Independent Expert Scientific Committee
on Coal Seam Gas and Large Coal Mining Development

Advice to decision maker on coal mining project

IESC 2017-092: Moolarben Coal Project – Optimisation Modifications (EPBC 2017/7974) - Expansion

Requesting agency	The Australian Government Department of the Environment and Energy, and New South Wales Department of Planning and Environment.
Date of request	3 November 2017
Date request accepted	6 November 2017
Advice stage	Assessment

Summary

The project is an expansion to the existing Moolarben Coal Complex, an open cut and underground (longwall) coal mine. The mine is approximately 40 km north of Mudgee in the Western Coalfields on the north-western edge of Sydney-Gunnedah Basin of New South Wales. The proposed expansion will disturb a net additional area of approximately 81.5 ha and will extract an additional 3 million tonnes per annum (Mtpa) from open cut operations over the expected 21 years remaining of the life of the mine. The proposed project will increase coal production from 13 to 16 Mtpa.

The proposed project will increase the amount of waste water produced from the Moolarben Coal Complex. The proponent has requested that the maximum allowable surface water discharges (to the Goulburn River) be changed from 10 ML/day to 20 ML/day.

The key surface water receptor within the region potentially impacted by the proposed project is the upper Goulburn River.

In response to a request from the regulators, the IESC has detailed in this advice some aspects of the surface water assessment that need to be improved. These include:

- an adequate geomorphological and ecological impact assessment of the likely increase in mine water discharge into the Goulburn River;
- a detailed consideration of cumulative impacts in the Goulburn River given that impacts of the action cannot be considered adequately without the context of water discharges and water quality impacts from other mines;
- a sensitivity analysis of the various inputs in the water balance model;

- an assessment of whether the action will cause an increase in dissolved metals entering the Goulburn River; and
- developing water quality objectives for a greater range of contaminants downstream of the discharge point.

The proponent's key mitigation measures for the action are the construction of a water treatment plant and the relocation of the surface water discharge point to a more appropriate location.

Context

The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) was requested by the Australian Government Department of the Environment and Energy and the New South Wales Department of Planning and Environment to provide advice on the Moolarben Coal Pty Ltd (the proponent) Moolarben Coal Project – Optimisation Modifications (the project) in New South Wales.

This advice draws upon aspects of information in the Environmental Assessment (EA), together with the expert deliberations of the IESC. The project documentation and information accessed by the IESC are listed in the source documentation at the end of this advice.

The scope of this advice relates to surface water impacts only because:

a) the request for advice only relates to surface water; and

b) the proposed action is adjacent to, and mostly up-dip of, already-approved open-cut operations which means that there is unlikely to be substantial additional aquifer depressurisation as a result of the action.

Although the scope of the request for advice is limited to issues relating to surface water discharges, the IESC also reviewed the proponent's groundwater assessments, although not at the same level of detail. Based on this review, the IESC considers that the proponent's assessment of potential groundwater impacts is appropriate for a modification of this scale. Further, the avoidance, monitoring and management of potential groundwater impacts for this proposed modification are appropriate as long as these measures are implemented as proposed by the proponent.

Key Potential Impacts

Key potential impacts on water resources from the proposed project include the following.

- Increased mine water production which will lead to a greater need for controlled water discharges and a heightened risk of uncontrolled water discharges. This could lead to changes to hydrology, water quality and aquatic ecology of the Goulburn River.
- Other mines are discharging water into the upper Goulburn River so the impact of this proposal can only be assessed by considering whether the cumulative impact of all discharges is within acceptable limits.

Response to questions

The IESC's advice in response to the requesting agencies' specific questions is provided below.

Question 1: Does the IESC consider that the additional water discharges associated with the proposed modifications are able to be treated and managed in a manner that would adequately minimise the risks to surface water resources, including the hydrology and water quality of the Goulburn River and its tributaries?

1. Given the scale and nature of the action, the proponent should be able to adequately treat and manage surface water impacts, provided that the additional potential impacts discussed below are adequately assessed, and further avoidance and mitigation measures for those impacts are developed and implemented.

Water Balance Modelling

2. The proponent proposes to increase the total controlled water discharge limit from the mine from 10 ML/day to a maximum of 20 ML/day into the Goulburn River. The only parameter that is varied in the proponent's OPSIM water balance model is climate. This results in some uncertainty around how often the potential maximum of 20 ML/day of surface water discharges to the Goulburn River would be required. To address uncertainty associated with other water balance inputs, including groundwater inflows, a sensitivity analysis of other input parameters needs to be undertaken.

Hydrological Impacts from Controlled Discharges

3. It is proposed to relocate the mine discharge point because the current discharge points in the ephemeral creeks have caused scouring. The IESC considers that the proposed discharge point at the confluence of Bora Creek and the Goulburn River Diversion will be less vulnerable to direct scouring impacts.

4. To date, discharges have occurred infrequently. However, under the proposal a discharge of 20 ML/day may occur on most or all days of the year under wetter climatic scenarios. The volumes of controlled releases per year are predicted to vary substantially under different climatic scenarios (Table 6.2 in EA App. E, p. 69). Under a very wet climatic scenario, up to 20 ML would potentially need to be discharged every day. Even under median climatic conditions there are several years of operation (2024-2026) where discharges would occur on most days. Impacts other than scouring at the discharge points were not considered in detail in the assessment. For example, a constant flow of 20 ML/day for a sustained period could potentially impact the macrophyte beds in the Goulburn River Diversion. This could de-stabilise the sediment in the channel and lead to sediment mobilisation. Given the history of mine water discharge into the channel, there is a risk that the sediment contains high concentrations of heavy metals.

5. A combined mine water discharge of 50 ML/day (from both Ulan and Moolarben mines) could occur for sustained periods in the Goulburn River downstream of Ulan Creek, resulting in a decrease in the frequency of low to very low flows. The EA states that based on macroinvertebrate data, '*historic discharges from the UMC* [Ulan Mine Complex]*, which have reduced low and no-flows in the Goulburn River, have not resulted in adverse impacts to aquatic ecology'*, and *'the loss of prolonged periods of low flow is considered a beneficial impact that offsets the loss of low-flow variation*' (App. G, p.25). Attachment A illustrates that flow in the Goulburn River (approximately 115 km downstream of the project site) has been typically less than 50 ML/day since 2012, and that the flow is inherently variable. The IESC notes that there will be more and longer low flow periods in the Goulburn River immediately downstream of the project site than at the gauging station. Low flows and flow variability are crucial to maintaining in-stream and riparian habitats that vary in size, substrate composition, flow and inundation (Rolls et al.

2012), and in many streams the native biota is adapted to the natural flow regime, including low flow. Artificially greater and more sustained flows may have the following impacts:

a. Coarsen bed-sediments, reducing suitability of instream habitat for some water plants.

b. Inhibit upstream migration by aquatic invertebrates and fish (especially small ones that cannot swim against the current). Many Australian native fish spawn at low flows, so this altered flow regime could potentially alter breeding success of some of these fishes.

c. Altered conditions that may favour the invasion and establishment of exotic species that impact upon native ones.

6. The proponent needs to assess the potential impacts of up to 20 ML/day sustained discharge on the Goulburn River (including the diversion channel), addressing:

a. the identification of the in-stream macrophytes in the diversion channel;

b. risks to the persistence and health of macrophyte beds, including their capacity to survive sustained higher flows;

c. potential consequences of sediment mobilisation should macrophyte cover be reduced;

d. the metal and other contaminant content of sediment within the channel and potential bio-concentration of metals and other contaminants in the macrophytes;

e. the capacity of the macrophyte beds to reduce turbidity of mine water discharge;

f. the potential geomorphological impacts (to sediment composition and depth) of up to 50 ML/day of cumulative mine discharge (from both Moolarben and Ulan mines) to the Goulburn River downstream of the diversion channel;

g. potential ecological effects of a reduction in low flows, changes to flow variability and geomorphology in the Goulburn River (as discussed in paragraph 5); and

h. avoidance and mitigation measures for potential hydrological, water quality and ecological impacts.

Downstream Water Quality Impacts

7. To manage water quality for the proposed maximum 20 ML/day discharge, a water treatment plant (with a capacity of up to 10 ML/day) has been proposed. Discharge water quality trigger values set out in the approved Surface Water Management Plan (SWMP) (Moolarben Coal 2016) have been proposed to be updated to: pH 6.5-8.5, electrical conductivity (EC) 80th percentile trigger of 900 µS/cm, and turbidity 25 NTU (EA App F, p. 21 Table 2.9) which are outside the ANZECC recommended guidelines for pH and EC (discussed further in paragraph 12 c). Most of the trigger values are similar to the baseline water quality values presented in the plan; however, two of the three baseline values for EC were measured downstream of both the Moolarben and Ulan mines and therefore do not provide pre-impact baseline water quality values.

8. The Hunter River Salinity Trading Scheme (HRSTS) aims to control salinity in low flows and allow saline water to be released during high flows (NSW Government 2017). Appendix F of the EA (p. 39) states that the HRSTS '*does not apply to discharges from the Moolarben Coal Complex*' and the salt load from the project '*would represent a negligible proportion of the total salt load in the Hunter River during high flow and flood flow conditions.*' This ignores the impacts of increased releases during dry conditions. The additional salt from Ulan and Moolarben mines could result in an elevated salt load entering the Hunter River during periods of low natural flow, which may be inconsistent with the HRSTS.

9. Attachment A shows that flows of moderate salinity occur at the downstream gauging station. Additional flows, particularly if pulsed, could lead to high-salinity 'slugs' from saline near-stream areas. These could affect instream biota that cannot adapt sufficiently quickly to sudden pulses of salinity. Field surveys of stream salinity are needed to investigate the significance of salt mobilisation before initiating discharges. If significant, alternative flow management measures may be required to mitigate the risks to in-stream biota.

10. The EA does not quantitatively assess the impacts of discharges on downstream total suspended solids (TSS). Appendix F of the EA (p. 38) states that the macrophyte beds in the Goulburn River Diversion would '*effectively filter and further limit the amount of TSS received downstream of the Diversion.*' This again highlights the importance of ensuring that macrophyte beds in the Goulburn River Diversion are maintained in the long term. However, the macrophyte beds may not filter the finest suspended sediments, which could potentially contain the highest concentration of sediment-bound contaminants (discussed further in paragraph 18 a).

11. The EA does not quantitatively assess the potential downstream impact of increased dissolved metals in discharges (App. F, p. 38), despite already elevated levels of some dissolved metals in the Goulburn River. In addition, the current SWMP does not include trigger levels for dissolved metals. The EA (App F, p. 39) states that '*MCC* [Moolarben Coal Complex] *would aim to limit the concentrations of dissolved metals in discharge water via the water treatment process as follows: Aluminium, Copper and Zinc to the 80th percentile upstream concentration; and Cadmium, Manganese and Nickel to the ANZECC 95% freshwater aquatic ecosystem guideline values.*'

12. Given the issues raised in paragraphs 7-11 above, maximum water quality discharge limits for pH, EC, turbidity and dissolved metals are needed to protect water quality in the Goulburn River. The proponent needs to derive new trigger levels for discharge water quality (pH, EC and turbidity) and dissolved metals so that the proposed water treatment plant can be best utilised in the reduction of total pollutant load into the Goulburn River. The water quality assessment should consider:

    a. a quantitative assessment of downstream dissolved metals and turbidity likely to occur during maximum discharge;

    b. the development of objectives and triggers for the Goulburn River using un-impacted baseline data;

    c. justification of any water quality triggers and objectives that significantly differ from the ANZECC guidelines for freshwater aquatic ecosystems (given the Goulburn River downstream passes through Goulburn River National Park);

    d. cumulative impacts of other mines in the area (e.g. in elevating salinity in the upper Goulburn River); and

    e. how the altered water quality and volumes of discharged water influence the aims of the HRSTS.

Impacts from Uncontrolled Discharges

13. There are multiple proposed and existing water storage dams to control excess water on-site (EA App E, pp. 24-33). A period of reduced free capacity of water storages (2023-2027) coincides with the peak water production (2025). The total predicted uncontrolled discharges from sediment dams during this time are 1,200 ML/year in a very wet (1st percentile) climatic scenario, 500 ML/year for a wet (10th percentile) climatic scenario, or 50 ML/year for a median climatic scenario (EA App. E, p. 71).

14. Although the proposed increase to controlled releases will help reduce the likelihood of uncontrolled releases, uncontrolled discharges of up to 1,200 ML/year may still have impacts. The

EA does not adequately assess the potential downstream impacts of large volumes of uncontrolled discharges. Previous IESC advices for Bylong mine (IESC 2015-071) and the Wilpinjong extension (IESC 2016-075) identified water quality from uncontrolled releases as being inadequately assessed, and the cumulative impacts of uncontrolled releases are not addressed in this EA. The proponent needs to assess the possible hydrological, water quality and ecological impacts to the Goulburn River of up to 1,200 ML of uncontrolled discharge, taking into consideration the cumulative impacts of uncontrolled discharge from the Ulan and Wilpinjong mines and the proposed Bylong mine.

Water Treatment Facility – Waste Products

15. Impacts could arise from the disposal of brine produced by the proposed water treatment facility. The facility will generate a brine by-product with a volume approximately 20-25% of the initial water inputs, at a rate of up to 2.5 ML/day (EA, p. 31). The majority of by-products generated from the treatment process would be diluted with mine water and used for dust suppression (for which there is an average daily demand of 3 ML/day), and runoff from dust suppression would be recaptured in the water management system. Residual by-products are proposed to be temporarily kept in water storages on-site, reticulated to mining or waste emplacement areas, or disposed of by other methods such as evaporation cannons. Once void space is available in the underground workings, it is proposed that by-products would be permanently stored underground. Although the regulators did not request advice on groundwater impacts, the IESC recommends that the risk of brine stored in underground mine voids or temporary storage options leaching into groundwater should be assessed.

16. The impact of using brine for haul road dust suppression is not discussed in the EA. Without further analysis, it should be assumed that salts and contaminants in brine water used for haul road dust suppression will either re-enter the natural surface water or groundwater system or eventually end up back in the water management system. The proponent needs to specify in the EA whether there will be sufficient storage capacity to hold brine (which could be produced at the rate of 2.5 ML/day) until mine voids become available for storage around 2027.

17. Measures to monitor, manage and address the risks associated with the proposed water treatment facility's waste products are identified below in response to question 2.

Question 2: Does the IESC recommend any additional measures for the treatment, management and/or monitoring of additional water discharges to address residual risks to surface water resources?

18. The SWMP contains measures to monitor and manage the existing and potential future surface water impacts associated with the proposed project. The IESC recommends the proponent update its Water Management Plan (Moolarben Coal 2015a), which includes the SWMP and a Site Water Balance (Moolarben Coal 2015b). The updated SWMP should include the following additional measures to avoid, monitor, manage and treat the risks associated with the proposal.

    a. Avoidance measures are required to reduce the risk of sediment mobilisation in the Goulburn River diversion channel. Fine sediments not retained by the macrophyte beds (see paragraph 10) are likely to be contaminated. The proponent needs to suggest potential treatment options for these fine sediments. Where macrophytes have bio-accumulated contaminants, the plant matter may need to be harvested to prevent decaying litter releasing contaminants back into the river.

    b. The range of parameters to be collected at various surface water sampling locations (Moolarben Coal 2016, Table 23) should be updated to monitor water quality parameters including, but not limited to, pH, EC, TSS, Total Dissolved Solids (TDS), metals and metalloids (including dissolved aluminium, zinc, copper, cadmium, manganese and nickel), dissolved oxygen, hydrocarbons and (total and soluble) phosphorous and nitrogen.

c. Water quality triggers are provided for pH, EC and turbidity (Moolarben Coal 2016, Table 19). Development of water quality objectives and triggers for the range of parameters identified above (and considering the discussion in paragraph 12) is needed to ensure that the increased discharges will not reduce the quality of water within the Goulburn River, particularly during the period before the water treatment facility is constructed.

d. A water quality monitoring program for treated water should be provided. This program should include identification of water quality monitoring parameters and parameters to be used as triggers, where exceeding that trigger value will prevent the water being discharged to the Goulburn River or reused on the minesite.

e. The SWMP contains a surface water response and contingency plan (Moolarben Coal 2016, Table 22). The current contingency plan does not contain any response actions to prevent 'trigger events' from recurring. The SWMP should be updated to include a Trigger Action Response Plan (TARP) to support an adaptive management approach and prevent repeated impacts.

19. The IESC suggests that the proponent should work with operators of the neighbouring Ulan and Wilpinjong coal mines to install a flow and water quality monitoring point on the Goulburn River downstream of the confluence of Wollar Creek to measure the cumulative surface water quality impacts of the three mines. The data from this monitoring point should be used in a collective TARP developed by the operators of Moolarben, Ulan and Wilpinjong mines to support an adaptive management approach and prevent repeated impacts.

20. The proponent needs to develop a plan that identifies management measures to address the potential risks associated with brine storage, re-use (blending with mine water) and long-term disposal. This plan could be appended to or included in the updated SWMP, and should include:

    a. timing for commencement of reverse osmosis water treatment;

    b. the predicted amount of brine to be produced throughout the life of project;

    c. monitoring of brine water quality;

    d. monitoring of blended brine and mine waste-water prior to re-use, to ensure the water to be reused will not impact on the surrounding environment due to leaching from brine stored in underground voids and evaporative deposition;

    e. a proposed brine pond design and seepage monitoring system, including parameters to be monitored; and

    f. how any salt produced by the water treatment facility or in the brine ponds will be managed to prevent potential long-term impacts.

Date of advice	15 December 2017
Source documentation available to the IESC in the formulation of this advice	Environmental Assessment 2017. *Moolarben Coal Complex Open Cut Optimisation Modification: Environmental Assessment*. Moolarben Coal. November 2017. IESC 2015. *Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals* [Online]. Available at: http://www.iesc.environment.gov.au/system/files/resources/012fa918-ee79-4131-9c8d-02c9b2de65cf/files/iesc-information-guidelines-oct-2015.pdf. Moolarben Coal 2015a. *Water Management Plan*. Moolarben Coal. July 2015. [Online]. Available at: http://www.moolarbencoal.com.au/page/environment/environmental-management-plans/ Moolarben Coal 2015b. *Site Water Balance*. Moolarben Coal. July 2015. [Online]. Available at: http://www.moolarbencoal.com.au/page/environment/environmental-management-plans/ Moolarben Coal 2016. *Surface Water Management Plan*. Moolarben Coal. January 2016. [Online]. Available at: http://www.moolarbencoal.com.au/page/environment/environmental-management-plans/
References cited within the IESC's advice	Department of Primary Industries 2017. Office of Water: *Real time water data for the Hunter River Basin – Goulburn River @ Coggan*. [Online]. Available at: http://realtimedata.water.nsw.gov.au/water.stm?ppbm=210_HUNTER&rs&2&rsvm_org NSW Government 2017. *Hunter River Salinity Trading Scheme*. [Online]. Available at: http://waterinfo.nsw.gov.au/hunter/trading.shtml Rolls R, Leigh C and Sheldon F 2012. Mechanistic effects of low-flow hydrology on riverine ecosystems: ecological principles and consequences of alteration. *Freshwater Science*, **31(4)**: pp. 1163-1186.

Goulburn River flows and electrical conductivity (EC) at NSW DPI water monitoring point 210006 Goulburn River at Coggan, 1/1/2012 – 3/12/2017.

Note: This monitoring point is approximately 115 km downstream of the proposal area, and so includes any water discharge from Ulan and Moolarben mines (Department of Primary Industries 2017). Natural flows at this location will be greater than in the Goulburn River near the proposal site, therefore changes to the number of low flow days from increased discharges will be more pronounced upstream of this gauge.