



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

## Advice to decision maker on coal mining project

### IESC 2013-040: Bylong Coal Project – New Development

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**Requesting agency** The New South Wales Mining and Petroleum Gateway Panel

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**Date of request** 15 January 2014

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**Date request accepted** 17 January 2014

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**Advice stage** Gateway Application

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#### Advice

The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) was requested by the New South Wales Mining and Petroleum Gateway Panel to provide advice on the Bylong Coal Project in New South Wales. The proposed project has been referred to the IESC at the 'Gateway' Stage due to its location on identified Biophysical Strategic Agricultural Land (BSAL) as legislated under the NSW *Environmental Planning and Assessment Act 1979*.

This advice draws upon aspects of information in the Gateway Certificate Application, including the Preliminary Groundwater Assessment, 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 lies within the Western Coalfields of the Sydney-Gunnedah Basin in New South Wales. Approximately six million tonnes per annum of run of mine coal is proposed to be extracted via open cut and underground mining methods from the target Coggan and Ulan coal seams. The proposed project is located along the Bylong River, a tributary of the Goulburn River, which in turn is a tributary of the Hunter River. The closest large regional centre is Mudgee, located approximately 55 km south-west of the proposed project. The small settlement of Bylong Village is located within the proposed project boundary. The mine life is anticipated to be approximately 29 years.

The IESC recognises that the Gateway Certificate Application has been designed to address the criteria specified as part of the Gateway process, which differs in scale and detail and does not contain the level of analysis expected for a development application and accompanying environmental assessment. The IESC recommends that any further project assessment documentation includes the type of information that enables a robust assessment of impacts on water resources such as that outlined in the Information Guidelines<sup>1</sup>.

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

*Question 1: The potential likelihood and extent of any impacts of the proposal on water resources, as well as the appropriateness of the proposed mitigation measures.*

1. The limited level of detail in project documentation at the Gateway stage restricts the ability of the IESC to assess the extent and likelihood of impacts to water resources as a result of the proposed project. Consequently, this advice is only able to describe broadly the potential impacts of the proposed project, many of which have been identified in the documentation accompanying the Gateway Certificate Application.
2. Key issues include surface-groundwater interactions, impacts as a result of subsidence and potential contamination of water resources following mining. Limited information is available on surface water and ecological impacts at this stage. Potential impacts to water resources, as well as the scientific adequacy of proposed mitigation measures are discussed under the headings below.

#### Subsidence

3. Subsidence of up to 3.4 m above the proposed longwalls is predicted. Subsequent impacts to water resources include ponding, changes to flood paths, erosion and scouring along drainage lines and loss of surface flows as a result of fracturing of bedrock and surface cracking. Proposed mitigation and remediation methods for subsidence include infilling of surface cracks, regrading and compacting the surface, planting of vegetation for stabilisation and constructing bunds adjacent to drainage lines to control flooding. There is limited information provided at this stage about the effectiveness of proposed stream remediation measures, such as the proposed reinstatement of stream beds with highly cohesive soils or grouting of bedrock. Documentation provided with the development application would benefit from evidence of success of the proposed subsidence remediation methods, including case studies.
4. The proponent has designed the mine layout to maintain buffer distances from most alluvial aquifers, with the exception of the Dry Creek alluvium. Longwall mining in proximity to streams and associated alluvium has the potential to fracture the confining hard rock layers, providing direct conduits from surface waters to coal seams. Future iterations of the project assessment documentation should clearly define alluvial extents along Dry Creek and specify buffer distances from proposed longwalls.

#### Groundwater

5. The preliminary groundwater model predicts that once mining commences depressurisation of Permian strata occurs and the flow rate from the Permian strata to the alluvium (net 7.7 ML/day upward flow across the model domain) will be reduced. In some areas adjacent to the proposed open cut pits, this net upward flow is reversed to downward flow. Documentation provided with the development application should include groundwater recovery predictions across the model domain, including an assessment of whether groundwater flow from the Permian strata to the alluvium will return to pre-development levels and the time taken to reach equilibrium. Given the magnitude of the predicted alluvial drawdown, the potential for impacts to porosity and permeability and consequential implications for long-term flow storage and movement in the alluvium should be assessed.
6. Preliminary modelling indicates drawdown of up to 18.46 m for bores within the alluvium. Twenty three alluvial bores and one bore within the Permian hard rock are predicted to experience drawdown of greater than 2 m. Proposed mitigation measures include land acquisition, drilling deeper bores or supplementing water supplies.

7. Impacts of groundwater drawdown on ecological assets and associated mitigation measures have not been considered at this stage. The IESC recommends that impacts on water dependent assets (including aquatic ecosystems, terrestrial ecosystems, drinking water supply, irrigation water supply, surface infrastructure and other industries), should be assessed following updates to the groundwater model. Mitigation measures to address impacts on groundwater dependent assets should be included.
8. Contrary to the stated significant alluvial through-flow to the Goulburn River, the preliminary groundwater model predicts that the Goulburn River will not be impacted by the proposed project<sup>2</sup>. The representation of the Goulburn River as a constant head boundary within the model may be influencing this inconsistency. The IESC has included recommendations for further studies into the representation of streams in the groundwater model in response to Question 2.

#### Surface water

9. The steady state water budget indicates a net outflow of 3 ML/day from groundwater to the Bylong River and Lee Creek systems. As a result of the proposed project, there is predicted to be an average reduction in baseflow to these streams of 0.21 ML/day. Streamflow and rainfall data collected by the proponent show that the Bylong River maintains some baseflow through winter, but almost no flow between October and February. The spatial and seasonal variation in streamflow and the groundwater pumping regime should be reflected in future versions of the groundwater model. These modifications would more accurately represent current surface-groundwater flux and therefore improve confidence in the predictions of impacts.
10. The proponent intends to contain all mine-affected water on site, with no discharges, but does intend to use mine water for dust suppression. Sediment-affected water may be released from site, following treatment if necessary. Documentation provided with the development application should include:
  - a. Assessment of potential for salinity to increase as a result of storing mine-affected water on site;
  - b. Identification of contingency measures to ensure that mine water is not released from site;
  - c. Measures to ensure stability of the landform and maintenance of water quality, given the potential for sodic soils across the proposed site;
  - d. Assessment of the risks to surface and groundwater quality of using mine water for dust suppression; and
  - e. Provision of details of the proposed treatment options for release of water of appropriate quality from sedimentation dams.

11. The proponent's documentation contains limited information about other impacts to surface water at the Gateway stage. The IESC has included recommendations for further studies into surface water impacts in response to Question 2.

#### Final landform

12. There is potential for contamination of the alluvium due to leaching from Coal Handling and Preparation Plant rejects and tailings within the backfilled pit, which may then flow into the adjacent surface water systems, in particular the Growee River and Lee Creek. Groundwater quality modelling of the final landform would be needed to accurately determine the potential transport of contaminants, including salts, to the alluvium and surface streams.

*Question 2: The IESC may also recommend further studies that should be undertaken if relevant.*

13. The IESC considers that any further studies in preparation for a development application should have reference to the type of information that enables a robust assessment of water resources such as those outlined in the Information Guidelines<sup>1</sup>. Specific recommendations for further work are made under the headings below.

Subsidence

14. Future iterations of the subsidence assessment should include a survey of the existing drainage lines and other surface water features and an assessment of their current condition, including associated vegetation, to provide a baseline against which the predicted changes to the landform can be assessed.
15. The monitoring and management programme for subsidence would benefit from further investigations on the height and impacts of connective cracking and the effectiveness of proposed mitigation and remediation measures.

Water balance

16. Studies are needed on the location and volumetric requirements of the proposed borefield to supplement mine water requirements. The proposed water take from this borefield should then be incorporated into the groundwater model.

Groundwater

17. The IESC agrees that improvements to the preliminary groundwater model are needed, consistent with the proponent's commitments. The IESC recommends that the updated numerical model should reflect the modifications and additions to the groundwater conceptualisation specified in paragraphs 18-21.
18. Finer-scale understanding is needed of the spatial and temporal aspects of the existing connectivity regime between each of the hydrogeological units and surface water. In particular, the conceptualisation should include current groundwater extraction, streamflow, alluvial through-flow and discharge to the Goulburn River. In order to match the groundwater model outputs to seasonal field observations, consideration should be given to a variety of boundary conditions for streams across the model domain, including constant head or general head boundaries, river cells and drains. The project assessment documentation would benefit from sensitivity analysis of stream boundary conditions and justification for the conditions applied in the final groundwater model.
19. Studies should assess the predicted perturbations to, and recovery of, the hydrological regime resulting from the proposed project. In particular, the assessment should consider changes to hydraulic connectivity above shallow longwalls, where cracking is predicted to extend to the surface. Assessment of changes to interconnectivity between hydrogeological units and surface water would benefit from predictions at the sub-catchment level, including Lee Creek, Bylong River, Growee River and the Goulburn River.
20. Further evidence should be provided to confirm the extent of the alluvium associated with Dry Creek and buffer distances from the proposed longwalls. Any modifications needed to the mine layout to maintain the integrity of alluvial aquifers should be clearly described.
21. Water related assets should be identified. Studies relating to dependence on water resources for fauna (including stygofauna, macroinvertebrates, frogs and fish), flora and habitat, as well as the location of shallow groundwater discharge points and other groundwater dependent ecosystems

(GDEs), should be included. A systematic approach to assessment of GDEs is recommended in which:

- a. The hydrogeological conceptualisation identifies areas of shallow groundwater (less than 20 metres below ground level) and groundwater discharge.
- b. Vegetation and wetland mapping is overlaid to identify areas of potential GDEs. Preliminary mapping should consider data sourced from the Vegetation Information System database, available from the NSW Office of Environment and Heritage.
- c. Techniques from the Australian GDE Toolbox<sup>3</sup> may then be applied to confirm groundwater use by vegetation and groundwater discharge to surface water bodies.

#### Surface water

22. The IESC recommends that the baseline characterisation for the proposed project should include:
  - a. Hydrogeochemical characterisation of the coal measures and overburden, including the potential for saline and acid forming material;
  - b. The development of local water quality objectives; and
  - c. Surveys of aquatic ecology in the Blylong River water source within and downstream of the mine lease.
23. Surface water studies would benefit from consideration of the combined impacts of loss of catchment area, loss of baseflow and surface cracking, streambed cracking and ponding as a result of subsidence. An assessment of the potential for impacts to water dependent assets should also be undertaken.
24. Documentation provided with the development application should include a flood assessment. The flood assessment should include the potential for:
  - a. Subsidence to alter existing flood paths;
  - b. Flooding of the mine pits;
  - c. Erosion or destabilisation of overburden emplacement areas; and
  - d. Impacts to in-stream and riparian vegetation, channel morphology, mine infrastructure or adjacent properties as a result of flooding.

#### Final landform

25. Geochemical characterisation of tailings and rejects should be undertaken to assess the potential contamination risk to the alluvium and surface waters.

#### Risk assessment

26. The documentation associated with the development application would benefit from inclusion of a stand-alone risk assessment considering specific water-related risks to the environment. This assessment should quantitatively assess the likelihood and consequence of identified impacts and the residual risk following application of proposed mitigation measures.
27. The Hunter Subregion within the Northern Sydney Basin has been identified for Bioregional Assessment. Data and relevant information from the proposed project should be made accessible to this Bioregional Assessment to assist the knowledge base for regional scale assessments.

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<b>Date of advice</b>	14 March 2014
<b>Source documentation available to the IESC in the formulation of this advice</b>	Hansen Bailey, 2014. Bylong Coal Project – Gateway Certificate Application Supporting Document. Report prepared for KEPCO Bylong Australia
<b>References cited within the IESC's advice</b>	<p><sup>1</sup> Information Guidelines for Proposals Relating to the Development of Coal Seam Gas and Large Coal Mines where there is a Significant Impact on Water Resources available at: <a href="http://www.environment.gov.au/coal-seam-gas-mining/project-advice/pubs/iesc-information-guidelines.pdf">http://www.environment.gov.au/coal-seam-gas-mining/project-advice/pubs/iesc-information-guidelines.pdf</a></p> <p><sup>2</sup> AGE, 2013. Bylong Coal Project – Groundwater Impact Assessment. Report prepared for KEPCO Bylong Australia.</p> <p><sup>3</sup> Richardson, et al, 2011. The Australian Groundwater Dependent Ecosystems Toolbox. National Water Commission, Canberra.</p>

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