DENDROBIUM AREA 3B
LONGWALL 18 SUBSIDENCE MANAGEMENT PLAN
Reasons for Approval

1. DEVELOPMENT CONSENT

- The Dendrobium Coal Mine was approved by the then Minister for Planning in 2001 following a Commission of Inquiry and was subsequently modified by a later Minister for Planning in December 2008. The 2008 modification significantly reduced the potential water impacts of the approved mine by removing longwall mining from under large sections of Wongawilli Creek and Sandy Creek.
- The existing development consent expressly allows longwall coal mining in mining Areas 1, 2, 3A, 3B and 3C. Longwall mining has already occurred in Areas 1, 2, 3A and parts of Area 3B.

2. SMP APPLICATION

- While the mining in Area 3B (including the area covered by Longwall 18) is already approved, the development consent requires a Subsidence Management Plan (SMP) to be approved before any longwall mining can actually occur.
- The preparation of a SMP allows the assessment of impacts on all built and natural features to be focused at the local level, ensuring that impacts are appropriately monitored, and impact management regimes are further refined during the life of the project in response to subsidence monitoring and recorded impacts. SMPs may cover a group of longwalls, or in this case a single longwall (ie Longwall 18). Each SMP is prepared in consultation with relevant NSW Government agencies.
- The consent expressly notes that, in approving an SMP, the Secretary may "*impose conditions containing subsidence impact limits, subsidence management mechanisms or other conditions*" (condition 8 of Schedule 3). SMPs, including performance measures and monitoring requirements, provide a framework to avoid, minimise and mitigate subsidence impacts and maintain a robust adaptive management framework.
- On 18 August 2020, South32 Pty Ltd (South32) lodged an application on the Department of Planning, Industry and Environment's (the Department's) Planning Portal, on behalf of South32's subsidiary Illawarra Metallurgical Coal, for approval of a draft SMP for the extraction of Longwall 18 (LW18).
- The draft SMP comprises a number of documents. In addition to the SMP itself (which is somewhat of a summary document), conditions of consent require that the SMP integrates two other, more detailed plans, being the Watercourse Impact Monitoring, Management and Contingency Plan (WIMMCP) and the Swamp Impact Monitoring, Management and Contingency Plan (SIMMCP). Each of these two plans also contains a Trigger, Action, Response Plan (TARP). Most of the detailed monitoring, management, remediation and contingency measures applicable under the SMP are contained within the WIMMCP and SIMMCP and their associated TARPs.
- South32's SMP application was also supported by seven specialist assessments addressing subsidence effects, impacts and consequences, but these do not comprise part of the application itself.
- On 24 November 2020, South32 provided an updated SMP which contained a limited amount of additional information regarding Aboriginal heritage.

3. KEY MINING PARAMETERS

- The draft SMP shows that LW18 would be the last and most southerly longwall proposed to be extracted in Area 3B from the Wongawilli Seam. LW18 is proposed to be to be located to the south of the approved LW17 and the west of Wongawilli Creek and to be oriented generally east-west. The extraction direction is from west to east.
- The proposed total void length for LW18 is 1018 metres (m), the proposed total void width (ie including first workings) is 305 m and the maximum mining height would not exceed 3.9 m. The depth of cover from LW18 to the surface varies between 295 m and 380 m.

- The SMP's Study Area is defined by the outermost of any of three variables – the 35^{O} angle of draw, the predicted 20 millimetre (mm) vertical subsidence contour, and all sensitive natural features located laterally within 600 m of the proposed void area.
- South32 has designed the mining layout of LW18 to avoid Lake Avon, Wongawilli Creek, a major igneous intrusion and a number of significant geological faults.

4. CONSIDERATION BY AGENCIES

- On 13 August 2020, South32 sought comments on its SMP application from WaterNSW, the Department's Biodiversity and Conservation Division (BCD) and Water Group (including the Natural Resource Access Regulator), the Department of Regional NSW's Division of Mining, Exploration and Geoscience (MEG), Dams Safety NSW (DSN), the NSW Resources Regulator and Subsidence Advisory NSW. Advice was received by the Department from each of these agencies.
- South32 provided the Department with a response to the issues raised by agencies on 30 September 2020, which was forwarded to relevant Government agencies for further comment.
- Additional comments were received from BCD and WaterNSW. WaterNSW provided several recommendations to be considered in assessment and any approval of the SMP. These recommendations have been carefully considered by the Department.
- DSN advised that its previous comments had been adequately addressed. However, the Department notes that South32 is still required to obtain a separate approval from DSN under the *Dams Safety Act 2015*, as parts of LW18 are located within the DSN's notification area for Lake Avon.
- WaterNSW was given the opportunity to review the conditions of the SMP approval before the decision was made. Comments were received on 4 December 2020 and taken into consideration in finalising the conditions.

5. CONSIDERATION BY INDEPENDENT EXPERT PANEL ON MINING IN THE CATCHMENT (THE CATCHMENT PANEL)

- In early 2018, the NSW Government established an Independent Expert Panel on Mining in the Catchment (the Catchment Panel) with terms of reference to:
  - undertake an initial review of current mining in the catchment;
  - review and update the findings of the 2008 Southern Coalfield Inquiry; and
  - strengthen the assessment of the ongoing operation of approved mines and any applications for new mining within the Special Areas of the catchment by providing advice.
- The Catchment Panel provided Government with an Initial Report in November 2018 and a Final Report in October 2019. The two reports contained 50 recommendations, two of which proposed establishment of a new, independent, standing subsidence advisory panel to provide advice to Government regarding new underground coal mining proposals and subsidence-related performance outcomes under existing mining approvals (see **Section 6** below). In April 2020, the Government announced that it would adopt all 50 of the Catchment Panel's recommendations.
- The Catchment Panel also gave specific consideration to the existing operations of the Dendrobium Mine, mainly in its Initial Report (which was updated to become Part 1 of the two-part Final Report).

6. CONSIDERATION BY INDEPENDENT ADVISORY PANEL ON UNDERGROUND MINING (THE MINING PANEL)

- Following adoption of the Catchment Panel's recommendations, a new independent subsidence advisory panel was established in August 2020. The new Independent Advisory Panel for Underground Mining (the Mining Panel) is chaired by Emeritus Professor Jim Galvin, who also chaired the Catchment Panel.
- On 28 October 2020, the Department wrote to Prof Galvin seeking advice on the SMP application. This request for advice focussed on the following:
  "The Department requests advice from the Panel as to the adequacy of the investigations completed for the SMP on the potential leakage from Avon Dam associated with these geological structures, and whether an increased offset distance from the full supply level of Avon Dam would be warranted to reduce risks of increased leakage from the reservoir into either Area 3B or the Elouera colliery workings.

  The Panel should also feel free to provide any other advice it considers would assist the Department in reviewing the Extraction Plan."
- The Mining Panel provided the Department with its advice on 26 November 2020. The Panel's 11 conclusions regarding South32's SMP application are as follows:

Groundwater

1. The Panel acknowledges the genuine and significant investigations undertaken to specifically consider the potential effects of mining LW18 on lineaments, the Elouera Fault Zone and leakage from Lake Avon. The additional field data and focus on characterizing the Elouera Fault and subsequent specific modelling of predicted potential changes following mining of LW18 are noted in particular.
2. Based on the information provided and reviewed by the Panel, the Panel considers the following predictions of the groundwater impacts associated with the mining of LW18 to be reasonable:[1]
    i. Increased leakage from Lake Avon ranges between of 0.01 and 0.13 ML/day (Watershed HydroGeo, 2020);
    ii. Increased leakage from overlying water courses (not including Lake Avon) estimated at a maximum of 0.46 ML/day (Watershed HydroGeo, 2020);
    iii. Increased inflow to the mine workings is estimated to be between 0.5 and 1.5 ML/day, (Watershed HydroGeo, 2020).

Surface Water

3. The surface water report supporting the SMP (Attachment D) is of a high technical standard with clear and generally appropriate interpretations of the data. A constructive effort has been made to address the recommendations of the IEPMC (2019).
4. The Panel has no concerns about incremental subsidence impacts on Wongawilli Creek due to LW18; and considers that the total incremental increase in surface water loss from Lake Avon and its tributaries due to LW18 is likely to be very low compared to existing losses due to Dendrobium mine.
5. The nature and degree of water quality impacts is likely to be similar to those previous experienced in Area 3B.
6. There is a sufficient number of surface water monitoring (flow, pool and water quality) sites and they are at suitable locations.
7. Good progress has been made in improved use of control stations in the estimation of surface flow losses and in improved TARPs. However, further assessment and peer review of the new accounting methods and TARPs are required prior to regarding them as suitable for use.
8. While the water quality TARPs are acceptable for management of LW18 impacts, the water quality TARPs are not sufficient indicators of medium to long-term trends in water quality.

Generally

9. Overall, the SMP reflects a genuine effort to undertake sound field studies, numerical modelling and risk assessment.
10. The Panel concludes that it largely responds to and satisfies the recommendations of the Part 1 report of the IEPMC (Part 2 only being published while the SMP was in the process of being prepared) and a number of other past reviews and advices prepared for the Department in relation to Dendrobium Mine.
11. The Panel concludes that the investigations undertaken into assessing the potential for additional leakage from Lake Avon due to the extraction of LW18 are adequate and that based on the outcomes of those investigations, there is no need to increase the setback distance of 300 m from Lake Avon.

- The Panel's 10 recommendations regarding determination of the application (and, in some cases, development of future SMP applications) are as follows:

Groundwater

1. The Panel supports the recommendation of DPIE Water for additional standpipe monitoring bores to be constructed adjacent to vibrating wire piezometers (VWP) to provide validation of VWP sensor data.
2. It is recommended that one or two additional nested groundwater monitoring sites are established to the south west of LW18: either between LW18 and Lake Avon and/or between LW18 and the Elouera Mine workings, in order to consider groundwater pressures and water quality in the shallow/mid and deeper Hawkesbury Sandstone.
3. Ongoing monitoring of groundwater levels within the fault should continue at site 3 (S2490).

[1] NB. These predictions were in the SMP's accompanying Groundwater Assessment by Watershed Hydrogeo.

4. The Panel supports the recommendation to construct either VWPs or open holes at the vertical holes at Sites 1 and 2. Ongoing monitoring of pressures should occur at these two sites. Ideally, if future drilling is to occur in this area, consideration should be given as to whether an open standpipe bore into the fault zone could be constructed to provide both verification of water level and also to provide for monitoring of water quality changes within the fault over time.
5. The Panel recommends additional stress investigations at end of mining LW18 to confirm unloading changes.
6. Monitoring the groundwater (both pressures at depth and the water table) overlying Elouera Mine is recommended. This information will contribute to the conceptual understanding of groundwater recovery processes post mining in this area.
7. Any observed reversal in the Hawkesbury Sandstone groundwater level gradients between Lake Avon and the Elouera fault monitoring bores to the south-west of LW18 should result in a review by an independent expert to ascertain the water loss rate (as committed to in the South32 Response to Agency advice).
8. For future mining areas groundwater TARPS and performance measures should be considered.

Surface Water

9. The previous (pre-LW15) surface water flow TARPs should be employed in parallel with the new surface water flow TARPs, and the most conservative outcome taken, until the new trigger metrics have undergone further assessment and peer review for fitness for purpose.
10. A method of quantifying and reporting trends in key water quality indicators (both concentrations and loads) should be trialled in addition to applying the proposed water quality TARPs.

- The Department provided the Mining Panel's report to South32 for its review and any appropriate comment on 26 November 2020. South32 provided its response the following day, simply requesting that *"any condition of approval relating to the recommendations of the [Mining Panel] for additional monitoring includes some flexibility to account for access to the proposed locations. Establishment of additional monitoring sites needs to account for the environmental impact of installation (i.e. reducing the clearing of vegetation), safety (i.e. very difficult terrain in some areas) and land tenure (i.e. S32 does not have tenure over the Elouera goaf as this is within the Wollongong Coal lease)."*
- The Department supports this flexibility and has provided for it in the recommended conditions.

7. KEY ISSUES

Shortening of the Longwall at its Eastern End

- South32 previously planned that LW18 would have a total void length of approximately 1,928 m, which is less than but similar to LW17, which has a void length of 2,014 m. However, South32 had to shorten LW18 by some 900 m at its eastern end, owing to a series of faults and associated igneous dykes which transect the seam. These faults reflect a large block of strata (including the seam) being downthrown by some 10-15 m (see Figures 2-4 and 2-5 in the SMP's Attachment B) and this area is too extensive and too difficult to mine through.
- The eastern (finishing) end of the longwall is now proposed to be located some 70 m west of the first of these faults.

Elouera Fault

- The potential for subsidence movements above Longwall 18 to lead to dilation of fault planes within the compound Elouera Fault and thereby open up pathways for leakage of waters from Lake Avon has been recognised by South32, Government agencies and the Catchment Panel for some years.
- Consequently, South32 has undertaken investigations and made other efforts to better understand the Elouera Fault and the extent of these risks. Reports of these investigations were included with the SMP application.
- The Mining Panel acknowledged *"the genuine and significant investigations undertaken to specifically consider the potential effects of mining LW18 on lineaments, the Elouera Fault Zone and leakage from Lake Avon"* and concluded that *"the investigations undertaken into assessing the potential for additional leakage from Lake Avon due to the extraction of LW18 are adequate and that based on the outcomes of those investigations, there is no need to increase the setback distance of 300 m from Lake Avon."*
- The Department accepts this conclusion.

Waterfall WC-WF54

- As a consequence of shortening Longwall 18 at its eastern end, there are no anticipated subsidence impacts on a major waterfall on Wongawilli Creek denominated in South32 documents as WC-WF54 (see the Mining Panel's conclusion #4).

Upland Swamps

- There are six small upland swamps within the general vicinity of LW18, as follow:
    - Den14, which has already been undermined by LW16 and LW17;
    - Den149, which has been mostly undermined by LW17 but extends to the northern edge (ie tailgate) of LW18;
    - Den35a, which is mainly south of LW18 but with a northern limit directly overlying the southern edge (ie maingate) of LW18;
    - Den35b, which extends to 85 m south of the maingate of LW18;
    - Den150, which extends to 225 m south of the maingate of LW18; and
    - Den151, which extends to 325 m south of the maingate of LW18.
- The two swamps most likely to be impacted by the extraction of LW18 are Den35a and Den 35b, which are likely to be impacted by both conventional compressive strain, valley closure (particularly Den35b, which is in an incised valley) and upsidence.
- South32 has already provided a Biodiversity Offset Strategy, in consultation with BCD and WaterNSW, for all impacts on upland swamps in both Area 3B and Area 3C. The offset was approved by the Secretary, in accordance with condition 15 of Schedule 2 of the mine's development consent, on 16 December 2016.

Aboriginal Heritage Management

- There are three recorded Aboriginal heritage sites within the 35^{O} angle of draw and predicted 20 mm subsidence contour of LW18. The sites are recorded on the Aboriginal Heritage Information Management System (AHIMS) as 52-2-1772, 52-2-2248 and 52-2-3068. All three sites are rock shelters with art. One shelter also contains grinding grooves.
- Condition 12 of Schedule 3 of the mine's development consent requires an Aboriginal Cultural Heritage Management Plan (ACHMP) to be developed as part of each SMP. Due to weather-related delays and other reasons, South32 has not yet completed a new ACHMP. The updated SMP advises that: "*At the time of writing, [South32] is developing an updated Aboriginal Cultural Heritage Management Plan to manage sites 52-2-1772, 52-2-2248 and 52-2-3068 in consultation with the [Registered Aboriginal Parties]. Once finalised, this document will be sent to Heritage NSW for comment."*
- The Department accepts this position and considers that this ACHMP must be completed and approved prior to commencing extraction of LW18. South32 is proposing to submit its new ACHMP within a matter of weeks.

Mining Panel Recommendations

- The Mining Panel made a total of ten recommendations, the majority of which relate to improved monitoring of subsidence impacts associated with LW18. In effect, these recommendations amount to a further level of risk assessment and assurance. However, one recommendation (#8) is relevant only to future SMP applications.
- The Department recommends that South32 implements each of these recommendations and has proposed that South32 prepare a plan, in consultation with WaterNSW and to the satisfaction of the Secretary, setting out the manner in which it would implement all recommendations contained in the Mining Panel's advice. This plan would have to be approved by the Secretary prior to South32 commencing extraction of LW18.
- However, preparation and finalisation of this plan would not prevent South32 undertaking early discussions with WaterNSW and/or the Department in order to agree on suitable sites to undertake the additional drilling and down-hole monitoring proposed by the Mining Panel. Such early agreement may well be necessary in order for South32 to complete these drillholes and install the necessary downhole monitoring equipment that should be in place before longwall extraction commences (presently planned for October 2021).

8. OTHER FACTORS

- The Dendrobium mine remains a significant contributor to regional employment in the Illawarra, with around 400 people working at the mine, and a further 600 people indirectly reliant on the mine.
- The coal extracted from the mine is a key component in the production of a premium coal blend that is used in steel production at the BlueScope Steelworks in Port Kembla, which employs 3,000 people.
- The coal proposed to be recovered from LW18 (1.973 Mt) is estimated to provide approximately $26 million in State Government revenue through royalties, levies and payroll tax.

9. EVALUATION AND CONCLUSIONS

- The Department has assessed the SMP application in accordance with the relevant requirements of the approved consent and has carefully considered the potential impacts of the extraction of LW18 on the surrounding environment. The Department has carefully considered the matters summarised in the foregoing sections of this report.
- Extraction of coal by South32 in Area 3B using longwall methods is already approved under the existing development consent, as modified in 2008. This extraction is subject to the performance measures listed in the consent and to the preparation and approval of an SMP.
- The key matters for consideration by the Department in determining whether to approve the SMP application are whether South32 can meet the two relevant performance measures contained within the development consent. These are that South32 must, to the satisfaction of the Secretary:
    - *ensure that underground mining operations do not cause subsidence impacts at … Wongawilli Creek other than "minor impacts" (such as minor fracturing, gas release, iron staining and minor impacts on water flows, water levels and water quality*); and
    - *ensure the development does not result in reduction (other than negligible reduction) in the quality or quantity of … surface water inflow to the Cordeaux River at its confluence with Wongawilli Creek.*[2]
- The Department is satisfied that LW18 can be extracted, as proposed under the SMP, with a low risk of exceedance of either of these two performance measures.
- Extraction of LW18 would allow the recovery of valuable coal resources, using existing infrastructure and without significantly increasing the existing disturbance footprint within the approved project boundary.
- Extraction of LW18 would continue to underpin the wide-ranging benefits for the local and State economies that derive from the continued operation of the Dendrobium Mine and the part that it plays in supporting the wider coal mining and preparation operations of South32 in the Illawarra Region and the coking coal which it provides for consumption at BlueScope's Port Kembla Steelworks and for export.
- On balance, the Department considers that the extraction of LW18 is in the public interest and that the SMP application should be approved, subject to strict conditions as discussed below.

10. RECOMMENDED CONDITIONS

- The development consent and previous SMP approvals have established a strict regulatory framework, including stringent performance measures, and comprehensive monitoring requirements.
- All key provisions of the previous LW17 SMP approval has been carried forward into the new LW18 SMP approval, which is divided into two key schedules. The first of these applies to ALL longwalls in Area 3B and the second only applies to specific longwalls.
- South32 has proposed to shorten LW18 to provide for a setback of 300 metres from the full supply level of Lake Avon, which is in line with previous approvals from DSN to ensure the integrity of Lake Avon. The Department has formalised the proposed setback by including a condition to this effect.
- The Department has imposed a requirement for South32 to implement all recommendations of the Mining Panel in respect of LW18 and future longwalls.
- The Department also recommends the continued application of a condition, first imposed on extraction of LW17, that would require South32 to offset any loss of surface water that may have otherwise reported to the Lake Avon reservoir as a result of the extraction of LW18.
- The Department notes that the proposed requirement to offset surface water losses is consistent with the existing consent, which requires South32 to "*provide suitable offsets for loss of water quality or loss of water flows to WaterNSW storages"*. A transfer of 33 hectares of land to WaterNSW occurred under this condition in 2010.
- South32 has reviewed the proposed conditions and, on 2 December 2120, generally accepted them subject to two relatively minor comments. The Department has given these comments consideration in finalising the conditions.

11. ONGOING MANAGEMENT

- The Department considers that the additional conditions to be imposed through the SMP approval provide effective safeguards against any significant impacts as a result of the extraction of LW18 and would also provide additional information to inform decision-making about any future mining at the Dendrobium Coal Mine.

[2] See conditions 2 and 3 of Schedule 3 of consent DA-60-03-2001, as modified.

- This SMP approval continues the Department's precautionary approach by enforcing substantial setbacks from key features (ie Lake Avon) in accordance with advice from relevant government agencies including WaterNSW and DSN.
- The Department also has a role under the *Environmental Planning and Assessment Act 1979* (EP&A Act) to ensure compliance with the existing development consent and subsequent approvals under the consent.
- In undertaking this role, the Department has a range of enforcement powers available to it if it considers that there may have been or may potentially be a breach of the development consent or subsequent approvals under the consent, including but not limited to, requiring further setbacks from key features or the cessation of mining operations if considered necessary.

8/12/2020

Stephen O'Donoghue
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as nominee of the Secretary