Moolarben Stage 1 MOD 15

Further Information on the impact on the groundwater system from UG4 mine

Moolarben Coal mine Complex (MCC) Modification 15 application seeks approval to locate and install 4 expanded dewatering sites above Underground No. 4 Mine (UG4). This would involve the drilling of a cluster of 3 de-watering boreholes (nominal diameter ~700mm) per site plus associated clearing for installation and access tracks in an existing biodiversity offset area.

The location of the northern bore sites - opposite The Drip GDE[1], and approximately 250 metres from the Goulburn River is of major concern considering the close proximity to significant natural features, cultural sites and the potential interception and depressurisation of the Triassic/upper Permian groundwater system. Construction of the northern dewatering sites is predicted to occur about the year 2026.

MCC has provided an inadequate 2-3 page groundwater review that is predicated on 2011 approval (Stage 1 MOD 7) for a dewatering borefield based upon questionable 2006 groundwater modelling (Dundon, 2006). The MOD 15 groundwater review has not considered the latest groundwater monitoring since the commencement of Underground No.1 Mine (UG1) in mid-2016 and a subsequent extensively '*recalibrated*' groundwater model (HydroSimulations, 2017).

There has been a more than 6 fold increase in actual mine water-make (1 ML/day to > 6.8 ML/day) compared to the earlier predictions of groundwater inflows (Middlemis and Fulton, 2011) (HydroSimulations, 2017). The source of this extra inflows has not been adequately investigated but is most likely to have been due to interception of additional groundwater sources above the coal seam - from Triassic and upper Permian water bearing strata. Groundwater monitoring since 2016 show a significant decline in standing water levels in all water bearing strata at a number of monitoring bores 2-4 kms from UG1 (Figure 1 - PZ179, PZ191, PZ192 and PZ193).

Between 2001 and 2017 monitoring of upper groundwater levels above the Ulan Coal longwall No. 3 Mine showed a 15 metre decline in standing water levels (SWLs) 500 metres from the edge of the longwalls (UCML, 2004; UCML, 2017; UCML, 2015). If a similar outcome is experienced in UG4, the groundwater drawdown would extend well under both the Goulburn River and The Drip GDE.

Protection of valuable aquifers – exceedance of AIP threshold

MCC has frequently reported that the quality of groundwater within the UG4 footprint is low quality and of limited value. The salinity and pH of groundwater monitored at PZ103 and PZ105 (located within the UG4) demonstrates the presence of high quality, potable water sources in all three water bearing strata - the median range of salinity EC levels 235 - 580 µS/cm, with a potential yield in excess of 4 litre per second (Table 1). The characteristics of these groundwater sources should trigger the Aquifer Interference Policy (NSW Office Of Water, 2012). There is also evidence based on hydrochemical characteristics and behaviour of the SWLs in response to mining that there is connectivity between the water bearing strata. A possible explanation for the high quality potable groundwater in the east could be the result

[1] Groundwater Dependent Ecosystem

of an active rainfall recharge area associated with the overlying alluvial drainage basin that supports Tea-tree riparian heathland vegetation (Hill, 2000).

Approval in 2007 and failure of the groundwater modelling

The 2007 Independent Hearing and Assessment Panel (IHAP) (Galvin *et al*., 2007; Mackie, 2007) stated they lacked confidence and had serious reservations about the development of the Moolarben Coal's UG4 mine. They were **'***unable to comprehend with sufficient certainty, the magnitude and extent of impacts likely to prevail upon aquifer systems as a result of longwall mining operations'***.**
IHAP concerns regarding the predicted impacts of mining on regional groundwater systems included:

- the limited knowledge and sensitivity of the important Triassic aquifer system and its interaction with the Goulburn River
- the potential for measurable depressurisation of groundwater systems within the Triassic aquifers
- a lack of confidence in the computer numerical models used to predict impacts and validity of those predictions depends on how well the models approximate field conditions including the 'unusual' regional hydraulic properties.

The 2007 IHAP concluded that "*Sub-surface fracturing impacts need to be confirmed by monitoring of ground behaviour and groundwater response …" and* ***if mining is found to impact upon the Triassic aquifer system, the mine layout may need to be modified.***

An outstanding assumption on which the Moolarben Coal model depends was that subsidence cracking of the strata above the coal seam would be restrained to under 122 meters from the surface and the upper Triassic aquifers [2] would not be drained (Mackie, 2007). This differs significantly from the Ulan Coal Mine experience that recorded the complete dewatering of Triassic strata. MCC's claim is also disputed by other subsidence experts (Tammetta, 2015; Mackie, 2007).

The potential extent of depressurisation resulting from UG4 may be extrapolated from the measured decline in excess of 15 meters of Triassic groundwater levels experienced at Ulan Coal Mine between 2001 and 2017, as mentioned above.

MCC Approval Conditions

MCC has failed to show how 'nil impacts' on The Drip water supply and negligible impacts on the Goulburn will be achieved as required by their approval conditions (Mod 15, Attachment 1- Tables 11 & 14 – Schedule 3: 78A).
The 2016 Planning Assessment Commission's report on UG1 Modification 12 required *"an additional level of monitoring, reporting and government oversight"* to ensure the adequacy of the mines predictions and there be no impacts on The Drip. Subsequent variance from UG1 Modification 12 modelling and monitoring predictions should now initiate further investigation and scrutiny from an independent expert panel.

Conclusion
These outstanding uncertainties need to be fully investigated and considered before MOD 15 can be confidently assessed. This requires comprehensive independent groundwater report to fully

[2] This was based on the incorrect assertion that the Triassic strata above UCML 206m wide panels were not drained - MCC LW panels are 208 m wide

inform this approval application in regard to the impacts of UG4 mine depressurisation on Triassic/Upper Permian aquifers; potential interaction with the Goulburn River and interference to The Drip groundwater supply.

The proposed construction of the dewatering borefield from 2023 allows a reasonable period for this to be completed. Failure to clearly investigate these impacts and act on the outcomes could result in a potentially permanent and devastating degradation of the groundwater system and dependent ecosystems along the Goulburn River with the long term costs being borne by future generations.

The MOD 15 expanded groundwater dewatering bores should not be approved.

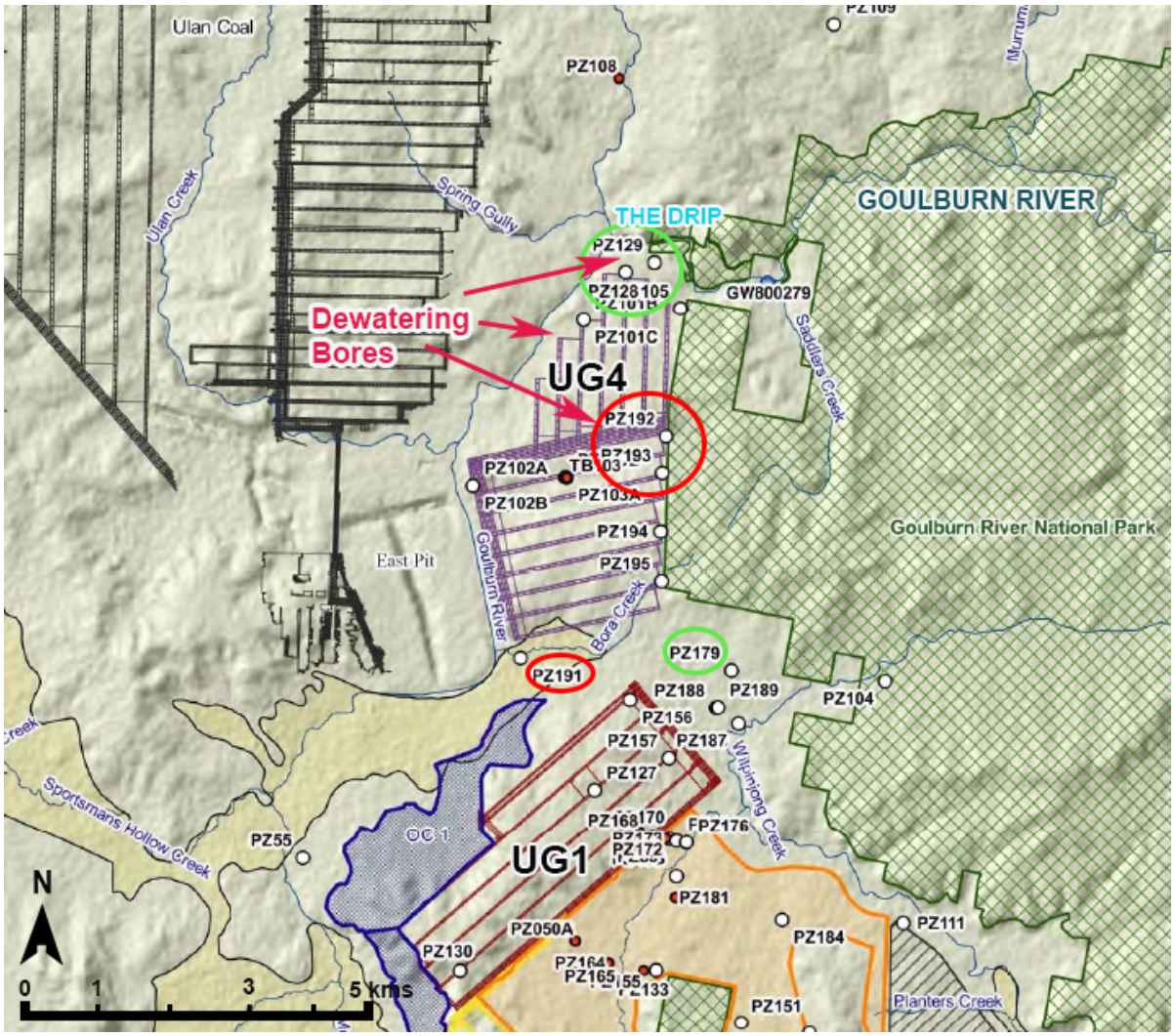

Figure 1: Location of MCC UG1 & UG2; monitoring bores PZ192,, PZ193, PZ105, PZ103, PZ191 & PZ179 and proposed location of dewatering bore sites (MOD 15)

Table 1: Water quality of monitoring piezometers located in UG4. For location see Figure 1 (2017 MCC AMR)

MCC UG4 Piezometer	Lithology	Median EC	Median pH
PZ103C	Lower Triassic	350	6.6
PZ103B	Upper Permian	438	6.7
PZ103A	Ulan Seam	580	6.5
PZ105C	Lower Triassic	265	6.1
PZ105B	Upper Permian	235	5.6
PZ105A	Ulan Seam	317	6.2

References

Dundon, P. J., 2006. *Appendix 5 Groundwater Assessment* Moolarben Coal Mines Pty. Ltd.,

Galvin, J. M., Mackie, C. D. and Karantonis, P., 2007. *Report for the Independent Hearing and Assessment Panel for the Moolarben Coal Project*, Prepared for the Director General Department of Planning New South Wales.,

HydroSimulations, 2017. *Moolarben Coal Open Cut Optimisation Modification Groundwater Assessment: Appendix I*, Moolarben Coal Operations Pty Ltd., YANCOAL, Australia,

Mackie, C. D., 2007. *Moolarben Coal Mine Groundwater Assessment: Report to Independent Planning Assessment Panel*, Mackie Environmental Research Pty Ltd,

Middlemis, H. and Fulton, A., 2011. *Moolarben Coal Complex Stage 2 Preferred Project Report Appendix E - Groundwater Impact Statement.*, Hansen Bailey On behalf Moolarben Coal Mine,

NSW Office Of Water, 2012. In *NSW Aquifer Interference Policy*.

Tammetta, P., 2015. Estimation of the Change in Hydraulic Conductivity Above Mined Longwall Panels, *Groundwater*, **53**(1): 122-129. Available at: http://dx.doi.org/10.1111/gwat.12153 (accessed

UCML, 2004. *Ulan Coal 2004 Annual Environmental Management Report - Appendix 4*, Prepared by Ulan Coal Mines Limited,

UCML, 2015. *Attachment D: Groundwater Monitoring Report*

UCML, 2017. *Ulan Complex Annual Review*, GLENCORE, Mudgee, NSW.