

Advice to decision maker on coal mining project

IESC 2017-083: Isaac Plains Mine Extension Development (EPBC 2016/7827) – Expansion

Requesting agency	The Australian Government Department of the Environment and Energy
Date of request	08 February 2017
Date request accepted	08 February 2017
Advice stage	Assessment

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 to provide advice on the Stanmore IP Coal Pty Ltd Isaac Plains Mine Extension Development (the proposed project) in Queensland.

This advice draws upon aspects of information in the assessment documentation 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 proposed project is an extension to the existing Isaac Plains open cut coal mine and is located approximately 7.3 km north-east of Moranbah, Queensland. The existing Isaac Plains mine comprises five open cut pits with approval to produce up to 4 Mtpa ROM coal, and has an associated disturbance area of approximately 530 ha. Current production is up to 2 Mtpa ROM coal. Existing infrastructure includes a coal handling and processing plant (CHPP), rail facilities, industrial area, administration area, mine water management infrastructure, sewage treatment facilities and haul roads. An EPBC Act referral was submitted for the existing mine in 2005 (EPBC 2005/2070), prior to the water trigger. The mine was determined not to be a controlled action and commenced operation in 2006.

The proposed project will comprise five new open cut pits directly east of the existing mining lease. Over seven years, the proposed project will extract 2 million tonnes per annum (Mtpa) Run of Mine (ROM) coal from the Leichhardt Seam within the Bowen Basin. Associated proposed infrastructure includes haul roads, ROM coal stockpile areas, a reload pad, powerline extension and substation, stormwater drains, pit water pipelines and sediment control works. The disturbance footprint is approximately 611 ha.

The proposed project is located in the upper reaches of the Isaac River catchment and is traversed by Billy's Gully to the south, and by Smoky Creek, and Smoky Creek northern tributary to the north. All

three watercourses are ephemeral creeks that drain into the Isaac River, which is part of the larger Fitzroy River Catchment. The area is covered by the Isaac Connors Groundwater Management Area under Schedule 3 of the Fitzroy River Basin Water Resource Plan.

The proposed project is located close to a number of existing coal mining and coal seam gas (CSG) operations (e.g. Moranbah North Mine, Isaac Plains Mine, Arrow Energy's Moranbah Gas Project), as well as the Broadlea water supply borefield. Several of these mines have been operational for several years and have altered the Permian coal measures, Tertiary sediments and Tertiary basalt aquifers of the area and the Isaac River.

Key potential impacts

- Long-term drawdown impacts to the groundwater system, including the good water quality Tertiary basalt aquifer system. The proposed project's drawdown would contribute to an existing extensive cumulative drawdown impact to the basalt groundwater system associated with other mining operations within the region. Groundwater modelling predicts that these cumulative impacts include groundwater depressurisation of the Rewan Group and Leichhardt Seam from the proposed project.
- Potential long-term impacts associated with the five final voids, including ongoing groundwater losses through evaporation from the surface of the voids, poor final void water quality, and the potential to influence ongoing losses from adjacent alluvial systems with associated impacts to riparian vegetation and dependent communities.
- Alteration of flow regimes (e.g. longer low-flow or zero-flow periods) of surface watercourses (e.g. Smoky Creek, Smoky Creek northern tributary, Billy's Gully), resulting in impacts to their associated aquatic and riparian ecosystems.
- Potential impacts to downstream water quality and ecosystems from release of mine water.

Assessment against information guidelines

The IESC, in line with its Information Guidelines (IESC, 2015), has considered whether the proposed project assessment has used the following:

Relevant data and information

Data is limited on the hydraulic properties and temporal variations in groundwater quality and ecological condition of alluvial systems in the area of predicted long-term alluvial drawdown.

Where more confidence is required in the scale of predicted impacts across faults, additional field data (fault permeability, water level variations on either side of the fault/s) and updated modelling techniques which account for fault properties may be required.

Limited water quality data collected by the existing Isaac Plains mine operation has been provided to support the impact assessment for the proposed project. Under the current Isaac Plains mine EA (Environmental Authority), monitoring of water storages, discharges and the receiving environment is required (EHP, 2016, pp. 9-21). This data is essential information about the existing environment and is required to determine the potential impacts of the proposed project.

Data to support the geochemical assessment of tailings and waste rock has not been provided.

Application of appropriate methods and interpretation of model outputs

Final void water quality was not modelled. This is required to assess potential long-term impacts to groundwater quality. Cumulative impact modelling should be broadened to encompass regional

impacts, given the scale of cumulative impacts in the region (see response to Question 5). Ongoing improvement in the groundwater model parameterisation, including improved estimates of recharge, would bolster confidence in future modelling predictions.

No risk assessment has been carried out for the proposed project. This is required to help inform the design of monitoring, mitigation and management measures.

Advice

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

Question 1: Has the proponent collated the relevant information to identify and assess impacts to surface and groundwater resources? If not what additional information would assist the identification and assessment of impacts to water resources?

Response

1. No. Although the proponent has collated substantial hydrogeological, hydrological and ecological information, further information is needed to assist the identification and assessment of impacts to water resources.
2. Consideration of surface water quality monitoring and aquatic ecology data collected since operations began in 2006 would improve identification and assessment of impacts to water resources from discharges. This data may also assist in the identification of potential changes in water quality and aquatic biodiversity in response to altered flow regimes.
3. In the context of potential impacts, the proponent has largely collected the relevant information required to identify and assess potential impacts to groundwater. However, the following additional information would improve identification and assessment of impacts to water resources:
 - a. Additional localised assessment of recharge rates and hydraulic properties of strata potentially impacted by the proposed project, as these were identified as sensitive parameters for improving confidence in the groundwater model drawdown predictions.
 - b. Information on the hydraulic properties of the shallow Tertiary and alluvial sediments of Smoky Creek, which may be impacted by the project. This information will assist in understanding the potential for reduced groundwater residence time in the alluvial system and associated pools within Smoky Creek.
 - c. Site-specific information on fault structure and permeability, including across-fault and along-fault flow properties, to improve predictions of impacts to flow and propagation of drawdown in areas of faulting.
 - d. Detailed evidence to support the prediction of all final voids being long-term groundwater sinks.
4. Identification and assessment of impacts would also be improved by modelling of water quality evolution of final voids, including assessment of the influence of variable climatic conditions and associated inflow and evaporation rates, inflow water quality and water levels. The assessment of inflow water quality should be informed by data from the geochemical assessment that has been undertaken for tailings and waste rock.

Explanation

Surface water

5. Despite the proponent's statement that there is an extremely low probability that a discharge will be necessary, four separate discharge events from the existing Isaac Plains operation have been reported between 2013 and 2017. The IESC notes that these discharges were considered compliant by the Queensland Government (see <http://www.ehp.qld.gov.au/land/mining/water-releases/monthly.php>). Under the current EA, monitoring of water storages, discharges and the receiving environment needs to be carried out to ensure that any adverse impacts on water quality are detected and addressed (EHP, 2016, pp. 9-21). The proponent has not provided data to characterise the water quality of previous discharges or within the mine water management system. Data from the existing mine on discharges and aquatic ecology would provide baseline information and enable identification and assessment of any impacts.

Groundwater

6. The sensitivity analysis (Environmental Assessment Report, 2016, App. A, App. IV) highlighted that the modelled drawdown in the Tertiary basalt is most sensitive to recharge rates and hydraulic conductivity values used for the Rewan Group, Leichhardt Seam and Tertiary basalts. Additional measurement of these parameters and subsequent inclusion in model updates will improve confidence in model predictions of long-term impacts.
7. The fault system is implemented within the model through offsetting of strata in the vicinity of faults, generally resulting in barriers to flow. A sensitivity analysis was undertaken (EAR, 2016, App. A, p. 37) which investigated the conceptualisation of the fault zone as a conduit rather than a barrier to flow. This indicated that drawdowns in Tertiary basalt and Leichhardt Seam were sensitive to changes in hydraulic properties of the Isaac Fault Splay. The appropriateness of the fault characterisation should be considered in future updates to monitoring and modelling. Where observations related to flow and drawdown in the vicinity of faults show clear variation from predictions, more detailed characterisation of faults may be required in the groundwater model.
8. Limited information on the final void level modelling is presented in the Water Management System Modelling Report (EAR, 2016, App. C). Although the proponent indicates that final voids are likely to be groundwater sinks, information including long-term prediction of the range of likely water tables in the vicinity of final voids would increase confidence in impact prediction. Final voids may have long-term impacts on local groundwater levels and quality.
9. Long-term drawdown post mining is predicted within a section of the alluvial system of Smoky Creek (EAR, 2016, App. A, Figure 24). The IESC considers there is a possibility that the riparian vegetation in this area relies on ephemeral groundwater. The proponent has not provided an assessment of: the hydraulic properties of the alluvium in the area predicted to be impacted; the potential for decreased residence times (if any); and the subsequent potential impact on long term persistence (including recruitment) of riparian vegetation and associated communities. Fragmentation of the riparian zone corridor along Smoky Creek in this area would disrupt riparian connectivity, potentially affecting movements and habitat use by associated biota, including greater gliders and koalas.

Question 2: Is the modelling provided appropriate for a project of this type and at this stage of development? If not, what changes or improvements should be made to the modelling?

Response

10. No. Improvements should be made to the surface water and groundwater models to increase confidence in predictions, as outlined below.

11. The appropriateness of the surface water modelling was not able to be assessed because the information provided did not include adequate data and analysis.
12. Peak flows used for flood modelling are based on an uncalibrated hydrologic model with no comparison to other flood estimation techniques for validation purposes. To improve confidence in the flood modelling, peak flow estimates calculated from the Rational Method for the 1% Annual Exceedance Probability (AEP) event to enable validation of peak flows from the hydrological model should be provided.
13. There is limited information provided on the water balance model, parameters, calculations and input data. This information is required to assess the validity of the water balance model and therefore whether site discharges are likely. To improve confidence in the water balance modelling, the following information should be provided:
 - a. The use of 0.6 as a factor applied to groundwater inflow rates to account for losses due to evaporation and infiltration should be justified.
 - b. Dust suppression demand calculations should be provided.
 - c. Evaporation calculations should be provided for the S3 Pit water storage to explain how values have been adjusted to account for the water surface being below ground level.
14. The groundwater modelling conducted for the proposed project is appropriate for general prediction of impacts to groundwater levels across the area, but may not accurately predict localised impacts. In addition, no modelling has been undertaken of the potential long-term water quality in final voids.
15. Confidence in the groundwater modelling would be improved by:
 - a. Additional information on local hydraulic properties and recharge to improve confidence in drawdown and pit inflow predictions (see Point 3).
 - b. Modelling of final void water quality should consider, but not be limited to: inflow water quality of both surface and groundwater; climate variability; evaporation rates (may vary depending on changed climatic conditions and increased salinity); reactivity of exposed pit strata; and potential for seepage to adjacent groundwater systems.
 - c. Modelling of potential changes to residence times of Smoky Creek ephemeral alluvial groundwater and subsequent potential impacts to riparian vegetation, including from drawdown.
 - d. Independent technical peer review of any future updates to groundwater modelling should be undertaken as recommended in the *Australian Groundwater Modelling Guidelines* (Barnett et al., 2012).

Question 3. Does the proponent's assessment of groundwater and surface water provide reasonable estimations of the impacts to water resources, their severity and likelihood of occurrence? Are any other impacts likely?

Response

16. No. Reasonable estimations of impacts to water resources are hampered by a lack of data and subsequent limitations in the assessments of the probability of off-site discharges to surface waters; potential changes to flow regimes of surface watercourses; the dependence of riparian vegetation (including recruitment and drought tolerance) on alluvial groundwater; and potential impacts of the final voids on groundwater dynamics and groundwater and surface water quality.

17. An improved description and presentation of the results demonstrating the likelihood of controlled and uncontrolled discharge from the mine should be provided. As noted in Point 5, there have been four separate reported release events from the existing Isaac Plains mine site between January 2013 and January 2017 (EHP, 2017). These release events and the limitations of surface water modelling (identified in Point 13) potentially contradict the conclusion that there is an extremely low probability that releases of mine affected water will occur.
18. An assessment of the water quality of potential controlled discharges (as per the EA) should be carried out to demonstrate the adequacy of the mine water management system in mitigating and managing potential impacts to downstream environmental values (see response to Question 4).
19. Assessment of the potential changes to flow regimes of the surface watercourses traversing the proposed project site should be carried out. This should include the likely increase to the duration of low-flow and zero-flow periods in Smoky Creek caused by drawdown in Pits 4 and 5. Such changes in flow regimes in ephemeral creeks that reduce longitudinal hydrological connectivity can have ecological repercussions, including reduced persistence of pools and increased fragmentation of populations of aquatic biota (e.g. Jaeger et al. 2014).
20. The proponent's assessment identifies the most likely impacts as being to groundwater resources in the Tertiary basalt aquifer and potentially to the relatively small alluvial systems close to the proposed project. However, there is potential for additional impacts associated with final voids which have not been fully assessed. These include leachate seepage from overburden emplacement to groundwater systems and/or final voids, and the subsequent long-term water quality issues. Further monitoring (see response to Question 4) and model calibration/predictions should occur on an ongoing basis to improve understanding of likely mid to long-term impacts.
21. Preliminary sampling has revealed the presence of stygofauna (EAR, 2016, Ch. 4, p. 4-45) but further assessment and monitoring should be undertaken in accordance with the Queensland Guideline for the Environmental Assessment of Subterranean Aquatic Fauna (DSITI, 2015). This will enable appropriate mitigation and management of potential impacts of groundwater depressurisation on this obligate groundwater-dependent ecosystem if needed.

Question 4. Are the proposed monitoring, mitigation and management measures adequate to identify, avoid or reduce the likelihood, extent and significance of impacts to water resources? If not, what additional measures are required to monitor, mitigate and manage impacts to water resources?

Response

22. No. The proponent's existing Receiving Environment Monitoring Program (REMP) was not provided and this prevents assessment of potential impacts of discharges on surface water quality. It is noted that the limited surface water quality data provided for the receiving environment indicates several exceedances of the relevant Water Quality Objectives (EHP, 2011), which the existing EA states should be investigated.
23. No mitigation, monitoring or management measures have been proposed to address potential impacts on groundwater levels, flow and quality from final voids.

Explanation

Surface Water

24. Commitments to surface and groundwater monitoring should be presented as part of the water management and monitoring plan. This plan should be consistent with the National Water Quality Management Strategy and include monitoring of the full suite of analytes listed in the EA. The IESC considers that the ability of the monitoring program to detect an impact would be improved

by the addition of a monitoring point on the Isaac River above the confluence with Smoky Creek to enable comparison and assessment of data from monitoring downstream on the Isaac River.

Groundwater

25. The monitoring approach should be reconsidered to ensure predictions of potential long-term impacts are supported by observations. Measures to address this include, but are not limited to:
 - a. Further characterisation of ephemeral alluvial systems associated with the watercourses traversing the proposed project site and their role in maintaining riparian ecosystem functioning.
 - b. The derivation of site-specific trigger values for groundwater quality, consistent with the EA.
 - c. Additional monitoring of basalt aquifers and both up-gradient and down-gradient of final voids would improve confidence in the likelihood and scale of predicted impacts. It is noted that three groundwater monitoring bores appear to be located within areas to be mined. Justification for these locations has not been provided.
 - d. Monitoring and modelling of final void water quality, with appropriate management measures developed as the project progresses.
26. No mitigation measures are proposed for the potential impacts from the final voids to basalt and alluvial aquifer systems. Mitigation options should be considered for riparian vegetation and associated ecological communities.

Question 5. Do these assessments give adequate consideration to the project's contribution to cumulative impacts associated with other mining activities and coal seam gas production in the area?

Response

27. No. The assessments do not adequately consider the project's contribution to cumulative impacts. While the proponent has presented modelled outputs showing areas of cumulative drawdown to which they contribute, the overall cumulative impacts to groundwater in the area are not shown. This limits the understanding of the extent of potential impacts to groundwater more regionally from mining, coal seam gas and water extraction. Given the potential cumulative impacts in the region, the proponent should consider collaboration with other mining companies in the area to estimate and manage potential cumulative impacts in the region.
28. Ongoing updates to the groundwater impact modelling could be done in a collective and collaborative manner with other mining companies in the region, and with additional observations and characterisation of hydraulic properties. This would enable ongoing improvements of estimates/predictions of the likely long-term impacts to the basalt aquifers (and other aquifers) in the region.
29. The assessment does not give adequate consideration to the proposed project's contribution to cumulative impacts to surface water quality into the Isaac River, given the proponent has discharged on four separate occasions in the period from January 2013 to January 2017 (EHP, 2017).
30. The reductions in catchment area of Smoky Creek and Billy's Gully from the proposed project are small at approximately 1–2%. However, there are other mines in these catchments and the cumulative impact of catchment reduction on surface watercourse flow has not been considered. An assessment of the cumulative impacts needs to consider these mines with a focus on low flow parameters which are likely to change more than total annual flow.

Date of advice 24 March 2017

Source documentation available to the IESC in the formulation of this advice Hansen Bailey 2016. *Isaac Plains East Project: EPBC Act Environmental Assessment Report*. (EAR)

Hansen Bailey 2016. *Referral of proposed action: The construction and operation of an extension to the existing open cut coal mine at Isaac Plains Mine near Moranbah, Queensland*. (Referral)

Hansen Bailey 2017. *Response to Additional Information Request on Water Resources from the Department of the Environment and Energy*. (Response)

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