

Advice to decision maker on coal mining project

IESC 2018-097: Middlemount Coal Mine Western Extension (EPBC 2017/8130) – Expansion

Requesting agency	The Australian Government Department of the Environment and Energy
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Date of request	26 September 2018
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Date request accepted	27 September 2018
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Advice stage	Assessment
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The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) provides independent, expert, scientific advice to the Australian and state government regulators on the potential impacts of coal seam gas and large coal mining proposals on water resources. The advice is designed to ensure that decisions by regulators on coal seam gas or large coal mining developments are informed by the best available science.

The IESC was requested by the Australian Government Department of the Environment and Energy to provide advice on Middlemount Coal Pty Ltd's - Middlemount Coal Mine Western Extension Project in Queensland. This document provides the IESC's advice in response to the requesting agency's questions. These questions are directed at matters specific to the project to be considered during the requesting agency's assessment process. This advice draws upon the available assessment documentation, data and methodologies, together with the expert deliberations of the IESC, and is assessed against the IESC Information Guidelines (IESC, 2018).

Summary

The Middlemount Coal Mine Western Extension proposes expansion of an existing approved open cut coal mine in Queensland. The proposed project will extend the current mine life by six years and recover an additional 21 million tonnes (Mt) of metallurgical and thermal coal. The proposal expands on the *Environment Protection and Biodiversity Conservation* (EPBC) Act 1999 approval 2010/5394 and EPBC approval 2016/7717.

The groundwater assessment appears generally appropriate, though the projected impacts are dependent on a number of assumptions that would benefit from further hydrogeological characterisation and investigation, based on field measurements, which would help improve confidence in the model's predictions of groundwater drawdown.

The surface water assessment is sound, covering water quality, changes to flows and the likely impact of unfilled final voids. The proponent has made good use of the data collected as part of existing and surrounding mine operations. Water balance modelling using OPSIM has been in place and continually updated since the inception of the mine. Flood modelling using URBS and TUFLOW has been developed and appears fit for purpose. References and some detail of the water management plans in place for current approved operations have been provided but without seeing the plans in their entirety, the IESC cannot assess their suitability for the current proposal.

Ecological surveys reveal the project area contains EPBC Act-listed Brigalow Threatened Ecological Community (TEC); habitat supporting the potential presence of four EPBC Act-listed species (one of which has been confirmed by targeted surveys); a High Ecological Significance (HES) wetland and several Queensland Regional Ecosystems (REs). The proponent has proposed offsets for predicted disturbance of these ecological assets. However, there is little information available in the proposal to address potential risks to groundwater dependent ecosystems (GDEs), external, but nearby, to the project, e.g. the wetlands to the north of the project area.

Context

The Middelmount Coal Mine Western Extension is approximately 3 km south-west of Middelmount Township. Target seams for production include the Middelmount, Tralee and Pisces seams of the Rangal Coal Measures. The proposed project is in the Roper Creek catchment within the Mackenzie River sub-basin of the greater Fitzroy Basin, Queensland.

The Middelmount coal mine is an open cut operation. The Middelmount Coal Mine Western Extension project comprises an extension of operations in the northwest of ML 70379 and into MLA 70027 to the east of the existing approved operation. Proposed surface disturbance of the extension is approximately 575 ha. In addition, changes to approved infrastructure and the approved final landform are being sought to allow further road construction and an additional final void to be located in the south of ML 70379. As part of the approval of Stage 2 of the project, the proponent is licensed to divert water flow in Roper Creek and Thirteen Mile Gully. The project proposes to extend and realign Thirteen Mile Gully to 1 km upstream of the existing levee. Current operations are managed under EA EPML00716913 (21 May 2018). The Interim IESC provided advice on the Stage 2 project on 31 July 2012.

Water-related assets in the surrounding region include a number of wetlands offsite, close to the northern boundary of the proposed project as well as five landholder bores used for water supply 5-10 km to the north. There is also the potential presence of groundwater-dependent terrestrial and riparian vegetation in these areas.

Key Potential Impacts

On the basis of information in the Preliminary Documentation (PD), the key potential impacts are identified to be:

- groundwater interaction/leakage from the final voids due to probable fracturing associated with the Jellinbah Fault that lies close to the eastern boundary of both voids.
- indirect impact as a result of groundwater drawdown to at least two wetlands (extents and areas unknown) in adjoining property close to the northern boundary of the proposed project.
- changes to water quantity and quality within the floodplain from the two final voids as a result of potential overtopping and leakage into or from groundwater. There is also a risk of density-driven groundwater flow arising from salinity build-up in the final voids.
- changes to surface water quality as a result of uncontrolled releases from site water management storages and potential impacts to downstream aquatic ecosystems and users.

- direct removal of an approximately 0.75 ha wetland and surrounding regulated vegetation defined in Queensland as being of High Ecological Significance (HES).

The IESC has identified areas in which additional work or information is required to address the key potential impacts, as detailed in this advice. These are summarised below.

- Clarify the hydrogeological character of the Jellinbah Fault and associated fracture systems within the project area to reduce uncertainty in the groundwater model conceptualisation and associated predictions.
- Provide greater detail of the fault characterisation drilling program that was referenced and used to inform the conceptual and numerical modelling.
- Hydrogeological parameters (such as hydraulic conductivity and specific storage) should be measured and used to inform the numerical groundwater model.
- Design and construction of the Thirteen Mile Gully diversion should follow recommendations by White et al. (2014) to incorporate channel variability to support ecological function.
- Further detail and characterisation of surface water release events noted in the PD should be presented. It is unclear if these releases were controlled or uncontrolled. If uncontrolled, management plans should be updated to account for the circumstances leading to the discharges.
- Site-specific surface water quality guidelines should be derived from historical monitoring data for a range of parameters.
- Further consideration of how the project can be modified to retain the HES wetland. If the wetland cannot be retained, further explanation of the suitability of proposed wetland offsets to account for the loss of the HES wetland is needed.
- Placement of additional monitoring bores screened at appropriate depths (including nested bores) and in locations to provide information about the hydrogeology of shallow groundwater, in the areas between the northern final void and neighbouring wetlands. This will inform assessment of risks to potential GDEs associated with these wetlands.
- Reconcile the discrepancy between the assertion that terrestrial vegetation is unlikely to be a GDE as the groundwater depth is beyond 12 metres below ground level (mbgl) with findings by Kath et al. (2014), which shows that two species found in the project area (*Eucalyptus camaldulensis* and *E. populnea*) can access groundwater below this depth and below the average measured depth provided in the PD.
- Further stygofauna sampling is recommended, especially in alluvial sediments (when saturated), and in bores in areas where drawdown is predicted. Results will guide risk assessment of drawdown on GDEs and development of a suitable monitoring program to inform an effective trigger-action-response plan (TARP).
- Further consideration of the long-term impacts of increasing salinity in final voids and the potential for density-driven flow to reverse predicted groundwater flow. This is particularly important given the proximity of the Jellinbah Fault to the two final voids.

Response to questions

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

Question 1 - Could the Committee please advise on the adequacy of information provided in the draft PD (including the adequacy and reliability of groundwater modelling), and the veracity of conclusions made by the proponent, for understanding and assessing the project's potential water-related impacts. In particular groundwater drawdown impacts and changes to surface water regimes. If the information is not sufficient, what additional material would assist in the identification and assessment of potential impacts to water resources?

1. The proponent has generally presented appropriate information to understand and assess the proposed project's potential water-related impacts. The use of historical site-specific and regional surface water and groundwater data in the assessment of project-related impacts is commended. Further consideration and information on: shallow groundwater levels within the Quaternary Alluvium; characterisation of local and regional faults and associated fracture systems; historical discharges; field sampling and geochemical characteristics of waste rock; and GDEs is needed to ensure all potential impacts to water resources are addressed. These are discussed in more detail below.

Groundwater

2. The groundwater assessment in general has been appropriately considered and documented. The primary stated objectives of the numerical groundwater model are to predict mine inflows and to assess groundwater drawdown impacts on the surrounding environment. The proponent has provided an appropriate assessment of potential cumulative groundwater impacts for the project through incorporation of information from neighbouring mines and the proposed coal seam gas (CSG) project into the numerical model. However, further consideration of the conceptual model and model parameterisation is needed, especially as additional data are collected, to improve confidence in the model.
3. The provision of an uncertainty analysis gives more confidence in projected outcomes. A good example of this is shown in Figure 7.2 (PD, Attachment F, p. 26), where the 5 per cent and 95 per cent drawdown extents are presented for layers two and three (Tertiary and weathered Permian) of the groundwater model. This information is important in identifying potential risk of drawdown to the northern wetlands. Drawdown extents for layer one (alluvial sediments) are not presented. When additional bores and hydrogeological information are available to better characterise groundwater within this unit, predicted drawdown extents for layer one should be generated to inform appropriate management and monitoring options for GDEs within the zone of predicted impact.
4. The current hydrological conceptualisation (PD, Attachment F, Figure 6.8) is plausible but further consideration is needed on the representation of the Jellinbah Fault. The Jellinbah Fault is stated to dip east; however, the conceptual model presents the fault as a vertical feature. In addition, alternative conceptualisations should be considered (i.e. hydrogeological connections with GDEs) to allow a more comprehensive assessment of drawdown impacts.
5. Further information is also needed on the location and characteristics of faults identified within the project area, particularly the Jellinbah Fault and other minor faults noted in PD Attachment F Figure 5.4. The Jellinbah Fault is a prominent geological feature within the project area. Its location coincides with the eastern boundary of the two final voids. An intensive fault investigation drilling program (36 bores drilled along the fault) was carried out in 2017 (PD, Attachment F, p. 56). However only a summary of this investigation was presented and therefore cannot be fully assessed. The summary notes intersections with groundwater and potential presence of localised fracture zones.
 - a. Information from this drilling program, if not already obtained, should:
 - i. confirm the location and nature of the fault within the project area, including its damaged zone;

- ii. include the presentation of cross-sections through the geological model within the project area;
 - iii. describe the fault's potential influence on groundwater flow paths during mining operations (e.g. variation in stress conditions) and leakage from final voids; and
 - iv. inform the hydrogeological conceptual model and be incorporated into the groundwater model.
- 6. The scale and construction of the numerical model are adequate to limit boundary effects, and the model considers the presence of the Jellinbah Fault and cumulative impacts with nearby coal and CSG operations. However the following aspects require further information and consideration.
 - a. Model layer thicknesses should be provided.
 - b. Evapotranspiration (ET) was not applied due to depth of water below the groundwater surface. However, given the presence of overlying vegetation in the project and surrounding area, further consideration of ET is needed.
 - c. Recharge (0.06 mm/year) as applied to layer one only (alluvial sediments) and appears unrealistically low and below detectable limits. Justification should be provided on how this value was derived and how recharge is accounted for in areas not containing alluvial sediments.
 - d. Hydraulic parameters are based on the 2010 model for the Stage 2 project and do not appear to be based on any field testing. Future groundwater drilling and monitoring activities should consider pump testing to derive site-specific hydraulic parameters.
 - e. Pit inflows have been estimated from the groundwater model. Model estimates of groundwater inflow should be verified with site-based measurements.
- 7. These issues should be addressed by ongoing collection of site-specific hydrogeological information and using it to inform model conceptualisation and calibration. Uncertainty analysis that explores a broad range of realistic parameters and model conceptualisation should be completed.
- 8. The groundwater assessment concluded that riparian and terrestrial vegetation is unlikely to be dependent on groundwater, given the depth to groundwater is greater than 20 m, and the ephemeral nature of the watercourses. The IESC notes that two of the tree species occurring in the project area can access groundwater below this depth (Kath et al. 2014).
 - a. While alluvial sediments have been reported dry during drilling, the Quaternary Alluvium is stated to provide some recharge to underlying units and flow into surface water drainages following rainfall. There are no monitoring bores within the Quaternary Alluvium providing ongoing reference points for measuring groundwater fluctuations.
 - b. In addition, there are a lack of monitoring bores near the wetlands to determine the likely depth to groundwater at wetland sites (e.g. the HES wetland and individual wetlands to the north). This inhibits the assessment of groundwater dependence and potential impacts due to groundwater drawdown. This information should be gathered using strategically placed nested monitoring bores that would enable vertical and horizontal hydraulic gradients to be determined.
- 9. The potential interactions of the final void with groundwater are assumed by the proponent to be as an evaporative sink (PD, Attachment F, p. 84). However, the IESC notes that as the water within the final voids becomes more saline, the possibility of density-driven flow reversing the direction of groundwater flow away from the voids should be considered.

10. The peer review recommended the addition of groundwater monitoring bores between the project area and landholder bores to the north. The IESC supports this recommendation as it will provide ongoing groundwater monitoring and help validate groundwater drawdown predictions in this area.

Surface Water

11. The surface water assessment and modelling have been well considered and documented. Adopted data, methodologies and predictions are considered reasonable for the assessment of changes to surface water flow and flood characteristics as a result of existing and proposed diversions and ongoing changes to landform. Further attention to parameter uncertainty could be considered in future model updates to improve confidence in model predictions. The site water management simulations look realistic although the accounting and reporting of water use could be improved by referring to the Minerals Council of Australia (MCA) Water Accounting Framework (Minerals Council of Australia 2014).
12. Flood impact management is stated to be suitable to manage the 0.1% AEP flood. The IESC notes that the degree of non-linearity assumed for the flood model is lower than usually adopted (0.7), and it is doubtful that there is sufficient evidence in the locally calibrated event to support this assumption. However, this is likely to result in the flood estimates being conservatively high, so this provides additional confidence in the assessed level of flood protection.
13. The outcome of the diversion is stated to be consistent with Queensland watercourse diversion guidelines. The functional characteristics of the realigned diversion are stated to be the same as the existing diversion. Some variability in channel characteristics, as illustrated in Figure 6.2, should be incorporated into the design as recommended by White *et al.* (2014).

Site water management

14. Overall the Middlemount coal mine has a water deficit with the need for water to be supplied via a pipeline from the former German Creek mine. Using regional rainfall data, the water balance model has been in place since mine operations commenced and is stated to have been continually updated. The variation in model parameters with land-use is consistent with both physical reasoning and with regional information and the proponent is to be commended for calibrating the model with data from the local mine site. To improve the accounting of water it would be helpful to report aspects of the water balance as monitored, modelled, and estimated as outlined in the MCA's Water Accounting Framework (Minerals Council of Australia 2014).
15. Monitoring data for the receiving environment for the three release events from the two sediment dams between January 2013 and February 2014 need to be provided. Investigations into the three release events were stated to have been completed to ensure compliance with the EA conditions. However limited information on the reason for release, and associated monitoring data during and after release, are not presented. Given the site water balance has a general water deficit and that the likelihood for discharges is low, the nature and reason for the three releases need to be addressed and associated management plans updated to reflect the possibility of another occurrence. Adequate responses (based on prior knowledge) need to be put in place to reduce the likelihood of reoccurrence and potential downstream impacts.
16. The February 2014 release event was noted to not comply with water quality guidelines due to elevated concentrations of zinc and copper (PD Attachment D, p. 40). The proponent stated that these contaminants were also elevated at the upstream reference site, suggesting naturally high background levels. The reasons for these exceedances at the reference site are not adequately considered or discussed. The IESC notes that monitoring of the receiving environment under natural flow conditions and during discharge events is a requirement under the EA (EA 21 May 2018, condition C19). However, there is currently not enough monitoring data available, for a range of

parameters, at these locations to make any statistically supported conclusions about instream water quality. Further monitoring and investigation should be considered to determine the cause of elevated metal concentrations, including zinc and copper at the upstream reference site. This investigation together with ongoing water quality monitoring should establish a robust dataset from which site-specific water quality guideline values can be derived.

17. The geochemical assessment is based on samples taken in 2012 and indicates a low potential for acid generation. However, there is a residual risk due to variability of materials and aerial oxidation pathways. Therefore, the potential for acid generation remains and sampling should continue until after mine closure.

Ecology

18. The ecological assessment was focused within the project area and did not consider wetlands to the north of the mine. The assessment of stygofauna was limited (see Paragraph 22-23). Potential GDEs within the project area and surrounds include terrestrial vegetation within the western extension area and riparian vegetation along surface water drainage lines and wetlands, including the HES wetland within the project area.
19. The proponent concluded that terrestrial vegetation within the project area is unlikely to be groundwater-dependent because groundwater was deeper than 12 mbgl. The absence of appropriately distributed monitoring bores, particularly in the Quaternary Alluvium and within the Tertiary units to the north, prevent field measurement of groundwater depth. Kath et al. (2014) shows that *E. camaldulensis* and *E. populnea* (both species that occur in the project area) may access groundwater at depths over 22 mbgl.
20. The project proposes to remove 0.75 ha of HES wetland within the project area. State of Queensland's (2018) WetlandInfo mapping shows two wetlands to the north of the project, which are potentially within the zone of groundwater drawdown. The characteristics of these wetlands have not been surveyed and assessed. Although these wetlands may be supported by perched groundwater within the Tertiary units, there are no shallow bores close to these features to measure their groundwater regime.
21. Although the diverted creeks are ephemeral, the planned diversion should incorporate suitable instream habitat heterogeneity (White et al. 2014) to optimise habitat diversity for benthic biota and promote hyporheic exchange during periods of flow. Deeper sections (e.g. pools) could be included that would hold water longer after flow ceases and act as refugial pools for aquatic biota.
22. Stygofauna are stated to be unlikely to be present within the project disturbance footprint, due to a combination of groundwater depth (>30 mbgl) in the Permian aquifer and the level of salinity (>20,000 $\mu\text{S}/\text{cm}$) in both the Permian and Tertiary aquifers. Stygofauna have been collected in Queensland from waters up to 54,800 $\mu\text{S}/\text{cm}$ (Glanville et al. 2016), suggesting that salinity cannot be used to rule out potential stygofauna presence. The Quaternary Alluvium is stated to be predominantly dry in the mine vicinity and therefore unlikely to support stygofauna. However, there are few empirical data available to justify this conclusion and further sampling is recommended (see Paragraph. 23).
23. Although desktop analyses implied stygofauna were unlikely to be found in the project area, stygofauna sampling of bores around the Middlemount Coal Mine in 2011 revealed at least two taxa (Oligochaeta and Copepoda) from bores within and outside the maximum zone of drawdown (PD, Attachment E, p 55). Given these findings, further stygofauna sampling is recommended, especially in alluvial sediments (when saturated), and in groundwater bores in areas where groundwater drawdown is predicted. Appropriate sampling methods are described in the guidelines by DSITI (2015). Where possible, sampling should match up with baseline monitoring of groundwater levels and water quality. Results will allow the proponent to judge the extent of Type 1 GDEs (e.g. aquifers

harbouring stygofauna) and the risk of potential impacts of the proposed project so that a suitable monitoring program can be devised to guide an effective TARP.

Final Landform

24. The proponent has not examined the potential for hydraulic loading from out-of-pit waste rock dumps to modify the groundwater regime. The implications of processes associated with hydraulic loading for vegetation, surface-groundwater interactions and landform stability should be considered. In addition, the ongoing characterisation of this material is needed to inform final landform management.
25. The surface water assessment states that the voids will not interact with each other as levels are primarily driven by climatic conditions rather than groundwater inflows. However, this appears to be inconsistent with the groundwater assessment which suggests that a flow gradient from the northern void to the southern void will develop as the predicted water levels in the voids are at different levels. The proponent should clarify this relationship and interaction.

Question 2. Could the Committee please advise on the nature and extent of the project's expected impacts on water resources? In particular impacts to GDEs, groundwater users, and surface water resources?

26. From the information presented in the PD, the IESC considers the nature and extent of impacts to water resources to include:
- a. direct removal of 0.75 ha of HES wetland and surrounding regulated vegetation at the northern boundary of the project.
 - b. direct removal of 1 km of riparian vegetation along Thirteen Mile Gully to accommodate the proposed diversion.
 - c. the removal of terrestrial vegetation within the western extension area, including 22 ha of EPBC Act-listed Brigalow TEC and 15.5 ha of associated gilgai habitat (PD, Attachment C Photo 15, p.72) suitable for the EPBC Act-listed Ornamental Snake (*Denisonia maculata*).
 - d. groundwater drawdown within the deeper Rangal Coal Measures, weathered Permian and shallow Tertiary units. Groundwater drawdown within the Tertiary units has the potential to impact the two wetlands offsite near the northern boundary of the project. The groundwater model predicts drawdown within the Tertiary unit and weathered Permian extending to these wetlands. The potential nature and extent of impacts to these wetlands have not been considered. The current predictions of groundwater drawdown indicate that the five privately owned bores used for water supply to the north of the project are not within the zone of groundwater drawdown.
 - e. potential changes to the surface water regime of Roper Creek as a result of the proposed diversion and levees and associated impacts during flood events. The proponent states that the diversion will provide environmental function equal to the currently approved diversion. The waste rock emplacements will reduce the extent and alter inundation frequency of the floodplain and increase flow velocities within the diversion and other drainage channels, permanently reducing potential floodplain habitat.
 - f. changes to surface water quality as a result of uncontrolled releases from the various onsite water storage dams (e.g. sediment dams) and potential impacts to downstream ecosystems.
 - g. changes to surface water quality due to leakage and/or uncontrolled release of poor and highly variable quality groundwater. The storage and management of groundwater inflows will be important to ensure elevated concentrations of particular parameters (e.g. Se, Ag and

hydrocarbons) do not pose a risk to surface water, nearby GDEs and downstream aquatic ecosystems in the event of an uncontrolled release.

- h. changes to groundwater quantity and surface water and groundwater quality from the two final voids as a result of potential overtopping onto the floodplain, leakage into groundwater and ongoing influence (i.e. 'take') on groundwater flow paths in perpetuity. The groundwater modelling indicates the voids will behave as an evaporative sink. The water quality modelling indicates both final voids will become hypersaline within 100 years, and are likely to continue increasing in salinity until saturation is reached and salts precipitate. These voids will be a permanent legacy of mining on the environment.

Question 3. Could the Committee please advise on the adequacy of the proponent's proposed avoidance, monitoring and management measures intended to mitigate impacts to water resources? If the proposed measures are not considered sufficient, what additional measures would assist in the avoidance, monitoring and management of potential impacts to water resources?

- 27. The proponent has referenced a number of management plans relevant to the existing operation. These plans were not provided for review. A summary of proposed monitoring and management measures is provided for groundwater and surface water. Based on the summary information provided, the IESC suggests the following to improve the monitoring, management and mitigation of impacts to water resources.

Groundwater

- 28. The current groundwater monitoring network is focused on the Duaringa Formation and the Rangal Coal Measures. No monitoring bores are completed within the Quaternary Alluvium. The proponent's commitment to install electronic water level loggers in selected bores to collect data (e.g. hydraulic parameters such as in situ specific storage) more frequently is supported and will be valuable, especially with the addition of strategic monitoring bores within the alluvium along Roper Creek and near the wetlands to the north of the project. The proposed quarterly manual water level monitoring to verify logger data is reasonable.
 - a. Additional nested groundwater monitoring bores are needed, screened at suitable depths and located to the north of the project to monitor groundwater levels and quality. These should ideally be nested bores, screened within the Tertiary, weathered Permian and deeper Rangal Coal Measures. Consideration should also be given to the completion of monitoring bores within the Quaternary Alluvium to observe groundwater levels and associated fluctuations, particularly during and following periods of rainfall.
- 29. The current EA trigger levels for groundwater appear to be derived from various guidelines (Queensland, ANZECC etc.) for different beneficial uses/environmental values (e.g. Se is the 80% species protection value from ANZECC/ARMCANZ for aquatic ecosystems). Silver was removed from groundwater quality monitoring as a trigger despite exceedances being observed. The proponent states that this was because of a lack of ANZECC/ARMCANZ water quality guidelines. The proponent should reinstate monitoring of silver in groundwater using the ANZG (2018) surface water aquatic ecosystem protection guideline value of 0.05 µg/L.

Surface water

- 30. Surface water quality data gathered from the receiving environment between 2013 and 2016 can be used to derive site-specific guideline values for water quality for some parameters. If there are exceedances for individual contaminants then direct toxicity assessments (need ANZECC reference) can be used to determine if upstream and downstream sites show similar toxicity i.e. are already impacted by activities upstream of the mine.

Final landform and voids

31. Although surface water modelling indicates a low potential for over-topping of the final voids and inundation of the floodplain, ongoing monitoring (level and quality) and updating of the surface water and groundwater models are needed to ensure appropriate consideration and implementation of management options during operation and post-closure.
32. Installation of nested groundwater monitoring bores at appropriate depths and locations between and around the final voids are required to monitor potential leakage into groundwater and to determine groundwater flow directions.

Water-dependent ecosystems

33. One HES palustrine wetland occurs in the upper north-east corner of the western study area (PD, Attachment C Figure. 19, p. 86) along with the regulated vegetation within 50 m of the wetland (PD, Attachment C Figure. 18, p. 85). As this is very close to the edge of the disturbance footprint, the proponent should assess options for modifying operations to avoid removing the wetland and associated vegetation.
34. Should removal of the HES wetland be required, further information should be provided on the proposed offset (3 ha of wetlands within the Western Extension State Offset Area). This information should show how the offset will match the ecological characteristics of the HES wetland and will compensate for its removal.
35. The construction of the new diversion should follow recommendations in White et al. (2014) to maximise its operation as an ecologically functioning channel (see Paragraph 21). Consideration should also be given to replanting and restoration of appropriate riparian vegetation to re-establish vegetation connectivity along the diverted creek-line.

Date of advice 13 November 2018

Source documentation available to the IESC in the formulation of this advice	Middlemount Coal Mine Western Extension Project – Preliminary Documentation Attachment A - EPBC act referral for the Middlemount Coal Mine Western Extension Project Attachment B - Request for preliminary documentation Attachment C - Ecology Assessment Attachment D - Surface Water Assessment Attachment E - AGE 2018 (Groundwater Assessment) Attachment F - Groundwater Assessment peer review letter Attachment G - Offset Management Plan/Vegetation Management Plan Attachment F - Environmental Authority EPML00716913 (21 MAY 2018) - Water Conditions
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