

## **IESC 2016-076: Hillalong Coal Project (EPBC 2012/6566)**

---

<b>Requesting agencies</b>	The Australian Government Department of the Environment Queensland Department of Environment and Heritage Protection (EHP)
<b>Date of request</b>	6 April 2016
<b>Date request accepted</b>	12 April 2016
<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 and Queensland's Department of Environment and Heritage Protection to provide advice on the Hillalong Coal Project in Queensland.

This advice draws upon aspects of information in the Environmental Impact Statement, together with the expert deliberations of the IESC. The project documentation and information accessed by the IESC are listed in the source documentation at the end of this advice.

The proposed Hillalong Coal Project (the project) is located 15 kilometres east of Glenden in the northern Bowen Basin of central east Queensland. The project is located within the Suttor River catchment which forms part of the larger Burdekin River catchment.

The project includes two open cut pits and 14 underground longwall panels, with a proposed operation life of 17 years and production of 4.2 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal from the Rangal Coal Measures. The project includes associated mine infrastructure including a 20-kilometre long transport corridor containing an access road and haul road, train load-out facility, rail balloon loop, coal handling and processing plant, sewage and waste management facilities and worker accommodation camp.

### Key potential impacts

There is a number of potential localised impacts associated with the project, including:

- Changes to water quality and flow regime with associated impacts on local riparian and water-dependent ecosystems resulting from groundwater drawdown, mine water discharges and leachate.
- Changes to volumes and discharges of local springs associated with drawdown of the water table and depressurisation of coal measures.

- Changes to surface water hydrology and sedimentation rates due to subsidence above longwall panels and within tributaries.

#### 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*

Surface water, groundwater and climatic data collected so far are too limited to adequately assess the project areas' existing hydrological and ecological conditions and their natural temporal variability.

While the system of springs and seeps in the area is not directly associated with listed Matters of National or State Environmental Significance, these water sources may play an important role in maintaining local ecosystems and their biota within the catchments of the ephemeral Suttor and Exe Creeks. The IESC considers that the proponent should undertake additional mapping, conceptualisation and assessment of ecological function and significance of these springs, seeps and water-dependent ecosystems.

There is limited spatial coverage and time series of groundwater data to develop a suitably conceptualised and parameterised groundwater model, reducing confidence in the predicted impacts. Additional hydraulic and piezometric monitoring data from parts of the model domain sensitive to predictions should be included in the process of ongoing refinement of the groundwater model.

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

The methods used for subsidence assessment are appropriate, although predictions may underestimate height of fracturing connected to the goaf above longwalls. The potential impacts to overlying surface drainages are poorly described.

The assessment of aquatic ecosystems has not yet included sampling during and immediately after a flow event, reducing confidence in complete assessment of existing conditions.

As noted by the proponent, the stygofauna assessment requires at least an additional round of sampling. This should be accompanied by more in-depth analysis of the findings including interpretation of likely impacts to stygofauna from predicted hydrological changes.

The groundwater modelling approach requires further justification of the extent of the general head and no-flow boundary conditions within the model, the appropriateness of the modelled extinction depth and consideration of drain cells (or similar) along Exe Creek to allow groundwater discharge from the model.

The flood modelling methodology is not appropriate for the operation and post-operation stages of the project due to the lack of consideration of infrastructure, open cut pits and final landforms.

The risk assessment used an appropriate methodology.

## Advice

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

Question 1: Does the Committee consider that the information provided in the EIS documentation (including baseline and modelled data), and the conclusions drawn by the proponent are appropriate to assess the project's impacts on water resources and water-related assets?

In this regard, comment is sought on the following matters identified by the Queensland Government:

- a) The selection of hydrostratigraphic units (HSUs) as an appropriate grouping of similar formations for the purposes of modelling potential impacts.
- b) The reasonability of the boundary conditions used in the numerical model construction.

## Response

1. No. There are insufficient water quality and aquatic ecological data collected under different flow conditions to provide confidence in the proponent's assessment of potential impacts to water resources and water-related assets. There is inadequate spatial coverage of groundwater data across the project area including to the north, the north-east along Exe Creek and nearby springs, and along Suttor Creek.
2. The IESC considers that the selection of hydrostratigraphic units is appropriate for the current model scale and level of groundwater information obtained by the proponent. However, the limited data collected reduces confidence in the model's ability to predict impacts. An improved hydrogeological conceptualisation identifying groundwater flows and spring sources would increase confidence in predictions. Consideration of alternative modelling approaches (e.g. unstructured grid methodologies) better able to represent complex areas, such as Exe and Suttor creeks and springs, within the model domain may also assist this process.
3. Justification based on site-specific evidence is needed to support the general head boundaries to the northwest and southeast applied in the groundwater model. The boundary conditions in the vicinity of Exe Creek do not enable discharge of groundwater, which is inconsistent with the hydrogeological conceptualisation that groundwater within the Elphinstone seams discharges along sections of Exe Creek (EIS, Appendix 9, p. 3-18).

## Explanation

### *Groundwater data*

4. Additional groundwater data (water level and quality) are needed to build on the one year of data gathered so far. The proponent's hydrogeological conceptualisation would be improved by increasing the spatial and temporal extent of their groundwater monitoring network, particularly in areas where springs are located; to the north and northeast of the site to delineate and monitor potential impacts to Exe Creek; and to the south to monitor potential cumulative impacts associated with Hail Creek mine.
5. The choice of 12 m for an extinction depth for evapotranspiration (ET) appears to have a large impact on groundwater levels. This choice was partly based on the calibration and to cover elevation changes in discharge areas. This can be an unsatisfactory approximation as it can lead to discharge of hundreds of mm/yr even at water table depths of several metres. For more incised areas, water tables may be expected to be close to the lowest points within the grid cell. For flatter areas, it will lead to water tables being too low. The model currently simulates the piezometric levels in the Elphinstone at 8 m below the land surface in the Exe Creek region. Given this is a discharge area, it casts doubt on the ability of the model to estimate the zone of

influence of mining in the direction of Exe Creek. While it may be beyond such a regional model to accurately represent discharge through spring and stream baseflow, further consideration should be given to variable spatial application of the ET function across the site.

6. Assessments of the source aquifer for each of the eight reported springs close to the proposed project area have not been undertaken. Some springs and seeps may be related to deeper groundwater discharge as opposed to the contact zone between the basalt and underlying sediment layer. For example, Bottom End Spring and Blank Tank Gully Spring appear to discharge along the stratigraphical contact of the Elphinstone Coal Seams, and McCarthy's Spring is similarly located near to the contact subcrop of the underlying Fort Cooper Seam (EIS, Appendix 9, Fig. 2-14). Further assessment of the sources and hydrological and ecological significance of springs and seeps should be undertaken.

#### *Groundwater modelling*

7. There are uncertainties regarding model structure, parameterisation, model boundary conditions and associated predictions.
8. A sensitivity analysis of the effects of a variety of boundary conditions on model predictions has not been undertaken. Where data are not available to justify choices for boundary conditions, the proponent should undertake a sensitivity analysis to show the effect of different boundary conditions on groundwater flow and to identify the influence of boundary conditions on the range of potential groundwater impacts.
9. The groundwater model is inconsistent with the conceptualisation of discharge to Exe Creek due to a lack of drain cells (or similar) in areas of discharge. Further consideration should be given to representation of groundwater surface water interactions within the model (EIS, Ch. 11, Fig. 11-13).
10. An independent peer review of the proponent's groundwater model should be undertaken, as per the Australian Groundwater Modelling Guidelines (Barnett et al., 2012) and the IESC's Information Guidelines (IESC, 2015). This could be incorporated into the next phase of assessment following any changes the proponent makes to address comments on the groundwater model.

Question 2: What does the Committee consider are the key uncertainties, risks and impacts of the project to water resources and water-related assets? Is there additional information which could be provided to assist in the identification and assessment of impacts to water resources? In this regard, comment is sought on the following matters identified by the Queensland Government:

- a) The potential impacts to surface and groundwater quality from open pit mining, waste rock dumps, dams and disposal of waste products.
- b) The potential impacts from the release of mine affected water on surface water quality and ecosystem health.
- c) The potential incorporation of landform post subsidence and onsite water management infrastructure into the modelled flood scenario that was used to assess changes in water flows.
- d) Location of dams within existing waterways adjacent to Suttor Creek.
- e) Siting of waste rock dump on a subsidence area.
- f) The comprehensiveness of the stygofauna survey, noting that the Queensland guideline requires two seasons of sampling, and the potential need for further discussion of the survey findings and implications of the survey.

## Response

11. The IESC considers the key uncertainties are:

- i. physical and hydraulic properties of the groundwater system, and its interactions with surface water (especially seasonal waterholes and springs),
- ii. the flow and water quality conditions that the local downstream water-related ecosystems require to sustain ecosystem functions and complexity, and the potential water quality, volume and timing of impacts of mine water discharges, and
- iii. the potential contamination of groundwater and nearby areas of Suttor and Exe Creeks due to leaching from waste rock dumps and dams.

12. The IESC considers the key risks are:

- i. to downstream water quality and riparian and instream ecosystems due to impacts from mine water discharge and altered stream flows
- ii. to volumes and discharges of springs in the vicinity of the mine, and
- iii. increased long-term sediment and nutrient loads to Suttor Creek from erosion related to subsidence, siting of dams and final landforms.

13. The IESC considers the key potential impacts are:

- i. partial localised loss of biodiversity and impairment of ecosystem function within and downstream of the project area in Suttor and Exe creeks,
- ii. loss or reduction in flow from perennial and mostly perennial springs (those that dry only after severe drought) and associated impacts on local ecosystems (EIS, Appendix B of Appendix A9, Spring Survey),
- iii. localised contamination of groundwater and surface water bodies near waste rock dumps and mine dams, and
- iv. increased sedimentation and nutrient loading within Suttor Creek, potentially reducing waterhole longevity and affecting ecosystem health.

## Explanation

### *Groundwater quality impacts*

14. Potential impacts to groundwater quality include impacts associated with leaching from the waste rock dump site located within the subsidence zone and with groundwater flowing through pits backfilled with waste rock and tailings, potentially discharging to the surface adjacent to Suttor Creek. Although a large number of samples (82) were analysed for their contaminant forming potential, the geochemical characterisation did not assess the acid forming and contamination (metals and salinity) potential of the overburden or interburden in the location of the open cut pits. Further, geochemical characterisation was not undertaken on the coal seams. An understanding of the chemical composition and geochemical reactivity of the specific material to be extracted, including the waste rock and coal seams, is needed to determine if leachate from the waste rock pits or backfilled voids poses a long-term risk to the surrounding groundwater systems.

15. Inferred flow of shallow groundwater (i.e. the water table) east of the proposed project area is in the direction of Suttor Creek (EIS, Appendix A9, Fig. 2-9). There remains uncertainty whether shallow groundwater discharges to Suttor Creek, through unidentified springs or through

contributions to riparian evapotranspiration. Understanding of the flow paths and discharges is needed to determine the potential impacts of the proposed project.

16. Points 14 and 15 above are important to inform monitoring of potential leaching through the backfilled final voids given the backfilled pits are predicted at the completion of mining to have increased hydraulic conductivity, and to become a source of groundwater to the surrounding area. The proponent should outline a monitoring network to identify any potential contaminant transport from the backfilled voids and waste rock dumps. Monitoring bores should be positioned between the backfilled pits and Suttor Creek and Exe Creek.

#### *Surface water quality impacts*

17. The IESC considers the potential impacts to surface water quality to include increased sediment, salt, nutrient and metal loads as well as changes to flow volumes and their temporal variability (especially in reducing the duration of surface flow in the ephemeral tributaries of Suttor and Exe Creeks). These changes are likely to impact on the associated water-related ecosystems; however, there is insufficient evidence presented to determine the likely magnitude of impacts.

#### *Mine water release impacts to ecosystems*

18. The release of mine-affected water has the capacity to impact on downstream ecosystems by increasing salinity levels (e.g. through evapoconcentration in seasonal pools of temporary streams) and to exceed tolerance levels of some biota such as fish and certain aquatic macroinvertebrates (e.g. Cañedo-Argüelles et al., 2013). To assess this risk:
  - i. baseline water quality data are required to support the proposed “end of pipe” electrical conductivity (EC) limit for discharges, in particular the proposed no flow/low flow end of pipe EC limit of 1,000  $\mu\text{S}/\text{cm}$  (EIS, Ch. 10, p 10-48).
  - ii. the project’s site water balance model should be revised and used to inform the changing water demand or surplus for the project, and the likelihood and potential volume of mine water discharges from the site.

#### *Surface water modelling – inclusion of infrastructure*

19. The extent and severity of impacts to Suttor Creek are uncertain as the influence of mine site infrastructure (particularly diversions around infrastructure) on flood extent and surface water flows are not incorporated into the surface water model.
20. Four tributaries of Suttor Creek are proposed to be intersected by mining infrastructure or the western open cut pit. The diversion drain is proposed to divert water from much of the catchments of four Suttor Creek tributaries. However, the ability of the diversion to contain this amount of water during larger rainfall events has not been assessed or modelled. The proponent’s surface water assessment for multiple or larger rainfall events should include the following:
  - i. Changes to water flow velocity and bedforms in Suttor Creek caused by the diversion, including to reaches of the creek downstream of the proposed project area,
  - ii. Peak water flow velocity within the diversion and identification of potential engineered structures needed to reduce velocity,
  - iii. Change in flood extent caused by the diversion, both within the diversion catchment and downstream of the diversion’s confluence with Suttor Creek,
  - iv. An assessment of changes in slope and chainage caused by subsidence for tributaries of Exe Creek and Suttor Creek,

- v. An assessment of changes in pond drainage, surface tilts, flow velocity and water-holding capacity along the drainages affected by subsidence, and
  - vi. Identification of likely zones of erosion and sediment deposition.
21. Utilising the above assessments and those already completed, the proponent needs to undertake a combined assessment integrating the cumulative effects of subsidence, mine infrastructure, diversions and water releases on flood extent, surface water flow changes (i.e. spatial and temporal changes in flow regime and velocity), likely changes to sediment and nutrient transport, and mine dam water release requirements in Suttor Creek, Exe Creek and their impacted tributaries.

#### *Mine water and dewatering dams*

22. Two dewatering dams located within or immediately adjacent to the drainage lines of two tributaries of Suttor Creek. The majority of the tributary catchments are proposed to be diverted prior to each dam's construction. The dams would be filled primarily with groundwater abstracted through dewatering. The primary risks associated with the dams are therefore related to discharge water quality and the potential leaching of contaminated water through the dam walls or base.
23. The waste rock environment dam located immediately adjacent to Suttor Creek and within the zone predicted to experience flooding for all years of Average Recurrence Interval (ARI) peak flood assessment (EIS, Appendix B of Appendix 8, Figs B1 – B17). There is uncertainty regarding the potential risk for extreme flows or flood events to breach the dam wall resulting in spillage of contaminated waste rock runoff into Suttor Creek, and the subsequent loss of water storage capacity following such an event. The proponent has not yet identified the levee construction details or the minimum levee height, although notes the dams will be constructed in accordance with the 2012 guidelines on Dam Safety Management, Australian National Committee on Large Dams (ANCOLD). To address this risk, the proponent needs to undertake flood modelling incorporating mine site infrastructure and detail flood mitigation measures for dams within the potential flood impact zone.

#### *Waste rock dump – subsidence*

24. Siting the eastern ex-pit waste rock dump on the subsidence zone increases the risk of contamination to downgradient shallow groundwater and therefore increases the risk of impacts to the upper reaches of Exe Creek.
25. Vertical subsidence at the location of the eastern ex-pit waste rock dump is predicted to be up to 3 m, with strains predicted to be around 12 mm/m and resulting in surficial fractures between 1 and 10 m in depth. An understanding of the chemical characteristics of the waste rock is needed to identify the source of leaching should it occur. A shallow fracture network under the eastern waste rock dump caused by subsidence could be a potential pathway for leachate into aquifers.
26. The proponent has indicated a commitment to additional monitoring of groundwater and surface water to establish if seepage is occurring. Groundwater quality monitoring bores should be installed downgradient from the eastern ex-pit waste rock dump to identify any contaminant migration and to monitor any changes in groundwater quality. Placement of monitoring bores between the waste rock dump and Exe Creek is also needed to monitor potential leaching into shallow groundwater that is potentially utilised by riparian vegetation associated with Exe Creek.
27. The identified surface water monitoring points in Exe Creek appear to be located appropriately to identify any changes in surface water quality caused by runoff.

### *Stygofaunal surveys*

28. As noted by the proponent, a second round of stygofauna sampling is required as part of the QLD guideline for the Environmental Assessment of Subterranean Aquatic Fauna (DSITIA, 2014). These guidelines state that a comprehensive survey must collect a total of 40 samples from a minimum of ten representative bores and these samples must be acquired over at least two seasons, with sampling occurring at least three months apart. The IESC notes the proponent's commitment to ongoing stygofauna monitoring through the operations stage of the project. This should be combined with more detailed analysis of stygofauna found, including classification to morpho-species level to confirm their existence outside the project area. There is also a need for more detailed assessment of likely impacts as a result of potential groundwater drawdown and localised contamination.

Question 3: Does the Committee consider that the potential cumulative impacts on water resources from other existing and proposed mining projects in the region have been adequately addressed, noting that there are a number of proposed and existing mines in that part of the Bowen Basin, including the expansion of the Hail Creek Mine and the Proposed Broughton Coal Mine.

### Response

29. Yes. The IESC considers that the potential cumulative impacts of the proposed and existing mines in the region were adequately identified, and are likely to manifest mainly in the Suttor River catchment downstream of the project, potentially affecting water-dependent ecosystems and water users within the Suttor Creek and upper Suttor River catchments through the release of mine-affected water from the proposed project and the Newlands, Suttor Creek, Wollombi, and Byerwen mines (EIS, Appendix 7, p. 9-2).
30. The proponent's cumulative impact assessment considered 17 coal or gas extraction activities or associated infrastructure within the Bogie Hills subregion. Although the Hillalong Coal Mine will contribute to cumulative impacts on groundwater and surface water resources and their ecology, this contribution is likely to be minor in comparison to these surrounding projects, especially considering the scale and location of the proposed project.
31. The Hail Creek Mine and the proposed Broughton Coal Mine, located to the southeast of the proposed project, are situated within a separate catchment to the proposed project, which reduces the potential for significant groundwater and surface water cumulative impacts from the open cut and longwall mines.
32. While the proponent acknowledges the potential for evapoconcentration of saline mine water discharge, the IESC notes that evapoconcentration (EIS, Appendix 7, p. 9-2), especially during the drying and pool stages of temporary streams, can also affect other aspects of water quality including pH and ecotoxicity of various contaminants (review in Datry et al., 2014). The IESC considers that to properly manage and mitigate impacts from mine water discharges, additional studies are required to determine baseline conditions (under a range of flow conditions) of ecosystem health, together with salinity and ecotoxicological thresholds for biota and ecosystem processes within Suttor Creek and downstream.

### Explanation

33. The nearest existing mine, the Hail Creek Mine, is situated 8 km southeast of the proposed Hillalong mine, but is located on a separate synclinal structure to the Exevale Syncline meaning that the target coal seam is disconnected from the coal seams at the Hillalong Mine.
34. The predicted maximum drawdown cones between the Hillalong (predicted basecase 0.5 m drawdown) and Hail Creek (predicted 1.0 m drawdown) mines are approximately 1 km apart, with



the Hail Creek Mine drawdown being generally contained within a separate enclosed syncline (EIS, Appendix 9, p 3-47).

35. Changes to groundwater quality at Hillalong and Hail Creek mine sites would be expected to be localised with negligible potential for cumulative effects (EIS, Appendix 9, p. 3-47).
36. The Hillalong mine and the Newlands Coal, Suttor Creek, and Wollombi mines are located within the less developed Suttor River catchment of the greater Burdekin Basin. The majority of mines in the region are located along the Isaac River within the greater Fitzroy Basin.
37. Surface water flows in Exe Creek are likely to decline due to rainfall collection and captured surface runoff in open cut pits and subsided surface depressions. As the proposed project is in the upper reaches of Exe Creek, impacts from surface flows are likely to be ameliorated by inputs from tributaries downstream.
38. Cumulatively mining activities in the region may increase fragmentation of remnant native vegetation in the central and eastern parts of the project area (EIS, Ch. 15, Fig. 15-19) and vegetation corridors for wildlife movements in the region.

Question 4: Does the Committee consider that the measures and commitments proposed in the EIS are appropriate to mitigate and manage impacts to water resources and water-related assets? If not, what additional measures and commitments are required?

#### Response

39. No. Although the IESC considers that most of the mitigation and management measures and commitments (EIS, Ch. 21 and Ch. 22) are generally appropriate to manage and mitigate impacts to water resources and water-related assets, several additional measures, as outlined below, should be considered.

#### *Surface water management*

40. Develop sediment control and river morphology management measures to ensure ongoing existence and viability of waterholes potentially affected by increased sedimentation and altered flow regimes.
41. Ensure suitable reference sites outside the area of potential impact are chosen to enable discrimination of mine-induced impacts from natural environmental variability in flow, water quality and water-dependent ecosystems.
42. Include additional studies considering the suitability of proposed discharge water quality thresholds (EIS, Ch. 10, Table 10-17) through improved understanding of: a) downstream extent of water quality impact, b) water quality changes with time after flows cease, c) water quality thresholds required to maintain ecosystem health, and d) consideration of appropriate biomonitors (e.g. sentinel fish species) to use in conjunction with water quality measures to assess ecological impacts.

#### *Groundwater management*

43. Undertake additional studies to develop improved understanding of likely waste rock and backfill leachate composition and its potential likely effect on groundwater quality. Further, additional monitoring wells (and mitigation measures for cases where impacts are identified) should be considered downgradient of backfilled open cut pits and waste rock dumps.
44. The Queensland Open Source data mapping of basalt differs from the CSIRO mapping (EIS, Ch. 11, Figs. 11-4 and 11-5) contributing to uncertainty in the conceptualisation of spring sources in

the area. Improved mapping, conceptualisation, assessment and monitoring of springs and seeps across the project area will: a) improve prediction and determination of mine-induced impacts and b) inform consideration of suitable supplementary environmental flows if existing spring flow is impacted.

45. Make an additional assessment of water quality requirements and thresholds of potentially impacted GDEs, including springs, instream and riparian ecosystems, to ensure provision of environmental flows sourced from mine dewatering (proposed in EIS Ch 22, p 22-28) does not negatively impact sensitive GDEs, especially through chemical contamination.

#### *Ecological management*

46. Undertake additional studies into the composition and thresholds of aquatic faunal communities associated with waterholes in the vicinity and downstream of the mine, under a variety of flowing, pooled and drying conditions. This is because the pulsed flows typical of temporary streams can create pulses in concentrations of contaminants that may exceed tolerance levels of instream and riparian biota (Datry et al., 2014).
47. Undertake additional studies into instream and riparian GDEs downstream of the project area to assess existing condition and ecological thresholds related to sediments, likely contaminants associated with mine water discharge and altered flows.
48. Consider mitigation measures and management of potential impacts to the *Eucalyptus tereticornis* riparian woodlands located adjacent to and downstream of the East Waste Rock Dump (mapped in EIS, Ch. 15, Fig. 15-1) and the associated release points from associated waste rock dump sediment dams. Relevant hazards include groundwater drawdown (Reardon-Smith et al., 2010) and groundwater contamination.

Question 5: Does the Committee consider the monitoring and management framework proposed in the EIS is adequate to address the uncertainties and risks of the project?

#### Response

49. No. The proposed monitoring approach for surface water and groundwater systems and associated ecosystems is limited spatially and temporally, which reduces the capacity to address uncertainties and for the proposed management framework to successfully manage the risks associated with the project.

#### Explanation

50. The EIS states the proponent will determine appropriate local water quality objectives as part of the Receiving Environment Monitoring Plan (EIS, Ch. 22, pp. 22-26). Spatial and temporal expansion of the surface water monitoring networks, including event-based monitoring of surface water quality in temporary streams and additional assessment downgradient of the project area should be considered in this process.
51. Additional groundwater monitoring locations are required to reduce uncertainty in model predictions and to monitor changes during and post operations. Locations to consider obtaining additional hydrogeological data and installing monitoring bores include, but are not limited to:
  - a. downgradient of waste rock dumps, sediment dams and dewatering dams to monitor potential leaching
  - b. in the vicinity of the conceptualised discharge zone near Exe Creek and in the vicinity of the northern boundary of the model domain to validate boundary condition choices

- c. the southeast of the project site to monitor potential cumulative impacts associated with Hail Creek Mine
  - d. within areas of potential riparian and terrestrial groundwater-dependent ecosystems to enable assessment of groundwater dependence and to determine mine-related impacts during and post operations.
52. Two event-based surface water monitoring points are proposed along Suttor Creek. The furthest upstream monitoring point is downstream of release point 1 (mine water dam release). Data collected at this monitoring point will not be representative of uncontaminated water. An additional surface water monitoring point is needed upstream of any mine release points and diverted Suttor Creek tributaries to gather surface water quantity and quality data upstream of the mine influence. The upstream monitoring point should be used as a comparative reference point to inform surface WQOs and aid in the determination of surface water impacts. Alternatively, Suttor Creek could be monitored prior to mining commencing to ascertain baseline conditions.

---

**Date of advice** 23 May 2016

---

**Source documentation available to the IESC in the formulation of this advice** Queensland Coal Exploration, 2016. *Hillalong Coal Project Environmental Impact Statement*.

---

**References cited within the IESC's advice**

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.

Barnett, B., Townley, L.R., Post, V., Evans, R.E., Hunt, R. J., Peeters, L., Richardson, S., Werner, A. D., Knapton, A. & Boronkay, A., 2012. Australian Groundwater Modelling Guidelines, Waterlines report, National Water Commission, Canberra.

Cañedo-Argüelles, M., Kefford, B.J., Piscart, C., Prat, N., Schäfer, R.B., & Schulz, C.J., 2013. Salinisation of rivers: an urgent ecological issue. *Environmental Pollution*, 173,157-167.

Datry, T., Larned, S.T. & Tockner, K., 2014. Intermittent rivers: a challenge for freshwater ecology. *BioScience*, 64, 229–235.

DSITIA, 2014. Guideline for the Environmental Assessment of Subterranean Aquatic Fauna: Sampling Methods and Survey Considerations. Queensland Government, Brisbane.

IESC. 2015. Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals [Online]. Available: <http://www.iesc.environment.gov.au/system/files/resources/012fa918-ee79-4131-9c8d-02c9b2de65cf/files/iesc-information-guidelines-oct-2015.pdf>.

Larned, S.T., Datry, T., Arcsott, D.B., & Tockner, K., 2010. Emerging concepts in temporary-river ecology. *Freshwater Biology*, 55, 717-738.

Queensland Government. Technical Guideline, Wastewater release to Queensland

---

---

waters. Department of Environment and Heritage Protection EM112, Version 1.  
<https://www.ehp.qld.gov.au/assets/.../pr-gl-wastewater-to-waters.pdf>

Reardon –Smith, K., Le Brocque, A., & House, A., 2010. Riparian woodland dysfunction is driven by groundwater decline in a northern Murray-Darling intensive production landscape. In: Annual Conference of the Ecological Society of Australia (ESA 2010): Sustaining Biodiversity - the next 50 Years, 6-10 Dec 2010, Canberra, Australia.

---