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Our ref: *D2017/72359*

Paul Freeman
Team Leader Assessments
NSW Department of Planning & Environment
320 Pitt Street, Sydney NSW 2000
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Dear Mr Freeman

Hume Coal Project (SSD 7172) and Berrima Rail Project (SSD 7171)

I refer to your e-mail dated 31 March 2017 inviting WaterNSW to make a submission, including recommendations, on the Environmental Impact Statements (EIS) for the Hume Coal Project and related Berrima Rail Project. WaterNSW's primary concerns with the EISs are listed below, with more detailed comments provided in the attachments.

The Projects are located in the Sydney drinking water catchment as defined in State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 (the SEPP) and the declared Sydney catchment area as defined in the *Water NSW Act 2014*. The Project areas drain to the Wingecarribee River which flows to Warragamba Dam. Warragamba Dam supplies 80 per cent of Sydney's water.

Overall Comments

WaterNSW considers there are several shortcomings in the EIS for the Hume Coal Project that must be adequately addressed by Hume Coal prior to the Department's assessment.

WaterNSW considers that the Berrima Rail Project can be constructed and operated to have a neutral of beneficial effect on water quality.

The main concerns of WaterNSW regarding the Hume Coal Project are:

- The hydrogeological modelling supporting the Hume Coal EIS appears likely to underestimate the reduction in groundwater levels and baseflows, particularly during extended drought, which is a significant concern to WaterNSW. A prediction of these outputs including worst-case (extended drought) sensitivity testing of the groundwater model should be undertaken.
- Unless the water take is properly managed and accounted for, the Hume Coal project may significantly reduce the quantity of water in the Sydney catchment area and available for WaterNSW's supply requirements. Water take must be accurately predicted and accounted for by holding water access licences with sufficient entitlement volumes or accounted for under exemptions. Hume Coal must provide details of contingency measures to be implemented if the actual take of water exceed the allocation. This is particularly important during low flow periods including periods of drought.
- The method used for assessing neutral or beneficial effect on water quality (NorBE) is not considered appropriate. WaterNSW does not consider the comparison of groundwater and

surface water quality results an appropriate method to assess the impact on stream water quality of base flow reduction from depressurisation of groundwater. The method of NorBE assessment for the coal mining infrastructure and roads, although suggesting NorBE could be achievable, deviates from WaterNSW's recommended practice. This affects the quantum of water quality improvements and the applicability of the proposed improvements. An appropriate NorBE assessment for both surface and groundwater quality, including impacts arising from the interaction of impacted groundwater on stormwater quality should be undertaken.

WaterNSW expects the information requested above (and below) will be provided in the Response to Submissions report. Further WaterNSW expects it will be provided the opportunity to review the report and provide further advice to the Department prior to the Department undertaking its assessment.

Hume Coal Project

Hume Coal proposes a mining method which aims to minimise subsidence and associated impacts. Whilst WaterNSW supports this non-caving approach, we have no direct experience with this mining method and look forward to reviewing DPE's specialist review on subsidence predictions.

WaterNSW had adopted a set of principles (Attachment 1) that establish the outcomes it considers as essential to protect the drinking water supplies of Sydney and the surrounding region. The principles relevant to the Hume Coal Project relate to:

- Protection of water quantity
- Protection of water quality in Declared Catchment Areas
- Sound and robust evidence regarding environmental impacts

WaterNSW has assessed the EIS against its mining principles and has the following concerns about the prediction analysis and potential impacts:

Water quantity

Groundwater and Water Balance

The groundwater assessment, including predictions of drawdown and impacts on stream baseflows, is based on steady-state predictive modelling. This effectively means that these parameters are predicted as averages. Although the groundwater modelling calibration used dynamic (transient) rainfall and groundwater levels, the drawdown and baseflow impact predictions made by the groundwater model does not account for rainfall variability. It therefore appears likely to underestimate baseflow losses and water table declines during drought periods (see Attachment 2 for details). The water balance modeling also used average mine water flow estimates (see Attachment 3 for details) and does not consider groundwater level variability due to climatic effects and drawdowns induced by other users, particularly in extended drought periods.

Use of average rainfall input, rather than probabilistic or worst-case scenario ranges, makes derived groundwater impact predictions non-conservative/optimistic for dry periods. **This lack of conservatism is a significant concern to WaterNSW and should be addressed, e.g. through additional worst-case sensitivity testing of baseflow and groundwater level reductions on neighboring bores, prior to the Department's assessment of the Project.**

Surface water flow may also be more heavily impacted than is predicted by the proponent's models. The lumped rainfall-runoff model does not account for stream flow regulation (storages) or surface water abstraction by other users, greatly reducing its accuracy and reliability for making streamflow impact predictions. **This apparent lack of conservatism in predictions needs to be addressed prior to the Department's assessment of the Project.**

The lack of adequate monitoring and baseline data for both surface water and groundwater resources is a concern. Limited groundwater baseline monitoring data is available to estimate current/pre-mining water levels/pressures for the purpose of differentiating mine impacts (e.g.

baseflow reductions) and also for calculating any "make good" arrangements for creeks and bores.

High quality flow gauging in the catchments of the project area is limited, particularly downstream in Oldbury and Wells Creeks, Medway Rivulet and Wingecarribee River. The corresponding paucity of high quality monitoring data makes it extremely difficult to:

- set meaningful performance measures for baseflow reductions (particularly in low flow situations)
- monitor and verify predicted stream flow and catchment yield impacts for the Medway Rivulet and the Lower Wingecarribee management zones, and
- assess cumulative impacts associated with other licensed river extractions and STP discharges.

The mine inputs and outputs in the groundwater assessment in Volume 4b, Appendix I, Table 6 are inconsistent and appear to contradict the average annual water balance inputs and outputs in Volume 4a, Figure 8.2. Table 6 shows the mine operation is likely to experience net water deficit for 15 out of the 19 years of modelled mine operation whilst Figure 8.2 shows the mine will have net water balance on an average annual year. **This is a significant concern to WaterNSW and needs to be addressed prior to the Department's assessment of the Project.**

The project proposes reinjection of mine water back to mine voids to facilitate quicker recovery of impacted groundwater systems. However, the water balance modeling suggests in the average year 83 ML/year (approximately 5% of annual groundwater mine inflows) is predicted to be reinjected into voids, whilst 179 ML would be supplied from the voids to the surface. In other words, the volume of groundwater predicted to be abstracted from the mine is greater than the volume to be re-injected, which means that each year the groundwater deficit would increase. On this basis, WaterNSW does not consider the proposed reinjection as an effective mitigation measure for recovery of groundwater levels during the mine's operation.

WaterNSW notes Table 13.2 (Volume 4a, Main Report) proposes reinjection of surplus water into Hawkesbury Sandstone as a management measure for a number of potential risks. This methodology has not been discussed in detail or analysed in the EIS or supporting information. If it is proposed as part of the management mitigation strategies, then more detailed information on the feasibility and dynamics of the reinjection scheme should be presented.

Water Licensing

The EIS states that Hume Coal is planning to bid for groundwater, through any applicable controlled allocation process. A Controlled Allocation order on the 5 May 2017 made 14,935 shares available from the Sydney Basin Nepean Zone 2 Groundwater Source. This allocation is unavailable to the project however, as the Hume Coal Project is in Management Zone 1 and it is not permissible to transfer allocations from Zone 2 to Zone 1. WaterNSW is not confident that any future Controlled Allocation will be made in the Zone 1 source, which would mean that any groundwater required for the project that is not currently allocated to the Mine will need to be purchased through water trading.

The EIS has not provided the following key information:

- detailed maps clearly delineating relevant water sources, allowing identification of the amount of shares of access licenses required from each water source subject to the Water Sharing Plan
- strategies to acquire necessary licence shares. The EIS states that the proponent is planning to acquire licences through the water market, but its ability to do so is likely to be heavily restricted by market availability particularly during dry periods
- volumes of surface water the proponent estimates they are entitled to take under "Harvestable Rights" provisions, and the method of estimation; and

- details of how affected surface water users and holders of basic landholder rights will be compensated for reductions in flows, increases in zero flow days and declines in groundwater levels within landholder bores.

The proposed development is located within the Warragamba Dam Catchment. Unless the water take is properly managed and accounted for, the Hume Coal project may significantly reduce the quantity of water in the Sydney catchment area and available for WaterNSW's supply requirements. **This is a significant concern to WaterNSW and should be addressed prior the Department's assessment of the Project.**

Water take must be accurately predicted and accounted for by holding water access licences with sufficient entitlement volumes or accounted for under exemptions. Hume Coal must provide details of contingency measures to be implemented if the actual take of water exceed the allocation. This is particularly important during low flow periods including periods of drought. These details must be provided prior to the Department's assessment of the Project.

The operating licence issued to WaterNSW under the Water *Management Act 2000* requires WaterNSW to maintain minimum flows in the Wingecarribee River for environmental purposes and to supply downstream users (see Attachment 4). These daily release volumes for the environment and downstream users, and inter dam transfers should not be detrimentally impacted by the proposed development.

Water Quality

Surface water quality

The EIS states that site specific Water Quality Objectives should be based on 24 months baseline or reference data. Issues with the data include: many of the sampling sites have less than one year of data, last reported measurements were in September 2015, the number of samples downstream the project area significantly less than upstream, three supplementary sample sites added in close proximity on Oldbury Creek using farm dams, and sample data is only reported as summary statistics by creek system. Detailed water quality data for individual locations was not included in the EIS and only supplied to WaterNSW on 15 June 2017. **The extent and efficacy of the presented surface water data, is a significant concern to WaterNSW and should be addressed prior the Department's assessment of the Project.**

NorBE Assessment

Clause 10(1) of the SEPP states *"A consent authority must not grant consent to the carrying out of development under Part 4 of the Act on land in the Sydney drinking water catchment unless it is satisfied that the carrying out of the proposed development would have a neutral or beneficial effect on water quality."*

WaterNSW considers a neutral or beneficial effect on water quality is satisfied if the development:

(a) has no identifiable potential impact on water quality, or

(b) will contain any water quality impact on the development site and prevent it from reaching any watercourse, waterbody or drainage depression on the site, or

(c) will transfer any water quality impact outside the site where it is treated and disposed of, to standards approved by the consent authority.

WaterNSW considers the method used for the NorBE assessment is inappropriate as outlined below.

The EIS compares baseline stormwater and groundwater quality data to assess impact on stream water quality of base flow reduction from depressurization of groundwater. This method of NorBE assessment is considered inappropriate by WaterNSW. Stormflow water pollutant concentrations (specifically nitrogen and phosphorus), are often an order of 10 times greater than baseflow pollutant concentrations. Oldbury Creek and Medway Rivulet (both receiving creeks) are predicted

to experience 4.2 and 1.4% base flows reductions respectively compared to simulated stream flows (not actual stream flow). The low flow regime in Medway Rivulet is predicted to be significantly changed with the number of no flow days predicted to increase by up to 30%. WaterNSW considers the resultant stream water in Oldbury Creek and Medway Rivulet leaving the project site will have a higher concentration of nitrogen and phosphorous due to base flow reductions. **An appropriate NorBE assessment for water quality impacts from baseflow reduction needs to be provided, prior the Department's assessment of the Project.**

The maximum allowable water quality proposed by Hume Coal in releases (after first flush) from stormwater basins (SB03 and SB04) into Oldbury Creek is of concern. It uses "threshold levels" for applicable metals at concentrations between 2 to 4 times higher than the maximum values of the published baseline stream water quality for Oldbury Creek. This estimation does not appear conservative and such releases have a negative effect on water quality. WaterNSW considers the design criteria of a Water Treatment Plant and dam MW08 should be further investigated. These facilities should be installed during the construction stage as an additional safety factor for the project.

The EIS states that for infrastructure and roads NorBE is achieved. WaterNSW questions the method and MUSIC stormwater quality modeling assumptions used in this analysis. Issues with the infrastructure modelling include daily stochastic modelling and treating all pre development flow as stormflow. Issues with roads modeling include quantification of the infrastructure disturbance, soil parameters used, soil parameters post development after topsoil stripping, size and type of SQIDs proposed, how the SQIDs fit into the landscape, post development land use categories etc. When the assessment was replicated, WaterNSW could not obtain the same result.

WaterNSW considers that it is likely that NorBE can be met for the infrastructure and roads but further analysis and different management practices are required which should be addressed in the response to submissions report.

WaterNSW does not consider the assessment of grey and blackwater from the development, nor the proposed management techniques, adequate or suitable for use in the Sydney drinking water catchment. The impacts of the establishment of a 400 person construction accommodation facility on water quality are not adequately addressed in the EIS. **This is a concern to WaterNSW and should be addressed, prior to the Department's assessment of the Project.**

WaterNSW is concerned about coal dust emissions from the proposed mining ventilation shaft near Wells Creek and the Coal Processing Plant (CPP) and transportation operations near Oldbury Creek. Approximately 25 hectares adjacent or over Oldbury Creek are predicted to receive 1g/m2/month (120 kg/ha/yr) dust from CPP and transportation operations. Additionally for the ventilation shaft near Wells creek, approximately 10 hectare below MWD07 dam, has no protection of coal dust. Runoff from these areas is likely to deteriorate water quality in Oldbury Creek and Wells Creek. **This is a concern to WaterNSW and should be addressed, prior the Department's assessment of the Project.**

WaterNSW considers a detailed assessment is required of the impact of the construction, operation and decommissioning of the Project on the quality of both surface and ground water.

Ground water quality

The EIS states that groundwater will not be impacted. WaterNSW does not agree with this assessment, as the collected or re-injected water will not be the same quality as natural groundwater, and may be much lower or different (see Attachment 2). The EIS discusses the emplacement of lime-adjusted coal washery rejects but does not adequately discuss the implication of this material on groundwater quality, along with chemicals associated with coal processing or mine operation and lining of mine with rock dust. It does not adequately address the risk of increased contaminants leaching into groundwater over time, impacts on users accessing coal seam groundwater downgradient of the proposed mine or impacts on surface water quality via groundwater and surface water interaction. **This is a concern to WaterNSW and should be addressed prior the Department's assessment of the Project.**

Further there is insufficient data to assess the likely impact of salt leaching from the Wianamatta Group Shale (WGS). Predictions of induced vertical flux of salt from WGS to underlying Hawkesbury Sandstone (HBSS) is based on water quality data collected at a single sampling location that may not be representative for the whole project area. The EIS states that groundwater salinity at this WGS monitoring bore appears to be just moderately higher than groundwater in other formations. However, this result is not typical of, i.e. less saline than, WGS groundwater elsewhere in the Sydney Basin, and the single sample referred to in the EIS was in a relatively thin sequence of WGS. More analysis is necessary to adequately model the potential effects of draining WGS groundwaters into the underlying high quality HBSS aquifer, source of drinking water, via groundwater baseflows to surface waters.

Predictions of water quality in the primary water dam assumed average composition of the proportion of individual water sources based on water balance modelling. Temporal variations in water quality may occur as water will be recycled, mine water impacted by decants from the reject slurry or water balance components will change reflecting climate influence. **This needs to be addressed prior to Department's assessment of the project.**

Additionally, due to the proposed scale of the dams containing water and sediments with potentially elevated levels of metals and other pollutants, the management of the sites dams needs to ensure that the clay liners have sufficient impermeability to prevent contamination of the groundwaters.

Berrima Rail Project

The EIS states that NorBE is achieved. WaterNSW questions the method and MUSIC stormwater quality modeling assumptions used in this analysis (see Attachment 5). When replicated, WaterNSW could not obtain the same result. WaterNSW considers that subject to further analysis, different management practices including further stormwater quality improvement devices there is scope for NorBE to be met. WaterNSW considers Hume Coal should upgrade the level of detailed information supplied on this project including an updated water cycle management plan and NorBE assessment and associated MUSIC stormwater quality modeling.

WaterNSW requests the opportunity to continue to be involved in any ongoing assessment of the application including providing comments on the Response to Submissions report. Further queries about our submission can be directed to Malcolm Hughes, Manager Catchment Protection, who can be contacted on 98652520 or via e-mail malcolm.hughes@waternsw.com.au or Neil Cowley on 48689417 or via e-mail neil.cowley@waternsw.com.au.

Yours sincerely

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ATTACHMENT 1 – WATERNSW PRINCIPLES FOR MANAGING MINING AND COAL SEAM GAS IMPACTS IN DECLARED CATCHMNENT AREAS

WaterNSW has adopted a set of principles that underpin its decision making in relation to mining activities in the Special Areas. The principles establish the outcomes WaterNSW considers as essential to protect the drinking water supplies to the four and half million people of Sydney and the surrounding region, and are:

1. **Protection of water quantity**

   In Declared Catchment Areas mining and coal seam gas activities must not result in a reduction in the quantity of surface and groundwater inflows to storages or loss of water from storages or their catchments.

2. **Protection of water quality in Declared Catchment Areas**

   In Declared Catchment Areas mining and coal seam gas activities must not result in a reduction in the quality of surface and ground water inflows to storages.

3. **Protection of human health in Declared Catchments Areas**

   Mining and coal seam gas activities must not pose increased risks to human health as a result of using water from the drinking water catchments.

4. **Protection of water supply infrastructure**

   The integrity of the WaterNSW's water supply infrastructure must not be compromised.

5. **Protection of ecological integrity in Special Areas**

   The ecological integrity of the Special Areas must be maintained and protected.

6. **Sound and robust evidence regarding environmental impacts**

   Information provided by proponents, including environmental impact assessments for proposed mining and coal seam activities must be detailed, thorough, scientifically robust and holistic. The potential cumulative impacts must be comprehensively addressed.

ATTACHMENT 2 – Volume 4B – Appendix E (Technical Reports in Appendices F-O)

WATER IMPACT ASSESSMENT REPORT (EMM, 2017)

Appendix F: Surface Water Flow and Geomorphology Assessment (WSP PB, 2016)

Main Issues:

- The quality and distribution of the existing streamflow monitoring network present significant limitations for calibrating the model, as does the limited availability of gauged data for catchments which will be potentially influenced by the project activities. The limitations in networks and data also make identification of suitable reference catchments for comparison with mining impacts very difficult.
- Impacts of the project activities on stream flow regime was assessed for different climatic scenarios (including wet and dry years), but baseflow reductions were predicted separately by the groundwater model only for steady state conditions based on average rainfall. Predicted stream flow changes during dry years are therefore likely to be underestimated.
- Almost all catchments within, upstream and downstream of the proposed project area are disturbed/regulated with a number of storages and/or diversion works (pumps) extracting water for various purposes. The lumped rainfall-runoff model does not account for stream flow regulation (storages) or surface water abstraction by other users, greatly reducing its accuracy and reliability for making streamflow impact predictions.
- It will be extremely difficult to identify meaningful Performance Measures to confirm whether predicted stream flow and catchment yield impacts have been exceeded, particularly baseflow reductions for the Medway Rivulet and the Lower Wingecarribee Management Zones. It will also be difficult, if not impossible, to accurately measure, assess and verify that the impacts are consistent with the predictions.
- The report lacks a single detailed surface water map setting out the position and elevations of relevant waterways, water storages and surface water monitoring locations around the project area. Such a figure would be valuable in interpreting surface water monitoring locations, flow pathways and potentially impacted streams.

Other Comments:

- Descriptions of assessment methodology vary in the level of details provided for simulations of surface runoff at mine site to those for downstream catchments. Stream flow data used for calibration of the AWBM models developed for each catchment/management zones and calibrated parameters are not presented, and should be included in the report as a daily hydrograph and provided as analysable datasets.
- Predictions of potential stream flow impacts for the Lower Wollondilly Management Zone were approximated using model parameters calibrated to Medway Rivulet. It is not explained why the available and potentially more applicable long-term gauged flows at 212270 (Wollondilly River at Jooriland) were not used for quantification of yield reduction for this management zone.
- The report should clarify the differences in baseflow results obtained from hydrograph separation (presented in the groundwater data analysis report) to the Base Flow Index parameter incorporated in the AWBM model.

Appendix H. Groundwater Assessment Volume 1: Data Analysis (Coffey, 2016)
General comments

- In general, the report provides a comprehensive summary and in-depth data analysis of key features affecting the water balance of the region. It is considered a practical and rigorous attempt to build a plausible conceptual model and to summarise and interpret the

factors and information which will most influence regional surface water and groundwater behaviour.

Other comments:

- The report refers to analysis of baseflow discharge to streams for four Hume Coal surface water monitoring locations, but only two are reported. Details of all baseflow analyses should be presented.
- Inferred groundwater hydraulic surfaces in Upper Hawkesbury and Wianamatta Group aquifers for late 2013 - early 2014 cover only a small portion of the project area. There seems to be lack of baseline groundwater monitoring data within the project area to estimate current/pre-mining water levels/pressures. Comment on the adequacy of the baseline groundwater conditions should be provided.

Appendix I. Groundwater Assessment Volume 2: Numerical Modelling and Impact Assessment (Coffey, 2016)

General comments

- It is noted that the proposed mining method is not expected to cause caving and that cracking-induced desaturation above the panels is predicted to be restricted to a zone only 2m high. As a result, there is inferred to be considerably less uncertainty associated with modelling of the caving effects and fracturing on the overburden hydraulic properties and potential impact on groundwater system relative to a longwall-based proposal.
- Predicted mine inflow rates and reduction in baseflow discharge to streams are critical parameters used in the assessment of mine water balance/water requirements and estimates of potential impacts on catchment yield. These inflows are predicted in terms of steady-state (average) recharge conditions that do not account for climate variability.
- The modelling has been peer-reviewed by two respected practitioners, and with minor recommendations for improvements is considered by them to meet the requirements of the Australian Groundwater Modelling Guidelines.

Peer review reports:
Main issues:

- Predictions of potential impacts on groundwater drawdown and stream baseflow does not account for rainfall variability. The 100 years predictions based on average rainfall are unlikely to estimate the magnitude of the impact that may occur during dry periods.
- The predicted extent and duration of water table drawdown may change under different climatic conditions.
- Whilst the modelling appears robust, the uncertainty analysis is not comprehensive and it is not easy to confirm whether it adequately covers worst case conditions which might arise in and after the 19 year planned mine life.
- In particular, the model has tested the sensitivity of only three of the model parameters: height of drainage above underground mine voids, vertical hydraulic conductivity and the mine void drain conductance. Thorough analysis of the groundwater model's sensitivity to variations in a more comprehensive set of key parameters (including horizontal permeability, storativity and conceptualisations of the inferred sub-vertical flow barrier underneath the basalt and boundary conditions) is required.
- The modelling incorporates purely hypothetical simulations of groundwater pumping and it is not clear if reinjection was simulated. Some aspects of the water balance modelling appears to be optimistic, particularly in terms of being able to purchase necessary

groundwater entitlements, and the sensitivity of the groundwater and water balance modelling to lower water levels (e.g. during drought years) is required.

Other comments:

- Predictive simulations using groundwater model required calculations of the approximate mine water balance, which are then used to refine water balance predictions – this creates a potential source of error and uncertainty.
- The mine inputs and outputs in the groundwater assessment in Volume 4b, Appendix I, Table 6 are inconsistent and contradictory when compared with the average annual water balance inputs and outputs in Volume 4a, Figure 8.2. Table 6 shows the mine operation is likely to experience net water deficit for 15 out of the 19 years of modelled mine operation whilst Figure 8.2 shows mine will have net water balance on an average annual year.
- The project proposes reinjection of mine water back to mine voids to allow quicker recovery of impacted groundwater systems. However, the water balance modelling suggests in the average year 83 ML/year (approximately 5% of annual groundwater mine inflows) is predicted to be reinjected into voids, whilst 179 ML would be supplied from the voids to the surface. In other words, the volume of groundwater predicted to be abstracted from the mine is significantly greater than the volume to be re-injected, which means that in each year the groundwater deficit would increase. WaterNSW does not consider reinjection as an effective mitigation measure for recovery of groundwater level.
- Table 6 presents net water balance deficit (page 28) for mining years 2-16 that will be satisfied by pumping from Hume bores and withdrawal of water from recovering mine voids. On the other hand "Base Case" scenario (Table 8, page 36) refers to water injection behind bulk head. It is difficult to follow how the mitigation measures (particularly injection or pumping from sealed panels and disposal of slurry) and other components of mine water management were incorporated into groundwater model.
- Table 16 (page 57) includes estimated proportion of total drawdown due to Hume operations at the start and end of a sustained dry period. It is not clear how it was possible to assess the influence of climate (dry or wet periods) on groundwater drawdown using model predictions based on average rainfall.
- Predictions indicate that the drawdown footprint in water table is very similar to the drawdown footprint in the Wongawilli Seam extending only a maximum of 2 km in the south east corner of the mine footprint. The report would benefit from more detailed discussion of these predictions and underlying assumptions.
- Permian sediments including coal seams outcrops in the Black Bobs Creek and its tributaries west and northwest of the project area and GDEs in Black Bobs Creek. There is no assessment of impact of coal seams dewatering on baseflows in the Black Bobs Creek tributaries where the Permian sediments outcrop within or just on the boundary of the project area. The report should provide modelled groundwater flow pattern for the Wongawilli Seam and more detailed discussion for setting the western groundwater model boundary.
- The report does not provide any results on how perennial/ephemeral boundaries are likely to change as a result of groundwater drawdown.

Appendix K. Hydrogeochemical Assessment (Geosyntec, 2016)
General comments:

- Assessment of groundwater quality is based on data collected from Hume Coal monitoring bores between 2011 and 2014. Predictions of water quality from the coal processing plant were based on the results from the kinetic leaching test by RGS (2016) and geochemical

modelling for assessment of general water quality and trace metals exceedances for beneficial water use. The assessment used average water quality data for the estimated components of mine water balance.

Main issues:

- The report does not provide any information and discussion on chemicals associated with coal processing/mine operation and if such chemicals may cause any contamination issues and potentially impact on users accessing coal seam groundwater downgradient of the proposed mine.
- There is not enough data to assess/predict impact of salt leaching from the WG shale. Predictions of induced vertical flux of salt from WG shale to underlying Hawkesbury SS is based on water quality data collected at one sampling location that may not be representative for the whole project area. It is commented in the report that groundwater salinity at this WG shale monitoring bore appears to be just moderately higher compared to groundwater in other formations and it can be expected that salinity of groundwater in thicker occurrences of WG shales could be an order of magnitude greater than reported for the project area (at one location).
- Predictions of water quality in the primary water dam assumed average composition of the proportion of individual water sources based on water balance modelling. Temporal variations in water quality may occur as water will be recycled, mine water impacted by decants from the reject slurry or water balance components will change reflecting climate influence.
- It appears possible that water will be recirculated several times through the various storages, and may become progressively saltier as it does.

Other comments:

- Water quality in the primary water dam (PWD) for subsurface disposal was assessed using geochemical modelling and assuming mixing ratios of end members waters indicated from water balance (70% of extracted groundwater, 20% of rainfall, 10% of process water and dust suppression returns). It was assumed that no volumetric changes will occur due to evaporation (concentration) or direct rainfall (dilution). Simulated processes involved gas exchange with atmosphere (CO_2 degassing and oxygen dissolution) and precipitation of reactive mineral phases. It was concluded that the PWD water quality is likely to be similar to the Wongawilli Seam groundwater having similar exceedances of dissolved metals criteria and a similar overall beneficial use profile. Predicted exceedances for copper and nickel were considered conservative as these were related to process water that may be overestimated and further dilution with influx of natural groundwater is likely to occur after injection into underground voids.

- Some potential issues relating to the geochemical modelling results are:
    - CO_2 degassing effects carbonate equilibria that are associated with changes in pH (an increase). It is not clear what reactions are likely to cause a predicted decrease in redox potential during CO_2 degassing.
    - The composition of the PWD water is likely to change as proportions of the end member waters are likely to vary depending on climate and mine water demand.
    - Stability of colloidal iron precipitates (ferrihydrite) and subsequently mobility of adsorbed metals in the PWD may be affected by dam stratification. Reducing conditions after underground placement and groundwater recovery may impact on mobilisation of metals from iron precipitates in the stockpiled reject material.

- Presentation of water quality results would be improved if the data described in the text were supported with box plot diagrams and the Piper Plot showed results for all groundwater samples rather than averages (for each monitoring locations).
- Many groundwater samples collected outside the project area would be classified as sulphate-type waters, with low pH and low (on non-detected) concentrations of chloride and bicarbonates. It is noted by the consultants that this sulphate dominance (unusual in Hawkesbury Sandstone pore water) may be associated with areas subject of particularly efficient rainfall recharge. Clarification of the term efficient recharge is requested.
- It was predicted that the maximum mining induced salt flux will peak by 9 % above baseline approximately 14.5 years from start of mining. This does not appear to account for variability in salt content and thickness of WG shale within the area predicted to be impacted by groundwater drawdown.

ATTACHMENT 3 – Volume 4A – Appendix E (APPENDIX A TO E)
HUME COAL PROJECT ENVIRONMENTAL IMPACT STATEMENT (EMM, 2017)

Water Impact Assessment Main report:

Chapter 3.2.1 Water Sharing Plans and Chapter 12 Water Licenses
Two Water Sharing Plans are applicable for the project and surrounds, although 99% of the project area is covered in the plans and sources described below:
Surface water:

- Water Sharing Plan (WSP) for the Greater Metropolitan Region Unregulated River Water Sources 2011
- Upper Nepean and Upstream Warragamba Water Source
- Medway Rivulet Management Zone (approximately 90% of the project area)
- Lower Wingecarribee Management Zone (remaining 10% west in Belanglo)

Groundwater:

- Water Sharing Plan (WSP) for the Greater Metropolitan Region Groundwater Sources 2011
- Sydney Basin Nepean Groundwater Source
- Nepean Zone 1.

The estimated total peak water demand is Unregulated 54.5 shares, Groundwater 2235 shares. The EIS states that the Company have obtained Unregulated – 31 shares, Groundwater – 1391 shares which constitute the 60% level required to lodge the development application .

WaterNSW is delegated to determine dealings under S71 of the *Water Management Act 2000* for all customers including major mining developments. The following provisions (Offences) in PART 2, Division 1A of the Act apply in relation to take of water from unregulated water sources and aquifers:

60A taking water without, or otherwise than authorised by, access license

60D Taking water otherwise than by a nominated water supply work

To comply with s 60A Hume Coal is required to hold access licenses of sufficient shares from each water source. This includes shares of access licenses from each zone of the unregulated water sources and the Zone 1 of the Sydney basin Nepean Groundwater Source.

To comply with s 60D each of the above licenses need to nominate water supply work/s. This is a dealing under s 71W of the Act and subject to determination by WaterNSW.

Hume Coal is also required to:

- Develop strategies to comply with cease to pump requirements under the rules of the water sharing plan and conditions of licences
- Develop strategies to mitigate impacts on licenced users and basic landholder rights where it is likely that reduction in baseflows likely to impact on ability of other users to take water triggering early cease to pump conditions
- Account for the water take as a result of drawdown of the water table resulting in loss of baseflow and subsequent changes to the flow regime.

In the EIS, Hume Coal state they are planning to bid for groundwater, through any applicable controlled allocation process. A controlled allocation order on the 5th May 2017 made 14,935 shares available from the Sydney Basin Nepean Zone 2 Groundwater Source. This water is unavailable to the Project, as the Hume Coal Project is in Management Zone 1, and it is not permissible to transfer allocations from Zone 2 to Zone 1. The proponent is required to purchase aquifer category water from Zone 1 to use on the mine site. To take water for the project, the

proponent is required to apply for a dealing to nominate the water supply works that will take water from the water source.

Main Issues:
The EIS has not provided:

- Detailed maps clearly delineating relevant water sources, allowing identification of the amount of shares of access licenses required from each water source subject to the Water Sharing Plan
- Strategies in place to acquire necessary licence shares. The EIS states that the proponent is planning to acquire licences through the water market, but its ability to do so is likely to be heavily restricted by market availability particularly during dry periods
- Volume of surface water entitled to take under the Harvestable Rights, and the method of estimation
- Details of measures to compensate the effected surface water users and holders of basic landholder rights due to reduction in flows and increase in zero flow days.

The area subject to the proposed development is located within the catchment of Warragamba Dam. Unless the water take is properly managed and accounted for, the Hume Coal project may significantly reduce the quantity of water in the Sydney catchment area and available for WaterNSW's supply requirements. Predicted water take must be accurately predicted, along with an explanation of what contingency measures will be taken to replace any water takes above predictions during drought periods.

The operating licence issued to WaterNSW under the *Water Management Act 2000* requires WaterNSW to maintain minimum flows in the Wingecarribee River for environmental purposes and to supply downstream users. These operations should not be allowed to be impacted by the proposed development.

Chapter 8.2 of the Main Report and Appendix D Water Balance.

The water balance indicates that excess water can be managed by either reinjection in the void or pumping to the PWD and that there is no requirement to treat excess water to allow it to be discharged into Oldbury Creek.

Main Issues:

- The water balance model is using simulated rainfall runoff data but appears to be using average groundwater estimates, which doesn't change under different groundwater conditions.
- Due to the scale of the dams, and their depth (PWD is 16 metres deep at maximum), the management of the site needs to ensure that the clay liner has sufficiently low permeability to prevent the contamination of groundwater. The stored water in the dam will be a mixture of mine groundwater, rainwater and process water, with potentially elevated levels of metals and other pollutants.
- The EIS discusses a clay liner for the PWD only. There should also be a requirement that other sediment basins coming into contact with the sediments from coal washings should also be lined.

Chapter 8.4 and Appendix E Surface water Quality

- The water quality report references the threshold nutrient levels from the Healthy River Commission (HRC 1998) for Nitrogen (N) and Phosphorus (P). The 80th percentile baseline information for N and P exceed the threshold for the heavily disturbed agricultural

catchments (e.g. Medway Rivulet, Oldbury Creek, Wells Creek). The more forested catchments to the west (Belanglo Creek and Planting Spade Creek) have 80th percentile baseline readings below the HRC guideline.

Main Issues:

- Reductions in baseflows in streams above and around mined areas will result in less stream flow rates. Stormflow water nutrient concentrations are often an order of 10 times greater than groundwater-derived baseflow nutrient concentrations. Where these baseflow reductions are significant relative to storm flow components, stream water will therefore have a higher concentration of nitrogen and phosphorous, indicating NorBE will not be met.
- Water quality at site infrastructure should generally be able to be managed by the proposed strategies. However concern exists with releases (after first flush) from stormwater basins (SB03 and SB04) into Oldbury Creek. The assessment has used threshold levels for applicable metals, at concentrations between 2-4 times higher than the maximum values of the published baseline stream water quality. This would not meet NorBE.
- The daily electronic MUSIC models were supplied on 8 June 2017 to audit results.
- The surface water quality monitoring of sites used to create baseline concentrations of existing creeks and the baseline for operational monitoring locations potentially have data sampling issues (discussed below).
- The proposed onsite wastewater management (black and greywater) for construction activities is not considered satisfactory t. The proposal is forfiltering of greywater (estimated at 32,000litres/day) then irrigation ointo paddocks. No detailed allocation of treatment methodology or effluent disposal areas with suitable buffer areas are provided.
- Water quality concerns exist from coal dust deposition associated with the proposed mining ventilation shaft near Wells Creek and the Coal Processing Plant and transportation operations near Oldbury Creek. Approximately 25 hectares of the 1g/m2/day (120 kg/ha/yr) isopleth is adjacent or spreads over Oldbury Creek. Part of these areas, are also within the flood impacted areas of the site. Additionally about half of the isopleth from the ventilation shaft near Wells Creek, has no protection of coal dust pollution to the waterway above Medway dam.

Other Comments:

- Estimates of base water discharge to Medway Rivulet (and tributaries) are predicted to decrease by 0.8 ML/day for many years during the life of the mine. These predictions are based on modelling, and issues on baseflow modelling are discussed below in the groundwater section.
- To justify the impact of reduced baseflow on water quality for other metals, Table 5.13 compares streamflow baseline data with groundwater baseline data. Errors in Table 5.13 exist in the Nitrogen and Phosphorus levels reported for Medway Rivulet.
- The groundwater baseline data in Table 6.2, has not used any below detection level values in the calculation of summary statistics. This analysis method makes the existing groundwater concentrations look worse, when compared with streamflow baseflow values and also leachate concentration figures.
- The methods for quantifying water quality impacts of the surface infrastructure in the EIS have some technical issues. Infrastructure water quality impacts were modelled in MUSIC using GoldSIM output as daily inputs. The use of daily values has much lower repeatability for stochastic load modelling, than 6 minute impacts as required in WaterNSW's standard for the "Use of MUSIC in Sydney's drinking water catchments" (Sydney Catchment Authority 2012).
- This daily electronic MUSIC models were only supplied on 8 June 2017 to allow WaterNSW to partially audit results.
- For infrastructure areas, nodes created from GoldSIM with daily flow volumes, classified all existing flow as pervious stormflow. Using modelled soil storage capacity for silty to clay loam soils on the sites where the mine infrastructure is being constructed, this shows that

potentially a third of flow would have been baseflow. In MUSIC, baseflow has much lower pollutant concentrations than stormflow. This effectively makes the pre-existing case worse, reducing the level of post development treatment required to meet NorBE.

- The use of MUSIC (principally as a water balance tool) to model NorBE and then estimate threshold levels for metals, suffers the same issue of reduced total flow volume, and increased pre nutrient load.
- The surface water quality monitoring of sites to create: Baseline concentrations of existing creeks and baseline for operational monitoring locations; have some data issues. These include:
    - Medway Rivulet has 40 months upstream data readings and only 15 months downstream data
    - Oldbury Creek has 17 months upstream readings and only 5 months downstream.
    - Wells Creek (near the proposed ventilation shaft) has 3 only months data in a very short section of the creek
    - In 2015, 3 sites (with 5 readings each) of supplementary data in connected farm dams were added in Oldbury Creek. Issues exist with both the amalgamation of water samples from farm dams with flowing creeks, and potential pseudo replication of the dam sites, and
    - Raw data for individual monitoring sites not presented, nor could the existing variability be assessed.
- EIS states that 'ideally site specific Water Quality Objectives (WQO)'s' should be based on 24 months baseline or reference data. The datasets at many of the sampling sites have less than one year of readings. Also, last reported measurements were in September 2015, 12 months before the draft Water Quality report was produced and 18 months old when the EIS was released. Monthly data has continued to be collected, but not reported (nor able to be assessed).
- The rationale for the treatment of baseline water quality data, is not always clearly shown. Issues exist with the treatment of less than detection limit measurements and also outliers. One outlier (ten times the mean) was removed for phosphorus in the Stoney Creek catchment, but for many other sites, single outliers for a site, that are at least 2 standard deviations above the mean have been retained.
- NorBE has been assessed in numerous separate models for the mine infrastructure works, the access roads and the railway line and associated yards. A combined electronic MUSIC model was supplied.
- MUSIC modelling issues exist with the quantification of the infrastructure disturbance, soil parameters used, soil parameters post development after topsoil stripping, size and type of SQIDs proposed, how the SQIDs fit into the landscape, post development land use categories etc. The rerunning of individual MUSIC models with standard parameters that WaterNSW use, show that NorBE was not met.
- These developments should be able to meet NorBE with appropriate SQIDs. However, the methods chosen by the consultant to meet NorBE in models does not always appear appropriate.
- The operational road proposed over Medway Creek (from the main amenities to the Ventilation shaft) and Oldbury Creek (from the CPP to coal loader), will both be impacted by the greater than 5 year ARI floods. The roads should either be suitable constructed to deal with these events or alternatively relocated.

Chapter 13 Monitoring, mitigation and management

This section reasserts the mitigation and avoidance measures previously outlined in the report. It identifies that operational and construction management plans will be prepared, provides a basic skeleton of what will be included, but does not provide a draft plan.

Part of the Water Management Plan will be the reconsideration:

- of the Projects water balance
- a review and updating of the numerical groundwater model

A range of further monitoring locations are discussed for consideration once the project commences. These monitoring sites should be incorporated as definite sites along with continuation of baseline monitoring, if the project is approved.

Potential risks and management measures are outlined in Table 13.2, and include:

- Water quality after first flush from SB03 and SB04 not meeting required threshold values
- Drawdown in landholder bores significantly greater than predicted
- Ground inflow to underground sump greater than predicted
- High rainfall with high groundwater inflow years and both PWD and voids at capacity
- Spills from dams or equipment
- Accumulation/ concentration of contaminants in PWD as a result of recycling
- Acidification of Sealed voids
- Greater than predicted drawdown of shallow groundwater.

Main Issues:

- If the reassessment of the project water balance and numerical groundwater model is showing significantly different outcomes, what contingency exists for the acquisition of additional water Licenses if take is considerably greater than estimated.
- The solution for a number of these scenarios is the untried technique of reinjection into Hawkesbury Sandstone. This methodology has not been discussed in detail or analysed in the EIS or supporting information. If it is proposed as part of the management mitigation strategies, then detailed background information should be presented.
- The construction of a Water Treatment Plant and dam MW08, should be further investigated. These facilities should be installed during the construction stage as an additional safety factor for the project.

ATTACHMENT 4 – WaterNSW OPERATING LICENSE RELEASE AND TRANSFER CONDITIONS

Water Supply Work	Maximum transparent release rate (ML/d)	Translucency percentage (%)
Wingecarribee Reservoir	4 3 ML/day for environmental release and 1 ML/day for other releases	
Avon Dam	6.8	20
Cataract Dam	14.5	20
Nepean Dam	20.1	20
Cordeaux Dam	4.5	20
Pheasants Nest Weir	4.5 Plus the volume of water released on the same day from Avon, Nepean and Cordeaux Dam	20
Broughtons Pass	4.4 Plus the volume of water released on the same day from Cataract Dam	20

Table 5. Transfer Rules for releases from Wingecarribee Reservoir

Transfer rules	Wingecarribee Link[a]	Glenquarry Link[b]
Start up phase	250 ML/d over 10 days; & 150 mm/hr rate of rise	50 ML/d; & 150 mm/hr rate of rise
Maximum transfer release rates		
15 Sep – 15 Mar	400 ML/d	400 ML/d
16 Mar – 14 Sep	600 ML/d	600 ML/d
Start-up between 1 Nov & 31 Jan	200 ML/d	200 ML/d
Minimum transfer release rates		
1 Oct – 28 Feb	20 ML/d	5 ML/d
1 Mar – 30 Sep	4 ML/d	0 ML/d
Shut-down phase		
600 ML/d transfer	<70 mm/hr rate of fall over 20 days	<50 ML/d
400 ML/d transfer	<70 mm/hr rate of fall over 16 days	<50 ML/d
Shutdown during heavy rain	Rate that reduces overbank flooding downstream	

ATTACHMENT 5 – Volume 3A – Appendix D
BERRIMA RAIL PROJECT ENVIRONMENTAL IMPACT STATEMENT (EMM, 2017)

Main Report: Chapter 13 Water Resources

Main Issues:

- The assessment states that NorBE is achieved. WaterNSW questions the method and MUSIC assumptions used in this analysis and do not obtain the same result. It is likely that NorBE can be met for the development, but further analysis, different management practises and further stormwater quality devices will be required.
- Before approval of the railway line, Hume Coal needs to upgrade the level of detailed information supplied on the development. An updated water cycle management plan and upgraded NorBE assessment are required.
- Post approval WaterNSW needs to be consulted on future operational and construction environmental management plans, incident plans, monitoring plans and rehabilitation plans to ensure that development is constructed to a suitable standard and also maintained, operated and then rehabilitated to an appropriate standard to meet NorBE.

Other Comments:

- Adequate and appropriate erosion and scour measures need to be constructed for each waterway type being crossed. These structures need to deal with any potential flooding impacts at the crossing and also able to be easily maintained for the life of project.
- For the construction and operational stages, suitable human wastewater management systems are proposed, but no details provided.
- Adequate stormwater and wastewater controls are incorporated into the maintenance shed facility, the refuelling and reprovisioning areas, to manage stormwater and prevent spills or discharges of oils, fuels or other potential contaminants. These are referred to in the document, but no details provided.
- Notwithstanding the EIS stating the MUSIC model meets WaterNSW standards, when WaterNSW assessed the supplied MUSIC model, the model did not accurately represent WaterNSW's standards. Auditing and revision of the electronic model by WaterNSW: for the railway corridor impervious area, more realistic future landuse classifications on batters and verges, appropriate sizing and modelling of proposed swales; show the proposed rail line development as proposed does not meet NorBE.
- Revision of the design to incorporate appropriate stormwater quality improvement devices should make NorBE achievable for the development.
- No discussion on potential incident management for the railway line construction and future use is incorporated in the documentation.