

## Advice to decision maker on coal mining project

### IESC 2015-074: Curragh Extension Project (EPBC 2015/7508) – Expansion

<b>Requesting agency</b>	The Australian Government Department of the Environment
<b>Date of request</b>	04 November 2015
<b>Date request accepted</b>	04 November 2015
<b>Advice stage</b>	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 to provide advice on the Wesfarmers' Curragh Extension Project in Queensland.

This advice draws upon aspects of information in the Preliminary 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 Curragh Extension Project is an expansion of an existing open cut coal mine, located approximately 6 km north of Blackwater in Queensland. The proposed project will extend the life of the current mine for a further 8 years at current production rates (18 million tonnes per annum of run of mine coal) from the Rangal Coal Measures of the Bowen Basin. Associated features include: basic mine infrastructure areas; fuel and mine water storage facilities near proposed Pit X and Pit Z; in-pit and out-of-pit spoil dumps; and residual voids.

#### Key potential impacts

The proposed project has the potential to impact groundwater-dependent ecosystems (GDEs) through:

- the direct removal of ~80 ha of likely GDEs and ~8 ha of potential GDEs;
- the loss of baseflow to Blackwater Creek and Mackenzie River (these streams may also be impacted by stream diversions, loss of catchment area and mine discharges); and
- the drawdown of groundwater that supports vegetation communities.

There is also the potential for impacts to water resources as a result of the final landform and cumulative impacts to GDEs and surface water resources with the existing Curragh mine, as well as other nearby coal mines.

#### 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: key conclusions*

The assessment documentation provided does not include relevant information gathered during operation of the existing Curragh mine such as groundwater level, surface water flow and surface water quality data. Potential impacts to water resources and water-dependent assets from the existing Curragh mine have not been clearly stated nor supported by monitoring data. Despite the proposed expansion around the existing Curragh mine, no groundwater data exists within the currently undisturbed extension areas.

##### *Application of appropriate methods and interpretation of model outputs: key conclusions*

The impacts to water resources from three of the four proposed pits and their potential cumulative impacts have not been assessed. There is inadequate data for calibration of the numerical groundwater model, which represents only one of the four proposed pits (Pit X) and some hydraulic parameters have been derived from literature. Sensitivity and uncertainty analysis have not been undertaken.

GDE identification and aquatic surveys were in accordance with relevant survey guidelines. However, stygofaunal sampling was not undertaken and water requirements of identified GDEs have not been described.

A site water balance has not been presented and therefore any impacts to water resources, such as those as a result of changes to the frequency of discharges, have not been assessed.

#### **Advice**

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

Question 1: Does the Committee consider that the proponent has presented appropriate information to identify key uncertainties and risks of the project in relation to water resources and water-dependent assets?

#### Response

1. No. Impacts to water resources are uncertain at this stage as relevant information, such as groundwater level and surface water flow and quality data gathered during operation of the existing Curragh mine, has not been presented. A stand-alone quantitative risk assessment should be provided to identify key risks to the quality and quantity of water resources and water-dependent assets.

## Explanation

### *Risk assessment*

2. Hydrogeological conceptual models, including a series of cross-sections, have been developed for the four proposed pits based on drill hole data across the existing and proposed sites. Based on these conceptualisations and a preliminary risk assessment, the proponent determined that the key risk to water resources was posed by mining at Pit X. The IESC is unable to provide advice on this risk assessment as it has not been provided in its original form. The proponent has presented insufficient evidence in the project assessment documentation to support the conclusions drawn from this risk assessment.
3. The project assessment documentation should include a quantitative assessment of the likelihood and consequence of potential impacts to water resources and water-dependent assets and justify the residual risk following application of proposed mitigation measures.

Question 2: What does the Committee consider are the key uncertainties and risks of the project in relation to water resources and water-dependent assets?

## Response

4. The key uncertainty is the prediction of impacts to water resources and water-dependent assets given the limited confidence in numerical groundwater modelling. The key risks of the proposed project are:
  - a. impacts to GDEs, particularly to the Mackenzie River, with subsequent cumulative impacts on water supply reliability and instream ecosystems (which are known to provide habitat for the Fitzroy River Turtle (listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the White-throated Snapping Turtle (critically endangered under the EPBC Act));
  - b. impacts to water resources as a result of cumulative impacts with the existing Curragh mine and other nearby mining operations (refer to Paragraph 19); and
  - c. impacts to water resources from the final landform (refer to Paragraphs 11 and 12).

## Explanation

### *Numerical groundwater modelling*

5. There is low confidence in the numerical groundwater model developed by the proponent for Pit X as it:
  - a. does not allow for consideration of cumulative impacts from:
    - i. other pits in the proposed extension;
    - ii. existing operations at Curragh mine (in fact, the groundwater levels at the boundaries of the model domain are assumed to not be affected by existing operations at Curragh mine, which may not be the case depending on mine scheduling and groundwater recovery); and
    - iii. other nearby mining operations, particularly to the south and east;
  - b. has not undergone formal calibration, sensitivity analysis, or uncertainty analysis;

- c. simplifies the known hydrogeology (i.e. combining all units above the Rangal Coal Measures into one layer), which means that variations in hydraulic properties, including the known influence of weathering, have not been represented; and
  - d. does not represent the potential effects of paleochannels, faults and other structural features.
6. Recommendations for future numerical groundwater modelling are provided in Paragraphs 18 and 20.

#### *Groundwater-dependent ecosystems*

7. Despite the adequate identification of GDEs (other than stygofauna, as described in Paragraph 15), impacts to GDEs as a result of the proposed project remain uncertain.
- a. The water requirements of potentially groundwater-dependent vegetation communities have not been identified. In particular:
    - i. Whilst the proponent predicts drawdown in the vicinity of Pit X, impacts on nearby *Acacia harpophylla*, *Eucalyptus coolabah* and *Eucalyptus tereticornis* have not been quantified.
    - ii. Impacts to *Acacia harpophylla* adjacent to Pit J and in Blackwater Regional Park to the south of Pit Z have not been considered.
    - iii. Impacts to *Eucalyptus coolabah* to the east of Pit D have not been considered.
  - b. Potential impact pathways for GDEs reliant on the surface expression of water have not been conceptualised (see Paragraph 10c).
8. The proponent commits to field verification of GDEs near Pit X prior to the commencement of mining in 2025 to confirm their presence, characterise the nature of groundwater dependence and assess potential risks associated with mining. Details of these proposed studies have not been included within the project assessment documentation.

#### *Mackenzie River*

9. Prior to the development of the existing Curragh mine, there was reported to be groundwater discharge to the Mackenzie River particularly during the wet season and near Pit X. Following mining, evidence suggests that surface water may recharge groundwater, including:
- a. observations that the alluvium at Pit S (300 m from the Mackenzie River and to the north of the proposed Pit X) has been dewatered but that the Mackenzie River maintains flow; and
  - b. a trend in groundwater quality within the alluvial sediments and Rewan Formation whereby pH is increasing and electrical conductivity is decreasing over time, which is consistent with increasing surface water input.
10. The proponent predicts no impact on instream ecosystems or surface water users of the Mackenzie River as a result of the proposed project, as a water balance across the numerical groundwater model domain predicts no net reduction in flow in Mackenzie River. However:
- a. there is low confidence in results from the numerical groundwater modelling (as described in Paragraph 5);
  - b. a net prediction across the numerical groundwater model domain and the life of the proposed project does not provide adequate spatial and temporal resolution of the losing/gaining nature of the river during the proposed mine operation;

- c. no evidence has been provided to support the assertion that streamflow (as a result of upstream regulation) will compensate for loss of groundwater baseflow to instream ecosystems (which provide known habitat for turtle species listed under the EPBC Act); and
- d. the potential for resultant impacts to reliability of water supply through the Nogoia Mackenzie Water Supply System has not been presented.

*Final landform*

- 11. The proponent has not clarified whether residual voids will act as groundwater sources (with potential groundwater quality impacts) or groundwater sinks (with potential long-term groundwater quantity impacts). As such, potential impacts associated with the final landform remain uncertain.
- 12. In developing a residual void investigation plan, various options for backfilling should be investigated. If final voids are not to be backfilled, results should be presented which show that complete backfilling is not financially or technically achievable and/or results in adverse environmental outcomes. The final landform should be designed with consideration of impacts to water resources in perpetuity, and ensure that these impacts are minimised through mitigation, monitoring and management measures.

Question 3: Is there any additional information which would assist in the identification and assessment of impacts to water resources?

Response

- 13. Yes. A detailed assessment of impacts to surface water resources is needed. Additional information should be provided on the presence or absence of stygofauna and the water requirements of GDEs. This information should be incorporated into revised numerical groundwater modelling which allows for the assessment of cumulative impacts. The IESC information guidelines (2015) provide a framework for the identification and assessment of impacts to water resources.

Explanation

*Surface water resources*

- 14. The assessment of potential impacts to the Mackenzie River would benefit from assessment of combined impacts to streamflow (volume and rate) and water quality, including impacts at different locations (particularly in critical habitats such as refuge pools and riffles for turtle habitat and riffle crests for fish passage) and under different flow conditions (e.g. high flows, low flows, wet/dry season). All likely impact pathways should be assessed, including:
  - a. groundwater drawdown and loss of baseflow (as described in Paragraphs 9 and 10);
  - b. loss of contributing catchment area (which, when considered with the existing operation, is predicted to result in a combined loss of 17% in Bonnie Doon Creek, 21% in Minnie Creek and 6.1% in Blackwater Creek);
  - c. stream diversions (as discussed in Paragraph 28); and
  - d. controlled or uncontrolled discharges (as discussed in Paragraph 29).

### *Groundwater-dependent ecosystems*

15. The proponent's desktop review concluded that suitable habitat for stygofauna was present on site, but stygofaunal sampling to test this finding was not undertaken. Consistent with Queensland Government guidance (DSITIA, 2014), a pilot survey should be carried out to determine the presence or absence of stygofauna within the proposed project area.
16. Details of the methods to be used in the proposed field verification studies for GDEs (refer to Paragraph 8) should be explicitly described within the project assessment documentation and applied to GDEs within the vicinity of each of the four proposed pits.

### *Numerical groundwater modelling*

17. In order to upgrade the current Pit X groundwater model, the proponent commits to:
  - a. collect and use groundwater monitoring bore data for calibration;
  - b. incorporate results of GDE field verification studies;
  - c. simulate the effects of backfilling mine pits on recharge and groundwater flow; and
  - d. undertake sensitivity analysis and uncertainty analysis.
18. The deficiencies identified in Paragraph 5 and the commitments in Paragraph 17 should be addressed in future revisions of the numerical groundwater model for Pit X.
19. Pits D, J and Z also pose potential risks to water-dependent assets including groundwater-dependent vegetation. There are potential cumulative impacts to groundwater when considered with coal mining at the existing Curragh mine, as well as the nearby Blackwater, Washpool and Jellinbah mining complexes.
20. As described in Paragraph 2, the conclusions from the proponent's risk assessment were not supported by sufficient evidence. The risk assessment should be based on a numerical groundwater model which enables prediction of cumulative impacts with the existing and proposed mining developments described in Paragraph 19. A sensitivity and uncertainty analysis should be conducted on the numerical groundwater model. The model should be peer reviewed.

Question 4: What does the Committee consider are the features of a monitoring and management framework that would address these uncertainties and risks?

### Response

21. A monitoring and management framework needs to be appropriately targeted for future stages in the proposed development, including: establishing an appropriate baseline for impact assessment; then, once the impacts can be reliably assessed, supporting an adaptive management approach. Commitments for surface and groundwater monitoring should be presented as part of a water monitoring plan and should be consistent with the National Water Quality Management Strategy (ANZECC/ARMCANZ, 2000) and the Water Quality Objectives for the Fitzroy River (DEHP, 2011).

## Explanation

### *Surface water*

22. To ensure that potential impacts to water resources are identified, proposed extensions to the surface water monitoring network need to be presented within the project assessment documentation. Surface water quality and quantity monitoring locations should be co-located and additional locations installed to the west of the project area on Bonnie Doon Creek and Minnie Creek, both of which are proposed to be diverted.
23. Installation of a flow gauging station on the Mackenzie River immediately downstream of the Curragh mine would assist in determining any loss of surface flow within the reach downstream of Bedford weir under existing conditions and as a result of the proposed project.
24. The monitoring regime for proposed diversions would benefit from addition of water quality parameters (including pH, electrical conductivity and total suspended solids). The frequency of flow monitoring should be similar to that of the existing location on the Blackwater Creek diversion to ensure that all flow events are recorded.

### *Groundwater and groundwater-dependent ecosystems*

25. The IESC considers that:
  - a. a detailed description of the proposed baseline monitoring programme should be provided within the project assessment documentation, including: how data will be incorporated into the numerical groundwater models for Pit X and cumulative impacts; and how the baseline network will be transitioned for use during operations;
  - b. target formations for proposed monitoring bores should be described;
  - c. monitoring bores proposed to better understand GDEs should be nested – both at the water table and underlying confined or semi-confined strata; and
  - d. monitoring bores should be sampled more frequently (at least monthly) during baseline data collection and operations to better understand temporal variation in surface water-groundwater interactions.

Question 5: In addition to those identified by the proponent in the draft Environmental Authority for the project, are additional measures and commitments required to mitigate and manage impacts to water resources and water-dependent assets?

## Response

26. The IESC is unable to provide detailed advice on the effectiveness of mitigation and management measures at this stage as potential impacts are uncertain. Some general advice is included in the explanation below. Once impacts have been assessed, mitigation and management measures associated with the existing operations should be reviewed and updated.

## Explanation

### *Mitigation and management*

27. Management plans should include a series of trigger levels (early warning/investigation, mitigation/management and cease work) and associated response actions, to allow for adaptive management based on identified environmental objectives. Cease-work triggers should be defined based on maximum acceptable limits for impacts to water resources or water-related assets, such as GDEs and the Mackenzie River. The proponent's proposed approach of further monitoring, investigations and expert studies may not enable impacts to be effectively mitigated or managed.

### *Stream diversions*

28. Detailed design and assessment of the proposed stream diversions should be undertaken. In particular:
- a. The potential impacts of increases in peak flood levels in Minnie Creek should be assessed and minimised.
  - b. Diversions should be constructed offline and not be used for at least one wet season until the works have stabilised and vegetation has established.
  - c. The effect of proposed stream diversions on alluvial groundwater flow paths and the water regime for nearby GDEs should be considered.
  - d. The potential transport of sediments from stream diversions downstream into the Mackenzie River should be assessed, as these sediments may affect habitat for the Fitzroy River Turtle and White-throated Snapping Turtle (GHD, 2015).

### *Mine-affected water releases*

29. An updated site water balance, based on revised numerical groundwater model predictions and a detailed water management system design, would be beneficial to assess the impacts of the proposed project. Any change as a result of the proposed project in the frequency and duration of controlled or uncontrolled mine-affected water discharges should be determined, particularly as turtle species within the Mackenzie River are susceptible to the impacts of metals, metalloids and sulphates in their food sources.

Question 6: Have cumulative impacts with other developments in the region that may impact water resources been adequately addressed?
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## Response

30. No. There has been no quantification of impacts, particularly in terms of loss of catchment area to Blackwater Creek and groundwater impacts with the existing Curragh mine and surrounding operations. Numerical groundwater modelling as described in Paragraph 20 and the IESC cumulative impact checklist within the IESC information guidelines (2015) should be used to inform a revised cumulative impact assessment.



<b>Date of advice</b>	10 December 2015
<b>Source documentation available to the IESC in the formulation of this advice</b>	<p>Parsons Brinckerhoff Australia, 2015a. <i>Curragh Extension Project - Blackwater, Queensland (EPBC 2015/7508) IESC Checklist</i>. Document No: 2172652H-ENT-LTR-000 Rev A 29 October 2015.</p> <p>Parsons Brinckerhoff Australia, 2015b. <i>Curragh Extension Project - Blackwater, Queensland (EPBC 2015/7508) Preliminary Documentation</i>. Document No: 2172652H-ENV-REP-001 Rev A 27 October 2015.</p> <p>Parsons Brinckerhoff Australia, 2015c. <i>EPBC 2015/7508 Curragh Extension Project, Request for further information</i>. Document No: 2172652H-ENT-LTR-005 Rev A 23 November 2015.</p>
<b>References cited within the IESC's advice</b>	<p>ANZECC/ARMCANZ, 2000. Australian Guidelines for Water Quality Monitoring and Reporting. <i>National Water Quality Management Strategy (NWQMS)</i>. Canberra: Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.</p> <p>DEHP, 2011. Fitzroy River Sub-basin Environmental Values and Water Quality Objectives. <i>Environmental Protection (Water) Policy 2009</i>. Queensland Government.</p> <p>DSITIA, 2014. Guideline for the Environmental Assessment of Subterranean Aquatic Fauna: Sampling Methods and Survey Considerations. Queensland Government.</p> <p>GHD, 2015. Appendix M Fitzroy River Turtle (<i>Rheodytes leukops</i>) species management program. <i>Lower Fitzroy Infrastructure Project</i>. Report for Gladstone Area Water Board and Sunwater.</p> <p>IESC, 2015. <i>Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals</i> [Online]. Available: <a href="http://www.iesc.environment.gov.au/system/files/resources/012fa918-ee79-4131-9c8d-02c9b2de65cf/files/iesc-information-guidelines-oct-2015.pdf">http://www.iesc.environment.gov.au/system/files/resources/012fa918-ee79-4131-9c8d-02c9b2de65cf/files/iesc-information-guidelines-oct-2015.pdf</a>.</p>