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Mike Young
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via email: Mike.Young@planning.nsw.gov.au

Dear Mike,

RE: DENDROBIUM EXTENSION PROJECT (SSD-8194) – ADVICE FROM INDEPENDENT ADVISORY PANEL FOR UNDERGROUND MINING

Thank you for providing the advice prepared by the Independent Advisory Panel for Underground Mining (IAP) in regard to the Dendrobium Extension Project (SSD-8194) (the Project). Please see below our preliminary comments on the IAP's Report.

Please note that South32 accepts all of the IAP's **Recommendations 1 to 14**, noting that some of these recommendations may be addressed to the Department of Planning, Industry and Environment (DPIE).

We consider the key points from the Report to be as follows:

Panel Width

- South32 agrees with **Conclusion 1** that panel width is not the key control when considering potential mining-induced impacts to surface features. We consider this, in addition to the independent mine plan review commissioned by DPIE from MineCraft which quantifies the loss of Project value of $100 million (net present value) per 25 metres reduction in panel width, demonstrates there is limited additional benefit to surface features and significant cost associated with narrower panels.
- In regard to the separate issue of the height of sub-surface fracturing and resultant surface water losses, which is influenced by panel width, we note the IAP considers:

  > *The conservative approach by the Proponent to assume connective fracturing to surface and to utilise offsets and compensatory provisions for impacts in the Sydney Water Catchment is a pragmatic means of setting performance measures that are consistent with the recommendation of the IEPMC*[1] *…"* **(Conclusion 6)**
  >
  > … [surface water loss] *is not a central issue if the proposal for compensation for water loss is accepted.* **(page 27)**

[1] Note: IEPMC = Independent Expert Panel for Mining in the Catchment

- South32 understands the key NSW Government Ministers have accepted the proposed compensation for predicted surface water losses during the life of the Project and post-mining.

Stream Feature Setbacks

- Noting the comments regarding panel width above, the IAP correctly identifies in **Conclusion 8:**

  > *The Proponent's approach, effectively, appears to be: 1) deciding which natural surface features warrant a level of protection from mining-induced impacts; 2) nominating the tolerable levels of impacts for these features; 3) avoiding exceedance of these levels through a combination of setback distances and remediation; and, 4) maximising economic returns by offsetting and compensating for environmental impacts to a range of other surface features and all subsurface features, notwithstanding that these impacts may not fully materialise, if at all, in Areas 5 and/or 6.*

- The IAP's reservations regarding the selection of surface features warranting a level of protection from mining-induced impacts and the tolerable level of impact are noted (**Conclusions 25-27**).
- It is also noted that it is uneconomic for the Project to setback from all surface water features (e.g. streams, stream features and swamps), with the IAP acknowledging that any viable mine plan will require some portion of swamps to be undermined in **Conclusion 37** (noting impacts to Upland Swamps would be offset for the Project).
- The selection of significant features is inherently subjective, as acknowledged in the Bulli Seam Operations Planning Assessment Commission (PAC) Report.
- The IEPMC in its Part 2 Report stated the following (with reference to the Southern Coalfield Inquiry):

  > *Ultimately it was the Government's responsibility to determine what environmental impacts are acceptable. This envelope of acceptability should be expressed in clear conditions of approval which establish measurable performance standards against which environmental outcomes can be quantified.*

- South32 considers the EIS provides a transparent and accurate description of the features considered to be relatively more significant, the relevant setbacks from longwall mining to these significant features, the likelihood of impacts and the associated consequences, and contingency measures that would be implemented (e.g. remediation) if impacts do occur.
- Ultimately it is the Government and consent authority's responsibility to determine the acceptability of the proposed setbacks in the context of potential environmental impacts and the economic implications to the NSW and regional economies of the setbacks (i.e. due to the associated resource sterilisation and/or implications to the economic viability of the Project).
- We support the IAP's **Recommendation 5** relating to the need for specific performance measures to be included in any Development Consent for the Project and the need for detailed Trigger Action Response Plans to demonstrate how these performance measures will be achieved.

Post-mining and Closure

- South32 agrees with **Conclusion 45** that Project Areas 5 and 6 are unlikely to change the existing legacy of past mining operations at Dendrobium Mine and in surrounding mines in respect of sealing Dendrobium Mine at the end of mining operations and how this impacts on managing mine water inflow in perpetuity.
- We accept **Recommendation 6** regarding the requirement for the preparation of a Mine Rehabilitation and Closure Plan.
- It should be noted that the compensation for predicted surface water losses, which South32 understands has been accepted by relevant NSW Government Ministers, includes compensation for post-mining surface water losses predicted using the EIS model.

Further responses to specific **Recommendations** and **Conclusions** are provided below**.**

If you have any queries please don't hesitate to contact me (Gary.M.Brassington@south32.net or 0438 042 897).

Yours sincerely
SOUTH32 LIMITED

Gary Brassington
Manager Approvals
Illawarra Metallurgical Coal – South32

IAP Recommendations

South32 accepts each of the IAP's **Recommendations** (numbered 1 to 14), noting that some of these recommendations may be addressed to the Department of Planning, Industry and Environment (DPIE).

In regard to **Recommendations 1 to 4**:

- **Recommendation 1:**
  - Justification for the selection of the Key Stream Features is transparently described in Section 6.6.3 of the EIS, and the Stream Risk Assessment (Appendix C to the EIS).
  - The approach adopted is consistent with previous Panel advice to identify features of significance requiring setbacks to avoid or reduce impacts (noting the identification of what is considered 'significant' is inherently subjective).
  - The selection of Key Stream Features based on the aspects identified in Section 6.6.3 is more sophisticated than past approaches of using Stream Order, resulting in the avoidance of direct undermining of several sections of 2nd order stream (that contain Key Stream Features).
  - The approach adopted in the EIS results in more stringent controls than the indicative "consequence measure" criteria shown in Table 2 of the IAP's Report (i.e. 30 m pool length and greater than 300 m^3 holding capacity).
  - As the Key Stream Features are located within or immediately adjacent to the EIS longwalls, it is not economic to setback from Key Stream Features to achieve less than 200 mm (or 150 mm) of predicted closure, however, the proposed setbacks of 50 m or greater will result in solid blocks of coal remaining beneath the Key Stream Features to reduce the likelihood of impacts (as evidenced by experience at Dendrobium Area 3B).
  - If impacts to Key Stream Features occur, physical damage will be remediated (where it is reasonable and feasible to do so).
  - Notwithstanding the above, relevant offset measures for the Project have been calculated on the basis that Key Stream Features are impacted (i.e. the area of habitat for relevant threatened aquatic ecology species to be offset includes the lengths of streams associated with Key Stream Features).

  South32 would accept *conditions that require the proposed setbacks from Key Stream Features to be enforced, and require physical damage to Key Stream Features to be repaired where it is reasonable and feasible to do so (i.e. where the impacts of remediation do not outweigh the benefits).*

- **Recommendation 2:**
  - It is accepted that the Avon River and Cordeaux River are of special significance, given they are regulated streams that transfer water from the Avon and Cordeaux Dams, respectively, to the take-off point at Pheasants Nest Weir.

  South32 would accept *a performance measure that requires negligible environmental consequence to the Avon and Cordeaux Rivers.*

- **Recommendation 3:**
    - It is agreed that a risk assessment approach will be required to be undertaken over the life of the Project to achieve approved levels of impact.
    - This risk assessment could be refined as part of Extraction Plans for the Project to confirm performance measures are being achieved.

    South32 would accept *conditions of consent, consistent with IAP* ***Recommendation 5****, that outline detailed performance measures for significant features and the requirement for Trigger Action Response Plans to be prepared as part of the Extraction Plan process to demonstrate how performance measures would be achieved.*

- **Recommendation 4:**
    - It is noted the surface water offset offer for the Project, which South32 understands has been accepted by the relevant NSW Government Ministers, accounts for predicted post-mining surface water losses from the catchment.
    - South32 agrees with IAP **Conclusion 45** that:

        > *The extraction of Areas 5 and/or 6 is unlikely to change the existing legacy of past mining operations at Dendrobium Mine and in surrounding mines in respect of sealing Dendrobium Mine at the end of mining operations and how this impacts on managing mine water inflow in perpetuity. It could increase the scale of the legacy impacts that will need to be managed after mine closure.*

    - Accordingly, it is agreed that, irrespective of whether the Project is approved, further detailed groundwater modelling and engineering work is required with respect to long-term management of groundwater flows post-mine closure (noting that this is a regional issue resulting from the > 100 years of mining in the catchment area).

    South32 would accept *a condition, consistent with IAP* ***Recommendation 6****, that requires the preparation of a Mine Rehabilitation and Closure Plan well in advance of the cessation of mining.*

Points for DPIE Consideration

South32 seeks to bring the following to DPIE's attention, on the basis that this may assist with finalisation of DPIE's assessment of the Project:

- **Conclusion 1:**

  At Dendrobium Mine, longwall panel width is not the key control when considering environmental impacts on natural surface features due to mining-induced non-conventional subsidence, in particular, valley closure. This is because environmental impacts due to non-conventional surface subsidence start to plateau at longwall panel widths that are reported to be too narrow to be economic at Dendrobium Mine.

  - This conclusion is consistent with previous South32's responses regarding the Project (i.e. surface impacts would still occur at panel widths significantly narrower than 305 m).

  - It also acknowledges, consistent with advice DPIE has received from the independent mine planning review conducted by MineCraft, that the Project is not economically viable at significantly narrower panel widths.

- **Conclusions 6 and 7 and Section 6.2.8:**

  The conservative approach by the Proponent to assume connective fracturing to surface and to utilise offsets and compensatory provisions for impacts in the Sydney Water Catchment is a pragmatic means of setting performance measures that are consistent with the recommendation of the IEPMC (OCSE, 2019b) that "Government should seek opportunities to improve the effectiveness of performance measures, especially for watercourses and swamps, by specifying them in unambiguous, quantifiable and measurable terms."

  …

  Should this approach for dealing with connective fracturing due to conventional subsidence not be assessed as appropriate or adequate, changes in longwall panel widths and/or extraction height may be required, rather than (as in the case of non-conventional subsidence impacts) changes in the offset distances to longwall panels.

  …

  The Proponent has proposed to compensate for surface water losses by paying for water that is diverted out of the catchment. Following the IEPMC conclusions (OCSE, 2019b)38, the Panel supports the principle of compensation and beneficial use as methods of offsetting for water supply losses. The proposed compensation for surface water losses does not account for aquatic ecology impacts of flow loss. There is also potential for disagreement in quantifying the separation of groundwater and surface water losses[39], since ultimately all groundwater losses may be assumed to be recharged from the surface water system. A clear method of loss accounting would need to be agreed.

  - The IAP's conclusions that the approach adopted in regard to connective fracturing is conservative is noted, and that the compensatory provisions are consistent with the recommendations of the IEPMC.

  - It is understood that the approach of offsetting surface water losses (based on the conservative approach adopted) has been accepted by the relevant NSW Government Ministers.

  - South32 agrees that a clear method of accounting for losses will be required and proposes this be calculated using the groundwater model and actual data (e.g. rainfall, stream flow, mine inflow and drawdown) at the end of each water year.

  - Note, potential impacts to threated aquatic fauna species and Upland Swamps will be offset separately (i.e. in addition to surface water offsets).

- **Conclusion 11:**

  The methodologies for predicting mining-induced subsidence effects (movements) on the surface are adequately described in the EIS, are appropriate to the DEP and have been diligently applied in the defined Study Area, with deviations from predicted subsidence effects capable of being adequately managed through established approval conditions.

  - South32 agrees with this conclusion.

- **Conclusion 14:**

  The Base Case [i.e. the EIS longwall layout] *may be more realistic of the upper bound today for a mine layout in the Sydney Water Catchment than of an economically viable layout that takes ecological and mine closure implications into account.*

  - South32 agrees that the 'base case' (i.e. the EIS longwall layout) is the upper limit mine layout for the Project as constrained by the various setbacks adopted in the EIS.

  - It is acknowledged that, via further risk assessment and adaptive management during the Extraction Process, there may be changes to the mine plan to achieve no greater environmental consequences than those described in the EIS and performance measures in any Development Consent for the Project.

- **Conclusion 29:**

  The assessment of surface flow losses is based on the groundwater model. Due to the low resolution and accuracy of the groundwater model in the vicinity of watercourses, and the limited sensitivity analysis undertaken, the Panel does not consider the predicted losses from rivers and named creeks to be necessarily conservative. Nevertheless, they are likely to be very low relative to water supply yields from the catchment.

  - While it is maintained that the predicted surface losses are conservative (e.g. due to the assumption in the groundwater modelling that water in ephemeral streams is always available to be lost, which overestimates losses during natural no-flow and low-flow conditions), South32 agrees with the IAP that losses are likely to be very low relative to water supply yields from the catchment.

- **Conclusion 32 (and Section 6.2.1):**

  The hydrological modelling of swamps is a welcome addition to the assessment process. This and the surface flow modelling should be updated during the mine planning process as new data become available.

  ..

  Regarding the swamps, good use has been made of available data to comment on swamp lithology, moisture dynamics and their relation to groundwater conditions, which is a significant contribution to baseline knowledge.

  - These comments are noted.

- **Conclusion 37:**

  Approval of any viable mine plan in Area 5 or 6 will require some proportion of the upland swamps to be undermined.

  - South32 agrees that, following the avoidance measures incorporated in the Project longwall layout, an economically viable mine plan will result in some residual impacts to Upland Swamps.

  - Accordingly, offsets for potentially impacted swamps are proposed.

Points of Clarification

South32 offers the following points of clarification:

- **Conclusion 9:**

  In respect of the Department's initial request for the Panel to provide advice on the relative environmental costs and benefits associated with different longwall widths, including whether a reduction in the void widths would materially reduce the environmental impacts of the project, the Panel cannot provide this advice. This is because the EIS and supporting documentation, including the Proponent's responses to some of the Panel's questions, do not provide the necessary information and analysis to enable the impact of different longwall panel widths to be fully and adequately assessed.

  - It is noted that the IAP at **Conclusion 1** states that "*longwall panel width is not the key control when considering environmental impacts on natural surface features due to mining-induced non-conventional subsidence, in particular, valley closure. This is because environmental impacts due to non-conventional surface subsidence start to plateau at longwall panel widths that are reported to be too narrow to be economic at Dendrobium Mine.".*

  - As noted above, South32's responses in regard to the Project have indicated there would still be impacts to surface features at longwall widths significantly narrower than 305 m, and it is considered IAP **Conclusion 1** supports this position.

  - In regard to the separate issue of sub-surface fracturing, which is influenced by panel width, the IAP states at **Conclusion 5** that there "*continues to be much conjecture and uncertainty as to both how to predict the height of connective fracturing and how to confirm this height in the field".*

  - It is due to this uncertainty that it is difficult to quantify changes in surface water loss at varying panel widths, particularly when it would be reasonable to adopt a precautionary approach at narrower panel widths and continue to assume a conservative height of fracturing given the Project's location in the Special Catchment Area.

  - Accordingly, to account for predicted surface water losses during the Project and post-mining (i.e. in perpetuity), offsets are proposed. The payment mechanism provided by the offsets allows for compensation to be based on annually calculated surface water losses over the life of the Project (i.e. to allow for improvements to the groundwater modelling to account for data collected from Areas 5 and 6 as it becomes available).

- **Conclusion 12:**

  Mining-induced subsidence effects due to mining in Area 5 are predicted to extend beyond the Study Area and into Area 3B and their impact on features in Area 3B needs to be assessed.

  - This is considered to be adequately covered, as cumulative assessment with Area 3B mining has been considered in the relevant assessments, including the Subsidence Assessment with respect to closure predictions and the groundwater assessment with respect to drawdown and surface water losses.

- **Conclusions 26 and 27:**

  Although the EIS is supported by a document titled Stream Risk Assessment it does not constitute a risk assessment that is consistent with the intent of recommendations over the past decade of a number of Panels concerned with mining in the Southern Coalfield or with Australian and international standards and guidelines for risk assessment (such as MDG-1010 (2011) and ISO 31000 (2009)). This is because it does not objectively identify the likelihood of the hazards materialising, the consequences should they materialise, and the residual risk after implementing the controls. Rather, the Stream Risk Assessment is a useful tabulation of information on stream features, the threshold values used by South32 to determine key stream features, debateable likelihood predictions confined to only rivers and named creeks, and the remediation and offset provisions for features deemed to be at risk.

  …

  A risk assessment approach provides an objective basis for assessing the scale and acceptability of environmental impacts on watercourses. The Panel has tested the concept of a risk management approach along the lines recommended by Southern Coalfield Inquiry (DoP, 2008) and developed in the PAC report for the Metropolitan Coal Project (DoP, 2009) and considers that its application would provide considerable assistance in this matter in assessing the likelihood and consequences of environmental impacts and deciding on acceptable threshold values that then inform mine design.

  - South32 does not agree with this conclusion, noting the Stream Risk Assessment follows the framework and assessment approach outlined in Section 6.2 of the Metropolitan Planning Assessment Commission (PAC) Report.

  - It should be acknowledged that classifying the relative significance of stream features (and the degree to which they should be protected) is inherently subjective (as was acknowledged in the Bulli Seam Operations PAC Report).

  - In addition, consideration of mine plan viability is also required (i.e. it is uneconomic to have nil/negligible impact at all swamps, streams and stream features).

  - In consideration of the above, the Stream Risk Assessment does identify the likelihood of hazards materialising, the consequences should they materialise and the residual risk after implementing the controls:

    - Likelihood of impacts materialising is via the:

      - rock bar model for named watercourses;

      - a qualitative assessment of reduced likelihood of impact for Key Stream Features based on observations from Area 3B at various offset distances from longwall mining (noting physical damage to Key Stream Features would be repaired where reasonable and feasible), and notwithstanding, relevant offsets assume Key Stream Features would be impacted [refer to matrix in Attachment 2 of the Stream Risk Assessment]; and

      - a statement that the full range of subsidence impact are expected for stream features to be undermined.

    - The consequences to each stream feature and residual risks (including the need for remediation and up-front offsets) are summarised in the matrix in Attachment 2 of the Stream Risk Assessment (refer to “Subsidence Impact Assessment” column).

- **Conclusion 31:**

  The assessment of potential for adverse consequences on stream and reservoir water quality lacks consideration of long term cumulative contaminant loads, including emergence of contaminated shallow and deep groundwater post-closure. It is not sufficient to assume, as the EIS does, that the current lack of evidence of water quality consequences will continue long term.

  - Of the Project longwall areas, only a small portion of Area 5 is within the catchment of the reservoirs. The remaining Project areas are downstream of the dam walls (i.e. no potential for accumulation of contaminant loads in the reservoirs).

  - Given mining in the catchment has occurred for > 100 years, the current lack of observed adverse impacts to water quality provides a reasonable basis for the EIS conclusions.

  - South32 would accept a performance measure for negligible impact to reservoir water quality, with this to be monitored over the life of the Project.

  - Additional analysis undertaken following the EIS and provided to DPIE indicates there is a low risk of adverse impacts to water quality in the Special Catchment Areas following groundwater recovery post-mining.

- **Conclusion 33:**

  The assessment of environmental impacts on streams identified as significant in the Surface Water Assessment is based on stream features, threshold values for these features, and fixed standoff distances all of which appear to have been nominated by the Proponent. The approach contrasts with that used to assess environmental impacts on the Avon River, Cordeaux River and Donalds Castle Creek. The Panel has not had the benefit of a field visit to form a view on the Proponent's impact assessment criteria for the specific streams.57 The merits and acceptability of the Proponent's impact assessment approach to watercourses and standoff distances need careful consideration during the assessment process.

  - South32 acknowledges that different setbacks have been adopted for named watercourses (Avon River, Cordeaux River and Donalds Castle Creek) versus the Key Stream Features.

  - This reflects the relative significance of the named watercourses compared to the Key Stream Features, and that it would be uneconomic to achieve less than 200 mm additional predicted closure at all Key Stream Features.

  - Notwithstanding, the proposed setbacks from Key Stream Features (i.e. leaving solid blocks of coal beneath the Key Stream Features) will reduce the likelihood of impacts.

- **Conclusion 39:**

  The risks of permanent loss of swamps due to the combination of mining impacts and severe bushfire need to be further considered in the context of the impacts of the 2019-2020 bushfires observed at other locations.

  - It is noted bushfires have occurred in areas within the Catchment that have been subject to longwall mining, and vegetation in previously undermined swamps has persisted following these previous bushfire events.

  - Notwithstanding, bushfire management practices would be implemented for the Project to minimise as far as possible the risk of bushfire due to the Project.

- **Conclusions 42, 43 and 44:**

  Some important aspects of the EIS have a reliance on being able to effectively seal the mine at the completion of mining so that it floods, groundwater levels and pressures recover, and water is not diverted from the catchment in perpetuity.

  …

  The EIS does not question whether it is physically feasible to seal the mine. This needs careful consideration as a basis for assessing the feasibility of some important controls associated with managing mine water inflow after mine closure, including the type, magnitude, longevity and cost of offsets and compensatory provisions for impacts on water quantity and water quality in the catchment in perpetuity.

  …

  Offset and compensatory provisions should have regard to the consequences of not being able to seal the mine effectively, should that possibility materialise.

  - It is noted that the surface water offsets offer, which South32 understands has been accepted by the relevant NSW Government Ministers, includes compensation for post-mining losses based on the conservative EIS groundwater modelling predictions.

  - South32 agrees with IAP Conclusion 24 that, regardless of the Project, further detailed groundwater modelling and engineering work is required to confirm post-mining strategies to management groundwater resulting from the > 100 years of mining in the catchment.