INDEPENDENT ADVISORY PANEL FOR UNDERGROUND MINING

ADVICE RE:

TAHMOOR COAL MINE

NORTH WESTERN DOMAIN

LONGWALLS W3 AND W4

Extraction Plan

September 2021

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1.0 SCOPE OF WORKS

Tahmoor Coal Mine is an underground coal mine located approximately 80 km south-west of Sydney. The mine has been operating using bord and pillar mining methods since 1979 and longwall methods since 1987. Longwall panels in the 'Western Domain' (immediately south – west of Picton township) are currently being extracted, with 34 longwalls having been previously extracted in the Tahmoor North mining area.

Tahmoor Coal Mine operates under several development consents. The two key State development consents relating to underground mining operations are DA57/93 and DA67/98. Modifications to DA67/98 in 2018 introduced Condition 13H that requires the preparation of an Extraction Plan for all longwall panels commencing with Longwall W1 (LW W1) in the North Western Domain of the Tahmoor Coal Mine. The Extraction Plan must demonstrate that mining operations do not cause exceedances of performance measures identified in Condition 13A and 13E of DA67/98.

On 23 June 2021, NSW Department of Planning, Industry and Environment (DPIE) requested the Independent Advisory Panel for Underground Mining (the Panel) to provide advice in relation to the Extraction Plan for Longwall W3 (LW W3) and the adjacent Longwall W4 (LW W4). LW W3 abuts LW W2 which, in turn, abuts LW W1 and so there is potential for interaction between all four longwall panels.

Specifically, DPIE requested advice on the following:

- *The scale and likelihood of potential subsidence impacts, effects, and environmental consequences on Stonequarry Creek, with particular focus on Pool SR17, Rockbar SR17 and associated Aboriginal cultural heritage site.*

- *Whether the setback distance of LW W3 from the grinding groove site at Rockbar SR17 is adequate to achieve a performance measure of "Negligible subsidence impacts or environmental consequences", as required by DA 67/98.*

- *Whether potential impacts on creek baseflow and surface water levels have been adequately assessed in the Extraction Plan, particularly in the context of greater than predicted surface and groundwater level decline observed from the mining of Longwalls W1 and W2.*

- *Whether any additional or modified performance measures should be considered in the context of the Extraction Plan.*

- *Whether the proposed monitoring program and Trigger Action Response Plans are adequate to satisfactorily identify subsidence impacts and related environmental consequences on Stonequarry Creek, Pool SR17 and Rockbar SR17, and to protect key public infrastructure.*

The Chair of the Panel nominated the following members of the Panel to prepare the advice:

- Em. Professor Jim Galvin – Chair – subsidence and mining
- Em. Professor Bruce Hebblewhite – subsidence and mining
- Dr Lucy Reading – surface and groundwater
- Professor Neil McIntyre – surface and groundwater

2.0 METHOD OF OPERATION

COVID19 constraints prevented the Panel from meeting in person and from undertaking a site inspection. Instead, the Panel convened by videoconference throughout the preparation of its advice and was administratively supported by Secretariat staff provided by DPIE's Energy and Resources Policy Team.

A wide range of documents was reviewed by the Panel in preparing this review, the principal ones being:

Document Reference	Document Name
Extraction Plan	Extraction Plan – Tahmoor North – Western Domain Longwalls West 3 and West 4 – May 2021 including the following addendums/volumes: • Land Management Plan • Water Management Plan • Biodiversity Management Plan • Heritage Management Plan • Built Features Management Plan • Public Safety Management Plan • Subsidence Monitoring Management Plan
LW W1 and W2 Extraction Plan	Tahmoor LW W1 and W2 Extraction Plan Approval – November 2021
Adaptative Management Report	Tahmoor Coal - Adaptive Management Report – Review of subsidence movements and impacts during mining of LW W2 for Adaptive Management Report prior to commencement of LW W3 – June 2021
Management Plan	Tahmoor Coal – Stonequarry Creek Rockbar Management Plan – Tahmoor North – Western Domain Longwalls West 3 and West 4 (Versions 1 to 6, Version 6 received on 8 September 2021)
TARP	Tahmoor Coal LW W3-W4 SCR Management Plan Appendix A - TARP (Versions 1 to 6, with Version 6 being submitted as a part of the Management Plan on 8 September 2021)

2.1. SUBSEQUENT INFORMATION, SUPPORTING DOCUMENTS AND MEETINGS

The Panel sourced additional reports from DPIE and submitted multiple sets of questions to SIMEC (the Applicant) that were addressed by way of videoconference, written responses, and additional documentation.

The Panel convened several times over the course of preparing its advice. DPIE's Resource Assessments Team was invited to several of these meetings to provide technical briefings and updates to the Panel as needed. In addition, the Panel attended several meetings convened between DPIE and the Applicant and raised questions as appropriate.

A list of documents, queries, responses and meetings which were critical to the Panel's advice are provided in chronological order below:

Document Reference	Document Name
SCT (2020)	Structure Determinations of the Nepean Fault Adjacent to the Picton Rail Tunnel - Appendix G of Extraction Plan (dated 22 December 2020).
SCT (2021)	Assessment of Rockbar SR17 and Nepean Fault Complex to Support LW W3 and W4 Extraction Plan – Appendix F of Extraction Plan (dated 1 February 2021)
Table Response to the Regulator	Tabulation of SIMEC Responses to the Regulator regarding Controls for Picton Tunnel and Picton Viaduct (dated 20 July 2021)
Panel Meeting (22 July 2021)	Initial briefing session
Panel Meeting (30 July 2021)	Subsidence and surface/groundwater discussion
Letter to the Regulator	SIMEC written response, to Dr Gang Li, Principal Subsidence Engineer, NSW Resources Regulator (dated 31 July 2021)
Responses to Panel (3 August 2021)	Applicant Response to Panel queries (of 29/07/2021) and associated PowerPoint presentation, received on 03/08/21, and associated PowerPoint presentation dated 30/07/2021, received on 03/08/21.
Panel Meeting (4 August 2021)	Subsidence and surface/groundwater discussion
Panel Meeting (11 August 2021)	Subsidence and surface/groundwater discussion as well as discussion of existing approvals

Panel Meeting (12 August 2021)	Response to Panel queries and introduction of SCR Management Plan
Management Plan Presentation (12 August 2021)	Applicant presentation introducing Stonequarry Creek Rockbar Management Plan (dated 12 August 2021).
Panel Meeting (20 August 2021)	SIMEC presentation and SCR Management Plan discussion
Panel Meeting (24 August 2021)	Management Plan and associated TARP discussion
Panel Meeting (27 August 2021)	Panel queries for SIMEC discussion
Responses to Panel (27 August 2021)	Applicant Response to Panel queries (of 25/08/2021), associated PowerPoint presentation and revised TARP, received on 27/08/21
Responses to Panel (1 September 2021)	Applicant Response to Panel queries (of 31/08/2021) and revised TARP, received on 01/09/21.
Responses to Panel (3 September 2021)	Applicant Response to Panel queries of (03/09/2021) and revised TARP dated, received on 03/09/2021.
Responses to Panel (6 September 2021)	Applicant Response to comments from DPIE (of 05/09/2021) and revised TARP (Version 6), received on 06/09/2021.
Panel Meeting (8 September 2021)	Panel advice finalisation and report drafting
Responses to Panel (8 September 2021)	In response to Panel request on 8 September 2021, Applicant provided final Management Plan (Version 6), including TARP (Version 6) on 8 September 2021
Panel Meeting (10 September 2021)	Panel advice finalisation and endorsement

3.0 PRIMARY FOCUS OF THIS ADVICE

In addressing the range of issues requested by DPIE, this Panel advice has a primary focus on potential subsidence impacts on and environmental consequences for Stonequarry Creek and, in particular, Rockbar SR17. This rockbar contains Aboriginal heritage items including up to 120 Aboriginal grinding grooves (AHIMS 52-2-2071) over three areas. The site is acknowledged by the Applicant as being of high significance and heritage value.

Condition 13A of DA67/98 requires that the Applicant must ensure that extraction of longwalls at the Tahmoor Coal Mine does not cause any exceedances of strict performance measures relating to nearby natural and man-made features. Of particular relevance to this Advice, these performance measures include:

- Stonequarry Creek – *"No subsidence impact or environmental consequence greater than minor"*.
- Aboriginal and heritage sites – *"Negligible subsidence impacts or environmental consequences"*.

It is understood from DPIE, and has been accepted by the Applicant, that the condition of 'negligible' impact for Aboriginal and heritage sites has two components that must be considered:

- Values of **primary significance**: Aboriginal grinding groove features
- Values of **contributory significance**: Sandstone rockbar feature

Any proposed management strategy by the Applicant must therefore take both parameters or value sets into account, in order to meet a satisfactory level of subsidence impact management. The proposed Extraction Plan did not initially include a Management Plan specific to SR17 and the grinding grooves. Based on the descriptions of subsidence impacts and consequences in the Extraction Plan and the lack of a Management Plan for SR17, the Panel expressed concern very early on as to the closeness of the LW W3 starting location to SR17 (106 m laterally), noting that installation of the longwall equipment had already commenced at that location. The situation is challenging because one is dealing with a natural feature that has a degree of unpredictability as to when and how it might be impacted by subsidence and because one has to monitor for and respond in a timely manner to quite small changes in ground behaviour if impacts are to be restricted to negligible.

The Panel's concerns led to it submitting to the Applicant several sets of written questions and requests for clarification. The Applicant's written responses were supported on two occasions by discussions between its consultants and the Panel. The net outcome of this iterative process has been the development by the Applicant of a detailed Management Plan for SR17 that is supported by a Trigger Action Response Plan (TARP) and provides for ceasing to mine and relocating LW W3, if required by the TARP performance measures, to avoid exceeding the performance measure of negligible impact or environmental consequences. While some of the important data that informs this Management Plan is contained in the original Extraction Plan, the reader should be aware that the information and descriptions contained in the Extraction Plan no longer fully reflect the detail used to develop the Management Plan for SR17 and the associated triggers and threshold values contained within the TARP.

4.0 SUBSIDENCE ASSESSMENT

4.1. POTENTIAL IMPACTS TO ROCKBAR 17

The original Extraction Plan and supporting documentation provided by the Applicant's consultants contained predictions of potential subsidence effects and impacts on the rockbar. It acknowledged that there remained a small possibility that some fracturing could occur within the rockbar as a result of mining LW W3, commencing from a proposed starting face line position that was 130 m distant from the centreline of the rockbar, but only 106m from the nearest edge of the rockbar.

The risk associated with this proposed approach was deemed by the Panel to be unacceptable, in that it did not provide sufficient confidence that the negligible impact criteria for both the Aboriginal grinding grooves and the surrounding rockbar could be achieved. It was the preferred position of the Panel that the longwall start line for LW W3 be located further down the longwall panel, at a greater, acceptable distance from rockbar SR17.

The Panel was particularly concerned about the current state of the rockbar, in relation to significant geological structural features evident, all of which have the potential to result in some degree of instability within the rockbar as a result of mining-induced subsidence effects. Based on advice from the Panel, DPIE asked the Applicant to develop a more rigorous and comprehensive assessment of the rockbar integrity, from a structural geological perspective, to further inform the ongoing rockbar management. The Panel recommends that the report on this further independent structural geological assessment of the rockbar be provided to DPIE. This report should demonstrate the ongoing suitability of the Management Plan and TARPs to the satisfaction of DPIE prior to the extraction of LW W3 retreating more than 150 m.

It was subsequently agreed that, in response to the Panel's concerns, a stringent management strategy based on the Applicant's planned original start line for LW W3 would be developed by the Applicant for the Panel's consideration. This would involve a high level and frequency of monitoring to provide timely assessment of multiple critical parameters, in order to detect any potential adverse impacts on the rockbar, prior to any damage occurring to the Aboriginal heritage site or the surrounding region of rockbar.

The Panel has now reviewed Version 6 of the proposed Management Plan (dated 8 September 2021). The Management Plan includes a quantitative assessment of probabilities in relation to potential for subsidence impacts exceeding the negligible threshold. Based on the Panel's inquiries of the Applicant as to how it has calculated these probabilities, the Panel is unable to endorse the methodology that has been used and suggests that it be disregarded. The Panel has considered the balance of the Management Plan without any further regard to these probability considerations.

The Management Plan adopts a standard Trigger Action Response Plan (TARP) approach, which at higher TARP levels can lead to a pause, and potentially stopping of longwall extraction. The TARP approach has been developed through several iterations of discussion and information exchange between the Applicant and the Panel, and now incorporates a matrix system of critical parameters and threshold triggers for each parameter – any one of which can move the rockbar assessment through the different TARP levels from the initial green and blue stages into the more critical higher yellow and red levels. The Panel accepts and in fact strongly supports a process whereby the performance of all parameters against the nominated trigger levels are reviewed collectively. However, it is important to reinforce that the actual process

that moves the rockbar management from one TARP level to the next, can be triggered by an exceedance of any one of the multiple sets of triggering parameters, without the need for an exceedance on other parameters.

The Panel is now satisfied with Version 6 of the Management Plan for SR17, which incorporates the proposed TARP model (also as Version 6 and Appendix A of the Management Plan) and associated monitoring regime and proposed monitoring frequency – recognising that it requires a high level of precision measurements, frequent surveys and analysis and regular review by the proposed Technical and Steering Committees. Any failure to adhere to all these aspects of the Management Plan could severely jeopardise the ability to stay within the "negligible impact" criterion. It is particularly emphasised that in the event of a pause or permanent stoppage to longwall extraction being recommended by the Applicant's Technical Committee, as per the TARP, then the longwall extraction should be stopped in an immediate and timely manner, within practical limits, regardless of proximity to cut-through positions within the panel.

4.1.1. Recommendations

The Panel makes the following recommendations to DPIE:

- A report on the further independent structural geological assessment of the rockbar requested from the Applicant should be provided DPIE. This report should demonstrate the ongoing suitability of the Management Plan and TARPs to the satisfaction of DPIE prior to the extraction of LW W3 retreating more than 150 m.

- In the event that any of the parameters cause the TARP to enter into the Yellow Trigger Level, which automatically results in an immediate pause to longwall extraction:

    - Prior to recommencing longwall extraction following a Yellow TARP stoppage due to any of the triggered parameters, if it is deemed by the Applicant that longwall mining in the current location can be recommenced, approval should be gained from DPIE prior to recommencement of mining;

    - If, following a Yellow TARP stoppage, it is deemed that longwall extraction should not resume from the current location, but be relocated to a new longwall start line further down the longwall panel, then a proposal and geotechnical justification for the proposed new start line location should be submitted to DPIE for approval, prior to committing to development of the new start line.

4.2. POTENTIAL IMPACTS TO WATERCOURSES

The Panel is satisfied that the consequences for creek baseflow and surface water levels have been adequately assessed for the purpose of the Extraction Plan. The greater-than-predicted surface and groundwater level declines observed from the mining of Longwalls W1 and W2 have been addressed by additional investigation and modelling, including revised drawdown and flow loss estimates, and proposed further monitoring and model updates if required.

Significant loss of baseflow due to groundwater depressurisation, not necessarily associated with visible fracturing, is predicted upstream and downstream of the SR17 rockbar following mining of LW W3 and W4. Loss of baseflow at rockbar SR17 that is not associated with visible

fracturing or subsidence movement is not captured under the proposed performance indicators for Surface Water and Groundwater Resources or in the proposed performance indicators for Aboriginal and heritage sites. The Panel considers that mining-induced baseflow loss which causes visible reductions to water levels of pools adjacent to the grinding groove sites may lead to the performance measure of negligible environmental consequences not being met. This is not something that can be fully addressed by the Management Plan for SR17 due to the potentially long time-lags between baseflow loss and extraction. The subsidence performance indicators relating to the performance measure "Negligible subsidence impacts or environmental consequences" should cover the possibility of mining-induced baseflow losses at SR17. A suitable additional performance indicator would be: *This performance measure will be considered to be exceeded if mining impacts lead to cessation of flow over the SR17 rockbar.*

Potential reductions in pool water levels at SR17 associated with fracturing are not likely due to the controls that are proposed to ensure negligible subsidence impacts (see Section 4.1 of this Advice).

Further setback of LW W3 and/or W4 from SR17 would reduce depressurisation of groundwater near to Stonequarry Creek and, hence, reduce water flow losses and pool level reductions at SR17. Quantifying this would require further groundwater modelling. However, sensitivity of flow loss to setback distance is unlikely to be material to meeting the performance measures for Stonequarry Creek and the Aboriginal heritage site. Further investigation on this matter is not critical, noting that the possibility of model updates is embedded in the surface water TARPs.

As should be expected in numerical groundwater models, there are outstanding limitations and uncertainties that should be addressed in future model updates. In particular, there are deviations between conceptual understanding and numerical modelling approach and high uncertainty in surface water loss and groundwater drawdown predictions. The Applicant has committed to review the model as new observations become available, and to update the model if required and at least by April 2023. The Panel agrees with the approach of regular review and reporting on the need for updates as part of 6-month reporting.

The surface water TARPs for "Impact to physical features and natural behaviour of pools" do not explicitly include pools within rockbar SR17. Pools in the vicinity of the grinding grooves should be visually inspected during the progression of LW W3 at a frequency consistent with the "Detailed visual inspections" proposed in the Management Plan for SR17. Otherwise, the surface water TARPs are satisfactory.

The Panel recognises the challenges of developing groundwater TARPs that are applicable over multiple sites and generally supports the approach taken. However, the Panel has concerns about the deduction of the nominated drawdowns from the minimum observed groundwater levels prior to extraction at LW W1: the deduction from the minimum can lead to a large margin for greater-than-predicted drawdowns to occur. Also, for TARP level 4, the maximum predicted drawdowns may be longer-term and larger drawdowns than those relevant for adaptive management during mining, again potentially providing large margin for drawdowns prior to a trigger. These aspects of the groundwater TARP should be refined or further justified by the Applicant prior to approval of the Extraction Plan.

4.2.1. Recommendations

The Panel makes the following recommendations to DPIE in relation to subsidence impacts on watercourses in proximity to the longwalls:

- Performance indicators for Surface Water and Groundwater Resources and/or for Aboriginal and heritage sites should be adjusted to encompass possible environmental consequences related to baseflow loss not associated with visible fracturing.

- Under TARPs for "Impact to physical features and natural behaviour of pools", pools within SR17 adjacent to grinding groove sites should be included with a frequency of observation consistent with the detailed visual inspections proposed in the SR17 Management Plan.

- Aspects of the groundwater TARP noted in this advice should be refined or further justified by the Applicant.

4.3. POTENTIAL IMPACTS TO PUBLIC INFRASTRUCTURE

The Panel's advice on the potential impacts of extracting LW W3 and LW W4 on key public infrastructure is confined to railway infrastructure, principally the Picton Tunnel and Picton Viaduct. Both structures are located within the Nepean Fault system. LW W3 approaches no closer than 500 m to the Picton Tunnel (the closest of the two structures) and LW W4 no closer than 250 m and both structures are expected to experience far-field subsidence effects (SCT, 2020). Effectively, the key performance measures for both items of public infrastructure are that they are to remain safe and serviceable and any damage caused by mining impacts is fully repairable and is fully repaired in a timely manner.

The Built Features Management Plan provides an overview of the process developed for managing mining impacts on built features, including rail infrastructure. It commits to updating Management Plans for specific items of infrastructure prior to them being influenced by LW W3 and W4. The Panel presumes that this will include the development of TARPs relating to rail infrastructure.

On 29 June 2021, Dr Gang Li, Principal Subsidence Engineer, NSW Resources Regulator Report raised a number of queries with SIMEC which included the possible impacts of elevated subsidence effects associated with mining in the vicinity of the Nepean Fault. The Applicant responded to these concerns in a meeting on 20 July 2021 and by written correspondence on 29 July 2021 (Letter to the Regulator). The role of the Nepean Fault in modifying surface subsidence response to mining was considered by SCT (SCT, 2021) and also featured in the Panel's questions and discussions with the Applicant.

The Applicant reports that it has undertaken risk assessment to identify hazards and to select and implement appropriate control measures. In its responses to the Regulator (Table Response to the Regulator), the Applicant has advised that *'fundamental to the Risk Management Strategy for LW W3 and W4 is the mine layout that sets back longwalls an appropriate distance from the Picton Tunnel and the Picton Viaduct such that it would be feasible to maintain safety and serviceability'.* The document goes on to list an extensive range of controls to be implemented during the development of subsidence. While elevated subsidence over the mining footprint has occurred in the past in the vicinity of the Nepean Fault, the Applicant has

advised that subsidence behaviour beyond the footprint has been largely unaffected (SCT, 2021).

There is a large international experience base in managing mining-induced subsidence effects and impacts on railways, including substantial experience acquired over the last 15 or so years from successfully managing impacts associated with longwall mining at Tahmoor Colliery and the near-by Appin Colliery. The Applicant has given a commitment to the Regulator that Tahmoor Coal and ARTC will develop a plan to manage potential impacts during the mining of LW W3 and W4 prior to the influence of LW W3. Based on experience to date in mining in the vicinity of railway infrastructure in the Southern Coalfield, the Panel has no reason to believe that this approach, provided it is implemented effectively, will not result in the performance measures for rail infrastructure being satisfied.

The Panel concludes that the performance measures for rail infrastructure should be able to be satisfied through a Management Plan provided that it is premised on appropriate TARPs and implemented effectively.

4.3.1. Recommendations

The Panel makes the following recommendation to DPIE in relation to subsidence impacts on public infrastructure in proximity to the longwalls:

- LW W3 should not be permitted to retreat more than 150 m from its planned starting location until the Management Plan and associated TARPs for rail infrastructure have been developed by the Applicant and endorsed by the Regulator.

5.0 CONCLUSIONS

The Panel expressed its concerns early in its consideration of the proposed Extraction Plan on the proximity of the LW W3 starting location to SR17 which contains a substantial number of Aboriginal grinding grooves. These were conveyed to the Applicant and subsequently addressed through provision of a detailed Management Plan for SR17 that is supported by a Trigger Action Response Plan (TARP) aimed at ensuring the performance measures within Condition 13A of DA67/98 are not exceeded.

Rockbar 17

- The Panel is satisfied with the Management Plan (Version 6) and its incorporated TARP (Appendix A, Version 6). However, the Panel cautions that failure to adhere to all the aspects of the Management Plan could severely jeopardise the ability to stay within the "negligible impact" criterion that applies to SR17 in condition 13A of DA67/98. The Panel has made several recommendations for DPIE's consideration in Section 4.1.1.

Watercourses

- The Panel is satisfied the consequences for creek baseflow and surface water levels have been adequately assessed for the purpose of the Extraction Plan and considers the surface water TARPs to be satisfactory. Notwithstanding, the Panel has made several recommendations for DPIE's consideration in Section 4.2.1.

Public Infrastructure

- The Panel considers the approach proposed by the Applicant to manage potential subsidence impacts to the Picton Tunnel is appropriate, if implemented effectively through a Management Plan provided that it is premised on appropriate TARPs. The Panel has made several recommendations for DPIE's consideration in Section 4.3.1.