



OUT21/1380

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Dear Mr Turner

**Wongawilli Coal Mine Mod 2 - North West Mains Development (MP09\_0161)  
Modification Report**

I refer to your email of 4 February 2021 to the Department of Planning, Industry and Environment (DPIE) Water and the Natural Resources Access Regulator (NRAR) about the above matter.

Although the surface and groundwater impacts of the modification are predicted as low risk, the significant shortcomings of the numerical modelling and reporting, some of them fundamental, means that we are not confident in the reliability of the impact predictions. This concern is exacerbated by the sensitive environment hosting the proposal, noting that the working is planned to go directly underneath Avon Dam and nearby to other mining projects where cumulative impacts are a consideration.

Please refer to Attachments A and B for associated recommendations and detailed advice.

Any further referrals to DPIE Water and NRAR can be sent by email to:  
[landuse.enquiries@dpiensw.gov.au](mailto:landuse.enquiries@dpiensw.gov.au).

Yours sincerely

A handwritten signature in blue ink, appearing to read 'M Isaacs'.

Mitchell Isaacs  
Chief Knowledge Officer,  
**Department of Planning, Industry and Environment: Water**  
27 April 2021

## Attachment A

# Detailed advice to DPIE Planning & Assessment regarding the Wongawilli Coal Mine Mod 2 North West Mains Development (MP-09\_0161)

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## 1.0 Entitlement, works approval and water take

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### 1.1 Explanation

#### **Licensing**

The proposal concludes that during excavation of the drivage, groundwater will be drawdown to the base of the Bulli and Wongawilli Seams but will have negligible groundwater drawdown in the upper units i.e. alluvium/weathered zone or Hawkesbury Sandstone. The report advises there will be negligible impact to registered bores or to baseflow in rivers and creeks due to the project.

The mine inflow is predicted to peak at 36.8 ML/year in 2024. This represents the combined inflows for the already approved mining and the additional inflows due to the modification. Wollongong Coal's water take is regulated under WAL 36487 with a share entitlement of 1500 units/ML in the Sydney Basin Nepean Groundwater Source, Management Zone 1. This adequately addresses the project's groundwater entitlement requirements

However, should surface water baseflow in rivers and creeks be reduced as a result of Mod 2, this water take would need to be licenced under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Source 2011*.

As a controlled allocation from the Sydney Basin Nepean Groundwater Source, Management Zone 1 is unlikely, any additional groundwater entitlement if needed should be acquired through water trading.

Please note that the summary Water Sharing Plan rules ([https://www.industry.nsw.gov.au/\\_data/assets/pdf\\_file/0008/149885/Greater-Metro-Region-Groundwater-Rules.pdf](https://www.industry.nsw.gov.au/_data/assets/pdf_file/0008/149885/Greater-Metro-Region-Groundwater-Rules.pdf)) for the groundwater source advises that it would be very unlikely water would be made available from Management Zone 1 through a controlled allocation.

#### **Works Approval**

WAL36487 held by the project is linked to water supply work approval 10WA118768. This water supply work approval is located within the Sydney Basin South Groundwater Source.

The proponent should contact NRAR to modify this approval or link a new approval to ensure there is a linked water supply work (miscellaneous work) located in the same water source as the WAL which holds entitlement, i.e. Sydney Basin Nepean Groundwater Source, Management Zone 1.

Note – the WAL awarded to Wongawilli originally under a controlled allocation was located in the incorrect water source- Sydney Basin South Groundwater Source. This was modified to the correct Groundwater source.

#### **Surface water take – Lake Avon Reservoir**

The approved and proposed North West Mains Development (NWMD) partially underlies Gallahers Creek which forms the western arm of Lake Avon Reservoir. The modification report includes the following statement with regard to surface water impacts:

*“The 2010 EA identified that, although there will be some lateral depressurisation of the overburden above Gallahers Creek, the depressurization will not be notably transferred through the claystone to Lake Avon. As such, there will be no observable, adverse effect on the water storage capacity or water quality of Lake Avon (GeoTerra 2010). Additionally, there will be no*

*loss of flow from surface water systems upstream of Lake Avon Reservoir and no adverse effect on the ephemeral shallow soil groundwater system (GeoTerra 2010b).*

*Given that the existing surface water management system will be maintained for Mod 2, with minimal changes to Wongawilli pit top surface infrastructure, no impacts to the surface water systems or the surface water management system is expected to occur as a result of the proposed modification.”*

NRAR is concerned that the project may indirectly impact on the secure water supply currently held with Lake Avon Reservoir. Observable effects may not be predicted but this does not rule out the potential risks associated with mining under the water storage area. This issue is discussed further below in Section 2.

The proposal still may potentially cause lateral depressurisation that could lead to water take from the surface water source. This water take would need to be licenced.

The report also includes this statement in relation to subsidence:

*“There is no potential for the proposed NWMD roadways to cause any significant surface ground movement. Any surface subsidence is expected to be so small as to be imperceptible. Any potential impacts to natural and built features are expected to be imperceptible.”*

The project indicates there is expected to be no perceived impacts to natural and built features. The report has not clearly ruled out the potential for impacts in relation to surface cracking along bedrock within creek areas on the surface. Impacts to the surface may still occur, although imperceptible, potentially causing a reduction in baseflow.

## **1.2 Recommendation – Post Determination**

NRAR has reviewed the modification report and has the following recommendations:

- The project holds Water Access Licence (WAL) 36487 with a share entitlement of 1500 units/ML in the Sydney Basin Nepean Groundwater Source, Management Zone 1. The project is to ensure all water take falls under the existing entitlement as further entitlements in this water source will only be available by trading within the water source as controlled allocation in this zone is unlikely.
- The project has not indicated it holds any entitlement in the surface water source above the proposed location of Mod 2. If as a result of Mod 2, surface water baseflow in rivers and creeks were to reduce, this would be considered water take and must be licenced under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Source 2011*.
- The proposal is located in close proximity to the Lake Avon Reservoir, part of the Sydney Drinking Water supply. Any surface cracking that leads to water take must be licenced and any reduction in the reservoir capacity may directly impact on WaterNSW's licensable take.
- Any licensable water take requiring a meter must install a meter that is compliant with the NSW non-urban water metering Policy - [https://www.industry.nsw.gov.au/\\_data/assets/pdf\\_file/0017/312335/nsw-non-urban-water-metering-policy.pdf](https://www.industry.nsw.gov.au/_data/assets/pdf_file/0017/312335/nsw-non-urban-water-metering-policy.pdf)
- The proponent should contact NRAR to modify water supply work 10WA118768 or link a new work to ensure there is a linked water supply work (miscellaneous work) located in the same water source as the WAL which holds entitlement, i.e. Sydney Basin Nepean Groundwater Source, Management Zone 1.

## **2.0 Groundwater impact assessment and modelling**

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### **2.1 Explanation**

The proponent has not undertaken a full assessment against the NSW Aquifer Interference Policy (AIP, 2012) using the standard assessment framework. However, the AIP minimal impact

considerations have been adequately applied in evaluating the acceptability of the modelled drawdown impacts.

Drawdown predictions are provided for the mined coal seams (Illawarra Coal Measures) and the Bulgo Sandstone, which is the main aquifer of the Narrabeen Group that lies directly above the Illawarra Coal Measures. In summary, the model predicts:

- >0.5 m drawdown in the Bulgo Sandstone and water table during active mining
- No third-party bores impacted by >2 m minimal impact consideration
- 50 m drawdown in the mined coal seams.

Drawdown predictions for the Hawkesbury Sandstone are not provided. The Hawkesbury Sandstone is the main groundwater source and is widely accessed for groundwater supply regionally. It also provides baseflow contributions where incised along major rivers. Although it is reasonable to assume that drawdowns would be negligible due to the negligible drawdown in the Bulgo Sandstone, this omission is a significant concern.

The proponent concludes that Groundwater Dependent Ecosystem (GDE) impacts are unlikely due to the minimal change in water table levels predicted.

There are several instances of contradiction and uncertainty in the description of the project and the modifications proposed. The most concerning relates to the stated intention by the proponent not to mine using longwall methods (Sections 1.1, 3.2.4 and 4.7.2 of the Mod 2 report) that is contradicted by several statements describing the project and modelling. For example, in the description of mining system stresses (Section 5.4.3) and the report conclusion (Section 10) that states "*The proposed mining activities (NW Mains Modification) are to extend approved mining of six long wall panels in the Nebo Area (Nebo Longwalls 1 to 6) for another 5 years, until 31<sup>st</sup> of December 2025*".

The predicted groundwater impacts of the modification are generally considered to be plausible and hence likely to represent low impact risks. However, as reported below, the significant shortcomings of the numerical modelling and reporting, some of them fundamental, give DPIE Water significantly diminished confidence in the reliability of the impact predictions. This concern is exacerbated by the sensitive environment hosting the proposal, noting that the mining is planned to go directly underneath Avon Dam and nearby to other mining projects where cumulative impacts are a consideration.

The results of the groundwater model must be reliable with robust uncertainty analysis. They must include an assessment of potential depressurising under the Avon Dam. These predictions must be used in geotechnical modelling and assessment of material stability and potential for cracking under this important water asset.

Even if impact risks are low for this proposal, the proponent states that they intend to use the model for future potential developments. This reinforces the requirement for the model improvements as outline below to occur, to avoid errors and omissions moving forward into future assessments.

Accepting the numerical modelling without an insistence on improvement creates an unacceptable precedent for other project developments.

### **Model Review**

Below is a summary of a review of the modelling report which is provided in detail in Attachment B.

- The details of the proposed Project are unclear. The information provided in different documents and within each of them is contradicting and confusing.
- There are omissions in the groundwater modelling documentation.
- The stated modelling objectives were not met. The modelling work and reporting were not undertaken according to best practice guidelines. The model is not adequately calibrated

against an adequate number of targets that are of different types (heads and fluxes) and do not provide reasonable spatial coverage and representation across the model domain.

- There are discrepancies in the conceptualisation of mining that must be resolved. It is unclear that longwall mining is planned. If not, the longwalls represented in the model and their effects on the hydraulic properties of the overlying strata are not applicable and must be removed from the conceptual and numerical models and the report. Otherwise, the area's hydrogeology is well conceptualised.
- The report does not show that the modelling has made adequate use of available data, including data from South 32 (Dendrobium), which is accessible to the Project through formal data sharing agreement between the two mining operations
- The identified groundwater level rise is not reasonably explained.
- The report does not specify potentially affected parties, e.g. bores, and the assessment of effects is lacking, especially in terms of effects on the Hawkesbury Sandstone.
- There are inconsistencies between the text and figures with regards to the model boundaries. These must be resolved. Some boundary types seem to be wrong. The model representation of longwalls and foreseen associated changes in hydraulic properties in the overlying strata may be unnecessary.
- The model is not well calibrated against head and flux targets that are adequately distributed throughout the model domain. The report does not present model calculated and observed heads for all available points. The model mainly achieves model confidence level class 1, with very few attributes from classes 2 and 3.
- The impact assessment is incomplete. The Proponent is required to revise the model predictions in terms of potential impacts and licencing requirements following amending the model according to the recommendations made here.
- The adopted uncertainty analysis approach is basic, but acceptable considering the low–medium level of risk of the proposed Project. However, the analysis requires refinement. The results of the uncertainty analysis must be reported for all strata and potentially affected features and environs.
- The Groundwater Impact Assessment conclusions need to be revised and revalidated after improvements are made as identified by this review. This must include an assessment of drawdown impacts on the alluvium/weathered zone and the Hawkesbury Sandstone.
- The main modification report was prepared by EMM. The groundwater modelling and reporting was undertaken by SLR Consulting Australia Pty Ltd and the peer review by EMM. The NSW Aquifer Interference Policy (AIP, 2012) requires an *independent* review. Given that EMM is the main author of the modification report, the review is not considered independent.
- The included peer review report highlights important matters that the Proponent must address for the model to be considered fit for the purposes of assessing the Project's impacts and licencing requirements. Notwithstanding, DPIE Water does not agree with the conclusion that *'the modelling is fit for purpose for scenario modelling to inform groundwater impact assessment and water licencing.'*
- DPIE Water accepts and endorses the WaterNSW submission regarding the need to revise and update the mass water balance estimates to remove inconsistencies and clarify the model results.

Section 1.2 in the Groundwater Impact Assessment notes that the developed model is intended to be used for potential future mine modifications and groundwater impact assessments. This gives additional weight to the model. Deficiencies in the model could easily transpire to future model versions and form unfavourable precedents.

## **2.2 Recommendation - Prior to determination:**

DPIE Water recommends the following:

1. Address the contradictory and uncertain descriptions of the project and modification, in particular regarding the use of longwall mining methods.
2. Address all the requirements for improved modelling and reporting, these are listed in Attachment B.
3. With the improved modelling, provide updated predictions of drawdown effects at different receptors (bores, wetlands and adding the Hawkesbury Sandstone to the reporting), and inflow volumes of the approved and proposed mine workings.

**End Attachment A**

## Attachment B: Recommended groundwater model improvements

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1. The groundwater modelling report should be a standalone document, with minimal referral of the reader to external material.
2. The groundwater modelling report must include a clear description of the proposed Project, which is consistent with the description provided in other documents like the Main Report.
3. The groundwater modelling report must demonstrate that the proposed Project is properly represented in the numerical model. If no longwall mining is proposed, longwalls must be removed from the conceptual and numerical model and the effects of longwall mining on the overlying hydrogeological system must not be represented.
4. Revise the Model and the Report addressing comments and recommendations in:
  - a. The EMM peer review.
  - b. WaterNSW submission to Environmental Impact Statement - Wongawilli Mine Modification 2 (MP 09\_0161 MOD 2).
  - c. The Independent Expert Panel for Mining in the Catchment Report (IEMPC 2019) mentioned in Section 7.4 in the Report.
  - d. These comments by DPIE Water.
5. Include self-assessment of modelling using checklists in the AGMG 2012.
6. There are omissions in the Report that must be addressed including errors and inconsistencies in text and between text, tables, and figures. Most of the figures must be reproduced to meet expected professional standards and be useful. The content and formatting of tables must also be checked.
7. Please use consistent units. There are basic unit conversion errors that must be corrected, e.g. Table 3-7.
8. Explain what change in recharge and specific yield of less than 0% means (-300% and -500% as stated in Section 8, p 112).
9. Account for other mining operations in the area and clearly describe the approach adopted to assess cumulative impacts, including listing and characterisation of other considered operations.
10. Provide maps of the predicted drawdown due to the Project alone and all developments in the area including the proposed Project for all model layers at key times, e.g. start of the Project, end of the Project, then selected dates that will help understand the long-term effects of the Project.
11. Clearly indicate other operations modelled at various stages. Particularly, describe how was the Dendrobium Mine included in the model while it occurs outside the model domain.
12. Clarify the sources of all presented data.
13. Provide a clear geological map showing geological units and structure.
14. Clarify the extent of the used geological model/s.
15. List the hydraulic parameter values and boundary conditions adopted from Golder 2010 SEEP/W modelling, including providing a map showing the alignment of the modelled cross-section/s.
16. Provide a useful map of existing monitoring networks, including South 32 setups.
17. Make appropriate recommendations to set up a useful monitoring network to support future modelling of the Project and expected future modifications.
18. Obtain relevant surface water data and incorporate in the model, e.g. rivers and lakes stage and bed elevations, bed conductance, baseflow, etc.
19. Include lines representing the arithmetic and geometric mean of the K data in Figure 6-8.
20. In all assessments of effects, present 'Project only' and 'cumulative' impacts. Cumulative impacts include all historical and approved developments in the area in addition to the proposed Project.
21. Clarify the numerical model representation of surface water features, including the river zones shown in Figure 5-3.
22. Provide an assessment of potential groundwater level drawdown effects at individual nearby bores due to all developments in the area including the Project and due to the Project alone. The assessment must clarify assessment uncertainty.
23. Include the Hawkesbury Sandstone in all impact, sensitivity, and uncertainty analysis as it represents an important water source in the area.
24. Provide an assessment of the water level variation in groundwater associated with GDEs in support to the views regarding drawdown effects on GDEs expressed in Section 7.4.

25. Provide an assessment of potential impacts on individual neighbouring GDEs due to the Project alone and the Project and other developments in the area, including clarifying uncertainty in the analysis.
26. Clearly describe the northern GHB settings, including how the effects of the existing and future Dendrobium Mine operations have been accounted for.
27. Ensure that the model boundaries alignments, types, and descriptions are consistent in the text and figures.
28. Provide a clear description of the eastern model boundary.
29. Provide steady-state model calibration scatter plot (modelled vs observed heads).
30. Clearly describe the methodology for estimating initial rainfall recharge, including map presentation of the data.
31. Present maps showing rainfall recharge and evapotranspiration (ET) from the water table for steady-state conditions and an average from the transient simulation.
32. Clarify the assigned confinement status for each model layer.
33. Obtain and calibrate the model against surface water and mine inflow data.
34. Clarify the source and rationale behind the use of the Kh-depth equation to assign Kh values to the model cells, including the used factors and coefficients.
35. Clarify whether the initial Kh values assigned using the adopted Kh-depth relationship have been altered during the model steady-state and transient calibrations.
36. Undertake composite parametric sensitivity (parameter identifiability) analysis to determine influential parameters in the model. The results must be used to enhance the model calibration and guide the uncertainty analysis.
37. Explain in simple analytical formula/s (or other means) how the rising water levels noticed in some piezometers is related to an increase in storage due to recharge of the historical workings.
38. Identify possible reasons for the calibrated model not being able to replicate seasonality, long-term trends, and vertical relationships and discuss/implement potential solutions.
39. Provide a revised assessment of expected mine inflows, including appropriate uncertainty analysis.
40. Undertake sensitivity analysis of heads and conductance values used in the model's GHB.
41. Undertake sensitivity and uncertainty analyses of ET extension depth.
42. Undertake uncertainty analysis guided by the results of comprehensive sensitivity analysis including parameter identifiability assessment.
43. Examine the effects of concurrent changes in hydraulic properties in the uncertainty analysis (e.g. coinciding higher  $S_y$  and  $K_h$ ).
44. Arrange for the peer review to be re-done by an independent party, as required by the NSW Aquifer Interference Policy.

**End Attachment B**