NSW GOVERNMENT | Department of Primary Industries

OUT17/25201

Mr Paul Freeman
Resource Assessments
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Dear Mr Freeman

Hume Coal Project (SSD 7172) and related Berrima Rail Project (SSD 7171)
Comment on the Environmental Impact Statement (EIS)

I refer to your email of 31 March 2017 to the Department of Primary Industries (DPI) in respect to the above matter. Comment has been sought from relevant divisions of DPI. Views were also sought from NSW Department of Industry - Lands that are now a division of the broader Department and no longer within NSW DPI.
Any further referrals to DPI can be sent by email to landuse.enquiries@dpi.nsw.gov.au.

DPI has reviewed the EIS and has identified a number of matters that should be further addressed to ensure that the project can be appropriately monitored and managed with appropriate conditions, and there will be clear and enforceable standards to strengthen Government's regulatory control.

Due to the breadth of recommendations and information, detailed assessments of the EIS have been included as **Attachments A - H**, with a brief summary of the key issues outlined below:

- The reduction of land capability classes as proposed represents a loss of the agricultural resource, and alternative measures to mitigate this should be explored.
- Further detail is required to address the impacts to agricultural land and enterprises in the region.
- A more comprehensive monitoring strategy is required to ensure impacts to ecosystems and water users can be readily identified and addressed. The monitoring regime should include both regular and event based monitoring across both up and down-stream locations. The proponent should clearly define how determination will be made of whether impacts to riparian and aquatic ecosystems are a result of mine activity.
- Detailed assessment is required of the potential impact to aquatic ecosystems posed by aluminium concentrations exceeding guideline values for aquatic ecosystems.
- DPI considers that the groundwater model has a confidence level of class 1, not class 2-3 as stated in the EIS. It should be noted that the Australian Groundwater Modelling Guidelines (pg 19) state that "if a model falls into a Class 1 classification for either the data, calibration or prediction sectors, it should be given a Class 1

model irrespective of all other ratings. The mass balance errors for the calibrated model were within a Class 1 classification. The model should be revisited to achieve the necessary confidence level by reducing water balance errors.

- The proponent should undertake a secure yield analysis in consultation with Wingecarribee Council to further assess impact to town water supply resulting from the reduction in yield and increased leakage predicted for Medway Dam.
- Further detailed assessment is required to quantify volumetric loss to surface water systems over the life of the project. A concept compensatory flow regime should be developed to mitigate impacts.
- The proponent should re-evaluate volumes required to be licenced based on maximum or worst case conditions, not average conditions. The proponent should provide detailed confirmation of access to entitlement.
- Further consideration is required for the ability to implement the proposed make good provisions due to the high number of impacted bores and the scale of works and monitoring required. The proponent should provide detailed information regarding its strategy for dispute resolution in the case affected landholders elect not to engage in negotiations.

Yours sincerely

Mitchell Isaacs
Director, Planning Policy & Assessment Advice
16 July 2017

Encl.

Attachment	Title
A	DPI Water Detailed Recommendations
B	Groundwater Impact Assessment Review
C	Aquifer Interference Policy Assessment Review
D	Groundwater Modelling Review
E	Watercourse Assessment Review
F	DPI Agriculture Detailed Comments
G	Economic Assessment of Agricultural Impact Statement
H	DPI Fisheries Detailed Comments

DPI appreciates your help to improve our advice to you. Please complete this three minute survey about the advice we have provided to you, here:
https://goo.gl/o8TXWz

Attachment A

Hume Coal Project (SSD 7172) and related Berrima Rail Project (SSD 7171)
Request for comment on the Environmental Impact Statement
DPI Water Detailed Recommendations

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1. HUME COAL PROJECT

1.1 Gaps in Project Detail

- The groundwater model is considered by DPI Water to have a confidence level of Class 1 rather than the Class 2-3 stated in the environmental assessment (see Attachment C). This is due to the high water balance errors and a higher scaled root mean squared error (SRMS) than recommended by the Australian Groundwater Modelling Guidelines. The model is therefore not considered to be the required class as set by the Australian Groundwater Modelling Guidelines. It should be noted that the Australian Groundwater Modelling Guidelines (pg. 19) state that "if a model falls into a Class 1 classification for either the data, calibration or prediction sectors, it should be given a Class 1 model irrespective of all other ratings. The mass balance errors for the calibrated model were within a Class 1 classification.
- Due to the concern with the classification of the groundwater model, DPI Water considers there is significant uncertainty in the model predictions and hence the impact on groundwater and connected surface water sources (see Attachment, A, B and C).
- Medway Dam, which is a backup water supply for Wingecarribee Council, is predicted to be impacted by a reduction in yield of 0.9 % and an average increase in leakage of 36.5 ML/yr. Town Water Supply is a high priority hence any impact needs adequate consideration. The impacts raise concern in regards to town water supply security and the ability to adequately mitigate this impact such as through compensatory flows. The assessment provided doesn't clearly quantify the volumetric impacts for maximum or worse case scenarios, and advise whether this has been considered by Wingecarribee Council in future water supply planning.
- During dry periods the reductions in the baseflows of watercourses is predicted to impact on access to Basic Landholder Rights and to increase the number of no flow days in Medway Rivulet by 30 %. This is predicted only if the discharges are ceased from the Moss Vale STP. The EIS predicts reductions in baseflow to reach a maximum of 338 ML in Year 11 for Medway Rivulet and 310 ML in Year 13 for the Lower Wingecarribee River. Mitigating measures such as compensatory flows require addressing.
- The drawdown of the water table due to mining is predicted to exceed the Level 1 minimal impact consideration of the NSW Aquifer Interference Policy (AIP) at 93 bores (see Attachment A and B). DPI Water notes the proponent has commenced on-site bore verification assessments and intends to base formal make good agreements on the results of individual bore assessments. The concepts for proposed make good options appear reasonable however their application to individual bores and the timing is yet to be confirmed. This information will be required to understand the suitability of the proposed measures.
- The proponent's intended approach of entering into negotiated make good agreements with affected groundwater work owners is supported and recognised as the optimum outcome. The dispute resolution approach outlined in section 2.5 of Appendix O of the Water Impact Assessment Report does not provide sufficient detail of the approach to be taken in the event that a groundwater work owner will not engage in the negotiation process. This is a key risk if a significant proportion of affected groundwater work owners do not engage with the negotiation process and are therefore unable to reach an appropriate make good agreement (see Attachment A and B).

- Based on modelling predictions, the annual inflows to the underground are to range from a minimum of 127 ML in Year 1 to a peak of 2259 ML in Year 15. These inflows induce water take from a number of water sources, which the proponent will be required to obtain entitlements. This includes 844 units in Nepean Management Zone 1, 5.5 units in the Medway Rivulet Zone, 1 unit in Nepean Management Zone 2 and 18 units in the Sydney Basin South. The ability to obtain the entitlement in the Nepean Management Zone 1 is the key concern, as although entitlement is available the ability to acquire this is yet to be confirmed.
- The EIS states the proponent has access to a number of Water Access Licences (WAL) not registered in the proponent's name, and refers to a pathway to obtain the additional entitlement which is not specified. Uncertainty therefore exists in the current and future entitlement held by the proponent.
- The rate of groundwater recovery and hence the duration of impacts on landholder bores and watercourses is based on modelling assumptions of reinjection, groundwater inflows and the site water balance. Uncertainty in these predictions may have significant implications to impact predictions and the acceptability of proposed mitigating requirements. Understanding the worst case scenario and ensuring the model is fit for purpose is critical to assess this (see Attachment A, B and C).
- Implementation of compensatory flows to the surface water system would alter the water balance and the associated availability of water for mine use and aquifer recovery. Detailed review of the potential changes to water supply and drawdown impacts will be required.
- DPI Water River Styles® mapping has identified highly fragile river reaches within the project area which were not identified in the environmental assessment. Ensuring an adequate understanding of impacts to these reaches and developing adequate monitoring and management options is recommended (see Attachment D).

1.2 Recommendations Prior to Project Approval

Groundwater

- The numerical model, which forms the basis of the predictions and associated mitigation and management measures, needs to be revisited to achieve the necessary confidence level(s) in model predictions in accordance with the Australian Groundwater Modelling Guidelines (see Attachment A and C).
- The model developer needs to attempt to reduce water balance errors, improve the confidence level classification and provide further details of the model calibration (including detailed discussion of the convergence before and after the reworking of the model) (see Attachment A and C).
- The recalibrated numerical model must then be used to run scenarios apart from 'average' conditions for the explicit purpose of identifying the most significant impacts likely to arise (higher extractions and drought scenarios for example) (see Attachment A and C).
- Revised impact predictions should be documented in a supplementary report illustrating the comparative differences between those reported in the EIS and supporting documentation and the non-average scenarios (see Attachment A and C).
- If the numerical model cannot be stabilised and calibrated in accordance with the guideline confidence levels, then detailed and prescriptive monitoring, management and mitigation plans (beyond the general approaches currently identified) must be provided prior to approval to provide assurance that potential impacts arising from the project can be adequately identified, avoided or mitigated (see Attachment A and C).
- The proponent needs to provide further information to demonstrate that the Aquifer Interference Policy (AIP) requirements will be adequately addressed (see Attachment B).

- DPI Water recommends a meeting with the Hume Coal consultants to discuss the numerical modelling issues identified.

Surface Water

- To further assess the impact on town water supply the proponent is recommended to undertake a secure yield analysis in consultation with Wingecarribee Council. This would need to be in accordance with the draft NSW Guidelines on Assuring Future Urban Water Security – Assessment and Adaption Guidelines for NSW Local Water Utilities.
- Quantify the annual maximum volumetric losses to the surface water systems over the life of the projects impacts during dry and wet periods. Yield impacts identified in the EIS are currently expressed as a percentage.
- Complete an assessment of impacts on downstream users and the environment due to the proposed raising of the dam wall on an existing dam on Oldbury Creek. Increasing the dam wall has the potential to increase the dam capacity and hence may require the purchase of additional water entitlement. Consideration is recommended of the ability to install culverts to maintain the current flow regime from the dam. Consideration of dam safety matters in accordance with the *Dams Safety Act* is also required.
- Confirm the buffer distances between proposed works and the high bank of watercourses. DPI Water recommends buffers to be implemented consistent with the "Guidelines for Controlled Activities on Waterfront Land (DPI Water 2012)".

Water Licences

- Re-evaluate the volumes required to be licensed based on maximum/worst case conditions (not average conditions) direct and induced take from water sources impacted by the development, and evidence that sufficient entitlement can be obtained.
- Confirmation be provided of access to all entitlement referred to as the proponent's in the EIS. This is due to a number of the Water Access Licences not being held in the proponent's name. Further detail is also requested of the pathway referred to by the proponent to obtain the required additional entitlement. This information is required to understand the potential risks in obtaining the necessary entitlement.
- Confirm the location and license numbers of the potential licensed bores to be used to supplement water supply for the project and the maximum volume to be extracted.
- Confirm whether the Primary Water Dam is a turkeys nest dam and whether all dams meet the exclusion requirements of the Harvestable Rights Dam Order.

Management Measures

- Develop a concept compensatory flow regime of suitable quantity and quality to mitigate the impact to the surface water system in regards to losses to Town Water Supply and low flow impacts on Basic Landholder Rights users and the environment. The ability to supply this compensatory flow needs to be confirmed and the water balance and groundwater impact assessment rerun.
- Further consideration needs to be given to the ability to implement the proposed make good provisions due to the large number of impacted bores and the significant scale of works and monitoring required (see Attachment A and B). Significant risk exists in the ability to negotiate and implement this proposal at the outset and it may be required for many decades post mine closure. The results of the bore assessments are requested, along with proposed make good measures (based on bore assessment results) for each bore predicted to exceed Level 1 minimal impact considerations of the AIP.
- It is requested that the proponent provides additional information on the proposed approach for dispute resolution in regards to affected groundwater works (see Attachment A).

1.3 Recommendations Post Project Approval

- The proponent prepares and implements management plans to manage and mitigate water related impacts during construction, operation and rehabilitation.
- Preparation of an operational Water Management Plan will be required to detail the water balance, monitoring and mitigating measures for the project. This will be required to include a comprehensive surface water and groundwater monitoring program and a contingency response plan which would need to include accepted trigger levels and viable mitigating measures. Detailed make good provisions would be a key element to this plan.
- Specialist monitoring of the bulkhead integrity and pillar stability to be included as part of the water management plan and subsidence management plan to identify whether future irregular and unpredictable subsidence (resulting from periodic support failure) will have an impact on groundwater availability for licensed users and the potential for aquifer damage (see Attachment A).
- It is recommended that a subsidence expert considers the long-term stability of the pillars, potential for failure to occur and impact on groundwater resources.
- The proponent completes ongoing verification of impacts on surface water and groundwater sources. This will include regular updates of the surface water and groundwater models, and discussion with relevant agencies where impacts are diverging from original impact and water take predictions. Where variations in predictions occur, consideration would need to be given as to the consistency of the approved project in consultation with Department of Planning and Environment and relevant agencies.
- Where the project proposes the use of WALs currently linked to water supply works not associated with this project consultation with DPI Water will be required to confirm licensing amendment requirements.
- Works within waterfront land to be consistent with the DPI Water "Guidelines for Controlled Activities on Waterfront Land (2012)".
- It is recommended further surveys of unconfined River Styles® identified in the EIS and consistent with DPI Water's mapping assessment occur (see Attachment D). This should focus on those reaches identified as possessing high fragility in the DPI Water 2012 River Styles® assessment. Surveys should include identifying remnant ponds features, extent and standing pond level and depth.
- Areas likely to have differential settlement to have post-mining surveys conducted (see Attachment D). These should focus on identifying likely or potential disturbance and channelisation within or downstream of remnant ponds and valley fills. Where these may be classed as swampy meadows, surveys should incorporate catenary survey lines to detect drawdown within the fill sediments.
- Specific remediation programs should be developed to identify likely controls and where constructed controls may be required to prevent further channelization within and between chain of ponds (see Attachment D). These are to be consistent with existing rehabilitation standards (e.g. Rutherford *et al* 2000) and recent research on processes related to geomorphic recovery in high fragility river channels (e.g. MacTaggart *et al* 2006, Mould and Fryirs 2017).
- Reporting of current geomorphic condition and projected recovery trajectories under current management regimes, potential subsidence conditions and with rehabilitation actions in place is recommended (see Attachment D). These should be compared to ongoing management where management intervention is deemed necessary.
- Management of flows where baseflows are affected to consider replacement or replenishment options (see Attachment D). These could include geomorphic rehabilitation to replace and/or improve channel and pool condition.

2. BERRIMA RAIL PROJECT

2.1 Additional information required

- The flood assessment for a 1 in 100 year ARI event has identified afflux impacts to be primarily on Hume Coal or Boral owned land. A minor increase in flood extent is predicted upstream of the Hume Highway on private property. It is recommended confirmation be obtained from the private landholders that the afflux impacts are acceptable, or appropriate mitigation or compensation arrangements be developed.

2.2 Recommendation post project approval

- The proponent must prepare an Erosion and Sedimentation Control Plan in consultation with DPI Water prior to the commencement of activities.

A series of watercourse crossings are proposed on watercourses, including the replacement of a bridge on Stony Creek (5th order stream) with a series of culverts. The associated road embankments are predicted to concentrate flows and increase the risk of erosion and scouring at all crossings. Scour protection measures are proposed which will be critical to the design and ongoing management. DPI Water recommends all works associated with watercourse crossings to be in accordance with the DPI Water "*Guidelines for Controlled Activities on Waterfront Land* (2012)".

End Attachment A

Attachment B

Hume Coal Project (SSD 7172) and related Berrima Rail Project (SSD 7171)
Request for comment on the Environmental Impact Statement
Groundwater Impact Assessment Review

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1. Groundwater Impact Assessment Review Summary

An assessment of the groundwater-related impacts of the project in regard to the Environmental Assessment Requirements is summarised in the table below.

Summarised criteria	Proponent response	DPI Water comment
Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.	The Hydrogeochemical Assessment Report concludes that groundwater quality impacts will be negligible resultant from induced vertical flux of saline water. As outlined in Environmental Impact Statement and the Water Impact Assessment Report the mine is to utilise a non-caving method in which individual parallel drives are advanced between separating pillars that provide roof support. Upon completion of each drive bulkheads are to be installed which are intended to seal each drive (panel) immediately after extraction and backfilling (with coal reject material slurry). This method is suggested to have negligible subsidence. The model predicts drawdowns at greater than 2 m in 93 adjacent licensed bores. Whilst this is greater than the Aquifer Interference Policy minimal impact threshold, the Water Impact Assessment Report addresses this issue in the form of 'make good provisions'. No groundwater dependent ecosystems recognised by the current NSW Water Sharing Plans were identified as potentially affected by groundwater level impacts.	Further work required. Significant uncertainty as the model is not considered by DPI Water to satisfy a Class 2 or Class 3 confidence level classification. Reported calibration period mass balance closure error is greater than 1 % which is required to meet the Class 2 requirement. Calibration review is required if model is to reach Class 2 confidence level. Following this review the impact predictions may vary from those currently presented in the Water Impact Assessment Report. Geochemical modelling conducted and presented in the Hydrogeochemical Assessment Report indicates that due to mine dewatering altering local flow regime there is potential for a net increase in salt flux from the Wianamatta Group shale to the Hawkesbury Sandstone of 1.3 % above baseline conditions. This is not sufficient to significantly alter local quality and will not result in any change to beneficial use of the Hawkesbury Sandstone. The Environmental Impact Statement identifies that a Subsidence Management Plan (SMP) will detail how subsidence monitoring will be conducted. It is required that DPI Water review the SMP once drafted, and that the plan includes specific long-term pillar stability and bulkhead integrity monitoring. In the Water Impact Assessment Report an assumption is made about the construction of neighbouring licenced bores

Summarised criteria	Proponent response	DPI Water comment
		where construction reports ('Form A') were not received. A number of licence holders have bores located within the zone of impact calculated by the model to exceed two meters for which bore construction information (including standing water levels) is not available or not complete. It is recommended the proponent seek this information from these licence holders. It is also suggested the proponent collect (where possible) water level information from these licence holders at a minimum on a semi-annual basis in order to inform and verify the requirement for 'make good provisions'.
A detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures;	The Water Balance Report presents the water balance of the project water management system which was developed using the GoldSim™ Software. The software takes into account rainfall runoff inflow, groundwater inflow (from the model), evaporation, water usage and transfer. It was simulated at a daily time step for a 19-year duration (assumed from 2021-2039).	Further work required. Following review of the groundwater model, predicted groundwater inflows may alter the water balance inputs, which would in turn require a review of the project water balance calculations.
Identification of any licensing requirements or other approvals under the Water Act 1912 and/or Water Management Act 2000	The Water Impact Assessment Report outlines and commits to legislative licence requirements.	Satisfactory. With exception of providing sufficient detail of the currently held groundwater licences and compelling evidence that the additional entitlement requirements can be obtained, the Water Impact Assessment Report has adequately outlined groundwater licensing requirements, although this will need to be reassessed following review of the groundwater model.
Demonstration that water for the construction and operation of the development facilities can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any	The Water Impact Assessment Report outlines the project annual water demands for the life of the project based on a constructed water balance model. The Water Balance Report details annual project water demand and supply.	Satisfactory. The proposed supply meets project demand requirements for the facilities. Also, based on the modelled water balance, the current entitlements held appear to adequately account for the project supply demand, although this will need to be reassessed following review of the

Summarised criteria	Proponent response	DPI Water comment
relevant Water Sharing Plan.		groundwater model.
A description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo	The Water Impact Assessment Report outlines and commits to legislative licence requirements.	Further information is required (see section 6, below).
A detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.	The Water Impact Assessment Report outlines the site water management system.	Further information is required (see section 6, below).
Details of water proposed to be taken (including through inflow and seepage) from each surface and groundwater source as defined by the relevant water sharing plan.	The Water Impact Assessment Report presents the predicted annual take volume project requirements from each water source as a result of the activity. The maximum take volumes were predicted to occur in year 15 of the activity: • 36.5 ML/yr (Upper Nepean and Upstream Warragamba Water Source) • 18 ML/yr (Sydney Basin South) • 2,235 ML/yr (Sydney Basin Nepean, Management Zone 1) • 1 ML/yr (Sydney Basin Nepean, Management Zone 2) The numerical groundwater model currently predicts maximum daily surface water take via baseflow interception from Lower Wingecarribee River, Medway Rivulet, their tributaries and some adjacent rivers/streams.	Further work required. Following model calibration, the take volume predictions should be reviewed as they may vary from those currently presented in the Water Impact Assessment Report. The Water Impact Assessment Report does not currently include the annual take volume from Lower Wingecarribee River, Medway Rivulet, their tributaries and the adjacent rivers and streams outlined by the numerical groundwater model. It is therefore required this take be calculated and accounted for in the Water Impact Assessment Report.
Assessment of any volumetric water licensing requirements (including those for ongoing water take following completion of the project).	The Water Impact Assessment Report identifies that the volumetric licence requirements for the project equal the maximum predicted annual take. The Water Impact Assessment Report outlines the annual	Further work required. The maximum predicted groundwater annual take (subject to change following model calibration review) is the

Summarised criteria	Proponent response	DPI Water comment
	volume of inflow is predicted to continue for three years post mine completion of mining activities in year 19 (i.e. to year 22).	appropriate volume to establish as volumetric licence requirement. The induced leakage calculated from the Upper Nepean and Upstream Warragamba Water Source is based on average conditions. Induced leakage should be calculated based on maximum leakage to ensure adequate volumetric licence can be obtained before commencement to account for the predicted take in accordance with the Aquifer Interference Policy. Further clarification is required.
The identification of an adequate and secure water supply for the life of the construction and operation of the project. Confirmation that water can be sourced from an appropriately authorised and reliable supply. This is to include an assessment of the current market depth where water entitlement is required to be purchased.	Current volumetric entitlements (water supply) are detailed in the Water Impact Assessment Report	Further work required. Once the model calibration review has occurred required entitlements or water allocations may vary from those presented. The Water Impact Assessment Report identifies that the water entitlements held are not sufficient to meet the predicted take. However a market depth analysis presented in the Water Impact Assessment Report indicates sufficient water could be procured, depending on various trades or purchases. In addition, it is required that an account of model predicted annual take be prepared for the surface water sources that have predicted intercepted baseflow.
A detailed assessment against the NSW Aquifer Interference Policy (2012) using the NSW Office of Water's assessment framework	Included in the Water Impact Assessment Report.	Further work required. A review of the assessment has indicated that several requirements have not been satisfactorily addressed, primarily due to the findings being based on numerical groundwater predictions that might be significantly in error. Whilst the errors resulting from the current numerical modelling are significant, considerably more detail on the appropriateness and achievability of proposed mitigating measures needs to be documented. Identified gaps in the background monitoring could be resolved if the proponent adequately

Summarised criteria	Proponent response	DPI Water comment
		describes the reasons behind the sampling events not being reported.
Full technical details and data of all surface and groundwater modelling, and an independent peer review.	A transient numerical groundwater flow model was constructed and calibrated with baseline water level data from an extensive monitoring bore network in vicinity of the project. The monitoring bore network has collected a substantial amount of data (since November 2011). The model has been independently peer reviewed. A water balance model has been constructed and used to define the ongoing water supply demand for the proposed operation.	Further work required. The model is considered of confidence level Class 1 by DPI Water. To satisfy a Class 2 or Class 3 model confidence level classification, the mass balance error should be less than 1 %. Once the mass balance error threshold is achieved, the model needs to be recalibrated and the scenarios re-run to improve the predictions of impacts.
Proposed surface and groundwater monitoring activities and methodologies.	The Water Impact Assessment Report outlines that monitoring data will be collected for the life of the mine and for a period of 5 years post closure. Details of the monitoring are to be included in the Water Management Plan. A groundwater quality monitoring program is proposed by the Hydrogeochemical Assessment Report during operation of the mine and for sufficient time post closure to confirm the efficacy of the limestone amendment in mitigating acid and metals mobilisation from the emplaced reject material.	Further work required. It is recommended that DPI Water review the Water Management Plan once drafted. It is also recommended that the proposed monitoring extend beyond the nominated five year period to demonstrate that groundwater level recovery is occurring as predicted. It is noted from the Water Impact Assessment Report that a typically affected landholder bore will recover by 75 % within 23 years since it was first impacted. Monitoring should therefore be expected for an initial 20 year period, which could be reduced subject to recovery being demonstrated, particularly in landholder bores. In order to confirm the extent of the model predicted zone of impact calculated by the model to exceed two metres it is also recommended the proponent install a minimum of three monitoring bores with screened intervals in Hawkesbury Sandstone west of GW075036, and west/northwest of HU0088 A/B.
Proposed management and disposal of produced or incidental water.	The Water Balance Report outlines that incidental inflows of groundwater to the mine workings will either be reused/reinjected within the mine voids or pumped	Further work required. Following review of the model calibration predicted groundwater

Summarised criteria	Proponent response	DPI Water comment
	to the surface and placed into storage facilities (basins).	inflows may alter the water balance inputs, which would in turn require a review of the project water balance calculations.
Details surrounding the final landform of the site, including final void management (where relevant) and rehabilitation measures.	As outlined in Environmental Impact Statement and the Water Impact Assessment Report the mine is to utilise a non-caving method in which individual parallel drives are advanced between separating pillars that provide roof support. Upon completion of each drive bulkheads are to be installed which are intended to seal each drive (panel) immediately after extraction and backfilling (with coal reject material slurry). This method is suggested to have negligible subsidence. The model predicts drawdowns at greater than 2 m in 93 adjacent licensed bores. Whilst this is greater than the Aquifer Interference Policy minimal impact threshold, the Water Impact Assessment Report addresses this issue in the form of 'make good provisions'. No groundwater dependent ecosystems recognised by the current NSW Water Sharing Plans were identified as potentially affected by groundwater level impacts.	The Environmental Impact Statement identifies that a Subsidence Management Plan (SMP) will detail how subsidence monitoring will be conducted. It is recommended that DPI Water review the SMP once drafted, and that the plan includes specific long-term pillar stability and bulkhead integrity monitoring.
Assessment of any potential cumulative impacts on water resources, and any proposed options to manage the cumulative impacts.	As outlined in Environmental Impact Statement and the Water Impact Assessment Report the mine is to utilise a non-caving method in which individual parallel drives are advanced between separating pillars that provide roof support. Upon completion of each drive bulkheads are to be installed which are intended to seal each drive (panel) immediately after extraction and backfilling (with coal reject material slurry). This method is suggested to have negligible subsidence. The model predicts drawdowns at greater than 2 m in 93 adjacent licensed bores. Whilst this is	Further work required. Whilst the Environmental Impact Statement identifies the potential impacts in relation to the existing situation (pumping and Berrima Colliery effects) and the mining scenario (existing plus Hume Coal operations), to derive a project-only impact assessment, the residual predicted water levels do not appear to be realistic. The cumulative impact is not well described, and the unusual predicted water level impact contours derived from the modelling are strangely oriented and distributed. It is not clear whether the progression of mining

Summarised criteria	Proponent response	DPI Water comment
	greater than the Aquifer Interference Policy minimal impact threshold, the Water Impact Assessment Report addresses this issue in the form of 'make good provisions'. No groundwater dependent ecosystems recognised by the current NSW Water Sharing Plans were identified as potentially affected by groundwater level impacts.	is a factor, or if the difficulties with the numerical groundwater model have resulted in the strange distribution. Substantial clarification is required to understand this aspect of the proposal.
Consideration of relevant policies and guidelines	Completed.	Satisfactory.

Comments in relation to the technical adequacy of make good options are tabulated below.

Proposed make good option	Assessment response
Increased pumping costs	This is a workable option, provided the proponent accounts for all aspects of the expenses incurred by the landholder. Pumping against greater hydraulic head will likely affect flow rates and pressures at the surface as well as potentially generating iron-related encrustation problems within the bore under cyclic operating scenarios. This could translate into less efficient water distribution, more frequent maintenance and periodic cleaning, all of which will need recognition in any agreements.
Lowering of pumps	Lowering of pumps within existing bores will result in increased pumping costs (and the issues associated with that option will need to be addressed). As well, there may be a need to increase the size of the pump to provide adequate supply at the surface, subject to the constraints of the bore or casing diameter. Some limitations with this approach are the potential for the pump to be lowered to a depth where previously undisturbed water (incorporating concentrated constituents) could be extracted and accumulated silt and sediment within the bore could affect the performance of the pump.
Bore deepening	Deepening of an existing bore is a possible make good, however significant technical limitations are associated with such an approach. The age, construction details and status of the bore must be considered on a bore to bore basis. Where such information is unavailable, all efforts to determine the configuration of the work must be undertaken (e.g. using various geophysical methods to identify the below-ground setting). Concerns include: • Damaged casing (rust, corrosion, poor installation) potentially resulting in further damage to bore when inserting drilling equipment.

	• Non vertical or aligned drilling/installation potentially preventing use of drilling tools • Damage to bore during pump removal, damage to pumping equipment.
Replacement bores	Replacement bores are a sound make good option, provided the existing bores are appropriately decommissioned. Whilst such an approach allows the new installation to be properly constructed for its intended purpose, the repositioning of a work could impact on accessibility to existing infrastructure (e.g. piping or electricity) and needs to be carefully considered. As well, there is no guarantee that the yield and quality of the groundwater intersected by the replacement installation will be the same as the original bore.

Notwithstanding the make good options appear to be reasonable for the circumstances, there will likely be a need to apply a combination of these measures during and following mining. For example, as the groundwater levels are predicted to remain depressed for prolonged periods, the increased pumping costs will likely apply to all affected bores, in addition to any other make good measures applied previously. Similarly, there may be a future need to deepen bores that might have originally been assessed as only requiring pump lowering. Additional clarification of the timing of the make good arrangements is needed to fully understand the suitability of the proposed measures.

2. Connected water source potential and quantification of water take

The Environmental Impact Statement identifies a range of impacts from the proposed mining operation based on the results of a numerical groundwater modelling assessment. That means that the groundwater model is a critical component of the EIS in regard to the potential for connection between water sources, as well as in estimating the volumes likely to be taken as a result of the mining. The predicted impacts arising from the project are also heavily reliant on the numerical modelling to both frame the extent of the effects and to identify their magnitude.

It is not clear that the modelling has been applied to adequately understand the effects of the mining during climatic (e.g. drought) or weather (e.g. below-average rainfall) conditions that would be expected to exacerbate the impacts of ongoing groundwater and surface water take. For example, the Water Impact Assessment Report states as follows:

"*The groundwater model indicates that under existing (pre-mining) conditions, Medway Dam loses about 0.5 ML/day to the groundwater system (pre-mining). The model for the project predicts that during operation of the mine, losses from Medway Dam to groundwater will increase to an <u>average of about 0.6 ML/day</u>. These <u>additional average losses</u> from Medway Dam over the life of the project are therefore 0.1 ML/day (36.5 ML/year)*" (page 202, Water Impact Assessment report, emphasis added).

It is not clear what the potential maximum losses from Medway Dam might be and under what specific conditions they might occur.

Similarly, the EIS Main Report states as follows:

"*The average Medway Rivulet baseflow rate estimated from baseline monitoring is approximately 3.3 ML/day at SW04 during <u>average rainfall conditions</u>*" and "*this is approximately three times larger than the predicted maximum rate of baseflow reduction (0.9 ML/day)*" (page 175, EIS Main Report).

Therefore the maximum rate of baseflow reduction is around 27 % of the baseflow under average rainfall conditions. This is significant (at approximately one third of the average), and likely to be a substantially larger proportion of the flow under below-average rainfall conditions or a drought-impacted climatic setting. Clarification of the significance of the baseflow under these conditions is required to understand the potential impacts.

In accordance with section 3.2.3 (What is required from proponents?) of the NSW Aquifer interference Policy, the proponent is required to demonstrate that licenses for the maximum (not average) direct and induced take from water sources impacted by the development (including Medway Dam) at any point during the life of the project can be obtained prior to the commencement of the activity if consent is granted. The proponent should re-evaluate the volumes required to be licensed and provide the revised estimates to DPI Water together with evidence that the take can be accommodated under appropriate licences held by the company.

3. Aquifer Interference Policy Assessment

Section 3.2.3 of the NSW Aquifer Interference Policy states as follows:

"*if a development consent under Part 4, Division 4.1 (State Significant Development) or Part 5.1 (State Significant Infrastructure) of the EP&A Act has been granted or for any approved mining or CSG production activity that was not subject to the Gateway, the NSW Office of Water will recommend that a condition of approval require that the maximum of the predicted annual water quantities are to be licensed from the commencement of the activity regardless of when water will actually commence to be taken. This is required to eliminate any risk of there being insufficient market depth from which to obtain the necessary water entitlements at any point in time in the future. The proponent should therefore demonstrate during the planning assessment process that these licences can be acquired if development consent is granted*" (page 27, AIP, emphasis added).

As the Hume Coal Project has not passed through the Gateway process, DPI Water recommends that the maximum annual volumes of surface water and groundwater predicted to be taken by the proposed mine during operation and in the recovery phase (in case of ongoing residual take) is required to be licensed from the commencement of the mine. It is not clear that these assessments have been completed as part of the numerical modelling of the impacts of the underground mine, nor has it been demonstrated within the EIS framework to a necessary level of confidence that licences with shares adequate to account for the take of water have been, or can be, obtained by the proponent.

A step by step assessment of the project by the proponent was included as Appendix C of the Water Impact Assessment Report (Appendix E of the EIS). DPI Water review of that assessment, based on the EIS documentation, was completed and identified that various aspects were not satisfactorily addressed, or not clearly described. In particular, the validity of the numerical modelling in defining the potential impacts, and consequently the mitigation and management measures designed to address the adverse effects of the project, appears questionable and further work is required to increase confidence that the mining operation can be conducted appropriately.

4. Groundwater modelling

Groundwater Modelling staff within DPI Water have undertaken a review of the relevant numerical model reports provided with the application against the Australian Groundwater Modelling Guidelines requirements and identified various shortcomings within a compliance checklist framework.

Of greatest significance is the suitability of the model for the intended purpose of predicting the impacts of the proposed operation. The fitness for purpose attributed to the model by the Modelling Consultant (Coffey) is stated as "*the model is expected to conform the approximately 70 % of the criteria for Class 3 models, with remaining aspects of the model conforming to Class 2 criteria*" (page 26, Numerical Modelling and Impact Assessment report). DPI Water considers that the model does not conform to the requirements of a Class 2/3 model due to the following water balance errors.

- Modelled average flow budget over the calibration and verification periods combined (Table 4) has a discrepancy of -2.2 ML/day or -4.1 % water balance error (page 25, Numerical Modelling and Impact Assessment report).
- Modelled average flow budget over the period of mine inflow (mining and simulation, years 1 to 22 inclusive) for the case of active Hume Coal Project mining (Table 10) has a discrepancy of -3.2 ML/day or -6.8 % water balance error (page 38, Numerical Modelling and Impact Assessment report).
- Modelled average flow budget over simulation years 1 to 22 inclusive for the null case where Hume Coal Project mining is inactive (Table 11) has a discrepancy of -2.8 ML/day or -6.0 % water balance error (page 39, Numerical Modelling and Impact Assessment report).

The Australian Groundwater Modelling Guidelines identify key indicators for confidence level classifications as being a mass balance error of less than 0.5 % for Class 3 models, and less than 1 % for Class 2 models. DPI Water therefore considers the appropriate confidence level classification for the numerical groundwater model as being Class 1, and not suitable for the intended purpose.

Because of the high water balance errors and a scaled root mean squared error (SRMS) value higher than that suggested by the Australian Groundwater Modelling Guidelines, DPI Water does not consider that the model has achieved convergence and calibration (or it has been poorly reported). Calibration was attempted by simulating the initial heads to be used by running the model in the transient mode for a notional period of 32 years and then running the model again for the main calibration period between January 2011 and December 2015. Whilst the attempt to simultaneously reproduce the calibration of four different variables from the monitoring is commendable, the approach is not successful as the flow equation is inadequately solved. It would have been instructive if the simulated initial heads in 2011 were compared with observed data at the 59 sampling points across 24 sites.

Despite the intent to minimise uncertainty by simultaneously calibrating four different variables, the evidence provided to claim successful calibration with minimal uncertainty does not appear to be adequate. It is noted that when the calibration is unsatisfactory, sensitivity as a surrogate for uncertainty of inputs to the model (caving height, Kv, and mine drain conductance) results are not very meaningful. The uncertainty associated with the predictions is not documented.

To address these issues, it is recommended that the model developer attempt to reduce water balance errors, improve calibration and provide further details of the additional work for assessment.

As well, all supporting data and information relied on by the EIS must be provided for it to be considered in the assessment of the project. For example, information relating to other coal operations referred to in the Groundwater Assessment Data Analysis Report must be provided to identify the suitability of the data for the purposes of the current project and to enable the efficient and reasonable assessment of the project by DPI Water.

5. Reinjection and waste disposal underground

The proposed co-disposal of coal reject materials and excess water underground appears at face value to be a reasonable alternative to the need for a waste dump at the surface. The proponent has indicated that the waste will be dosed with limestone to buffer against the development of acidity from sulphide oxidation, therefore there should be minimal water quality impacts from the emplacement. Whilst the potential contamination issues would be a matter for the NSW EPA, the underground disposal option would be beneficial for maintaining the aesthetic appearance of the surface infrastructure for the mine.

Whilst the proposed injection of water would aid water level recovery, it is not clear that excess volumes will be available for this purpose as the relevant documentation suggests operational demand will be serviced preferentially. It is also not clear that saturated conditions within the mined panels will be sufficient (with a small proportion of incorporated reject material) to provide long-term support to the remnant pillars holding up the roof.

6. Additional information required prior to approval

The timing and nature of operational water demand is not well described within the EIS and supporting documentation, which means the amount of water likely to be reinstated to sealed mined panels is not clearly defined. For example, the Water Impact Assessment Report states as follows:

"*Active injection of water behind the bulkheads will occur from year three (ie once the first bulkhead is sealed) through to year 19 of mining, resulting in a decreased volume of groundwater inflow to the workings and faster recovery post-mining. Once mining ceases (end of year 19) groundwater inflow to the void is expected to continue for three years (ie until all panels are full)*" (page 24, Water Impact Assessment Report).

However, during the operational phase of the underground mine, more complicated water management measures are proposed:

"*The water balance model estimates surpluses and deficits in meeting total annual project demands from available water supplies and it shows that project demands will be fully met by using:*

- *rainfall-runoff from the mine water dams;*
- *groundwater collected in the underground mine sump (where groundwater inflow to underground workings will be captured); and*
- *additional groundwater abstracted from behind the sealed mine void bulkheads as required.*" (page 28, Water Impact Assessment Report).

"*Excess supply of water will be managed by injection to the void behind the bulkheads. If the void space is full and cannot take excess water, and the primary water dam (PWD) volume is also above the adopted capacity then the excess water will be treated in a water treatment plant (WTP) for release into Oldbury Creek, if required. The WTP is included in the project infrastructure as a provisional item only. In all climate sequences modelled, the water balance model indicates that the PWD has adequate capacity to store excess supply and that treatment and release will not be required.*" (page 28, Water Impact Assessment Report).

The schematic water balance flow model indicates that groundwater will be provided to the Primary Water Dam (PWD) 'when needed' (page 157, EIS Main Report).

Further to this, the EIS identifies that approximately 90 ML/year of water will be required to meet construction demands for the Hume Coal Project and the Berrima Rail Project. That demand is proposed to be met from registered bores on the Mereworth and Evandale properties under their existing licensed entitlement which totals 667 ML/year (page 32, EIS Main Report).

It is also of note that the water is intended to be "*primarily used for dust suppression on roads and earthworks, with other minor volumes required for the underground drift development (for example during drilling) and also for wetting bulk materials to aid compaction.*" (page 32, EIS Main Report). Consideration of the work summary reports for the identified bores indicates that 3 are authorised for domestic and stock purposes, and the remainder include an irrigation use. Clarification of which bores are to be used for the mine supply is required to consider whether additional uses and potential impacts are proposed.

The water management schematic presented in the EIS does not include the registered groundwater bores identified, nor their contributions to the mine water supply. This omission further complicates the understanding of the proposed water take for the project as a whole and requires additional clarification.

7. Management plan requirements

The proponent has been progressively developing and revising a Groundwater Modelling and Monitoring Plan for the project, which has been periodically reviewed by DPI Water. DPI Water recently responded to a request to the review the latest version of the plan and provided minor suggested amendments to improve the document. It is anticipated that such reviews will continue and that the monitoring will be adapted to suit future conditions now that the proposed mining method and mine layout have been finally identified.

It is known from historical mining areas elsewhere in the state that pillar collapse can occur at an undefined time after the first workings have ceased, leading to irregular and unpredictable ground surface settlement. The impact of such settlement above the proposed Hume Coal Project workings will ultimately be dependent on the integrity of the bulkhead seals and the coal rejects emplaced in the panels to provide both lateral and vertical stability to the intervening coal pillars. It is not clear if the reduced density of the (more loosely packed than in-situ) material emplaced between the coal pillars, in conjunction with the re-established hydraulic pressure in each sealed panel, will provide support adequate to maintain ground stability in the long-term. It is recommended that additional independent expert analysis to be undertaken into the likelihood of pillar failure in the future, potentially leading to impacts on the water supply to nearby users as a result of localised aquifer damage over the long-term.

As the mining operation is proposed to extend over almost two decades, a specific management plan for progressively monitoring the behaviour of the pillars, the bulkhead seals and the coal reject emplacement from the commencement of mining is required to demonstrate that the supports are appropriate to protect the aquifer from damage.

Additional specific requirements will be applied to the project within management plans conditioned by the approval, should it be granted. These will likely require the ongoing measurement and monitoring of take volumes, water quality, piezometric and potentiometric levels, periodic model refinement and scheduled reporting arrangements. Advice on the Subsidence Impact Assessment and subsequent Subsidence Monitoring Plan (should the project proceed) should be sought from an expert Subsidence Engineer to identify whether long-term aquifer impacts are likely from periodic pillar failures.

DPI Water is aware the Department of Planning has engaged third party experts to address subsidence and would recommend concerns on groundwater be passed to these experts for consideration and further assessments. In order to understand the potential long-term effects, and specifically those to nearby licensed third party users who may be directly impacted by periodic and unpredictable ground movements, it is imperative that the subsidence expert review include advice in relation to the long-term stability of the pillars, the potential for failure to occur and the ongoing or periodic impact on groundwater resources.

End Attachment B

Attachment C

Hume Coal Project (SSD 7172) and related Berrima Rail Project (SSD 7171)
Request for comment on the Environmental Impact Statement
Aquifer Interference Policy Assessment Review

Assessment against the NSW Aquifer Interference Policy has been undertaken in accordance with the DPI Water assessment framework, and referring to Appendix C of the Water Assessment within the EIS.

The assessment against the Aquifer Interference Policy by the proponent has not addressed the requirements of the policy, rather it has referred to sections of the EIS, complicating the review. DPI Water has referred to the broader EIS in undertaking its review.

While not assessed by the proponent, the water level / pressure impacts are considered to be Level 2, while the water quality impacts are likely to be Level 1.

Table 1. Does the activity require detailed assessment under the AIP?

	Consideration	Response
1	Is the activity defined as an aquifer interference activity?	YES
2	Is the activity a defined minimal impact aquifer interference activity according to section 3.3 of the AIP?	NO

1. Accounting for, or preventing the take of water

Table 2. Has the proponent:

	AIP requirement	Proponent response	DPI Water comment
1	Described the water source(s) the activity will take water from?	Refer to: 2.1.4 Water resources 5 Surface water 6 Groundwater	Subchapter 2.1.4 is a summary of the water sources. Chapter 5 details the surface water sources. Chapter 6 details the groundwater sources. Satisfactory.
2	Predicted the total amount of water that will be taken from each connected groundwater or surface water source on an annual basis as a result of the activity?	Refer to: 12 Water licences	Volumes are based on predictions derived from the numerical model and water balance model. Issues with calibration of the numerical model and application of average conditions mean the volumes predicted could be in error. Not satisfactory.

	AIP requirement	Proponent response	DPI Water comment
3	Predicted the total amount of water that will be taken from each connected groundwater or surface water source after the closure of the activity?	Refer to: 12 Water licences 10 Surface water assessment 11 Groundwater assessment	Volumes are based on predictions derived from the numerical model. Issues with calibration of the numerical model and application of average conditions mean the volumes predicted could be in error. Not satisfactory.
4	Made these predictions in accordance with Section 3.2.3 of the AIP? (refer to Table 3, below)	Yes	Not agreed – see response at Table 3.
5	Described how and in what proportions this take will be assigned to the affected aquifers and connected surface water sources?	Refer to: 12 Water licences	Volumes are based on predictions derived from the numerical model and water balance model. Issues with calibration of the numerical model and application of average conditions mean the volumes predicted could be in error. Not satisfactory.
6	Described how any licence exemptions might apply?	Refer to: 12 Water licences	No exemptions discussed. Unlikely that exemptions will apply. Satisfactory.
7	Described the characteristics of the water requirements?	Refer to: 12 Water licences	Distribution of groundwater take throughout mining and recovery periods presented based on model predictions that could be in error. Not satisfactory.
8	Determined if there are sufficient water entitlements and water allocations that are able to be obtained for the activity?	Refer to: 12 Water licences	Discussion of recent trades, licences held and market depth included. Entitlement from “other licences” totalling 504 shares in Table 12.2 has not been well defined. Not satisfactory.
9	Considered the rules of the relevant water sharing plan and if it can meet these rules?	Refer to: 12 Water licences	Rules of the Water Sharing Plan have been described. Satisfactory.

	AIP requirement	Proponent response	DPI Water comment
10	Determined how it will obtain the required water?	Refer to: 3.2 Water Management Act 2000 12 Water licences	General comments in relation to the securing of additional water entitlement for affected water sources have been included. Discussion of recent trades, licences held and market depth also included. Entitlement from "other licences" totalling 504 shares in Table 12.2 has not been well defined. Not satisfactory.
11	Considered the effect that activation of existing entitlement may have on future available water determinations?	Refer to: 3.2.2 NSW Aquifer Interference Policy 10 Surface water assessment 11 Groundwater assessment 12 Water licences	Not clearly discussed or described. Numerical modelling considers average conditions, not specifically conditions under which available water determinations would be triggered. Clarification of the project impacts under available water determinations is required. Not satisfactory.
12	Considered actions required both during and post-closure to minimize the risk of inflows to a mine void as a result of flooding?	Refer to: 13 Monitoring, mitigation and management (table 13.1) 2 Project setting (description of method)	Flooding impacts are not likely to be significant due to the physical setting of the project and proposed progressive sealing of mined panels. Satisfactory.
13	Developed a strategy to account for any water taken beyond the life of the operation of the project?	Refer to: 12 Water licences (licences 'held')	Post-closure monitoring nominated to be 5 years after completion of mining. It is not clear that this is sufficient to define the management of ongoing impacts. Not satisfactory.
Will uncertainty in the predicted inflows have a significant impact on the environment or other authorised water users? Yes, other users. If **YES,** items 14-16 must be addressed.			

	AIP requirement	Proponent response	DPI Water comment
14	Considered any potential for causing or enhancing hydraulic connections, and quantified the risk?	Refer to: 8.6 Groundwater numerical flow model Appendix H Groundwater Assessment Volume 1 - Data Analysis Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment	Impacts from the project are based on predictions derived from the numerical model. Issues with calibration of the numerical model and application of average conditions mean the volumes predicted could be in error. Data analysis relies on information not supported by evidence therefore interrogation of adopted values and conceptualisation is not possible. Reports are considered to be extremely difficult to read and hinder an efficient reasonable assessment of the project. Not satisfactory.
15	Quantified any other uncertainties in the groundwater or surface water impact modelling conducted for the activity?	Refer to: 8 Assessment methods 10 Surface water assessment 11 Groundwater assessment Appendix D Water Balance Appendix E Surface Water Quality Assessment Appendix F Surface Water Flow and Geomorphology Assessment Appendix G Flooding Assessment Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment	Volumes and impacts from the project are based on predictions derived from the numerical model and water balance model. Issues with calibration of the numerical model and application of average conditions mean the volumes predicted could be in error. Uncertainties only broadly described. Not satisfactory.
16	Considered strategies for monitoring actual and reassessing any predicted take of water throughout the life of the project, and how these requirements will be accounted for?	Refer to: 13 Monitoring, mitigation and management Appendix O Drawdown impacts in landholder bores – proposed ‘make good’ provisions	Repeated groundwater model validation (at undefined schedules) based on ongoing monitoring and annual reporting proposed. Satisfactory.

Table 3. Determining water predictions in accordance with Section 3.2.3 (complete one row only – consider both during and following completion of activity)

	AIP requirement	Proponent response	DPI Water comment
1	**For the Gateway process**, is the estimate based on a simple modelling platform, using suitable baseline data, that is, fit-for-purpose?		
2	**For State Significant Development or mining or coal seam gas production**, is the estimate based on a complex modelling platform that is: • Calibrated against suitable baseline data, and in the case of a **reliable water source,** over at least two years? • Consistent with the Australian Modelling Guidelines? • Independently reviewed, robust and reliable, and deemed fit-for-purpose?	Yes Refer to: 4 Baseline monitoring program Appendix H Groundwater Assessment Volume 1 - Data Analysis 7 Site conceptual model 8.6 Groundwater numerical flow model Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment Appendix J Groundwater Assessment peer review	Model is not considered fit-for-purpose in accordance with Australian Groundwater Modelling Guidelines. Baseline data includes gaps which are not clearly justified. Data analysis relies on information not supported by evidence therefore interrogation of adopted values and conceptualisation is not possible. Reports are considered to be extremely difficult to read and hinder an efficient reasonable assessment of the project. Not satisfactory.
3	In all other processes, estimate based on a desk-top analysis that is: • Developed using the available baseline data that has been collected at an appropriate frequency and scale; and • Fit-for-purpose?		

Other requirements to be reported on under Section 3.2.3

Table 4. Has the proponent provided details on:

	AIP requirement	Proponent response	DPI Water comment
1	Establishment of baseline groundwater conditions?	Refer to: 4 Baseline monitoring program Appendix H Groundwater Assessment Volume 1 - Data Analysis Appendix K Hydrogeochemical Assessment 6 Groundwater 7 Site conceptual model	Baseline data includes gaps which are not clearly justified. Data analysis relies on information not supported by evidence therefore interrogation of adopted values and conceptualisation is not possible. Reports are considered to be extremely difficult to read and hinder an efficient reasonable assessment of the project. Not satisfactory.
2	A strategy for complying with any water access rules?	Refer to: 12 Water licences	Overarching discussion of licences held and identification of possible means to obtain additional authorisations included. Clarification of some licences required. Satisfactory.
3	Potential water level, quality or pressure drawdown impacts on nearby basic landholder rights water users?	Refer to: 11 Groundwater assessment Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment Appendix K Hydrogeochemical Assessment Appendix N Project impact and total impact landholder bore drawdown over time Appendix O Drawdown impacts in landholder bores – proposed ‘make good’ provisions	Detailed assessment of the impacts of the project on nearby users, and several make good options identified. Additional clarification required for monitoring and identifying landholder-preferred option suitable to make good under each individual agreement. Notwithstanding predictions are based on numerical model that is considered to not be fit-for-purpose, the proposed management measures are considered reasonable at this stage. Satisfactory.
4	Potential water level, quality or pressure drawdown impacts on nearby licensed water users in connected groundwater and surface water sources?	Refer to: 10 Surface water assessment 11 Groundwater assessment Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment Appendix K Hydrogeochemical Assessment Appendix N Project impact and total impact landholder bore drawdown over time Appendix O Drawdown impacts in landholder bores – proposed	Predicted impacts based on numerical model that is considered to not be fit-for-purpose. Use of average conditions for predictions is not considered suitable. Not satisfactory.

	AIP requirement	Proponent response	DPI Water comment
		'make good' provisions	
5	Potential water level, quality or pressure drawdown impacts on groundwater dependent ecosystems?	Refer to: 11 Groundwater assessment Hume Coal Project Biodiversity Assessment Report	Assessment of the location, potential dependence and likely impact reported in documents. Impacts not considered to be significant based on distance from project. Satisfactory.
6	Potential for increased saline or contaminated water inflows to aquifers and highly connected river systems?	Refer to: 10 Surface water assessment 11 Groundwater assessment Appendix E Surface Water Quality Assessment Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment Appendix K Hydrogeochemical Assessment	Predictions based on numerical model that is considered to not be fit-for-purpose. Impacts not considered to be significant based on likely change in water quality from water quality data. Satisfactory.
7	Potential to cause or enhance hydraulic connection between aquifers?	Refer to: 11 Groundwater assessment Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment Appendix K Hydrogeochemical Assessment	Predictions based on numerical model that is considered to not be fit-for-purpose. Impacts not considered to be significant based on proposed method of mining. Additional monitoring for long-term stability of pillars and integrity of bulkheads required. Satisfactory.
8	Potential for river bank instability, or high wall instability or failure to occur?	Refer to: 10 Surface water assessment Appendix F Surface Water Flow and Geomorphology Assessment	Not applicable.
9	Details of the method for disposing of extracted activities (for coal seam gas activities)?	Not applicable	Not applicable.

2. Addressing the minimal impact considerations

Table 5. Minimal impact considerations

Aquifer	**Porous Rock – except Great Artesian Basin**
Category	**Highly Productive**
Level 1 Minimal Impact Consideration	**Assessment**
Water table Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, 40 metres from any: ▪ high priority groundwater dependent ecosystem or ▪ high priority culturally significant site listed in the schedule of the relevant water sharing plan. **OR** A maximum of a 2 metre water table decline cumulatively at any water supply work.	Refer to: 11 Groundwater assessment Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment Appendix M Project impact and total impact water table drawdown over time
Water pressure A cumulative pressure head decline of not more than a 2 metre decline, at any water supply work.	Refer to: 11 Groundwater assessment Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment Appendix N Project impact and total impact landholder bore drawdown over time Appendix O Drawdown impacts in landholder bores – proposed 'make good' provisions
Water quality Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 metres from the activity.	Refer to: 11 Groundwater assessment Appendix K Hydrogeochemical Assessment

3. Proposed remedial actions where impacts are greater than predicted.

Table 6. Has the proponent:

AIP requirement		Proponent response	DPI Water comment
1	Considered types, scale, and likelihood of unforeseen impacts *during operation*?	Refer to: 11 Groundwater assessment Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment Appendix K Hydrogeochemical Assessment Appendix M Project impact and total impact water table drawdown over time Appendix N Project impact and total impact landholder bore drawdown over time	Clarification required, for example the monitoring of pillar stability and management of major subsidence impacts. Not satisfactory.
2	Considered types, scale, and likelihood of unforeseen impacts *post closure*?	Refer to: 11 Groundwater assessment Appendix I Groundwater Assessment Volume 2 – Numerical Modelling and Impact Assessment Appendix K Hydrogeochemical Assessment Appendix M Project impact and total impact water table drawdown over time Appendix N Project impact and total impact landholder bore drawdown over time	Clarification required, for example the monitoring of pillar stability and management of major subsidence impacts. Not satisfactory.
3	Proposed mitigation, prevention or avoidance strategies for each of these potential impacts?	Refer to: 13 Monitoring, mitigation and management Appendix O Drawdown impacts in landholder bores – proposed 'make good' provisions	Clarification required, for example the proposed make good arrangements and their scheduled application to individual landholder bores. Not satisfactory.
4	Proposed remedial actions should the risk minimization strategies fail?	Refer to: 13 Monitoring, mitigation and management	Clarification required, for example the monitoring of pillar stability and management of major subsidence impacts. Not satisfactory.
5	Considered what further mitigation, prevention, avoidance or remedial actions might be required?	Refer to: Appendix O Drawdown impacts in landholder bores – proposed 'make good' provisions	Clarification required, for example the proposed make good arrangements and their scheduled application to individual landholder bores. Not satisfactory.
6	Considered what conditions might be appropriate?	Refer to: 13 Monitoring, mitigation and	Clarification required, for example the monitoring

AIP requirement		Proponent response	DPI Water comment
		management	of pillar stability and management of major subsidence impacts. Not satisfactory.

4. Other considerations

Table 7: Has the proponent:

AIP requirement		Proponent response	DPI Water comment
1	Addressed how it will measure and monitor volumetric take? (page 4 of the AIP)	Refer to: 12.3 Required licence volumes (direct measurement of volumes)	Clarification required. Not satisfactory.
2	Outlined a reporting framework for volumetric take? (page 4 of the AIP)	Refer to: 13 Monitoring, mitigation and management	Reporting arrangements deferred to development of water management plans for the project. Not satisfactory.

End Attachment C

Attachment D

Hume Coal Project (SSD 7172) and related Berrima Rail Project (SSD 7171)
Request for comment on the Environmental Impact Statement
Groundwater Modelling Review

Compliance checklist

1. Are the model objectives and model confidence level classification clearly stated?

DPI W considers that the confidence level of this model is Class 1, not straddling between Class 2 and 3, as claimed by Coffey (Section 4.3.5, Volume 2, Appendix H). The main reason for this disagreement is the level of water balance error reported for the calibrated model at 4.1 % (For scenarios, it is over 6 % - See Tables 4, 10 and 11, Volume 2, Appendix H). This is completely unacceptable for a model to be classified as Class 2 or 3[1]. Typically (even in ill-posed, non-unique or, poorly calibrated models), the water balance error is 0.5 % or less (Reilly and Harbaugh, 2004[2]). It is a measure of how accurately the matrix of flow equations is solved for a 'given' parameter set. If the errors in the mass balance calculations are significant, then the matrix solution was not good, and the model should be corrected. Usually, such high errors are due to poor selection of solvers, discretisation, time steps and convergence criteria.

An exception could be where the model is poorly supported by observation data (spatial or temporal). This can be the case at Hume Coal, a mining environment, where constraints may be relaxed, and error of up to 2 % may be acceptable. Failure to satisfy a lower convergence target could well be an indicator of availability/reliability of observed data. Based on the information presented in reports, this is not the case. Data available is considered adequate by the modeller, and the two external reviewers.

The use of DRAIN package to model plunge tunnels, cut-throughs, gate roads, is appropriate. The DRAIN package will set the head to atmospheric pressure (zero), and it is possible that finite-difference cells adjacent to DRAIN cells may have very high head value, resulting in convergence issues. Desaturation of the porous media, especially around the DRAINs will require fine discretisation and small time steps for satisfactory convergence.

If the model calibration was done within a GUI environment (e.g. Vistas), which has an override that says "continue simulation even if no convergence". This should not normally be used.

Poor convergence reported makes the review of the report difficult. As the model did not adequately solve the groundwater flow equation, it is not clear what reliance can be placed on the model outputs.

2. Are the objectives satisfied?

Although the objectives of the model are not explicitly stated, they are deducible from the introductory sections of Volume 1 and 2 of Appendix H. For the convenience of the readers of this report; they are enumerated as below. Review comments will refer to the listed objectives.

(1) Develop a database to support the development of a regional numerical groundwater flow model for the Hume Coal project, by developing a hydrogeological conceptual model, with reduced uncertainty in model parameters of the numerical model.

(2) Simultaneously replicate observed/reported values of hydraulic conductivity, hydraulic heads, shallow groundwater discharge (base-flow to streams), deep groundwater discharge (discharge

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[1] The Australian Groundwater Modelling Guidelines suggest a mass balance error less than 0.5 % for Class 3 models, and less than 1 % for Class 1 models. See page 20, Table 2.1Barnett et al, 2012, *Australian groundwater modelling guidelines*, Waterlines report, National Water Commission, Canberra

[2] Reilly, Thomas E., and Arlen W. Harbaugh. 2004. *Guidelines for evaluating ground-water flow models*. US Department of the Interior, US Geological Survey, pp30.

to mine voids) during calibration to provide a suitable basis for predictive simulation of the proposed Hume mining operations.

(3) Use the calibrated numerical model in a predictive capacity to assess impacts from Hume mining operations using the Pine Feather layout and method.

The first objective has been satisfactorily met. Simultaneously replicating hydraulic conductivity, hydraulic heads, shallow groundwater discharge, and deep groundwater discharge had been met to varying degrees of satisfaction. Considering the large (unacceptable levels) of water balance errors of the model, even if the replication is satisfactory, it can only be considered accidental. Results from the model to predict the impacts of mining should be viewed within the context of unsatisfactory water balance errors.

3. Is the conceptual model consistent with objectives and confidence level classification?

Yes.

4. Is the conceptual model based on all available data, presented clearly and reviewed by an appropriate reviewer?

Yes. Dr Noel Merrick, the independent reviewer through model development and application, notes that the Document A 'serves as a standalone report without any undue reliance on other reports or inaccessible data sources'. His comments on Document A, Document B and Data Matters suggest that he is satisfied with the conceptual model.

5. Does the model design conform to best practice?

Yes. The domain used is large enough to prevent assumptions regarding boundary conditions had little or no effect on the drawdown predicted due to pumping. A finer grid is used to discretise 'panels' to be mined within the project area. Seven strata are grouped appropriately to form 13 model layers. Hawkesbury sandstone and Wongawilli seam are split into multiple layers to represent vertical head gradients observed.

6. Is the model calibration satisfactory?

DPIW does not consider that the model is calibrated. Our concerns are, (1) very high water balance errors, and (2) the SRMS value is higher than that suggested by the Australian Groundwater Modelling Guidelines. The attempt to simultaneously reproduce four different variables monitored is commendable. However, it is noted that predicted values of all four variables are outputs of the same model, in which the flow equation is inadequately solved (because they have high water balance errors).

7. Are the calibrated parameter values and estimated fluxes plausible?

Calibration was done by simulating initial heads to be used by running the model in the transient mode for a notional period of 32 years somewhere within the period between 1926 and 2011. The exact period selected was not specified. That period was chosen for the application of a steady state model to determine initial heads for the selected calibration period. The resultant heads were used as the initial heads for the transient calibration between 1 January 2011 and 31 December 2014. Therefore the transient calibration was only carried out for the identified four year period.

It would have been instructive if the simulated initial heads in 2011 were compared with the observed data at 59 sampling points across 24 sites corresponding to the same starting point.

The objective of calibration is to simultaneously for four different variables.

(1) Reported values of hydraulic properties: As evident in Fig 4.5, the calibrated values of K compares well with reported values of K.

(2) Observed hydraulic heads: The scatter plot (Fig 4.2) compares simulated heads in Aug 2015 with observed heads between March and July 2015. Why was the data observed from 2011 till

2014 not used to compare observed Vs simulated heads? Even for the final step, the SRMS values are higher than those suggested by the Australian Groundwater Modelling Guidelines. Residual plots are missing. They could help assess calibration. Comparison provided in Fig 4.3 is reasonable. Hydrographs in Appendix B show that the model reproduces the trends of groundwater level changes satisfactorily except when there are stresses (pumping e.g., HU_37, HU_38 and HU_88). This may have to do with the poor quality of pumping data and assumptions made to populate the WELL package.

(3) Observed baseflow to streams: Agree with the assessment made in the report. A figure comparing the temporal variation of streamflow at flow gauge 212009 could have been more helpful.

(4) Observed discharge to mine voids: Simulated values are within the range observed, although, fluctuations are a lot less than those observed.

8. Do the model predictions conform to best practice?

No. Water balance errors for calibration and the two predictive scenarios are unacceptably high.

9. Is the uncertainty associated with the predictions reported?

Despite the intent to minimise uncertainty by simultaneously calibrating four different variables, the evidence provided to claim successful calibration with minimal uncertainty is inadequate. It is noted that when the calibration is unsatisfactory, sensitivity as a surrogate for uncertainty of inputs to the model (Caving height, Kv, and mine drain conductance) results are not very meaningful. Uncertainty associated with the predictions is not provided.

10. Is the model fit for purpose?

No, because of poor water balance errors reported during calibration and prediction. Furthermore, despite high water balance errors, and intent to calibrate four variables simultaneously, the calibration remains poor (or inadequately reported). If the model is not solving the flow equations correctly, and calibration is questionable, then the model is not fit-for-purpose. We recommend that the model developer attempt to reduce water balance errors and improve calibration and provide further details of calibration.

Review checklist

1. Planning

1.1 Are the project objectives stated? Yes.

1.2 Are the model objectives stated? Yes.

1.3 Is it clear how the model will contribute to meeting the project objectives? Yes. Table A.1 and B.1 of Appendix A is very helpful.

1.4 Is a groundwater model the best option to address the project and model objectives? Yes. A groundwater model is the only option for this task. Data, information and knowledge, should be parsed carefully and linked to governing physical laws is the only way we could get an impression of what may happen due to stressing (pumping) a natural system.

1.5 Is the target model confidence-level classification stated and justified? No. Please see our response to Question 1, of the Compliance list.

1.6 Are the planned limitations and exclusions of the model stated? Only very briefly in Section 10 of Volume 2 of Appendix H. The main limitation of the model, namely high water balance errors, has to be acknowledged.

2. Conceptualisation

2.1 Has a literature review been completed, including examination of prior investigations? Yes. In Volume 1 of Appendix H.

2.2 Is the aquifer system adequately described? Yes.

2.3 Hydrostratigraphy including aquifer type (porous, fractured rock, etc.)?

2.3.1 Lateral extent, boundaries and significant internal features such as faults and regional folds? Yes.

2.3.2 Aquifer geometry including layer elevations and thicknesses? Yes.

2.3.3 Confined or unconfined flow and the variation of these conditions in space and time? Yes.

2.4 Have data on groundwater stresses been collected and analysed?

2.4.1 Recharge from rainfall, irrigation, floods, lakes? Yes. In Section 2 and 3.1.

2.4.2 River or lake stage heights? Rivers and Dams had been noted. No analysis of stream flows present.

2.4.3 Groundwater usage (pumping, returns, etc.)? In Section 9 of Volume 1, Appendix H.

2.4.4 Evapotranspiration? In section 3.2.3. Volume 2, Appendix H.

2.4.5 Other?

2.5 Have groundwater level observations been collected and analysed?

2.5.1 Selection of representative bore hydrographs? Yes. 59 bores at 24 sites.

2.5.2 Comparison of hydrographs? Yes. To demonstrate vertical gradients as well as horizontal gradients.

2.5.3 Effect of stresses on hydrographs? There's no discussion on this, largely due to a lack of groundwater usage records. Assumptions of groundwater use had been made to be consistent with entitlements.

2.5.4 Watertable maps/piezometric surfaces? Yes.

2.5.5 If relevant, are density and barometric effects taken into account in the interpretation of groundwater head and flow data? No.

2.6 Have flow observations been collected and analysed?

2.6.1 Base flow in rivers? In Section 8.1, Volume 1 of the Appendix H.

2.6.2 Discharge in springs? Yes. Springs are modelled as DRAINS.

2.6.3 Location of diffuse discharge areas? No. May not be present within the model domain.

2.7 Is the measurement error or data uncertainty reported?

2.7.1 Measurement error for directly measured quantities (e.g. piezometric level, concentration, flows)? No.

2.7.2 Spatial variability/heterogeneity of parameters? Yes. We believe all available details has been provided.

2.7.3 Interpolation algorithm(s) and uncertainty of gridded data? Not applicable. Initial heads for calibration obtained through 32 nominal years of transient simulation.

2.8 Have consistent data units and geometric datum been used? Yes.

2.9 Is there a clear description of the conceptual model?

2.9.1 Is there a graphical representation of the conceptual model? Yes.

2.9.2 Is the conceptual model based on all available, relevant data? Yes.

2.10 Is the conceptual model consistent with the model objectives and target model confidence level classification? Yes.

2.10.1 Are the relevant processes identified? Yes.

2.10.2 Is justification provided for omission or simplification of processes? For estimation of ET, stream flows and groundwater pumping.

2.11 Have alternative conceptual models been investigated? No.

3. Design and construction

3.1 Is the design consistent with the conceptual model? Yes.

3.2 Is the choice of numerical method and software appropriate? Yes.

3.2.1 Are the numerical and discretization methods appropriate? Yes.

3.2.2 Is the software reputable? Yes. MODFLOW-SURFACT is used.

3.2.3 Is the software included in the archive or are references to the software provided? Yes.

3.3 Are the spatial domain and discretization appropriate?

3.3.1 1D/2D/3D? This is a 3D model, as necessary to meet modelling objectives.

3.3.2 Lateral extent? Yes. Model boundaries are chosen far away from the project site. Hence errors associated with assumptions will not any impact on the model performance and results.

3.3.3 Layer geometry? Yes.

3.3.4 Is the horizontal discretization appropriate for the objectives, problem set, conceptual model and target confidence level classification? A suitable compromise has been made considering data availability, processing time and desired accuracy of results in deciding the discretisation.

3.3.5 Is the vertical discretisation appropriate? Are aquitards divided in multiple layers to model time lags of propagation of responses in the vertical direction? Yes.

3.4 Are the temporal domain and discretisation appropriate?

3.4.1 Steady state or transient? Transient to determine initial heads (conditions).

3.4.2 Stress periods? Yes.

3.4.3 Time steps? Not reported.

3.5 Are the boundary conditions plausible and sufficiently unrestrictive? Yes.

3.5.1 Is the implementation of boundary conditions consistent with the conceptual model? Yes.

3.5.2 Are the boundary conditions chosen to have a minimal impact on key model outcomes? How is this ascertained? Yes.

3.5.3 Is the calculation of diffuse recharge consistent with model objectives and confidence level? Yes.

3.5.4 Are lateral boundaries time-invariant? Yes.

3.6 Are the initial conditions appropriate?

3.6.1 Are the initial heads based on interpolation or on groundwater modelling? No. They were estimated using a nominal 32 year period. A comparison of actuals in 2011 and those estimated by transient simulation would be instructive.

3.6.2 Is the effect of initial conditions on key model outcomes assessed? No.

3.6.3 How is the initial concentration of solutes obtained (when relevant)? Not applicable.

3.7 Is the numerical solution of the model adequate?

3.7.1 Solution method/solver? Not reported.

3.7.2 Convergence criteria? Not reported.

3.7.3 Numerical precision? Not reported.

4. Calibration and sensitivity

4.1 Are all available types of observations used for calibration? Yes. It is innovative to calibrate against four variables simultaneously. See our response to Question 6 of Compliance List.

4.1.1 Groundwater head data? Yes.

4.1.2 Flux observations? Yes.

4.1.3 Other? Hydraulic Conductivity.

4.2 Does the calibration methodology conform to best practice? Not Applicable. See our response to Question 6 of Compliance List.

4.2.1 Parameterisation?

4.2.2 Objective function?

4.2.3 Identifiability of parameters?

4.2.4 Which methodology is used for model calibration? Trial and error.

4.3 Is a sensitivity of key model outcomes assessed against?

4.3.1 Parameters? Only for K. No justification for excluding others provided.

4.3.2 Boundary conditions? No.

4.3.3 Initial conditions? No.

4.3.4 Stresses? Yes, three levels of extractions simulated.

4.3.5 Other? Caving heights and mine flows.

4.4 Have the calibration results been adequately reported? Less than desired. See our response to Questions 6 and 7 of Compliance List.

4.4.1 Are there graphs showing modelled and observed hydrographs at an appropriate scale? Not provided.

4.4.2 Is it clear whether observed or assumed vertical head gradients have been replicated by the model? No evidence provided.

4.4.3 Are calibration statistics reported and illustrated in a reasonable manner? To a limited extent.

4.5 Are multiple methods of plotting calibration results used to highlight goodness of fit robustly? Is the model sufficiently calibrated? No. See our response to Questions 6 and 7 of Compliance List.

4.5.1 Spatially?

4.5.2 Temporally?

4.6 Are the calibrated parameters plausible? Yes. K values, stream flows and discharge to voids are all in plausible range.

4.7 Are the water volumes and fluxes in the water balance realistic? No. Water balance errors are unacceptable.

4.8 Has the model been verified? Limited data used.

5. Prediction

5.1 Are the model predictions designed in a manner that meets the model objectives? Yes. However, the modelled scenarios do not represent the possible influences of wet or dry years (weather conditions are not fully accounted for) and therefore cannot be used to understand impacts under stresses outside the average situation.

5.2 Is predictive uncertainty acknowledged and addressed? No.

5.3 Are the assumed climatic stresses appropriate? No. Only a percentage of rainfall is used as recharge estimate.

5.4 Is a null scenario defined? Yes. Australian Groundwater Modelling Guidelines consider a base condition (say climate) as null condition, and as the base condition to assess the impact of changed condition (climate change). This definition of a null scenario is not appropriate here. However the base condition of extraction without mining activities may be considered as a null scenario.

5.5 Are the scenarios defined in accordance with the model objectives and confidence level classification? Yes.

5.5.1 Are the pumping stresses similar in magnitude to those of the calibrated model? If not, is there reference to the associated reduction in model confidence? Not applicable. Pumping rates and duration of pumping for dewatering is much higher than those pumped by irrigators and S&D users.

5.5.2 Are well losses accounted for when estimating maximum pumping rates per well? Not relevant.

5.5.3 Is the temporal scale of the predictions commensurate with the calibrated model? If not, is there reference to the associated reduction in model confidence? Not relevant.

5.5.4 Are the assumed stresses and timescale appropriate for the stated objectives? Reasons for choosing assumed stresses and time scales are provided. How the stresses were implemented in each scenario is presented.

5.6 Do the prediction results meet the stated objectives? No, because of large water balance errors.

5.7 Are the components of the predicted mass balance realistic?

5.7.1 Are the pumping rates assigned in the input files equal to the modelled pumping rates? Yes.

5.7.2 Does predicted seepage to or from a river exceed measured or expected river flow? No.

5.7.3 Are there any anomalous boundary fluxes due to superposition of head dependent sinks (e.g. evapotranspiration) on head-dependent boundary cells (Type 1 or 3 boundary conditions)? No.

5.7.4 Is diffuse recharge from rainfall smaller than rainfall? Yes.

5.7.5 Are model storage changes dominated by anomalous head increases in isolated cells that receive recharge? No.

5.8 Has particle tracking been considered as an alternative to solute transport modelling? Not applicable.

6. Uncertainty

6.1 Is some qualitative or quantitative measure of uncertainty associated with the prediction reported together with the prediction? No.

6.2 Is the model with minimum prediction-error variance chosen for each prediction? Not relevant.

6.3 Are the sources of uncertainty discussed?

6.3.1 Measurement of uncertainty of observations and parameters? Yes.

6.3.2 Structural or model uncertainty? Yes.

6.4 Is the approach to estimation of uncertainty described and appropriate? Not relevant because a stochastic approach to uncertainty analysis was not undertaken.

6.5 Are there useful depictions of uncertainty? Not relevant.

7. Solute transport

7.1 Has all available data on the solute distributions, sources and transport processes been collected and analysed? Not applicable.

7.2 Has the appropriate extent of the model domain been delineated and are the adopted solute concentration boundaries defensible? Not applicable.

7.3 Is the choice of numerical method and software appropriate? Not applicable.

7.4 Is the grid design and resolution adequate, and has the effect of the discretisation on the model outcomes been systematically evaluated? Not applicable.

7.5 Is there sufficient basis for the description and parameterisation of the solute transport processes? Not applicable.

7.6 Are the solver and its parameters appropriate for the problem under consideration? Not applicable.

7.7 Has the relative importance of advection, dispersion and diffusion been assessed? Not applicable.

7.8 Has an assessment been made of the need to consider variable density conditions? Not applicable.

7.9 Is the initial solute concentration distribution sufficiently well-known for transient problems and consistent with the initial conditions for head/pressure? Not applicable.

7.10 Is the initial solute concentration distribution stable and in equilibrium with the solute boundary conditions and stresses? Not applicable.

7.11 Is the calibration based on meaningful metrics? Not applicable.

7.12 Has the effect of spatial and temporal discretisation and solution method taken into account in the sensitivity analysis? Not applicable.

7.13 Has the effect of flow parameters on solute concentration predictions been evaluated, or have solute concentrations been used to constrain flow parameters? Not applicable.

7.14 Does the uncertainty analysis consider the effect of solute transport parameter uncertainty, grid design and solver selection/settings? Not applicable.

7.15 Does the report address the role of geologic heterogeneity on solute concentration distributions? Not applicable.

8. Surface water–groundwater interaction

8.1 Is the conceptualisation of surface water–groundwater interaction in accordance with the model objectives? Yes.

8.2 Is the implementation of surface water–groundwater interaction appropriate? Yes.

8.3 Is the groundwater model coupled with a surface water model? No.

8.3.1 Is the adopted approach appropriate? Not applicable.

8.3.2 Have appropriate time steps and stress periods been adopted? Not applicable.

8.3.3 Are the interface fluxes consistent between the groundwater and surface water models? Not applicable.

End Attachment D

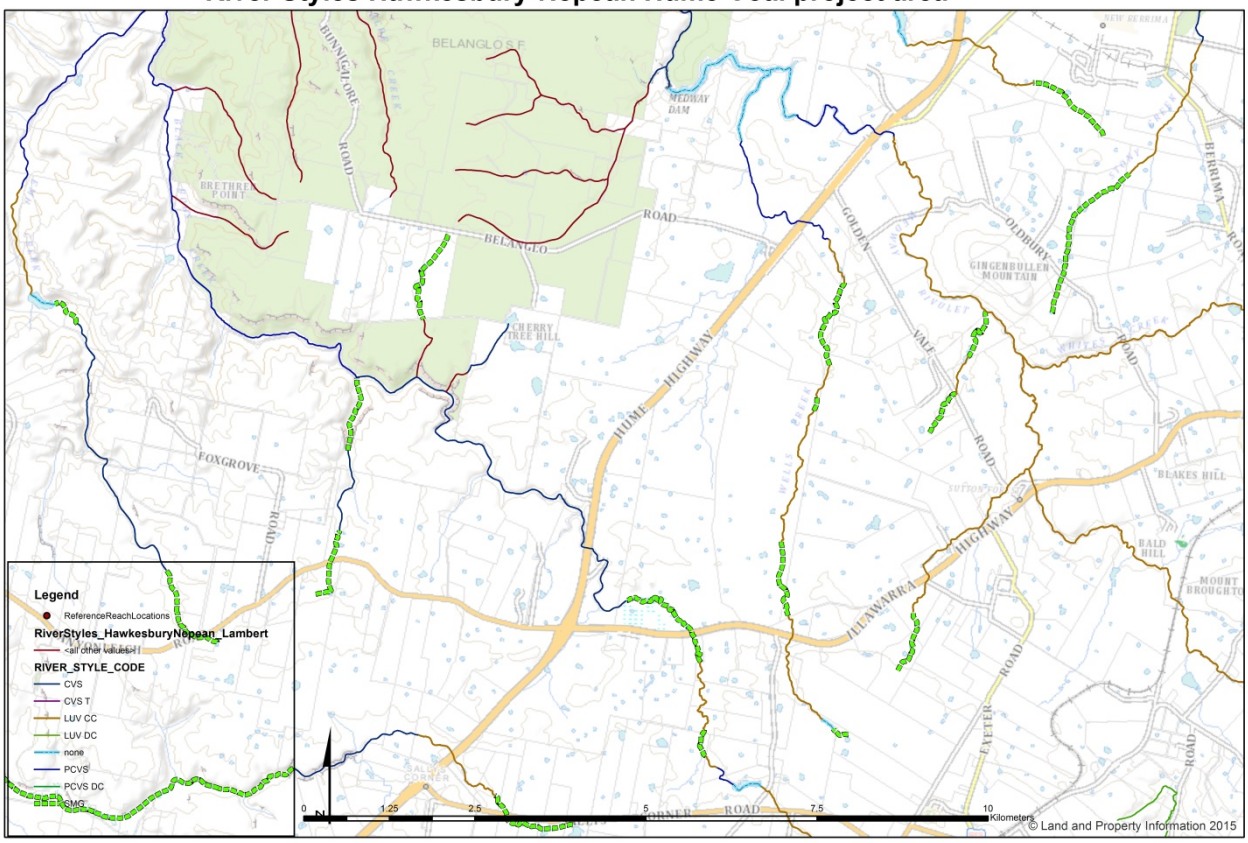
Attachment E

Hume Coal Project (SSD 7172) and related Berrima Rail Project (SSD 7171)
Request for comment on the Environmental Impact Statement
Watercourse Assessment Review

The footprint of the extraction area occupies nearly all of the Wells Creek catchment, which drains into Medway Rivulet as an arm of Medway Dam. Wells Creek is formed of upland fill that has incised and channelised between fill and chain of ponds reaches. Wells Creek contains remnant chain of ponds classed as moderate condition and with moderate recovery potential. The River Styles® of Wells Creek and that portion of Medway Rivulet within the assessment area is shown in Figure 1.

Figure 1. Valley settings of Wells Creek and Medway Rivulet. Note the combined Laterally Unconfined discontinuous chain of ponds and valley fill, fine grained reaches noted as broad green lines. These are highly fragile and rare/threatened River Styles® in the Hawkesbury-Nepean catchment.

River Styles Hawkesbury-Nepean Hume Coal project area



The highly sensitive reaches identified in Figure 1 are largely confined above farm dams and/or road crossings. These structures have the effect of preventing upstream knickpoint migration from incised and channelised reaches downstream of the remnant highly fragile reaches. Further disturbance to Wells Creek or Medway Rivulet may initiate further incision and degradation of these two rivers.

Wells Creek is not mentioned in the assessment of waterway presence or protection. Medway Rivulet is discussed, but its geomorphic status and risks are not addressed in any meaningful way. The river is classed as being moderately fragile over most of its length above Medway Reservoir and with moderate recovery potential. This implies higher sensitivity to alteration under disturbance, including subsidence

The mine will employ only first workings extraction across the entire mining domain. Maximum predicted subsidence is below 20mm, which extends across 80 % of the mining domain. The anticipated consequence of such subsidence on the river channels overlying the mining area is not

specified, as the high fragility reaches of Medway Rivulet, Belanglo Creek and Wells Creek are not identified in Figure 5.2 of Appendix E of the Environmental Impact Statement compared to the 2012 Department of Primary Industries – Water assessment. Appendix F of Appendix E of the EIS (Geomorphology assessment) contains survey information on watercourses lying within or adjacent to the mining area. Limited photographic records provide broad description of river character, but do not identify more fragile remnant river channel forms that have channelised into moderate fragility forms following European settlement.

It is important that the assessment should identify and protect those remnant channel forms, such as Laterally Unconfined chain of ponds and valley fill, fine grained reaches, as these River Styles® provide refuge to frogs and other species where pool storage levels remain intact during dry periods (Hazell et. al. 2003). Although numerous scattered reaches of these River Styles® exist in the Wollondilly and Wingecarribee catchments, they are regarded as threatened due to the historic loss of the majority of these characteristic river forms, and their sensitivity to alteration and destruction should incision and channelisation between the remnant ponds occur (Mould and Fryirs 2017).

The groundwater impact prediction (Appendix I, section 7.1.1) indicates less than 30 ML/yr baseflows will be lost from Wells Creek and other smaller watercourses due to differential groundwater drawdown. Although these figures appear to be small, they may have a significant effect on isolated pools or remnant chain of ponds located above the mine workings. Little work has been done on the ecosystem tolerance of loss of potential refuge due to pond level loss or drainage from a chain of ponds that has been affected by surrounding land uses or channelisation (Young 1986, Hazell et al 2003, Boulton et al 2004). It is important that both the absolute level drawdown of affected ponds is well understood and a mechanism to arrest and remediate ponds level loss and physical degradation is properly constructed and implemented where broad scale impacts are likely.

Medway Rivulet is predicted to lose approximately 330 ML pa baseflow. This loss will be noticeable during extended dry weather, when restrictions on pumping and interception are imposed on other water users. The impacts to both the river and water users reliant on inflows to Medway dam are estimated in Appendix F at approximately 1 % of catchment yield during extended dry conditions. Other waterways, apart from Oldbury Creek, are assumed to have no measurable impact.

Response to pond drawdown in the remnant chain of ponds reaches identified from the DPI Water River Styles® is not discussed. No specific stream remediation or rehabilitation recommendations are provided, as the general assumption that no discernible impact will occur to streams or geomorphic features will occur. No specific commitment to remediation of streams, riparian zones or rare geomorphic features, such as remnant chain of ponds or partially saturated valley fills is made in the EIS.

Therefore, DPI Water has difficulties in determining the adequacy of management measures proposed by the applicant. In the absence of recommended management options and rehabilitation of effects of pond drawdown and/or increased channelised connectivity between remnant ponds and valley fill reaches, the following recommendations are provided.

Recommendations

It is recommended further survey of unconfined River Styles® identified in the EIS and consistent with DPI Water's mapping assessment occur. This should focus on those reaches identified as possessing high fragility in the DPI Water 2012 River Styles® assessment. Surveys should include identifying remnant ponds features, extent and standing pond level and depth.

Areas likely to have differential settlement should have post-mining surveys conducted. These should focus on identifying likely or potential disturbance and channelisation within or downstream of remnant ponds and valley fills. Where these may be classed as swampy meadows, surveys should incorporate catenary survey lines to detect drawdown within the fill sediments.

Specific remediation programs should be developed to identify likely controls and where constructed controls may be required to prevent further channelization within and between chain of ponds. These should be consistent with existing rehabilitation standards (eg. Rutherford et al 2000) and recent research on processes related to geomorphic recovery in high fragility river channels (eg. MacTaggart et al 2006, Mould and Fryirs 2017).

Reporting of current geomorphic condition and projected recovery trajectories under current management regimes, potential subsidence conditions and with rehabilitation actions in place should be presented. These should be compared to ongoing management where management intervention is deemed necessary.

Licensing of baseflow loss and management of flows where baseflows are affected should consider replacement or replenishment options. These could include geomorphic rehabilitation to replace and/or improve channel and pool condition.

References

Boulton A., Mika S., Rida D., Wolfenden B.J. (2004) raising the dead: can we restore the health of subsurface aquatic ecosystems by recovering geomorphic complexity using conventional rehabilitation techniques? In *Airs, water and places – Transdisciplinary research in ecosystem health*. G Albrecht (Ed.) University of Newcastle, Callaghan, NSW.

Hazell D., Osborne W., Lindenmayer D. (2003) Impact of post-European stream change on frog habitat: southeastern Australia. *Biodiversity and Conservation* **12**: 301-320.

McTaggart B., Bauer J., Goldney D., Rawson A. The restoration and protection of the swampy meadow within an agricultural landscape. Australian Farm Business management 3 (2006) 68-75.

Mould S., Fryirs K. (2017) The Holocene evolution and geomorphology of a chain of ponds, southeast Australia: Establishing a physical template for river management. *Catena* 149(1) 349-362.

Young A.R.M. (1986) The geomorphic development of dells (Upland Swamps) on the Woronora Plateau, NSW, Australia. *Geomorphology* 38 (3-4) 221-235.

End Attachment E

Attachment F

Hume Coal Project (SSD 7172) and related Berrima Rail Project (SSD 7171)
Request for comment on the Environmental Impact Statement
DPI Agriculture Detailed Comments

Below is a list of five key agricultural matters that require further consideration by the proponent, followed by further detailed assessment of the agricultural impacts:

1. The reduction of the land capability classes as proposed in both projects after rehabilitation is a loss of the agricultural resource. Alternative measures to address the harvested topsoil deficit for similar capability classes for both the Hume Coal and the Berrima Rail Project is recommended. This could include the use of organic products such as biosolids.
2. Landholder consultation in relation to groundwater management needs to be transparent and consistent. An open dialogue with landholders to implement the 'make good' arrangements is appropriate and should be implemented.
3. Consultation with private landholders in the vicinity of the Berrima Rail Project is required to ensure flooding impacts are acceptable and appropriate mitigation measures are identified.
4. Consultation with private landholders is also required to ensure that livestock access across the proposed railway line is acceptable.
5. The proposed subsidence management plan should include the management of subsidence impacts to rural landholdings including impacts to infrastructure and any impacts to agricultural operations.

The risk ranking for the proposed Hume Coal (SSD 7172) and Berrima Rail Project (SSD 7171) impact to agriculture is B3.

Key reasons for this ranking include:

- Loss of the agricultural resource from higher to lower classes (58ha for Hume Coal and 31.4ha for Berrima Rail Project), albeit still capable of grazing for the Hume Coal Project but agricultural resource capability loss for Berrima Rail Project.
- Potential impacts from subsidence may impact on agricultural operations or infrastructure.

PROBABILITY / **Consequence**	**A** Almost Certain	**B** Likely	**C** Possible	**D** Unlikely	**E** Rare
1. Severe and/or permanent damage. Irreversible impacts					
2. Serious and /or long term damage. Long term management implications					
3. Moderate and/or medium-term impact to agricultural resources or industries. Some ongoing management implications					
4. Minor and/or short-term impact to agricultural resources or industries. Can be managed as part of routine operations					
5. Very minor impact to agricultural resources or industries. Can be effectively managed as part of normal operations					

Agricultural land resource

The Hume Coal EIS states that the land to be utilised for surface infrastructure will be returned to its pre-mined land use: grazing, after rehabilitation. It states that 59ha will be returned to the same land and soil capability class (LSC) and 58ha will change from class 3 (3ha), 4(37ha) or 5(18ha) to class 6. Note Table 8.9 below. The justification for the reduction in LSC class in the EIS is that the land can be used for grazing purposes and there is insufficient topsoil for rehabilitation.

LSC class land 3, 4 and 5 (as exists currently) has a much higher productive potential than in class 6. Classes 3 and 4 (40ha combined) enable cropping, high intensity grazing and horticulture, with land in class 5 supporting grazing and some horticulture. Class 6 is restricted to low intensity grazing and does not have the capability to support horticulture, cropping or high intensity grazing.

The reduction in LSC class of 58ha represents a loss of potential important productivity. DPI Agriculture recommends that the proponent explore alternative measures that could return this soil to its original or similar capability class. Measures outlined in the box below under the headings 'rehabilitation, soil stripping procedure and soil stockpile management' may assist with managing the quality of the soil harvested. However, alternatives such as biosolids will need to be investigated to address the harvested topsoil (class) deficit.

Rehabilitation:

- Fertiliser and/or soil ameliorants rates determined to ensure a suitable growth medium as part of the soil balance plan during stockpiling and prior to spreading.
- Overburden will be deep ripped prior to soil spreading to create a rough interface between topsoil and overburden.

Soil Stripping Procedure:

- Soils (top and subsoil) with Exchangeable Sodium Percentage greater than 6% (sodic soils) will be ameliorated with gypsum prior to stripping. This reduces the erosion risk of the soils in the stockpile and during the initial rehabilitation phase.

Soil Stockpile Management:

- Soils will be tested for agronomic properties (including but not limited to pH, Electrical Conductivity, Nitrogen, Phosphorous, Potassium, Sulphur, Exchangeable cations and micro nutrients) prior to spreading for rehabilitation.

A similar situation is presented for the Berrima Rail Project (Appendix D of the EIS). Table 14.9, page 347, describes the change in land classes after rehabilitation. Class 3 (2.2ha), class 4 (10.1ha) and class 5 (19.1ha) land respectively will change to class 7 or 8 which is unsuited to agriculture. The reduction in LSC class for 31.4ha of land represents a loss of agricultural land potential productivity. As for the coal mine, alternative measures need to be investigated to address how the soil can be returned to its original or similar capability class for the 31.4ha of land identified as changing to class 7 or 8 which is unsuitable for agricultural use.

Hume Coal Project

Table 8.9 LSC class pre- and post-mining

LSC Class	Capability	Pre-mining LSC (ha)	Post-mining LSC (ha)	Amount lost or gained (+/- ha)	% change
LSC of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)					
1	Extremely high	-	-		
2	Very high	-	-		
3	High	144	141	-3	-2%
LSC of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)					
4	Moderate	2221	2184	-37	-2%
5	Moderate-low	704	686	-18	-3%
LSC for a limited set of land uses (grazing, forestry and nature conservation)					
6	Low	1641	1699	+58	+4%
LSC generally incapable of agricultural land use (selective forestry and nature conservation)					
7	Very low	300	300		
8	Extremely low	-	-		
None	**Waterbodies, Hume Highway,etc**	41	41		

Note % of class change is low due to the large amount of project land

Berrima Rail Project

Table 14.9 Land and soil capability classes – post disturbance

Class	Capability	Current area (ha)	Post disturbance (ha)	
			Preferred option	Alternative option
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)				
1	Extremely high	0	0	0
2	Very high	0	0	0
3	High	17.5	15.3	15.3
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)				
4	Moderate	44.5	34.4	34.4
5	Moderate–low	79.0	59.9	59.6
Land capable for a limited set of land uses (grazing, forestry and nature conservation)				
6	Low	21.5	19.0	19.0
Land generally incapable of agricultural land use (selective forestry and nature conservation)				
7	Very low	1.2	25.2	25.4
8	Extremely low	17.7	27.6*	27.7*

Groundwater

An open dialogue between Hume Coal and all affected landowners needs to be undertaken on the ‘make good’ arrangements to ensure transparency and consistency of outcomes.

Surface water management – Berrima Rail Project

Most of the properties to be affected by surface flooding for the Berrima Rail Project during the operational phase is on Hume Coal owned land. However, there are a number of private properties that will be affected by surface flooding which will reduce their stocking capacity.

Appendix D of the EIS (p255) has set acceptability criteria for flood events at less than 250mm afflux for a 1 in 100 year flood based on previous project experience. However, it is unclear where the previous project experience is drawn and may not be applicable to this region. Hence, individual consultation with affected private landowners should take place to ensure flooding impacts are acceptable and mitigation measures required to reduce the impacts are identified and implemented if ensuing discussions with landholders consider it appropriate.

Livestock Crossing – Berrima Rail Project

DPI Agriculture notes that on p350 (Appendix D) that livestock access areas will be created to cross underneath the railway line. Consultation with affected landowners should take place to ensure that the proposed livestock access under the railway line is appropriate and the proposed livestock access itself is not subjected to flooding.

Subsidence

The EIS states that subsidence is expected to be less than 20mm and that a subsidence management plan will be developed to address any potential impacts. That plan should include the management of subsidence on rural landholdings including impacts to infrastructure and agricultural operations.

End Attachment F

Attachment G

Hume Coal Project (SSD 7172) and related Berrima Rail Project (SSD 7171)
Request for comment on the Environmental Impact Statement
Socio-Economic Assessment of Agricultural Impact Statement

The following is an assessment of the socio-economic aspects of the Agricultural Impact Statement (AIS, Appendix G) provided as part of the Hume Coal Project Environmental Impact Statement (EIS, 8 March 2017, SSD 15_7172).
The AIS and supporting documentation have been reviewed with reference to the following material: Strategic Regional Land Use Policy Guideline for AISs (Re-issued October 2012) and AIS technical notes: A companion to the AIS guideline (April 2013).

Below is a summary of information provided by the proponent that is not sufficient for an assessment to be made followed by the full socio-economic assessment. The proponent should provide further detail on the following matters:

- Processing and value adding industries – The proponent does not assess whether there would be any adverse impacts on processing and value adding industries other than the Southern Regional Livestock Exchange.
- Local and regional employment – The proponent does not clarify what percentage of local operational recruitment would be drawn from agricultural-related businesses. Insufficient information is provided to verify the direct and flow-on impacts on employment. The proponent does not specifically address whether the temporary construction village or increased housing demand would affect accommodation available for agricultural-related labour.
- Visual amenity – The proponent does not address whether there would be any potential adverse visual impacts on agricultural-related tourism infrastructure in the project vicinity.
- Landscape values – The proponent does not address the impact on landscape values or whether there would be any potential impacts on the landscape values of Mereworth.
- Tourism infrastructure – The proponent does not sufficiently describe the nature of agricultural tourism in the region or sufficiently address the potential impacts on agricultural-related tourism infrastructure.
- Mitigation of agricultural lands – The proponent does not propose any grazing strategies or provide any information to substantiate that improved pastures could sustain the high stocking rates suggested for land owned by Hume Coal. Insufficient detail is provided regarding the Subsidence Management Plan and the management and monitoring of potential groundwater impacts.
- Mitigation of agricultural enterprises – Insufficient details are provided regarding the social impact management and/or stakeholder engagement plans.
- Mitigation of agricultural infrastructure – The proponent does not address the potential impacts on farm improvements. Insufficient detail is provided regarding the traffic management plan.
- Impacts of physical movement of water away from agriculture – With regard to groundwater, insufficient information is provided regarding the consultation process for make good provisions. If the proponent needs to secure additional water access licences, then they need to assess and report whether there would be any potential adverse impacts on agriculture.

1. Potential impacts on agricultural support services, processing and value adding industries and regional employment

a) Agricultural support services

The proponent reports in Section 4.2 (p.100) that 190 ha and 107 ha would be temporarily removed from agriculture during construction and operation respectively (Table 4.4). The proponent claims that no agricultural land would be permanently removed post operations (Section 4.4, p.111).
The proponent estimates that the net present value (NPV) of the temporary foregone loss of agricultural production over the project span of 23 years at a discount rate of 7% would be a maximum of $1.72 million, including the Berrima Rail Project (Section 5.4, pp.126-131). This loss represents 0.34-0.37% of the comparable NPV of the gross value of agricultural production for the Wingecarribee Shire, estimated using the 2010-2011 figure as the long-term average (reported to be $41.3 million in the Executive Summary (p.ES.1) and $44.8 million in Section 2.4.1 (p.27)).
The proponent addresses that the potential impacts on agricultural support services in Section 6.1 (p.133). The proponent estimates that the predicted reduction in livestock production for the Wingecarribee region would be 1.9% during construction and 0.8% during operations.
The estimated changes are expected to be below the 5% level recommended by NSW DPI as a significant threshold (NSW DPI technical notes, April 2013, Section 4.3, p.9).
This assessment has been informed by the following material:
Hume Coal Project EIS – Appendix G (AIS).

b) Processing and value adding industries

The proponent addresses the potential impacts on agricultural processing industries in Section 6.1 (p.133). The proponent estimates that the predicted reduction in throughput for the Southern Regional Livestock Exchange ranges from 0.5-1.1%. The estimated changes are expected to be below the 5% level recommended by NSW DPI as a significant threshold (NSW DPI technical notes, April 2013, Section 4.3, p.19).
However, the proponent does not assess whether there would be any adverse impacts on other processing and value adding industries (e.g., Inghams Enterprises Berrima Feed Mill described in Section 2.3.1 (p.19)).
Information provided by the proponent is not sufficient for an assessment to be made.
This assessment has been informed by the following material:
Hume Coal Project EIS – Appendix G (AIS).

c) Local and regional employment

The proponent addresses the potential impacts on local and regional employment in Section 6.3 (pp.136-138). The peak workforce in full-time equivalent (FTE) employees would be approximately 400 during construction and 300 during operation. The proponent explains that construction workers would require highly specialised skills and be mostly sourced from outside the local area. The proponent explains that over time an increasing number of operational workers would be drawn from the local workforce and priority would be given to local recruits who meet required criteria. The proponent posits two local-recruitment scenarios for the peak operations workforce (1 – 70% local recruitment; 2 – 50% local recruitment). However, the proponent does not clarify what percentage of local recruitment would be drawn from agricultural-related businesses.
The proponent reports in Section 6.3.3 (p.137) that there would be direct local impacts on employment of 0.2-0.4 FTE depending on the stocking rate, plus flow-on effects of 0.14-0.28 FTE. The proponent explains in Section 5.4.2 (pp.129-130) that there would be additional direct local impacts of 0.1 FTE plus similar flow-on effects due to the Berrima Rail Project. These impacts are based on estimated foregone agricultural production values and flow-on effects, and assumptions that “labour is supplied locally” and that a salary is $45,000 per annum; however, insufficient information is provided to repeat the calculation described in Section 5.4.1 iii (pp.128-129) to verify the impacts quoted.
The proponent explains in Section 6.3 (p.136) and Section 7.1.7 (p.143) that non-local construction workers would be housed in a temporary accommodation village within the project area, which would avoid “excessive pressure on local short-term accommodation supply which would disrupt the tourism industry”, as well as “eliminate project-related effects on the general availability of rental accommodation”. However, the proponent does not specifically address whether the village would avoid any potential impacts on accommodation available for agricultural-related labour.
The proponent also explains in Section 6.3 (p.136) that the population would change (i.e., increase) during operation and would impact on housing demand. However, the proponent does not specifically address whether increased housing demand would affect the availability of accommodation for agricultural-related labour.

Notably, the proponent states in Table 5.4 (p.116) that there would be potential negative impacts on agricultural labour (e.g., loss of jobs, lower income). The proponent states that these impacts would be managed and mitigated through a Stakeholder Engagement Plan. See point 3b).
Information provided by the proponent is not sufficient for an assessment to be made.
This assessment has been informed by the following material:
Hume Coal Project EIS – Appendix G (AIS).

2. Potential impacts on visual amenity, landscape values and tourism infrastructure relied upon by local and regional agricultural enterprises

a) Visual amenity

The proponent addresses the potential impacts on visual amenity in Section 6.2 (p.133). The proponent states that the project would "not have significant adverse visual impacts on the region surrounding the project area". The proponent asserts that the project would be "shielded from view" due to "existing mature vegetation in the landscape, and the area's topography and rural nature". The proponent acknowledges that "some changes to the landscape" would be "noticeable to viewers from certain viewpoints surrounding the project", "especially in the early stages prior to maturation of screen landscaping".
The proponent outlines the results of a visual impact assessment in Section 6.2.1 (p.134) and states that mitigation measures would include "tree planting to screen the proposed infrastructure". The proponent also states in Section 4.1.1 (p.93) that the project design would integrate "with the existing topography and landform" and be "set back from sensitive receptors where possible, to minimise the potential for visual, noise, dust and amenity impacts".
The proponent does not address whether there would be any potential adverse visual impacts on agricultural-related tourism infrastructure in the project vicinity. The proponent acknowledges in Section 6.2 (p.133) that tourism "is an important industry in the region". See point 2c).
Information provided by the proponent is not sufficient for an assessment to be made.
This assessment has been informed by the following material:
Hume Coal Project EIS – Appendix G (AIS).

b) Landscape values

The proponent does not address the impact on landscape values, although they claim to do so in Section 6.2 (pp.133-134). In fact, they make no statements with regard to landscape values in the AIS.
The proponent states that Hume Coal has sought to "avoid direct impacts on features like Mereworth House and gardens, which is a locally listed heritage place owned by Hume Coal" (Table 3.26, p.82; Section 7.1.3, pp.140-141). The proponent also states that the resultant surface-infrastructure design "completely avoids State-listed heritage items and direct impacts to locally-listed heritage items" (Section 7.1.3, p.141). However, the proponent does not address whether there would be any potential impacts on the landscape values of Mereworth.
Information provided by the proponent is not sufficient for an assessment to be made.
This assessment has been informed by the following material:
Hume Coal Project EIS – Appendix G (AIS); NSW Office of Environment & Heritage NSW heritage database (http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2680351).

c) Tourism infrastructure

The proponent states in Section 6.2 (p.133) that tourism "is an important industry in the region, and includes B&B and farmstay accommodation, cellar door sales at the various wineries in the region". The proponent states that the "wineries and accommodation are mostly to the south and south-west of the project". However, the proponent acknowledges in Section 3.7.1 (p.79) that some of the privately-owned agricultural properties in the project area "are used for tourism, such as the Red Cow Farm (a landscaped garden), and accommodation".
The proponent lists a number of agricultural-related tourism businesses "in the project area" in Tables 3.26-3.29 (pp.82-87). The information provided is not sufficient for an assessment to be made of the project's impacts and has been augmented by internet searches. The following business is owned by Hume Coal:

- Mereworth – A local heritage-listed house and garden; see point 2b) and http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2680351

and these seven businesses are privately owned:

- Cherry Tree Hill – A winery and cellar door; see http://www.cherrytreehill.com.au/
- Araluen – A property that hosts the Berrima Horse Trials and other equestrian events; see http://berrimahorsetrials.com.au/about-us-2/
- Eliza Grove – A property that is home to Sutton Forest Olives and runs tours and farm visits; see http://www.suttonforestolives.com.au/contact
- Crookes – A property that has a four-hole golf course; no information is available on the internet.
- Eling Forest Winery – An estate that has a winery, cellar door, function centre and accommodation, and runs courses; see https://www.elingforest.com.au/
- Sutton Farm – A property run as an equestrian facility and riding school; see http://www.suttonfarm.com.au/
- Red Cow Farm – A property with gardens, a nursery and gift shop; see http://www.redcowfarm.com.au/

The proponent does not sufficiently describe the nature of agricultural tourism in the region or sufficiently address the potential impacts on agricultural-related tourism infrastructure.
Information provided by the proponent is not sufficient for an assessment to be made.
This assessment has been informed by the following material:
Hume Coal Project EIS – Appendix G (AIS).

3. Mitigation measures for minimising adverse impacts on agricultural resources, including agricultural lands, enterprises and infrastructure at the local and regional level

a) Agricultural lands

The Proponent explains in Section 4.3.4 (p.107) that the land capability of 58 ha of surface disturbance would be permanently reduced (i.e., 3 ha of Class 3, 37 ha of Class 4 and 18 ha of Class 5 land would be reduced to Class 6). The proponent states in Section 7.6.1 (p.151) that the overriding goal of the rehabilitation strategy is to return disturbed land to grazing with improved pasture. The proponent states that pasture grass species would be "chosen to suit the chosen grazing strategy" (Section 7.6.4, p.156); however, no grazing strategies are proposed and no information is provided to substantiate that improved pastures could sustain the high stocking rates suggested in Table 5.6 (p.127) for land owned by Hume Coal.
The proponent states that management of subsidence would involve a Subsidence Management Plan (Section 7.2.4, p.144; Section 7.3.4, p.148). Such a plan is appropriate; however, information provided by the proponent is not sufficient for an assessment to be made.
The proponent acknowledges in Table 5.4 (p.115), Section 5.2 (p.117) and Section 7.4 (p.149) that potential impacts on agricultural groundwater users represents a high unmitigated risk. The proponent claims in Section 7.4 (p.149) that a "comprehensive mitigation program has been designed" and that make good provisions would reduce the risk substantially. However, management and monitoring of potential groundwater impacts described in Sections 7.2.1 (p.143) and 7.3.1 (p.147) respectively are not sufficient for an assessment to be made. Also see point 4.
This assessment has been informed by the following material:
Hume Coal Project EIS – Appendix G (AIS).

b) Agricultural enterprises

To manage potential agricultural impacts (identified in Section 5, pp.113-131), the proponent states in Section 7.2.11 (p.146) that it proposes to "develop and implement a social impact management plan (SIMP) for the project". The proponent elaborates that "SIMPs detail strategies to use during the construction, operation, and closure and rehabilitation phases of the project to monitor, report, evaluate, review and proactively respond to social change".

To monitor potential agricultural impacts, the proponent states in Section 7.3.9 (p.148) that "stakeholder and community consultation will be carried out through all stages of the project, including prior to closure" and that a "SIMP will be implemented".
The proponent also states in Table 5.4 (p.116) that potential impacts on agricultural stakeholders would be managed and mitigated through a Stakeholder Engagement Plan (SEP).
A SIMP and/or SEP are appropriate; however, information provided by the proponent is not sufficient for an assessment to be made.
The proponent provides an overview of their stakeholder engagement strategy in Section 8 (pp.159-161). The intended content of the SIMP and/or SEP should be described in detail here, including how agreed management and mitigation measures would be developed, implemented, monitored and reported, and what mechanisms for dispute resolution would be put in place. The proponent should also describe in more detail the ongoing functions of the two advisory groups noted in Table 8.1 (p.160), namely the social reference group and the water advisory group.
This assessment has been informed by the following material:
Hume Coal Project EIS – Appendix G (AIS).

c) Agricultural infrastructure

The proponent states in Section 1.5 (p.4) and Section 3.7.1 (p.79) that there are rural residences and farm improvements (e.g., outbuildings, dams, access tracks, fences, yards) across the project area. However, the proponent does not address the potential impacts on farm improvements. Information provided by the proponent is not sufficient for an assessment to be made.
The proponent acknowledges in Section 5.3.1 (p.125) that the project will use "major transport routes used by agricultural producers to access supporting services and to move their products". The proponent provides a summary of an impact assessment of traffic and transport "as it relates to agricultural support infrastructure", and concludes that no "significant adverse traffic impacts have been identified for future traffic movements generated by the project" (Section 5.3.1, pp.125-126). The proponent states in Section 7.3.10 (p.149) that a Traffic Management Plan (TMP) "will be developed".
A TMP is appropriate; however, information provided by the proponent is not sufficient for an assessment to be made. The intended content of the TMP with specific reference to agricultural-related traffic should be described in detail, including how agreed management and mitigation measures would be developed, implemented, monitored and reported, and what mechanisms for dispute resolution would be put in place.
This assessment has been informed by the following material:
Hume Coal Project EIS – Appendix G (AIS).

4. Impacts of physical movement of water away from agriculture

The proponent addresses the potential impacts of the physical movement of water away from agriculture in Section 5.5 (p.131). The proponent states that as Hume Coal would be required to provide make good provisions for landholders, there would be "no overall economic loss to agriculture".
The proponent states in Section 5.2.1 i (p.117) and Section 5.5 (p.131) that make good provisions "would be determined on a case by case basis involving consultation with the landholder" and require assessment of individual bores (presumably by Hume Coal) "to determine what 'make good' provisions might be required". Notably, the proponent reports in Section 5.2.1 iii a (pp.118-119) that 93 registered landholder bores could be impacted. The proponent acknowledges in Table 5.4 (p.115), Section 5.2 (p.117) and Section 7.4 (p.149) that potential impacts on agricultural groundwater users represents a high unmitigated risk. The concept of make good provisions is appropriate; however, insufficient information is provided regarding the consultation process, including how make good provisions would be agreed, implemented, monitored and reported, and what mechanisms for dispute resolution would be put in place. The proponent should also clarify whether the water advisory group mentioned in Table 8.1 (p.160) would have a role in the consultation process.
The proponent states in Section 5.5 (p.131) that Hume Coal has already secured 60% of the total peak licence requirements for the project, with a clear pathway to securing the remaining 40%. However, DPI Water notes that uncertainty exists "in the current and future entitlement held by the proponent". If the proponent needs to secure additional water access licences, then they need to assess and report whether there would be any potential adverse impacts on agriculture.
Information provided by the proponent is not sufficient for an assessment to be made.

This assessment has been informed by the following material:
Hume Coal Project EIS – Appendix G (AIS).

End Attachment G

Attachment H

Hume Coal Project (SSD 7172) and related Berrima Rail Project (SSD 7171)
Request for comment on the Environmental Impact Statement
DPI Fisheries Detailed Comments

DPI Fisheries is responsible for ensuring that fish stocks are conserved and that there is no net loss of key fish habitats upon which they depend. To achieve this, DPI Fisheries ensures that developments comply with the requirements of the *Fisheries Management Act 1994* (namely the aquatic habitat protection and threatened species conservation provisions in Parts 7 and 7A of the Act, respectively), and the associated *Policy and Guidelines for Aquatic Habitat Management and Fish Conservation (2013)*. In addition, DPI Fisheries is responsible for ensuring the sustainable management of commercial, recreational and Aboriginal cultural fishing, aquaculture and marine protected areas within NSW.

The EIS has been separated into two distinct projects, the Hume Coal project and the Berrima Rail project, therefore separate advice has been issued relating to each individual project.

Hume Coal Project

The footprint of this State Significant Development proposal is extensive and encompasses the catchments of Belanglo Creek, Bobs Creek, Wells Creek, Oldbury Creek, Medway Rivulet, Medway Dam and Medway River. The potential impact of the development upon the aquatic habitats and fish communities associated with these waterways is of particular interest to this Department.

DPI Fisheries has reviewed the documentation in light of the above and makes the following comments and recommendations.

Drawdown of groundwater and impact upon riparian vegetation

The impact of the mine of most significance to Fisheries relates to the predicted drawdown of groundwater. Section 7.5.5 states “baseflow reduction is expected to occur in the majority of drainage lines within the vicinity of the project area”. Drawdown of groundwater has the potential to result in adverse impacts to riparian and instream vegetation by reducing the frequency and duration of groundwater intersecting with streambeds and riparian zones.

The Biodiversity Assessment Report (Appendix H) identifies a high risk of impact to terrestrial vegetation associated with drainage lines (riparian vegetation) along Belanglo and Wells Creeks as result of water table drawdown. A moderate risk of impact to riparian vegetation is predicted along sections of Black Bobs Creek.

“Decline of native riparian vegetation along NSW water courses” has been listed as key threatening process under the FM Act in recognition of its role in the decline of several species of fish. It is therefore important to ensure that groundwater drawdown does not adversely affect riparian vegetation.

Table 6.1 of the Biodiversity Report outlines mitigation measures to monitor impacts to riparian vegetation. However, monitoring is only proposed in the areas of high risk (i.e. along Belanglo and Wells Creeks). There are no plans for assessment of any areas designated moderate or low risk. Monitoring of high risk areas is proposed to occur only

during ‘extended periods of drought’. Should a decline be detected, a response is contingent on the decline being attributable to mine activities.

DPI Fisheries does not consider that this measure will be adequate to ensure mitigation of potential impacts to at-risk riparian vegetation. The Department recommends that monitoring of the vegetation deemed to be at high or moderate risk occurs on at least an annual basis. This will help ensure that trends in decline are detected early and enable responses to be implemented before the decline becomes irreversible. An appropriate response strategy to alleviate impacts, should they be detected, needs to be developed prior to mining commencing. Clear parameters need to be established to define how a decline would be considered to be attributable to mine activities in addition to measures to ensure that an independent determination as to the attributable cause will be made.

Impacts upon water quality

DPI supports the adoption of the Neutral or Beneficial Effect (NorBE) principle for water quality of discharge from SB03 and SB04 into Oldfields Creek to a level at least 10% below that of pre-development baseline data. Proposed water quality monitoring is outlined in section 7.7.3 of the Hume Coal EIS. Proposed Water Quality Monitoring Plans (both construction and operation) need to be designed and developed to test predictions made in the EIS in relation to NorBE water quality outcomes and changes to base flow. The plans should include monitoring sites within the footprint and at upstream and downstream locations so practical comparisons can be made. The monitoring regime should include both regular (e.g. monthly) as well as event based (e.g. following more than 25mm of rain in 24 hours) sampling.

Section 7.4.2 iv (p167) of the Hume Coal Project EIS states depressurisation of groundwater systems will result in increases to aluminium levels, exceeding the guideline values for aquatic ecosystems. However, no further assessment or analysis of the potential impact has been provided. Further assessment of the potential impacts to aquatic ecosystems arising from the predicted exceedance of guideline values for aluminium is required.

Works within Key Fish Habitat

Several aspects of infrastructure related to the mine will require works within waterways mapped as Key Fish Habitat (KFH). These include water pipelines, conveyer belt, internal road, sediment basin outlets and scour protection. Each of these items has the potential to have adverse impacts upon fish habitats if poorly designed or constructed. If a Project Approval is issued, the conditions should require that detailed designs for any item located within or adjacent to a KFH waterway be referred to DPI Fisheries for consideration and advice prior to construction.

Berrima Rail Project

The proposed Berrima Rail corridor crosses the mapped Key Fish Habitat waterways of Stony Creek and Oldfields Creek along with associated tributaries and drainage lines. The potential impacts to fish passage and water quality within these waterways is of importance to this Department.

DPI Fisheries concur with the proposed waterway crossing types as outlined in Table 13.20 of Appendix D – Berrima Rail Project EIS. In order to ensure that the crossings facilitate fish passage the floor of proposed pipes and culverts must be recessed by at least 100mm below the existing bed level of the creek. If a Project Approval is issued,

the conditions should require that the final design for the crossing and associated scour protection at location FG / GEO01 – Stony Creek and at location FG21 / GEO04 – Oldbury Creek be provided to the Department for review and comment prior to construction.

We support the proponent's primary principle for surface water management to minimise erosion and sediment generation at the source. To ensure minimal impacts are achieved, all measures outlined in section 13.5.7 of Appendix D – Berrima Rail Project EIS need to be fully implemented.

End Attachment H