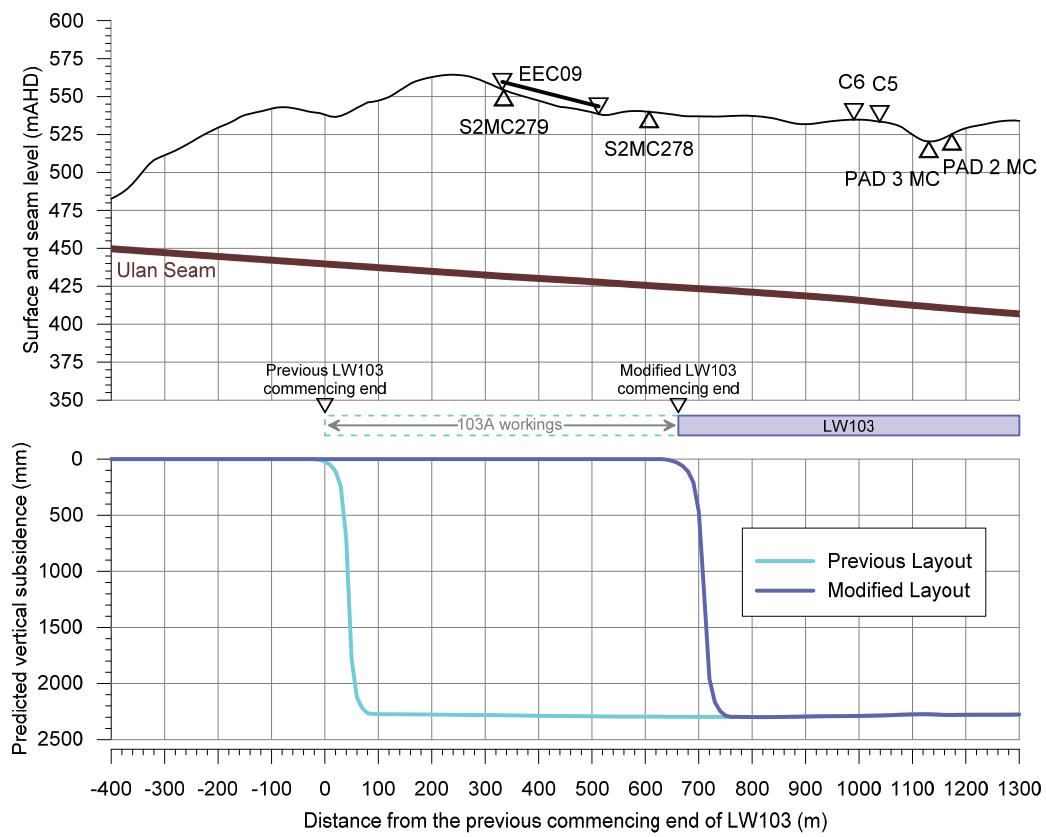


Figure 4 Predicted profiles of vertical subsidence along the centreline of LW103

The natural and built features located near the commencing end of LW103 and above the proposed 103A workings are shown in Figure 5.

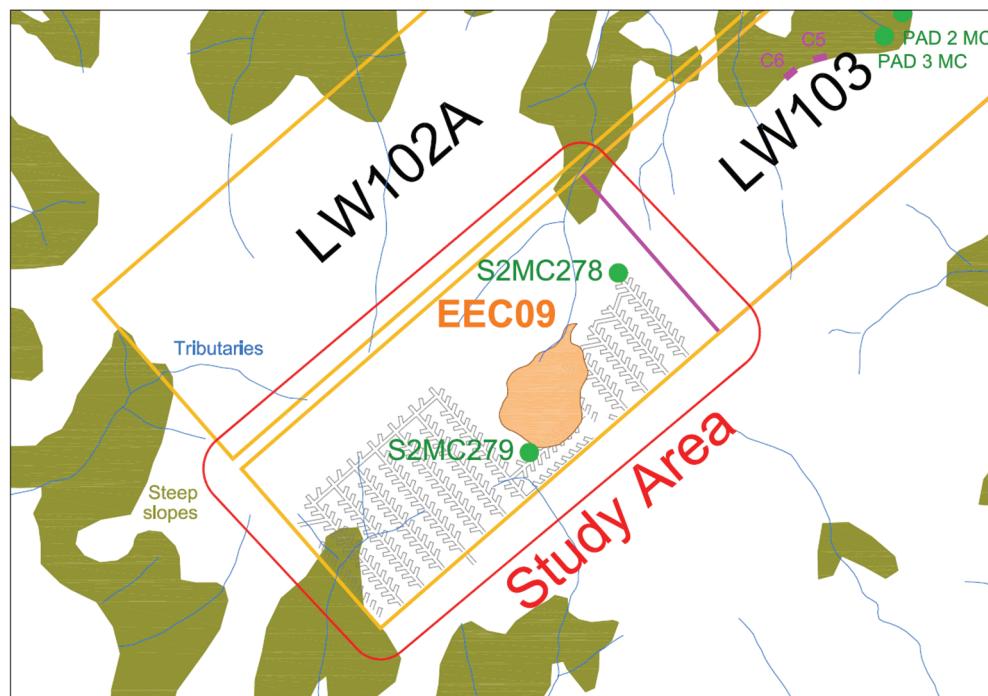


Figure 5 Natural and built features near the commencing end of LW103 and the proposed 103A workings

The *Study Area* has been defined as the zone where the predicted surface subsidence effects, based on the Modified Layout, are different to those predicted based on the Previous Layout. The Study Area has been based on the greater of the following:

- 26.5° angle of draw line from the commencing ends of LW103, based on both the original position (i.e. Previous Layout) and the modified position (i.e. Modified Layout); and
- the limit where the change in the predicted total vertical subsidence, due to the proposed modification to the longwall commencing end, is greater than 20 mm.

The extent of the Study Area is shown as the red line in Figure 5. The natural and built features located within this area comprise:

- tributaries;
- steep slopes;
- Endangered Ecological Community 9 (EEC09); and
- Aboriginal heritage sites S2MC278 and S2MC279.

Reviews of the predictions, impact assessments and management strategies for these features are provided below.

Tributaries

Ephemeral tributaries are located across the mining area.

The predicted subsidence effects for the tributaries located within the Study Area reduce due to the proposed modification. The predicted vertical subsidence is less than 20 mm for the sections of these tributaries located between the previous and modified commencing ends of LW103. The total length of the tributaries affected by surface subsidence also reduces due to the proposed modification.

The predicted tilt, curvature and strain for the upper reaches of the tributary located immediately to the north-east of the modified commencing end of LW103 slightly increase due to the proposed modification. However, the mining-induced tilt increases the natural stream gradient and, therefore, it will not result in the increased potential for ponding. This tributary could experience tensile cracking due to its proximity to the modified longwall commencing end. However, the overall level of impact on the tributaries reduces as the tributaries located south-west of the modified commencing end are no longer directly mined beneath.

The subsidence predictions and the assessed levels of potential impact for the tributaries reduce or do not change due to the proposed modification. The recommended management strategies for the tributaries are therefore the same as those previously provided in Report No. MSEC867 and in the Extraction Plan.

Steep slopes

Steep slopes are partially located within the Study Area. These areas have natural gradients greater than 1 in 3.

The predicted subsidence effects for the steep slopes located within the Study Area reduce due to the proposed modification. The predicted vertical subsidence for the steep slopes located in the southern part of the Study Area is less than 20 mm.

The subsidence predictions and the assessed levels of potential impact for the steep slopes reduce or do not change due to the proposed modification. The recommended management strategies for the steep slopes are therefore the same as those previously provided in Report No. MSEC867 and in the Extraction Plan.

Endangered Ecological Community 9

EEC09 is located between the previous and modified commencing ends of LW103 and it is located above the proposed 103A workings. The maximum predicted vertical subsidence for this feature is 2200 mm based on the Previous Layout and is less than 20 mm based on the Modified Layout. EEC09 is not predicted to experience measurable tilts, curvatures or strains based on the Modified Layout.

The subsidence predictions and the assessed levels of potential impact for EEC09 reduce due to the proposed modification. The recommended management strategies for this feature are therefore the same as those previously provided in Report No. MSEC867 and in the Extraction Plan.

Aboriginal heritage sites

Sites Refs. S2MC278 and S2MC279 are located between the previous and modified commencing ends of LW103 and they are located above the proposed 103A workings. These sites comprise artefact scatters.

The maximum predicted vertical subsidence for Sites Refs. S2MC278 and S2MC279 is 2200 mm based on the Previous Layout and is less than 20 mm based on the Modified Layout. These Aboriginal heritage sites are not predicted to experience measurable tilts, curvatures or strains based on the Modified Layout.

The subsidence predictions and the assessed levels of potential impact for Sites Refs. S2MC278 and S2MC279 reduce due to the proposed modification. The recommended management strategies for these heritage sites are therefore the same as those previously provided in Report No. MSEC867 and in the Extraction Plan.

Other surface features located outside the Study Area

The predicted subsidence effects and, therefore, the assessed levels of potential impact for the other surface features located outside the Study Area do not change due to the proposed modification. The recommended management strategies for these surface features are therefore the same as those previously provided in Report No. MSEC867 and in the Extraction Plan.

Summary

The maximum predicted subsidence effects due to the extraction of LW103 do not change due to the proposed modified commencing end and due to the extraction of the proposed 103A workings. However, the extent of the surface subsidence movements reduce. The surface area within the predicted limit of vertical subsidence (i.e. the predicted 20 mm subsidence contour) decreases by approximately 22 hectares (i.e. 220,000 m²).

The predicted subsidence effects for the natural and built features reduce or do not change due to the proposed modification. The predicted tilt, curvature and strain for the upper reaches of the ephemeral tributary located immediately to the north-east of the modified commencing end of LW103 slightly increase; however, these are similar to or less than the predicted values for tributaries located elsewhere above the mining area.

The tributaries located between the previous and modified commencing ends of LW103, EEC09 and Sites Refs. S2MC278 and S2MC279 were originally predicted to experience full subsidence, based on the Previous Layout, but are now predicted to experience less than 20 mm vertical subsidence based on the Modified Layout. These surface features are not predicted to experience measurable tilts, curvatures or strains based on the Modified Layout.

The assessed impacts for the natural and built features reduce or do not change due to the proposed modification. The management strategies and required monitoring therefore do not change. No revisions are recommended for the approved Extraction Plan or the approved Subsidence Monitoring Program.

I trust that this letter report is of assistance. If you have any questions, please do not hesitate to email or call me on (02) 9413-3777.

Yours sincerely,

James Barbato

Dr James Barbato

Mine Subsidence Engineering Consultants

References

MA (2019a). *Geotechnical evaluation of proposed taking of unsupported plunges in LW103A Block*. Mine Advice Pty Ltd. Report No. Moolarben28/1, dated 5 January 2019.

MA (2019b). *Geotechnical evaluation of proposed taking of unsupported plunges in LW103A Block*. Mine Advice Pty Ltd. Letter report dated 6 March 2019.

MSEC (2017). *Moolarben Project Stage 2 – Longwalls 101 to 103 – Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Extraction Plan*. Mine Subsidence Engineering Consultants Pty Ltd. Report No. MSEC867 (Rev. A), dated 4 May 2017.