

## Advice to decision maker on coal mining project

### IESC 2015-072: Hail Creek Coal Mine Extension Transition Project (EPBC 2014/7240) – Expansion

<b>Requesting agency</b>	The Australian Government Department of the Environment
<b>Date of request</b>	27 October 2015
<b>Date request accepted</b>	27 October 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 Rio Tinto's Hail Creek Coal Mine Extension Transition Project in Queensland.

This advice draws upon aspects of information in the Draft Preliminary Documentation (DPD), 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 Hail Creek Coal Mine Extension Transition Project is an extension to the existing Hail Creek mine, located 120 km south-west of Mackay, Queensland. The proposed project will expand the existing open cut mining activities and transition to an underground mining operation. The proposed project will extend operations to 2048 and will not alter the currently approved rate of production (i.e. 20 million tonnes per annum run of mine coal). The proposed project will rely largely on the existing infrastructure, however some upgrades and extensions may be required (e.g. upgrades to the water management infrastructure, coal reject emplacement facilities, access and haul roads and coal handling, preparation, and rail load out facilities).

#### Key potential impacts

Key potential impacts to surface water and groundwater resources resulting from the proposed project are associated with groundwater depressurisation, subsidence, the final landform and possible flooding of the longwalls. Due to the limited information provided in the proponent's conceptual model there is uncertainty associated with the numerical groundwater model predictions, particularly the potential for depressurisation effects in the shallow alluvial layers. There is the potential for impacts to Hail Creek and other groundwater dependent ecosystems (GDEs), including riparian vegetation, due to subsidence and groundwater drawdown.

### 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*

There is limited data provided to support the hydrogeological conceptualisation of the Hail Creek Syncline. The proponent referenced several reports regarding the hydrogeological interpretation of the area, but these reports were not made available to the IESC. The data provided is insufficient to confirm the presence and hydrogeological influence of a posited fault supporting the Brumby Waterhole. This fault was not included in the numerical groundwater model. No data was provided on groundwater drawdown within alluvial aquifers and dependent ecosystems. The proposed project area is a greenfield site with regard to underground mining and only limited data is available from other mining sites to support subsidence predictions from dual seam longwall extraction. There is a lack of monitoring data included in the assessment documentation. Data from the currently approved Hail Creek Mine project, particularly on groundwater levels, surface water quality and aquatic ecology (e.g. instream fauna, including fish passage), should be better utilised in the assessment of potential impacts of the proposed project.

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

The limited information supporting the hydrogeological conceptualisation leads to uncertainty in the numerical groundwater modelling predictions, and results in low confidence in the proponent's impact assessment. Further, the numerical groundwater model did not undergo transient calibration or verification testing, and no peer review was undertaken. The monitoring regime, including the location of monitoring sites, should be expanded to ensure impacts to surface water and groundwater resources are identified. As the currently approved Hail Creek Mine has been in operation for over a decade, it would be expected that there is sufficient data to enable the transient calibration of the groundwater numerical model, and inform a more robust ecological assessment.

### **Advice**

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

Question 1: Are the groundwater models (both conceptual and numerical) adequate to predict the likely cone of depression caused by dewatering activities? Is the conceptual model correct to assume that impacts to groundwater levels will be minimised as a result of the stratigraphic syncline that the mine is situated within?

### Response

1. No. The conceptual and numerical groundwater models are not adequate to predict the likely groundwater depressurisation associated with the proposed project. The conceptual model was lacking in detail, particularly hydrogeological information relating to the Hail Creek Syncline.
2. While the Hail Creek Syncline may function to constrain the extent of groundwater depressurisation, limitations of the conceptual model and resulting uncertainty in the numerical groundwater model reduce confidence in the predicted groundwater depressurisation associated with the proposed project.

## Explanation

### *Conceptual model*

3. The proponent reported that the Hail Creek Syncline is well defined and the geological extent of stratigraphic layers is well known. However, the assessment documentation provided limited evidence to support the hydrogeological conceptualisation of the proposed project site and surrounds, and included conflicting statements. This reduces confidence in the construction of the conceptual and numerical groundwater models. Limitations of the assessment documentation include:
  - a. An overarching schematic diagram of the hydrogeological conceptualisation was not presented.
  - b. No information was provided on the thickness of the stratigraphic units outside the mining area boundary (i.e. to the north, east and west of the Hail Creek Syncline).
  - c. Geological cross-sections to describe the syncline morphology and hydrology were not provided.
  - d. Horizontal hydraulic conductivities were determined based on limited hydrological testing (one pump test, seven falling head tests and seven packer tests).
  - e. While the proponent noted the variable but limited spatial extent of the Quaternary alluvium, predominance of clay and silts, and presence of brackish groundwater, the extent and hydrogeology of this potential water-bearing unit were not further described.
  - f. As discussed in response to Question 4, there was limited evidence to support the proponent's hydrogeological conceptualisation of the Brumby Waterhole.

### *Numerical groundwater model*

4. In addition to the uncertainties associated with the conceptual model outlined in Paragraph 3, further limitations of the numerical groundwater model and its outputs include:
  - a. Only a steady state calibration being undertaken, which resulted in a low confidence-level classification being assigned to the model.
  - b. General head boundaries were applied to the north, south and east boundaries of the model, with the geological outcrop of Permian sediments to the west defined as a specified head boundary. No sensitivity analysis was conducted on model boundaries.
  - c. The predicted groundwater depressurisation intersecting the southern and western boundaries.
5. Confidence in the numerical groundwater modelling predictions would be improved by:
  - a. Providing justification for the selection of the model head boundaries, setting model boundaries at sufficient distances from the proposed project to avoid affecting the groundwater drawdown predictions, and undertaking sensitivity analysis on the model boundaries.
  - b. Transient calibration of the numerical groundwater model.
  - c. Peer review of the groundwater model, as per the Australian Groundwater Modelling Guidelines (Barnett et al., 2012) and the IESC's Information Guidelines (IESC, 2015).

- d. Updating and re-running the groundwater numerical model once more data and information becomes available from the proposed project. This includes utilising data from the currently approved Hail Creek Mine project.
6. The proponent's assessment of potential impacts resulting from groundwater depressurisation, and proposed approach to monitoring and managing impacts, would be improved by:
- a. A systematic assessment of GDEs in which:
    - i. The hydrogeological conceptualisation identifies areas of shallow groundwater (less than 20 m below ground level) and groundwater discharge.
    - ii. Vegetation and wetland mapping is overlaid to identify areas of potential GDEs.
    - iii. Techniques from the Australian GDE Toolbox (Richardson et al., 2011) are applied to confirm groundwater use by vegetation, and groundwater discharge to surface water bodies.
    - iv. A desktop study is conducted to assess the likelihood of stygofauna presence. If stygofauna are likely to be present, a pilot study following the guidelines in DSITIA (2014) is required.
  - b. The assessment of potential impacts to GDEs should include GDEs beyond the proposed project boundary (e.g. including Homevale National Park) and describe the current condition of GDEs.
  - c. The assessment of potential impacts to Hail Creek should include an assessment of the gaining/losing nature of flows in Hail Creek, and an assessment of impacts to baseflow during and post operations.
  - d. Additional monitoring bores should be installed in the Hail Creek alluvium to improve estimates of mine water take from the alluvium and better assess the extent and magnitude of potential groundwater drawdown impacts to shallow groundwater and associated GDEs. The monitoring network should be extended outside the proposed project area (e.g. surrounding the Brumby Waterhole and within the Homevale National Park).

Question 2: What will be the likely impacts on surface water flows and riparian black ironbox eucalypt population of Hail Creek as a result of subsidence from underground mining activities? Does the IESC agree that due to the depth of the mine that subsidence cracking is unlikely to lead to dewatering of Hail Creek?

Response

- 7. Potential impacts to surface water flows as a result of subsidence from underground mining include alteration of the hydrological regime, stream geomorphology, and water quality. Potential impacts to riparian black ironbox (as a result of subsidence) include loss of alluvial and/or perched water sources, destabilisation and erosion of bank habitat, ponding leading to die-back, and root shear.
- 8. The IESC does not agree "that due to the depth of the mine that subsidence cracking is unlikely to lead to dewatering of Hail Creek". The proponent's information shows that the area to the north-west of the longwall panels displays potential connectivity between Hail Creek and the target coal seams (DPD, App. A, p. 62, Fig. 57). This impact should be quantified, and assessed with other impacts to surface water flows. To reduce/mitigate the risk of impacts associated with connective cracking on surface water flows, reconfiguration of longwalls that are directly overlain

by Hail Creek and Schammer Creek should be considered. An alternative option is to extract from only one of the coals seams thereby reducing the likelihood of connective cracking impacts.

### Explanation

#### *Impacts to Hail Creek*

9. Subsidence-related impacts to Hail Creek include: changes to stream channel geomorphology (including development of subsidence ponds), changes to hydraulic parameters including shear stress, stream power and velocity, and impacts associated with subsidence cracking. To adequately assess these impacts, baseline and current quantitative flow regime data on the magnitude and variability of surface flows (including seasonal, climatic high and low flow periods and contribution of baseflow) for Hail Creek are needed.
10. The proponent considered that within subsidence ponds, hydraulic parameters such as stream velocity will reduce sufficiently to trap all bed sediments. Further information is needed to justify this assumption, as bed sediments are likely to be transported beyond subsidence ponds during high flow events, and therefore the timeframe for infilling of subsidence ponds is likely to be underestimated. The proponent should assess the probability and timeframe for the filling of subsidence ponds and consider this when reassessing potential impacts to the hydrological regime of the site.
11. Water accumulating in subsidence ponds, which may be of poor quality, will be released to downstream environments during first-flush events. This effect is likely to be repeated along the length of Hail Creek that is impacted by subsidence.
12. The alteration to the flow regime of Hail Creek may be greater than that predicted by the proponent given:
  - a. The assessment documentation does not consider the combined impact to surface water from subsidence-related issues (e.g. surface cracking, streambed cracking, increased bank erosion and ponding), mine water discharges, the loss of catchment area, altered surface water-groundwater interactions, and the loss of baseflow.
  - b. The extent of vertical subsidence (up to 6.9 m), the impact of water ponding in the subsidence pools, and unproven effectiveness of mitigation measures.
  - c. The potential loss of surface water flow due to connective cracking. This was assessed to be negligible (and quantifying this loss was not attempted).
13. Surface tension cracks were predicted to develop above the proposed longwall area, with the widest cracks (in excess of 200 mm) predicted to extend 10 m below ground level. Surface runoff can be lost through these cracks to shallow strata. The proponent estimated that fracturing due to dual seam longwall mining will extend up to 180 m above the upper mined seam. If fracturing above the longwalls reaches the surface cracks, there is the potential for surface flows to be lost to the mine areas via connective cracking. The limited description of the stratigraphic layers in the conceptual model (as discussed in Paragraph 3) constrains the assessment of the potential for connective cracking to occur, although it is more likely where coal seams are shallow.
14. To reduce the risk of impacts to Hail Creek, the proponent should reconsider proceeding with extraction of longwall Panel 101A and the north-east third of Panel 103B, and reconsider extracting the eastern third of Panel 201 and the areas of panels 202 and 203 which are directly overlain by Hail Creek. In addition, the extraction of panels underlying Schammer Creek (panels 100, 101B, 102B, 103B, 200, 201, 202 and 203) requires reconsideration as dual seam extraction

is predicted to cause connective cracking which could impact on flow within the Schammer Creek and flood underground workings of longwall panel extraction.

*Impacts on black ironbox*

15. The proponent identified 193 ha of high value habitat for black ironbox within the proposed project area, and estimated approximately 9.5 ha of this will be impacted by subsidence ponding and 54 ha may be subject to tension cracking. The proponent indicated that the black ironbox population occurring along Hail Creek would be maintained. The extent of impact to this population may be greater than predicted as:
- a. The combined impact of changes to the hydrological regime, and impacts associated with subsidence (e.g. alteration to the flow path, bank erosion and avulsion, and modification of hydraulic parameters) have not been assessed.
  - b. Whilst areas subject to connective cracking have been identified, impacts associated with the loss of alluvial groundwater have not been considered.
  - c. The mitigation measures for impacts to the 54 ha of high value habitat for black ironbox due to tension cracking are assumed by the proponent to be effective, but no evidence was provided.

Question 3: Will tension cracks lead to substantial damage to riparian vegetation along Hail Creek? Is it likely that subsidence cracks will be adequately filled by sediments during heavy rainfall?

Response

16. Subsidence tension cracks may damage riparian vegetation by draining shallow/perched aquifers (riparian water sources) via connective cracking and physically damaging trees through root shear and bank erosion/slumping. The potential impacts from subsidence on riparian vegetation and aquatic ecosystems were not adequately addressed in the DPD and therefore the likelihood of substantial damage is uncertain.
17. Subsidence tension cracks may fill with sediment during heavy rainfall but this will depend upon factors including the width of cracks, the surface gradient, and the substrate composition. There is a lack of information or evidence provided in the assessment documentation to support the posit that tension cracks will fill with sediment during heavy rainfall.

Explanation

18. The proponent indicated that surface subsidence cracks can be readily sealed through crack remediation. There is a lack of discussion or supporting evidence in the assessment documentation to suggest these approaches may be effective. Given this uncertainty, ongoing monitoring, in particular of the condition of riparian vegetation, is needed to determine if additional mitigation measures should be implemented (Commonwealth of Australia 2014). On-site sediment mobilisation investigations would help to quantify if cracks are likely to be filled and over what time-frame.

Question 4: Will Brumby Waterhole be impacted by dewatering? Will any other mining practices associated with this project, such as blasting, be likely to impact on Brumby Waterhole?

Response

19. There is insufficient evidence to support the proponent's conceptualisation of the groundwater source of the Brumby Waterhole and it is therefore uncertain whether the waterhole will be

impacted by dewatering. There is a risk that groundwater drawdown may impact the waterhole should the proponent's conceptualisation be incorrect.

20. More detailed geotechnical evaluations are required to determine if other mining practices, such as blasting, may impact the Brumby Waterhole.

#### Explanation

21. The proponent considers that Brumby Waterhole will not be impacted by dewatering as it receives groundwater from a water-bearing fault that is hydraulically disconnected from groundwater systems that may be impacted by dewatering. This conceptualisation is based on limited data. Evidence supporting the presence of the fault and the groundwater source of the Brumby Waterhole is needed.
  - a. The Brumby Waterhole Groundwater Investigation Report (included as part of the assessment documentation) recommended pumping water from the waterhole to determine the rate of groundwater inflow. This proposal may have associated impacts on the ecological and cultural values of the site. Less invasive studies should be considered, including seasonal surface water and groundwater level monitoring.
  - b. Hydrogeological systems in the vicinity of the Brumby Waterhole should be characterised to enable a comparison of stratigraphy and groundwater levels across the inferred fault. This should inform understanding of the fault's presence, extent, influence on hydrology, and connection to surrounding aquifers. Targeted seismic studies may help to confirm the fault's presence.
  - c. Water chemistry analysis (including isotope studies) should be undertaken to identify the source of groundwater for the waterhole. As suggested in the Brumby Waterhole Groundwater Investigation Report, water quality sampling should be undertaken to establish a baseline water quality dataset. As per the ANZECC/ARMCANZ guidelines (2000), a minimum of two years of baseline data is suggested.
22. As the Brumby Waterhole is located upstream of the proposed project, there is low likelihood for mining practices and associated impacts, such as subsidence or discharges, to impact this site. However:
  - a. Given the magnitude of the predicted subsidence impacts to Hail Creek and subsequent change to aquatic habitats, they may become isolated from downstream environments and movement (dispersal and migration) of aquatic biota may be disrupted.
  - b. The potential for blasting to impact the proposed water-bearing nature of the fault has been identified in the Brumby Waterhole Groundwater Investigation Report. Blasting has the ability to increase fractures, and influence permeability and groundwater chemistry. Vibrational studies and higher resolution groundwater sampling between the blasting site and the waterhole, and at the waterhole, may assist in identifying any potential impacts associated with this activity.
23. After resolving the groundwater source(s) of the Brumby Waterhole, potential impacts to the waterhole associated with dewatering must be identified and assessed. This assessment should clearly identify values of the site (e.g. ecological and cultural), with ecological values informed by more than one survey. The proponent should indicate how impacts will be monitored and propose mitigation measures.

Question 5: Does the IESC have any concerns with the location of the voids in particular the potential losses of baseflow from Hail Creek?

Response

24. Yes. The concerns regarding the proponent's conceptualisation (as discussed in response to Question 1) mean that the potential impacts on water resources from the final voids are uncertain.

Explanation:

25. Concerns associated with the final voids include:

- a. The ongoing take of groundwater. The majority of this water is likely to be sourced from deeper aquifers, however the void location means that flow may be induced from overlying alluvial aquifers. Any impacts on the alluvium, baseflow to Hail Creek, and associated biota have not been discussed in the project assessment documentation.
- b. The accumulation of contaminants, including total salts due to evapoconcentration, within the final void lake.
- c. The proximity of the voids to water-dependent assets if a release of water from the void were to occur. The final voids are predicted to act as groundwater sinks (i.e. there will be no flow of water from the void to regional surface water or groundwater resources), but this needs to be confirmed through further assessment as discussed in response to Question 6.

Question 6: Does the IESC agree with the proponent's conclusion that the voids will be of sufficient capacity that they will be unlikely to overflow during flood events?

Response

26. No. Further evidence, including sensitivity and uncertainty analysis on the final void water balances and further assessment of the risk of flood ingress, should be provided to support the proponent's assertion that final voids will not overflow.

Explanation

27. Analysis of sensitivity and uncertainty of the water balance would be beneficial to assess final void water levels and the likelihood of the final voids discharging water into surface water and groundwater resources.
28. Flood ingress has not been considered as part of the final void water balance assessment as it assumes that establishment of flood protection levees will provide flood immunity. However:
  - a. Flood protection has been designed for a 1:1,000 Annual Exceedance Probability event. As the final voids will be permanent structures, the risks to water resources under the worst-case scenario (i.e. the probable maximum flood event) should be assessed.
  - b. There is a possibility of levee failure (particularly with any residual subsidence effects). The details of levee design need to be provided to assess the feasibility of flood protection of the final voids.



Question 7: Would backfilling to prevent excessive groundwater seepage be an effective management option to ameliorate post mining flow rates to the final voids? Are there any risks involved with this approach?

Response

29. Yes, backfilling could be an effective management option to reduce ongoing groundwater take associated with the final voids. However, there are risks involved with this approach. The proponent should assess the risks to water resources associated with various options for the final landform to inform its design.

Explanation

30. While backfilling may reduce groundwater losses to final voids, there is a risk that voids filled with overburden material may leach water through the spoil and potentially impact water quality within surrounding water resources. Leachate from waste rock and coal reject materials at the proposed site may be of concern with regard to sodicity and metalliferous leaching (particularly arsenic and selenium).

31. Although the geochemical assessment for the proposed project (Golder Associates, 2015) provides good references for coal reject and waste rock materials, a geochemical assessment of the target coal seams and open cut materials for the proposed project needs to be undertaken to ensure that results are representative of the proposed project.

32. The proponent should assess the various options for backfilling. If final voids are not to be backfilled, results should be presented which show that backfilling is not viable, including in terms of technical feasibility and potential adverse environmental outcomes. The final landform should be designed with consideration of impacts to water resources in perpetuity. Mitigation, monitoring and management measures should be proposed to ensure impacts are minimised to acceptable levels.

33. The following actions would assist to adequately assess the risk of seepage from backfilled (or partially backfilled) pits:

- a. The installation of additional bores in the Hail Creek alluvium between the open cut pits and Hail Creek to monitor water level and water quality to better estimate impacts of the proposed project on the alluvium.
- b. An assessment of the potential for shallow groundwater seepage from the backfilled voids towards Hail Creek, including the travel times and volume of seepage. Contaminant transport modelling may be necessary to support this assessment.
- c. 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.

Additional matters identified by the IESC for consideration by the Regulator

*Surface water*

34. Surface water quality data presented within the assessment documentation indicated that many water quality parameters are above the Isaac sub-catchment guidelines (DEHP 2011) or ANZECC/ARMCANZ (2000) guidelines for aquatic ecosystems. To ensure impacts to surface water quality can be detected and mitigated, local water quality objectives need to be established and improvements made to the proposed monitoring network:

- a. The surface water quality assessment presented in the assessment documentation is insufficient to establish baseline conditions. Issues with the existing assessment include data quality and inadequate analytical limits of detection, and the potential for impacts from the currently approved Hail Creek Mine project and loss of control sites. These are discussed further in Appendix F of the Surface Water Assessment (Attachment F of the DPD).
  - b. Additional baseline water quality monitoring, and monitoring sites should be considered. For example, monitoring locations on Schammer Creek and Hail Creek upstream of the project boundary should be developed as the existing control sites for mine discharges are likely to be impacted by the proposed project.
  - c. Water quality data from the impact-monitoring sites for the existing Hail Creek mine should be excluded from establishing baseline water quality conditions.
  - d. Data validation and quality assurance should be undertaken. Data not meeting the appropriate standards should be discarded in establishing baseline water quality conditions. Contextual information about the surface water quality dataset, such as time, frequency and corresponding flow level of sampling should be provided.
35. The proposal involves the release of mine water throughout the life of the project (median of approximately 8,500 ML per year during underground operations). While the proponent identified this will occur within the currently approved Hail Creek Mine project's existing release conditions, more frequent releases may be required, and additional release points to creeks in the project area are proposed. Additionally, the water balance has not been described in sufficient detail to understand the changing water inputs and outputs associated with the proposed project, and volume of water that is proposed to be released. To ensure that potential impacts from discharges are adequately assessed:
- a. The proponent should provide further detail on associated impacts, and how releases will be managed to ensure impacts to water quality and the flow regime within and downstream of the project area will be minimised.
  - b. The existing release conditions should be reassessed given the changing nature of the operations (e.g. increased volume and frequency of required releases, the potential for impacts to water quality within the receiving watercourses due to subsidence, and the potential for changed nature of contaminant loading in discharges due to underground extraction).

*Assessment of impacts to aquatic ecology*

36. Aquatic ecological values that may be impacted by the proposed project have not been sufficiently identified. The aquatic ecology survey was undertaken on one occasion, and did not include sites within Hail Creek, and potential impacts to aquatic ecology have been discounted. For example, the proponent concludes that:
- a. Despite subsidence disturbances, the ecological values of Hail Creek and Schammer Creek would be maintained due to the transitory and dynamic nature of aquatic habitats, the inherent resilience of the extant ecosystems, and upstream and downstream biota being available to recolonise disturbed habitat (DPD, Att. G, p. 76).
  - b. Fish passage will not be impeded as subsidence troughs are predicted to fill as they are created, and the system is expected to stabilise and provide ephemeral habitat with pool-riffle sequences in times of flow in much the same manner as the existing system behaves (DPD, Att. G, p. 76-77). While this impact is considered within the assessment documentation, it is discounted on the basis that subsidence voids will fill, reducing creek bed-level variation.

37. The aquatic survey did not take into account the potential for impacts to occur over an extended period, the time taken for ecosystems to re-establish, and relies on the assumption that subsidence voids will be infilled as they are created. The proponent's assessment should consider the uncertainty associated with the calculations of the infilling of subsidence voids (as noted in Paragraph 10). Evidence that similar ecosystems subjected to this type of disturbance are maintained would further improve the assessment.
38. Given the uncertainty associated with impacts to aquatic ecology, information presented in the assessment documentation, including the ongoing environmental monitoring program, should clearly define how impacts will be detected, and propose practical mitigation measures to ensure impacts are minimised and/or remediated.

<b>Date of advice</b>	10 December 2015
<b>Source documentation available to the IESC in the formulation of this advice</b>	Draft Preliminary Documentation (DPD) 2015. Hail Creek Coal Mine Extension Transition Project, Rio Tinto Coal Australia.
<b>References cited within the IESC's advice</b>	<p>ANZECC/ARMCANZ, 2000. Australian Guidelines for Water Quality Monitoring and Reporting. National Water Quality Management Strategy (NWQMS). Canberra: Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.</p> <p>Barnett, B., Townley, L. R., Post, V., Evans, R. E., Hunt, R. J., Peeters, L., Richardson, S., Werner, A. D., Knapton, A. &amp; Boronkay, A., 2012. Australian groundwater modelling guidelines, Waterlines report, National Water Commission, Canberra.</p> <p>Commonwealth of Australia, 2014. Temperate highland peat swamps on sandstone: evaluation of mitigation and remediation techniques, Knowledge Report, prepared by the Water Research Laboratory, University of New South Wales, for the Department of the Environment, Commonwealth of Australia.</p> <p>DEHP (Department of Environment and Heritage Protection), 2011. Isaac River sub-basin environmental values and water quality objectives, Queensland Government.</p> <p>DSITIA (Department of Science, Information Technology, Innovation and the Arts), 2014. Guideline for the environmental assessment of subterranean aquatic fauna, Queensland Government.</p> <p>Golder Associates, 2015 Hail Creek Transition Project Geochemical Assessment, prepared by Golder Associates for Rio Tinto Coal Australia.</p> <p>IESC, 2015. Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals [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> <p>Richardson, S., Irvine, E., Froend, R., Boon, P., Barber, S. &amp; Bonneville, B., 2011. Australian groundwater dependent ecosystems toolbox part 2: assessment tools, National Water Commission.</p>