

Advice to decision maker on coal mining project

IESC 2014-052: Baralaba North Continued Operations Project (EPBC 2013/7036) – Expansion

Requesting agency	The Australian Government Department of the Environment The Queensland Department of Environment and Heritage Protection
Date of request	12 June 2014
Date request accepted	13 June 2014
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 the Queensland Department of Environment and Heritage Protection to provide advice on the Cockatoo Coal Ltd Baralaba North Continued Operations Project (BNCOP) in Queensland.

This advice draws upon aspects of information in the Draft Environmental Impact Statement, 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 BNCOP provides for the continuation and expansion of open cut coal mining at the Baralaba Coal Mine and Baralaba North/Wonbindi North Mine. The BNCOP would produce up to 4.1 million tonnes per year (Mtpa) of run-of-mine (ROM) coal to produce up to 3.5 Mtpa of product coal, for up to 15 years. Currently the existing Baralaba mine produces approximately 500,000 tonnes per year, with an expansion to 1 Mtpa approved in 2013. The BNCOP is located approximately 115 km from Rockhampton and 70 km from Biloela and covers an area of 2,498 ha.

The BNCOP is located in the floodplain of the Dawson River in the Fitzroy River Basin, with surface water resources managed under the Water Resource (Fitzroy Basin) Plan 2011. The BNCOP is located outside of any declared groundwater management areas. The Dawson River is a wide and relatively deep permanent watercourse that primarily comprises run habitat and a series of pools. An anabranch of the Dawson River, located immediately south of the BNCOP, contracts to a series of disconnected pools during dry periods. Saline Creek and its associated tributary located to the north-west of the project area are ephemeral. There are numerous wetlands within and around the BNCOP, including the ephemeral, palustrine Northern wetland and North-west Soak. There are areas of Brigalow (*A. harpophylla*) Threatened Ecological Community (TEC) and Coolibah-Black Box Woodland TEC associated with these wetlands, floodplain areas and the Dawson River Anabranch.

Surrounding the BNCOP, there are areas of remnant riparian vegetation including *E. coolabah* and *E. populnea*, which the proponent notes are likely to be groundwater dependant. Three fauna species were recorded on site that are listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) or *Nature Conservation Act 1992* (Qld) (NC Act) or both, and the areas surrounding the site include “essential habitat” under the *Vegetation Management Act 1999* (Qld) for the Squatter Pigeon (*Geophaps scripta scripta*, listed as vulnerable under the EPBC Act and NC Act) and Brigalow Scaly-foot (*Paradelma orientalis*, listed as vulnerable under the NC Act).

Assessment against information guidelines

The IESC, in line with its Information Guidelines¹, has considered whether the proposed project assessment has used the following:

Relevant data and information: key conclusions

There is a degree of risk and uncertainty regarding whether the mine will penetrate the alluvium of the Dawson River. A better understanding of the drawdown impacts on the alluvial aquifer in the northern area is needed, including the use of additional hydrogeological and monitoring data, and information on annual fluctuations in water level and quality.

An assessment of existing geomorphological processes and condition has not been undertaken and is important to understand the risks to long term floodplain stability, water quality and riparian and floodplain ecosystems. There is limited ecological monitoring data. Investigation of the groundwater dependency of riparian and floodplain vegetation, and a broader coverage of wetland and river monitoring sites, would inform identification and management of impacts to water-related assets.

Application of appropriate methodologies: key conclusions

Consideration needs to be given to potential pit inundation scenarios, and resultant impacts to the Dawson River and downstream water-related assets, and potential mitigation options. Better substantiated characterisation of groundwater-surface water interactions is needed to understand and manage impacts to water-related assets. The proponent’s ecological risk assessment is not adequate to define, identify and assess impacts to water-related assets.

Reasonable values and parameters in calculation: key conclusions

The site water balance modelling and parameters are well considered. However in the groundwater model, key groundwater system water balance components, such as rainfall recharge and base flow, should be verified through independent methodologies (not determined from model calibration), and their uncertainty quantified. The proponent should also identify relevant data gaps to be addressed in subsequent groundwater model reviews.

Advice

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

Question 1: What does the Committee consider are the key uncertainties and risks of the project in relation to water resources and water-related assets?
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Response

1. While the scale of the proposed BNCOP is relatively small in the context of the Bowen Basin, its location on the Dawson River floodplain raises a number of risks and uncertainties.
2. The extent to which the pit may penetrate the alluvium, and also the degree of interaction between surface water and groundwater are uncertain. This in turn creates uncertainties over the

predicted impact on groundwater in the alluvium, groundwater dependent ecosystems (GDEs), water resources in the Dawson River, estimated pit inflow in the site water balance, the adequacy of site water management, and predicted discharge volumes.

3. The lack of geomorphic assessment leads to uncertainty regarding the likelihood of river erosion that may result in realignment of the Dawson River through the pit or final void.
4. Lack of ecological data and information, and insufficient risk assessment, means that the potential ecological impacts of the BNCOP remain uncertain.
5. Noting the BNCOP's location on the floodplain, key surface water risks include pit inundation during extreme flood events, potential loss of levees and pit wall failure.

Explanation

Groundwater risks and uncertainties

6. Due to the restricted extent of the Permian coal measures and the resulting limited lateral propagation of drawdown, impacts to water-related assets are more likely to occur through impacts to the alluvial aquifer and connected surface water bodies. The proponent's assessment needs greater focus on understanding of alluvial aquifer hydrology and groundwater-surface water connectivity.
7. The proponent concludes that the mine will not penetrate the alluvium of the Dawson River or its anabranch, and that the alluvium is mostly dry. However, this conclusion is not supported by sufficient hydrogeological data, particularly in the northern area of the site where the proponent's data shows that the alluvium may contain groundwater. If the mine pit intercepts the alluvium, there is a risk of permanent transfer of water from the alluvium into the final void, leading to impacts to the river and associated water-related assets that could exceed predictions.
8. There is uncertainty regarding the degree of groundwater-surface water interaction, as no site-specific assessment has been undertaken. The proponent's conclusions regarding the lack of interaction with the Dawson River need to be substantiated using local data.

Site water balance

9. Model staging, site water sources, demand assumptions and salinity parameters for the representation of the operational mining scenarios are well considered. However, there are uncertainties, particularly for pit groundwater inflows (discussed in point 7), which could impact on the performance of the mine water management system.

Flooding, geomorphology and hydraulic modelling

10. A key risk remains the potential for inundation of the final void post mining, through extreme flood events, geomorphological processes such as meander migration, or geotechnical pit wall failure or piping failure. The potential impacts of pit inundation could have significant consequences and include:
 - a. Loss of water from a stream system and downstream impacts on water dependent ecosystems;
 - b. Downstream water quality impacts associated with efforts to pump out the flooded pit; and
 - c. Incision or scour between the pit and the existing water course. There are potential flow paths that could develop as a result of flood related pit inundation that represent a risk of incision and scour in the mining and post mining landscape. Such flow paths have potential to capture

the alignment of the Dawson River with resulting impacts on the community, agriculture and the environment.

11. There is increased potential for erosion associated with constricting the Dawson floodplain (by levees and waste rock emplacements) and increasing floodplain stream powers and sheer stress. While the EIS flood assessment has recognised that there will be some zones of potential scour in the post mining landscape, the assessment has not taken into consideration the highly dispersive nature of the soils. There are also potential cumulative impacts when considering existing operations and the proposed Baralaba South Coal Project (BSCP), discussed in Question 3.

Ecology

12. Although the proponent's EIS technical reports provide a brief discussion of the potential risks associated with the mining activity, these do not include an attribute-based ecological risk assessment with which to compare pre, during and post mining environmental conditions. This information is needed to understand the risks to water-related assets and the adequacy of proposed mitigation and management measures.
13. No field investigation was conducted into the groundwater dependency of the wetlands or terrestrial vegetation communities, despite numerous areas of GDEs or potential GDEs identified along the river and on the floodplain in the National Atlas of Groundwater Dependent Ecosystems. As a result, the potential impacts of the BNCOP on GDEs are uncertain.
14. There is inadequate assessment and understanding of stygofauna communities to adequately identify risks arising from the BNCOP. The stygofauna assessment identified three bores that contained stygofauna, however the work concluded that the taxa were widespread and tolerant of environmental change and therefore not of conservation significance. The Family level and higher classification which was used cannot separate the specimens into species and cannot be used to determine endemism and conservation status.

Question 2: What does the Committee consider are the features of a monitoring and management framework that would address these uncertainties and risks?

Response

15. A number of additional features are necessary for a comprehensive monitoring and management framework, including:
 - a. Greater emphasis on shallow groundwater systems in the groundwater monitoring network, along with identification of GDEs and quantification of groundwater-surface water interactions;
 - b. Ongoing monitoring data to refine models including the site water balance model and flood models;
 - c. Geomorphic assessment to inform risks of the BNCOP and the potential impacts arising from geomorphological processes such as meander migration impacting the final landform; and
 - d. Additional monitoring data to address data gaps in relation to existing condition of ecosystems and water-related assets.

Explanation

Groundwater monitoring and management framework

16. Greater emphasis on the shallow groundwater systems in the groundwater monitoring program is important to understand impacts to these systems, as they are more likely to result in environmental impacts outside the mine area. Confidence in the model output could be improved through utilisation of more spatially and temporally representative hydrostratigraphic and potentiometric data across key hydrostratigraphic units, including those which may support GDEs.
 - a. Mapping and geological interpretation of the northern area and the details of all existing bores are needed to allow better understanding of the area and possible impacts on the alluvial groundwater.
 - b. A cross section from north to south across the BNCOP detailing shallow geology and groundwater levels over the whole proposed mine would improve understanding and facilitate the assessment of groundwater model.
 - c. Additional monitoring bores between the proposed mine excavation and the river and anabranch are needed to provide detailed information on these shallow systems. Monitoring frequency needs to address seasonal variability and groundwater-surface water interactions.
17. Systematic field and desktop investigations and monitoring programs are needed to confirm groundwater interaction with surface waters and GDEs. These should refine the understanding of local groundwater systems to identify areas of shallow groundwater in both alluvium and Permian and Triassic strata, and should include the following methodologies:
 - a. quantification of rainfall recharge and its validation with alternative recharge estimation methods;
 - b. base flow separation utilising historical flow records; and
 - c. derivation of more realistic river stage heights for the groundwater numerical model.

Site water balance

18. Monitoring of site water demands, catchment runoff and groundwater inflows for quantity and quality should be undertaken during mine operations to allow for calibration of the water balance model and evaluation of the adequacy of the mine water management system.
19. Greater differentiation in management of different water quality in runoff collected by sediment dams on-site would provide greater assurance that water quality in the Dawson River will be maintained.

Surface Water

20. The monitoring and management of risks associated with pit inundation, sediment accumulation and landscape scour should be based on a robust risk management framework that considers specific water-related assets and the identification of hazards.
21. Undertaking a geomorphic assessment of floodplain, channel and associated mine infrastructure (including levees and haul roads) would inform targeted monitoring and mitigation measures to address the uncertainties and risks of the BNCOP. Monitoring of geomorphic condition and process should include:

- a. topographic survey of floodplain, channel planform (plan-view configuration), cross-sections and long-sections;
 - b. repeat survey and comparison after significant flow events that result in physical channel changes (erosion, aggradation and planform change);
 - c. identification of potential zones of meander bend migration towards levee and pit, and proposed stabilisation and management options; and
 - d. areas at increased risk of landscape scour, and proposed management options.
22. Updating the modelling following flood events would allow for validation of predictions and improve confidence in results. Monitoring should include flood levels, timing, extent of inundation and observed impacts.

Ecology

23. Spatially and temporally representative monitoring of annual fluctuations in surface water and groundwater levels, water chemistry and the biological community within aquifers and other aquatic ecosystems is necessary to inform the design of an appropriate monitoring and management framework for aquatic ecosystems and GDEs.
24. Addressing the following data gaps would be important to understand risks to aquatic ecosystems and GDEs, and would inform development of a comprehensive monitoring program and mine closure plan:
- a. The directions of groundwater flow within the alluvial aquifer;
 - b. Species identity, endemism and distribution of stygofauna within both the alluvial and deeper coal aquifers;
 - c. Identification of terrestrial GDEs and their water quality and quantity requirements, including natural annual ranges and seasonal fluctuations, and on-ground field-based surveys for other groundwater dependent ecosystems in the area such as springs and groundwater discharge zones within nearby streams; and
 - d. The distribution of freshwater lenses within the alluvial floodplain or associated with near-surface fault zones.

Question 3: Have cumulative impacts with other developments on a local scale that impact water resources been sufficiently addressed?

Response

25. Cumulative impacts to groundwater have been sufficiently addressed, as there is expected to be very limited lateral propagation of groundwater drawdown. Cumulative water quality impacts from discharges of the BSCP have also been partially addressed. Flood impacts from the BSCP and existing operations have been considered, but in light of the preliminary nature of the previous BSCP flood modelling, additional flood modelling and a geomorphic assessment would reduce uncertainty. Cumulative impacts on the ecology have not been sufficiently addressed, due to the limited data and understanding.

Explanation

Groundwater cumulative impacts

26. Only the BSCP and the Baralaba North and Central pits have been included in the assessment and as their predicted drawdown cones of depression do not intersect, it is considered that the risk of cumulative impacts to groundwater is low.

Site water balance

27. The closest mine to the BNCOP and the existing Baralaba North and Central pits is the BSCP mine, while the Dawson and Moura mines are also within the Dawson River catchment, upstream of the BNCOP. The assessment of cumulative impacts has been undertaken only with reference to the BSCP, and the proponent concludes that cumulative impacts from mine discharges associated with these projects will not be significant. However insufficient data has been presented to demonstrate that no other projects or activities could contribute to cumulative impacts.

Surface Water

28. Cumulative impacts in terms of flooding have been partially addressed. The proponent predicts that impacts from the BSCP will dissipate well upstream of reaching the BNCOP. However only preliminary flood modelling is available for the BSCP, and as the BNCOP flood model extent does not include the proposed BSCP, there remains uncertainty regarding the cumulative flood impacts of these projects.
29. No geomorphic assessment for the BNCOP has been undertaken, therefore cumulative impacts of, or on, geomorphic processes have also not been addressed.
30. Potential impacts of the combined BSCP and BNCOP include constricting the Dawson floodplain (by levees and waste rock emplacements) and increasing stream powers, and increased risk of elevated flood heights and subsequent threats to levees. Modelling of the fully operational and post mining landforms for both BSCP and BNCOP and a comprehensive assessment of the cumulative impacts on fluvial geomorphology would assist in understanding potential impacts on the Dawson River and floodplain.

Ecology

31. Due to the limited ecological monitoring data, cumulative impacts of the BNCOP and nearby projects on GDEs and downstream aquatic ecosystems have not adequately been addressed. There has been minimal consideration of cumulative impacts on water chemistry.

Question 4: Are additional measures and commitments required to mitigate and manage impacts on water resources and water-related assets?
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Response

32. Refinements to the groundwater model should incorporate data from existing operations, and uncertainty in predictions should be quantified through ongoing data collection and use of independent estimates to validate calibrated values. Risk assessment and options analysis of the final landforms should be employed to address the risks associated with landscape scour, geomorphic risks to infrastructure such as levees, pit inundation, and final landform design. Management of impacts to ecological water-related assets would be improved through greater understanding of existing alluvial groundwater resources and their ecological relevance, the setting of water level and quality trigger values, and management responses.

Explanation

Groundwater additional measures and commitments

33. Key groundwater system water balance components, such as rainfall recharge, groundwater flow between model layers, and the groundwater contribution to baseflow in the Dawson River, should be verified through independent field based methodologies to reduce uncertainty in groundwater model outputs and predictions.
34. The proponent should quantify uncertainties in input data, identify relevant data gaps and information requirements to support future refinement of the groundwater model and parameters, including calibrated hydraulic conductivity values, particularly for the alluvium, colluvium and weathered Permian coal measures. Monitoring activities should be designed to establish the existing condition of groundwater resources as well as address key uncertainties and sensitivities in the groundwater model.

Surface Water

35. A risk assessment framework including hazard identification needs to be developed in order to determine additional measures and commitments required to mitigate and manage impacts to surface water. Further work, as identified in points 20, 21 and 22, is required to assess issues and resolve risks associated with pit inundation and post mining landscape scour.
36. The design of the post mining landform and final void should be based on a risk assessment that takes into account long term geomorphological changes such as meander migration and the probability of an extreme flood event occurring within the post closure planning horizon.

Ecology

37. Management of impacts to ecological water-related assets would be improved through better understanding of existing alluvial groundwater resources, and their ecological relevance, including groundwater dependencies of vegetation.
38. Specific measures to manage impacts to water-related assets, in addition to those discussed in points 23 to 24, may include setting of trigger levels for water level/quality in relevant waterways and aquifers, including the Quaternary, Tertiary and Permian strata. Establishment of drawdown buffer zones around GDEs within the area (based on field investigation and monitoring data) would be beneficial to avoid impacts from groundwater extraction.

Date of advice	17 July 2014
Source documentation available to the IESC in the formulation of this advice	Cockatoo Coal Ltd, 2014. Baralaba North Continued Project Environmental Impact Statement. Bureau of Meteorology. National Atlas of Groundwater Dependent Ecosystems.
References cited within the IESC's advice	¹ Information Guidelines for Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals available at: http://iesc.environment.gov.au/pubs/iesc-information-guidelines.pdf
