

Advice to decision maker on coal mining project

Proposed action: Watermark Coal Project (EPBC 2011/6201) – New Development

Requesting agency	Department of Sustainability, Environment, Water, Population and Communities
Date of request	17 April 2013
Date request accepted	17 April 2013
Advice stage	Environment Impact Assessment (draft)
Summary of request from the regulator	<p>The Department of Sustainability, Environment, Water, Population and Communities (the Department) is currently assessing the proposed project in accordance with the provisions of the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).</p> <p>The Department notifies the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the Committee) of an opportunity to comment on the draft Environmental Impact Statement. Specifically, the Department poses the following questions to the Committee:</p> <ol style="list-style-type: none"> 1. Does the Committee consider that the proponent has provided sufficient information on the water resources and its management to assess likely significant impacts from its proposed action? If the information is considered insufficient for that purpose, what advice regarding areas of inadequacy can the Committee provide? 2. Is the assessment of the current condition of the ground and surface water environments in and surrounding the project area accurate? 3. Are the various models used to assess the potential impacts of the project on ground and surface water, in and outside the project area, appropriate for the purpose and acceptable as compared to known industry best practice? Are the data and assumptions on which the models were based valid and accurate? Have all reasonably foreseeable scenarios been modelled (e.g. low flow periods, climate change, simultaneous flooding events in surrounding water bodies etc.)? 4. Are the model output data valid, accurate and representative of the systems they are modelling (including the ephemeral waterways)? Have the output data been presented and interpreted in an appropriate, relevant way, relative to the likely impacts of the proposal, including for the flow regimes of ephemeral waterways within and surrounding the project boundary? What level of confidence can be applied to the results and conclusions presented in the EIS?

5. Has the EIS comprehensively identified, assessed and quantified all potential impacts of the proposal on water systems within and outside the project area? If not, what impacts have not been covered and/or what information is required?
6. Is the assessment of the nature and extent of post-rehabilitation impacts on ground and surface waters accurate?
7. Has the cost-benefit analysis (page 55) properly considered the potential negative impacts of the proposal on water resources? If not, what would be required to address this?
8. Does the Committee find the water management, mitigation and monitoring measured proposed to be appropriate, accurate, reasonable and effective? To what degree, if any, do the proposed mitigation and management measures reduce impacts? Also:
 - a. Are the water storages proposed during operation sufficient to ensure no contamination of downstream surface waters?
 - b. Is baseline water monitoring data sufficient to provide an accurate and representative baseline against which changes may be determined during and after mining operations?
 - c. Are the parameters to be measured in ground and surface water monitoring appropriate and sufficient to cover the likely water quality impacts?
 - d. Are there any other mitigation measures that could be implemented to further reduce any impacts?
9. There are a number of other mines either existing or proposed in the area surrounding the proposed Watermark Coal project. The existence and operating management of these mines within this area raises the possibility of cumulative impacts. Does the Committee identify any particular concerns relating to cumulative impacts?

Advice

The Committee was requested to provide advice to the Commonwealth regulator on the Watermark Coal Project in New South Wales at the Environmental Impact Assessment (draft) stage. This advice draws upon aspects of information in the draft Environmental Impact Statement, together with the expert deliberations of the Committee. The draft Environmental Impact Statement and information accessed by the Committee are listed in the source documentation at the end of this advice.

The proposed project is a new development for an open cut coal mine, producing up to 10 million tonnes per annum of Run of Mine coal for up to 30 years, located 25 km from Gunnedah and immediately west of Breeza in Northern New South Wales. The site is adjacent to the Mooki River, which is a major tributary of the Namoi Catchment. The target coal seams are contained within the Black Jack Group of the late Permian strata of the Gunnedah Basin and include the Hoskissons and Melvilles seams. The disturbance area for the proposed project covers 4,084 ha.

Cumulative impacts on the Namoi Catchment

The Committee encourages the regulator to consider the water related impacts of the proposed project in a cumulative assessment context such as that presented in the Namoi Catchment Water Study. This Study presents a range of coal seam gas and coal mining development scenarios. The Study provides predictions of surface water losses and groundwater drawdown which should be used to provide context to individual project

impact assessments.

A regional water balance is an important component of a cumulative assessment and the Committee suggests, in relation to the Watermark project, that defined regional boundaries can be logically drawn, i.e. groundwater from the Liverpool Range to Gin's Leap and surface water from the project site to the Boggabri gauging station.

The Committee considers that the proposed project is likely to enhance the risk of salinity in the region. The proposed project is likely to result in salinity impacts from overflow of water storages, seepage from the backfilled and proposed open mine voids, connectivity between the alluvium and Permian strata and the removal of woodland from the proposed project site. A regional perspective on salinity is important to properly assess the significance of such impacts and this should be addressed through the development of a regional salt balance.

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

Relevant data and information: key conclusions

In the main, the proponent has used relevant data and information, with the exception of the areas noted below. The proponent has referred to data sources specific to the Namoi catchment, such as aspects of the proposed framework for assessing the cumulative risk of mining on natural resource assets in the Namoi catchment (Eco Logical, 2011) and the Namoi Catchment Water Study (Schlumberger, 2012).

However, the documentation provided would benefit from further information in relation to:

- Downstream aquatic ecosystems, assets and receptors;
- Groundwater dependence of vegetation communities (including the critically endangered White Box Yellow Box Blakey's Red Gum Woodland and Derived Native Grassland and endangered ecological communities found on site);
- Evidence for the assertion of no hydraulic connection to the Great Artesian Basin;
- Evidence for the low hydraulic conductivities modelled in the coal seams and their distribution;
- Evidence for groundwater model assumptions relating to constant irrigation use and constant conditions across the northern boundary; and
- Evidence for faulting and the role of faults in impeding or transmitting groundwater flow.

Appropriate methodologies which have been applied correctly: key conclusions

The proponent has selected appropriate methodologies in their environmental assessment, including a semi-quantitative risk assessment and appropriate use of software for the modelling of groundwater, flooding and the site water balance. The numerical groundwater modelling has undergone sensitivity and uncertainty analysis and peer review. However, the water budget across the groundwater model domain does not constitute a regional water balance and a regional salt balance has not been provided. Further, the Committee has concerns with respect to the application of these methodologies in some circumstances.

With respect to the application of these methodologies:

- The effectiveness of control measures used to address preliminary risks cannot be determined as these controls will be embedded in management plans which have not been provided;
- Insufficient justification and verification has been provided for the groundwater conceptualisation, particularly with regard to interconnectivity between the Upper Namoi Alluvium and Permian sequence,

which decreases confidence in conclusions drawn from the numerical groundwater model; and

- No sensitivity analysis has been performed on the site water balance to date and there has been no consideration of the potential impacts of climate variability, which results in a reduced level of confidence in the modelled results.

Reasonable values and parameters in calculation: key conclusions

The values and parameters used in calculations by the proponent appear plausible, with the exceptions and differences noted above and following:

- Climate data from early and recent years are underrepresented in the realisations modelled in the site water balance;
- Calculations of additional site water supply requirements have used average rather than maximum values and have not considered water availability; and
- The proponent classifies the Hoskissons and Melvilles coal seams as aquitards, whereas Schlumberger (2012) classified these coal seams as aquifers.

Question 1: Does the Committee consider that the proponent has provided sufficient information on the water resources and its management to assess likely significant impacts from its proposed action? If the information is considered insufficient for that purpose, what advice regarding areas of inadequacy can the Committee provide?

1. The Committee considers that applying a water balance model is the most appropriate basis for assessing potential changes in water resources and impacts on aquatic ecosystems, assets and receptors. The deficiencies in the regional and site water balances make a comprehensive assessment of likely significant impacts as a result of the proposed project difficult. Further areas where the assessment documentation could benefit from additional information are outlined below and have been addressed in questions 3, 4, 5, 6, 8 and 9.
 - a. In relation to the site water balance, the earliest and latest periods of historical data are underrepresented in the realisations modelled. The Committee has limited confidence in the predicted lack of release of mine water and recommends that, in order to minimise downstream water quality and ecological impacts, the proponent:
 - i. Undertake sensitivity analysis on the site water balance;
 - ii. Use the results of the site water balance sensitivity analysis, as well as predicted available water determinations, surface water availability and any applicable access rules to ensure that water supply licences will meet site water requirements under a full range of foreseeable conditions;
 - iii. Design mine water storages to contain a 1:1000 year average recurrence interval storm event; and
 - iv. Develop contingency plans to deal with the event of an emergency discharge of water from a mine water dam.
 - b. In relation to a regional water balance, the Committee recommends that a regional water balance be developed to allow for assessment of significant impacts. This water balance should:
 - i. Extend across the regional surface and groundwater systems to defined monitoring points, beyond which there will be no measurable impacts as a result of the proposed project, e.g. groundwater to Gin's Leap and surface water to the Namoi River at Boggabri gauging station;
 - ii. Detail the set of water stores and the flow of water between those stores under current conditions

- within this region;
 - iii. Assess the change as a result of the proposed project to the quantity or quality of water within any store or flow of water between these stores;
 - iv. Take into account a range of foreseeable climatic scenarios; and
 - v. Undergo sensitivity analysis.
- c. Significant impacts are also likely as a result of the proposed project's increase in salt loads downstream of the proposed project site, into a catchment already at risk from salinity. The project assessment documentation would therefore benefit from the inclusion of a local and regional salt balance. A salt balance should:
- i. Detail the set of salt stores and the transfer of salt between those stores under current conditions within this region;
 - ii. Assess the change as a result of the proposed project to the quantity of salt within any store or transfer of salt between these stores;
 - iii. Take into account a range of foreseeable climatic scenarios; and
 - iv. Undergo sensitivity analysis.

Question 2: Is the assessment of the current condition of the ground and surface water environments in and surrounding the project area accurate?

2. The assessment that surface and groundwater systems are generally in poor condition is accurate and supported by evidence. The Mooki River adjacent to the proposed project boundary is highly degraded and riparian vegetation is absent. Further, in terms of usage, the Upper Namoi Alluvium is a very important groundwater source in New South Wales and its stress has been well documented.
3. Insufficient information has been provided by the proponent that clearly identifies outside of the proposed project boundary: aquatic ecosystems, assets and receptors that are dependent on surface and groundwater systems; their current condition and how these assets and receptors will be impacted by both the proposed project; and any additional cumulative impacts.

Question 3: Are the various models used to assess the potential impacts of the project on ground and surface water, in and outside the project area, appropriate for the purpose and acceptable as compared to known industry best practice? Are the data and assumptions on which the models were based valid and accurate? Have all reasonably foreseeable scenarios been modelled (e.g. low flow periods, climate change, simultaneous flooding events in surrounding water bodies etc.)?

4. The surface water balance and flood models and the numerical groundwater model used by the proponent are fit for purpose and consistent with best industry practice.
 - a. The data and assumptions for these models are accurate and valid, with the exception of the issues detailed below in relation to the numerical groundwater modelling.
 - i. Insufficient justification and verification has been provided for the hydrogeological conceptualisation, particularly with regard to the nature of faulting and interconnectivity between the Upper Namoi Alluvium and Permian sequence, which decreases confidence in conclusions drawn from the numerical groundwater model.
 - ii. The assumptions of constant conditions at the northern boundary and constant groundwater use are both inaccurate. These assumptions limit the predictive ability of the model as it does not accurately represent the current conditions.

- iii. The extent of the Gunnedah Formation has been determined by the proponent based on geophysical surveys, but there has been no field verification of the results. Without verification, confidence is limited in the predicted drawdown impacts on the Gunnedah Formation and resulting impacts on groundwater users.
 - iv. Hydraulic conductivities for target coal seams have not been adequately justified. The parameters used have unknown spatial distribution and extend over a large range, with some values orders of magnitude lower than those used by Schlumberger (2012) and other groundwater studies including the same Permian sequence for previous referrals in the Namoi Catchment. The Committee considers that the large range of hydraulic conductivities could overly influence the model's predicted zone of depressurisation and that further evidence is required to justify the parameters used by the proponent.
 - v. Insufficient evidence has been provided to justify the presence of faults and their behaviour in transmitting or preventing groundwater flow in the groundwater model. The modelled results appear to show that the extent of the drawdown is limited by these faults. Further work should be carried out to confirm both the existence of these faults and their ability to act as hydraulic barriers. This assessment should include the potential for fractures and faults to transmit water, particularly from the Upper Namoi Alluvium.
- b. Not all reasonably foreseeable scenarios have been considered by the proponent in their modelling.
- i. The site water balance modelling has not considered the potential for increasing climate variability.
 - ii. The assessment of cumulative impacts has only considered Scenario 2 of the Namoi Catchment Water Study and therefore has excluded other foreseeable scenarios, including Scenario 3.

Question 4: Are the model output data valid, accurate and representative of the systems they are modelling (including the ephemeral waterways)? Have the output data been presented and interpreted in an appropriate, relevant way, relative to the likely impacts of the proposal, including for the flow regimes of ephemeral waterways within and surrounding the project boundary? What level of confidence can be applied to the results and conclusions presented in the EIS?

5. The Committee has identified concerns relating to input data, assumptions, sensitivities and the number of scenarios modelled for groundwater and water balance modelling, which decrease confidence in the outputs from these models. With respect to presentation and interpretation of model outputs:
- a. Site water balance results have been presented in full only for long-term average conditions, which does not allow for interpretation of the performance of the mine water management system under climate extremes previously experienced in the region;
 - b. Predicted groundwater drawdowns have not been presented for all model layers and the drawdown contours presented have not been adequately discussed. In particular:
 - i. Drawdown within the coal seams is likely to be greater than predicted by the proponent, as low hydraulic conductivity values have not been adequately justified and could be influencing the limited drawdown extent;
 - ii. It is difficult to determine the validity of the modelled impact of the faults, if any, on groundwater movement, in particular the role of these faults in impeding groundwater drawdown; and
 - iii. Drawdowns for the rest of the Permian sequence in this area have not been presented by the proponent, but are modelled in the Namoi Catchment Water Study. The Committee considers that drawdown contours for these Permian units should be presented. If no drawdown is predicted by the model for these units, then an explanation should be provided as to why this will not occur;

and

- c. Model outputs should be presented with an understanding of their sensitivity or uncertainty and referenced in terms of the impact to any water dependent assets.

Question 5: Has the EIS comprehensively identified, assessed and quantified all potential impacts of the proposal on water systems within and outside the project area? If not, what impacts have not been covered and/or what information is required?

6. Whilst the proponent has identified most potential impacts on water resources, the assessment and quantification of these impacts is not comprehensive. In addition to the information gaps identified in the assessment against the Information Guidelines and under questions 1,2, 3, 4, 6, 8 and 9, the project assessment documentation would be improved by including additional information on the following potential impacts:
 - a. The detailed design and construction details of pump site on the Mooki River and the diversion on Watermark Gully, including flood extents and flow velocities, to ensure that these constructions are stable and will not result in erosion or changes to downstream turbidity;
 - b. Predicted flood extents along the Mooki River which extend into the Eastern mining area. Proposed mitigation actions need to be clarified;
 - c. Impacts on dryland salinity as a result of the proposed direct removal of woodland; and
 - d. The intersection of the current water table, potential drawdown and the depth of the root zone of protected vegetation communities.

Question 6: Is the assessment of the nature and extent of post-rehabilitation impacts on ground and surface waters accurate?

7. Post-rehabilitation, both the final void and seepage from backfilled pits present potentially significant long-term environmental hazards, which have not been adequately addressed by the proponent.
 - a. The Western mining area void will have an area of 100 ha and depth of 60 metres. There are significant differences in the time to reach equilibrium and the water level at which this is achieved when the void is modelled from a groundwater or surface water perspective. As such, the Committee has limited confidence in the prediction that the void will not overtop. The Committee considers that voids are a long-term environmental legacy and backfilling of voids and pit lakes represents best environmental practice.
 - b. The Southern and Eastern mining area voids are proposed to be backfilled and predicted to recover relatively quickly. The proponent has modelled seepage from these mining areas, which they predict to be 0.08 ML/day 2,000 years after mining. Sensitivity analysis shows that the salt loads from this seepage from the Southern mining area could reach up to 17 kg/ha/day. The Committee recommends that the proponent investigate the potential impacts from seepage on downstream aquatic ecosystems, assets and receptors; commence long-term monitoring; and prepare a mitigation and management plan to address any potential impacts.

Question 7: Has the cost-benefit analysis (page 55) properly considered the potential negative impacts of the proposal on water resources? If not, what would be required to address this?

8. It is not within the Committee's terms of reference to consider the adequacy of cost-benefit analyses. However, in light of the question asked, the one-page cost-benefit analysis on page 55 of the draft Environmental Impact Statement is not comprehensive and methodologically robust. It includes only the environmental benefits and socio-economic costs of the chosen project alternative and notably not the environmental costs, including potential negative impacts on water resources.

Question 8: Does the Committee find the water management, mitigation and monitoring measures proposed to be appropriate, accurate, reasonable and effective? To what degree, if any, do the proposed mitigation and management measures reduce impacts?

9. The proposed control measures typically include management and mitigation actions, which are yet to be articulated in management plans. As such, the effectiveness of these measures cannot be determined at this stage. The Committee makes recommendations for mitigation and management in Question 8d and monitoring is discussed in Question 8b.

8a: Are the water storages proposed during operation sufficient to ensure no contamination of downstream surface waters?

10. No. There is potential for contamination of downstream surface waters from mobilisation of accumulated seepage (see Question 6), emergency release from mine water storages (see Question 1) and overflow of sediment dams. The key contaminant of concern is salt.
- a. Sediment dams that collect runoff from overburden emplacement areas are designed to overflow to ephemeral streams (although the frequency, quality and volumes of these predicted events are unknown). The proponent intends to mitigate impacts through treatment with a flocculant, or by moving the excess water to other storages on site where possible. Treatment with a flocculant will only control solids and other potential contaminants, including salt, are not proposed to be treated. These mitigation actions are insufficient without a full understanding of the potential impacts of these saline releases on downstream aquatic ecosystems, assets and receptors.
 - b. The Committee recommends that the proponent provide estimates of the frequency, quality and quantity of discharges of water (particularly saline water) proposed from the site, including potential emergency discharges, seepage and overflows from sedimentation dams. Further, the environmental assessment would benefit from a thorough investigation of the impacts of these discharges on the regional salt and water balance and downstream aquatic ecosystems, assets and receptors, including access to flows in the unregulated Mooki River water source.

8b: Is baseline water monitoring data sufficient to provide an accurate and representative baseline against which changes may be determined during and after mining operations?

11. Ground and surface water monitoring data has been collected by the proponent in and adjacent to the proposed site on a regular basis for over two years, which will be used in addition to New South Wales Government monitoring data to determine a baseline at these locations. The Committee recommends that, should the proposed project go ahead:
- a. Baseline monitoring of surface and groundwater systems continue during and post operations, as potential impacts of salt water seepage are predicted to extend beyond 2,000 years into the future;
 - b. Extensions to the groundwater monitoring network should be made in the alluvium and target coal seams both within and beyond the predicted zone of depressurisation; as the Committee is concerned that the proponent's predicted zone of depressurisation is limited;
 - c. Extensions to the groundwater monitoring network should also ensure that there is sufficient baseline information in aquifers which have a lower monitoring bore density including the Jurassic sediments of the Surat Basin and the Clare Sandstone; and
 - d. The proponent provide for additional monitoring sites as required for investigations recommended by the Committee on the water balance (Question 1), groundwater modelling (Question 3), seepage (Question 6), salt balance (Question 8a) and interconnectivity (Question 9).

8c: Are the parameters to be measured in ground and surface water monitoring appropriate and sufficient to cover the likely water quality impacts?

12. The water quality parameters measured in the proponent's ground and surface water monitoring program are appropriate. In order to manage potential risks to downstream assets and receptors as a result of loss of catchment flows, overflow of sediment dams, mobilisation of accumulated seepage from backfilled voids and potential emergency discharge, the Committee recommends that ongoing baseline water quality sampling is carried out on a monthly basis, as well as after any significant rainfall events at the 12 sites nominated by the proponent, including the ephemeral Watermark Gully.

8d: Are there any other mitigation measures that could be implemented to further reduce any impacts?

13. The Committee recommends that the proponent develop:

- a. A comprehensive sediment control plan,
- b. A detailed flood mitigation plan which prevents flooding of the Eastern pit under a 1 in 1000 year flood event; and
- c. Surface and groundwater management plans that include:
 - i. Regular quality and quantity monitoring, as outlined above;
 - ii. Site-specific quality and quantity triggers which are sensitive enough to provide an early warning of potential deviations from a defined baseline, but buffer seasonal climate variations; and
 - iii. Appropriate management actions for each trigger and backup mitigation actions should the proposed management action not be effective.

14. The proponent intends to mitigate their impacts on biodiversity through the revegetation of offset areas. Revegetation has the potential to control dryland salinity as well as conserve biodiversity. The Committee recommends that the proponent and regulator consider potential effects on local or regional dryland salinity when choosing offset sites.

Question 9: There are a number of other mines either existing or proposed in the area surrounding the proposed Watermark Coal Project. The existence and operating management of these mines within this area raises the possibility of cumulative impacts. Does the Committee identify any particular concerns relating to cumulative impacts?

15. The Committee identifies the following concerns relating to cumulative impacts, noting that the surface and groundwater systems likely to be impacted are in a poor / stressed condition, : :

- a. The sensitivity analysis performed by Schlumberger (2012) showed that the drawdown as a result of cumulative impacts in the Upper Namoi Alluvium Zone 7 is predicted to exceed 2 m, which is significant as the average saturated thickness of the alluvium in this zone is only 13 m (noting that Schlumberger have a low level of confidence in the prediction due to limited data);
- b. The proponent has not addressed cumulative impacts on hard rock groundwater, despite the modelling by Schlumberger (2012) of cumulative drawdown in extensive areas of the Gunnedah water management area of greater than 10 m;
- c. The proponent has not addressed cumulative impacts on surface water flow, despite modelled loss in flows by Schlumberger (2012), which show a cumulative reduction in flow in the Namoi River near Narrabri, equivalent to about half the current surface water extraction from the regulated Namoi River below Keepit Dam;
- d. The proponent has not addressed cumulative impacts on water quality, despite the predicted increase in salt loads to ephemeral water courses as a result of the proposed project and existing risk of salinity within the catchment; and
- e. There is no link provided by the proponent between these likely cumulative impacts and water

dependent assets and receptors.

16. The Committee recommends that adoption of the following will provide for a more robust cumulative impact assessment:
- a. A broader consideration of the Namoi Catchment Water Study's findings, particularly with respect to the use of scenario 3 and impacts to surface water and the Gunnedah-Oxley Basin; and
 - b. A local-scale focused investigation into groundwater gradients and flow, with particular regard to effects of predicted drawdown in the Permian sequence, based on connectivity between the Permian sequence, the alluvium and surface water. This investigation should be undertaken before projects proceed that are predicted to impact on the Upper Namoi Alluvium Zone 3, Zone 8 or Zone 7 in particular.
17. The Northern Inland Catchments, which includes the Namoi catchment, has been identified as a Bioregional Assessment priority region. Data and relevant information from the proposed project should be made accessible for this Bioregional Assessment to assist the knowledge base for regional scale assessments.

Date of advice	27 May 2013
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Source documentation available to the Committee in the formulation of this advice	Hansen Bailey Pty Ltd 2013. Watermark Coal Project Environmental Impact Statement. Prepared for Shenhua Watermark Pty Ltd. February 2013.
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References cited within the Committee's advice	<p>¹ 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: http://www.environment.gov.au/coal-seam-gas-mining/project-advice/pubs/iesc-information-guidelines.pdf</p> <p>Eco Logical Australia 2011. Proposed Framework for Assessing the Cumulative Risk of Mining on Natural Resource Assets in the Namoi Catchment, 14 Sep 2011.</p> <p>Schlumberger Water Services 2012. Namoi Catchment Water Study Independent Expert Final Study Report. Prepared for Department of Trade and Investment, Regional Infrastructure and Services, New South Wales. Report no. 50371/P4-R2 FINAL.</p>
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