



OUT20/13350

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Dear Mr Nevill

**Narrabri Underground Mine Stage 3 Extension Project (SSD 10269)
EIS**

I refer to your email of 29 October 2020 to the Department of Planning, Industry and Environment (DPIE) Water and the Natural Resources Access Regulator (NRAR) about the above matter.

The proponent has submitted an extensive EIS which comprehensively addresses most matters of interest. However several issues have not been adequately or fully addressed including:

- Inadequate groundwater entitlements held
- Subsidence impacts to watercourses
- Drawdown and water quality impacts
- Comprehensive update of the water management plan required.

Detailed explanation and requirements of the above can be found in **Attachment A**.

Any further referrals to DPIE Water and NRAR can be sent by email to:
landuse.enquiries@dpie.nsw.gov.au.

Yours sincerely

A handwritten signature in blue ink that reads 'Liz Rogers'.

Liz Rogers
Manager, Assessments
Water – Knowledge
15 January 2020

ATTACHMENT A

Advice to DPIE - Planning & Assessment regarding the Narrabri Underground Mine Stage 3 Extension Project (SSD 10269) EIS

1.0 Water take and entitlement

- Existing water entitlements held by the proponent are adequate to account for the proposed peak water take in all water sources except the Gunnedah Oxley Basin MDB groundwater source and the Lower Namoi Groundwater Source. An additional 1089 units of entitlement will be required in the Gunnedah Oxley Basin groundwater source. 1 unit of entitlement is required in the Lower Namoi Groundwater Source with sufficient market depth available.
- The feasibility, in terms of availability and timing, of transferring the Gunnedah-Oxley Basin MDB water requirement from other Whitehaven operations has not been demonstrated. The proponent should provide a detailed breakdown of Water Access Licences (WAL) held and the projects they are applicable, and a detailed plan of how WALs are to be transferred to meet all requirements across multiple projects.
- Insufficient assessment has been provided to quantify the water take due to subsidence related surface cracking for both the existing and proposed project. The EIS has indicated that where the cover is less than 300m above the 360m wide longwall panels or the cover is less than 390m above the wider panels it is likely that creek flows would be temporarily rerouted into the open cracks. There is also the potential for water losses from farm dams due to the subsidence impacts. In accordance with the NSW Aquifer Interference Policy this surface water take needs to be quantified and accounted for.

Pre-approval recommendations

- Quantify the annual volume of surface water take due to subsidence related surface fracturing for both the existing and proposed project for a range of climatic scenarios (wet, average and dry)
- demonstrate sufficient entitlement can be acquired in the relevant water source to account for the maximum surface water take which includes take resulting from subsidence related to surface cracking
- demonstrate that the required groundwater entitlements can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan. The proponent should also provide a detailed breakdown of all WALs held and the projects they are applicable, with a detailed plan of how WALs are to be transferred to meet all requirements across multiple projects.

Post approval recommendations

- The proponent must ensure sufficient water entitlement is held in a water access licence/s to account for the maximum predicted take for each water source prior to take occurring

2.0 Subsidence impacts

Watercourses

- The underground mine extracts coal at various depths below ground level. This results in subsidence troughs oriented north-south, crossing local watercourses at near perpendicular angles.
- The subsidence impacts are predicted to increase erosion of watercourses due to increased channel slope on the downstream side of each chain pillar and where the flow in minor channels is diverted to join larger creeks at different locations.
- These watercourses cross multiple subsidence block alignments and are expected to have significant channel gradient change as subsidence occurs and stream flow velocities increase from upstream chain pillars towards the centre of the individual longwall subsidence trough. All the affected watercourses are sand bedded systems, with moderate to very high sensitivity to

altered channel bed gradients. Alteration of surface gradient may exceed bedform competence thresholds by up to an order of magnitude.

- The affected watercourses are generally low order (1-2 Strahler) and are within 'hardened' banks, limiting lateral migration with the exception of Kurrajong Creek and Tulla Mullen Creek Tributary 1. With reference to the NSW River Styles database, DPIE Water considers that the two watercourses that may be impacted and trigger bed incision and flushing release of sand slugs are Kurrajong Ck and Tulla Mullen Creek Tributary No. 1. The loose sand beds of these watercourses are vulnerable to bed incision and channel degradation. Increased bed gradients along sand bed river channels lacking exposed bedrock controls or large woody debris are likely to incise and lead to extensive channel degradation. There is evidence of this as Kurrajong Creek has incised and degraded for several hundred metres immediately downstream of the easternmost longwall panel alignment.
- Surface subsidence is predicted to range between 2.35-2.8 metres. Maximum surface deformation is concentrated within the half longwall block alignment closest to the outer limit for each longwall block. Where subsidence troughs intersect watercourses, localised tension fractures create drainage conduits from surface into the deformed rock mass overlying the extracted panel, termed the goaf.
- The Environmental Impact Statement refers to a Subsidence Management Plan Trigger Action Response Plan (TARP) requirement for the existing mining operation in relation to stream channel impacts. No details are provided on trigger values or any response measures for potential or actual subsidence impacts or bed incision risk to these watercourses.
- This is not adequate for risk assessment or conditions for the extension. A description of channel form and any channel incision or bed and bank scour in watercourses overlying previous and existing mining operations should be provided to allow an assessment of channel alteration risk and documentation of channel alteration or remediation.
- Monitoring and remediation of such impacts to ensure stability will need to be implemented.

Post approval recommendations

- Triggers for investigation and remedial action of subsidence impacts to watercourses should be specified in the TARP and provided to DPIE Water for review. Where existing channel deterioration is detected, the application should nominate options for response and remediation of subsidence channel gradient alteration as well as bed and bank cracking.
- Performance reporting on channel form and any remedial actions undertaken should be provided to the Department for assessment and review of River Style condition and future geomorphic recovery.
- Subsidence impacts to watercourses need to be remediated to ensure stability and natural ecological functioning. Works are to be in accordance with the Guidelines for Controlled Activities on Waterfront Land (NRAR 2018).

3.0 Drawdown and Water Quality Impacts – Sensitive Receptors

- Drawdowns are predicted to exceed minimal impact considerations at eight third-party bores and several potential groundwater dependent ecosystem areas. The proponent has committed to make-good provisions for affected groundwater users.
- The project's dewatering requirement results in a maximum drawdown which closely matches the Aquifer Interference Policy (AIP) minimal impact consideration threshold of 2 metres at the boundary of the Namoi Alluvium. (Refer to Figure 1 in Appendix B). Therefore predicted drawdowns at all bores accessing "highly productive" water sources are within the AIP minimal impact criteria.
- The tight-scale map insets provided by the proponent show 2 metre drawdown contours coinciding very closely to the mapped alluvial groundwater source edge. Given this closeness, and the sensitivity of the Upper Namoi Zone 4 and 5 water sources, further detail should be provided testing the sensitivity of, and providing confidence in the accuracy of, the modelled predictions.
- The timing of the maximum predicted extent of drawdown has not been specified on the drawdown-contour maps or in the immediately related passages of text.
- The potential for drawdown within model layer 11 (Pamboola and older Formations) to impact on the directly overlying alluvium to the east of the project has not been adequately discussed. Six third-party bores within the extent of the model domain are sourcing groundwater from that

aquifer, with a combined total licensed volume of 17,250 ML/year. This indicates that aquifer is significant, with potential for connectivity with adjacent aquifers.

- Based on water salinity, the project meets the water-quality minimal impact consideration. The consideration of other indices (apart from total salinity) of water quality in relation to the beneficial use category, or vulnerability of potential receptors or users, has not been presented.
- The project exceeds the level 1 minimal impact consideration for water table drawdown at two potential Groundwater Dependent Ecosystem (GDE) areas of approximately 7.4 ha in the Namoi Alluvial Groundwater Source, and approximately 153.5 ha in the Gunnedah-Oxley Basin MDB Groundwater Source.
- The proponent has committed to make-good provisions, however areas mapped remotely as having a high potential for GDE have not been field verified (other than spring sites) or had their ecological condition and related risk assessed. Seasonal baseline groundwater levels in areas of potential GDEs have not been confirmed through direct measurement.
- Groundwater collected by the mine water management systems underground is pumped to the surface where it is treated by a reverse osmosis plant. During mining, the brine stream is directed to a series of lined brine water storage ponds. At the completion of mining, any remaining brine would be re-injected into the mine goaf. The brine injection volumes and total dissolved-solids concentrations given in the groundwater assessment (Appendix B) and the surface water assessment (Appendix C) are inconsistent and the source of some data cannot be traced. The maximum estimated brine injection volume specified in Appendix B is based on the median predicted value given in Appendix C. A risk thus exists for the true volume, and the associated quantity of total dissolved solids, to be significantly larger than estimated.

Pre-approval recommendations

- The proponent provides clarification on the forecast maximum drawdown in relation to:
 - The accuracy and reliability of the maximum drawdown that equates specifically to the minimal impact consideration (Aquifer Interference Policy 2012) of 2 metres at the boundary of the Namoi Alluvium.
 - The potential for drawdown within model layer 11 (Pamboola and older Formations) to impact on the directly overlying alluvium to the east of the project.
- The proponent clarifies the estimated volumes and salinity of remaining brine to be re-injected into the mine goaf at the completion of mining.
- The proponent field-verifies the existence, ecological condition and ecosystem value of the mapped terrestrial groundwater dependent ecosystem areas potentially affected by the project and advises on the make good provisions as required.

4.0 Groundwater Model

The model updated for the assessment of this modification is currently under review through a separate assessment as required by Condition 9 of Schedule 4 of Project Approval PA08_0144. The requested review is described as follows:

A groundwater model review is requested of the calibration report update for the GW model for the Narrabri Underground Mine operated by Whitehaven coal. This is a 5 yearly review as required by Condition 9 of Schedule 4 of Project Approval PA08_0144, shown below.

Condition 9:

Within 2 years of the commencement of longwall coal extraction, and every 5 years thereafter, the Proponent shall undertake a transient calibration of the groundwater model presented in the EA, in consultation with DPI Water, and to the satisfaction of the Secretary. This re-calibration of the groundwater model must include forward impact predictions of brine re-injection to the mine's goaf at the conclusion of mining operations.

AS background the groundwater model supporting the project was initially developed by Aquaterra in 2009 (Aquaterra, 2009). Since then, a number of modifications to the mining operations have been approved, with the Stage 2 Modification 5 (MOD5) for the current

operations supported by the groundwater model developed by HydroSimulations in 2015. Attached is the DPI submission on the Mod 5 project which includes the GW advice.

A review to determine the adequacy of the calibration update in line with the relevant consent condition and any other relevant considerations of DPIE Water is requested.

In order to avoid duplication, the model assessment required for both the operating mine, and this current modification is being combined. Hence, DPIE Water will not be able to provide recommendations in relation to the groundwater model in this advice.

Nonetheless, a summary of issues of the model reported for the proposed modification is provided below:

- No estimation is provided of any measurement error for any hydrogeologic parameters; or testing of the validity of underpinning assumptions (e.g. Data from vibrating wire piezometers “appears to be of good quality and not prone to the long equilibration periods”. The reliability of vibrating wire piezometer data over time requires verification against an alternative reliable method and well-documented procedure.
- There is inconsistency in the apportionment of geologic layers to model layers. In one instance, model layer 11 is described as the Pamboola Formation or other early Permian strata. In another model layer 10 is described as the Pamboola Formation and model layer 11 as the Purlawaugh, Deriah, Watermark, Porcupine and Maules Creek Formations and the Boggabri Volcanics.
- The proponent refers to discussions with site geologists about well-flow data to support the notion that all site faults are not significant groundwater conduits. This argument should be supported with the data.

Pre-approval recommendations

- DPIE Water is currently reviewing the groundwater model as part of a 5 yearly review as required by Condition 9 of Schedule 4 of Project Approval PA08_0144 and plan to provide this advice including recommendations by early February 2020 so that the proponent is able to review and respond in their Response to Submissions.

5.0 Groundwater Management Plan, Monitoring, TARPs and Quality Assurance Matters

Monitoring Network

The proponent refers to the approved and active Water Management Plan and Extraction Plan of the current operation. These plans, available online, are to be extended and updated for this proposal but were not presented as parts of the EIS. Accordingly, the EIS did not present plan details.

The current groundwater monitoring network has a number of deficiencies that we recommend are addressed. These are as follows:

- No monitoring sites exist to the south of the proposal, and only one site (Vibrating Wire Piezometer) exists to the immediate east. Additional monitoring should be designed for these areas for early detection of impacts on third party bores.
- There is inadequate monitoring in some areas that potentially host groundwater dependent ecosystems. No monitoring sites exist in the alluvium and Tulla Mullen Creek and its tributaries to the immediate east, southeast and south of the proposal, or in the vicinity of Spring Creek to the immediate west.
- Additional monitoring sites will be needed for the proposed additional water management infrastructure (e.g. mine-water storage), up and down gradient of the facility.
- The EIS Appendix A Section 12 recommends additional borehole extensometers and variable bore rams installations for subsidence-impact monitoring. This should occur.
- There are geological units in which baseline water quality has not been adequately defined. Water quality is inadequately represented by a single sampling site for each of the Hoskissons Coal Seam and Arkarula Formation, and water from the Digby Formation has not been sampled. The broad spread in electrical conductivity (Appendix B Fig. 5.8) from four bores in

the Purlawaugh Formation and three in the Pamboola Formation indicates that these formations are inadequately represented for water quality.

- The methodology applied at groundwater monitoring sites for the early detection of potential subsidence-related impacts has not been clearly and explicitly presented.

Water Quality Monitoring

The assessment methodologies for the establishment of baseline water-quality status and the interpretation of change or trends are inadequately defined and are based on total salinity only. Water-quality objectives have not been clearly defined for each relevant water source and have not been reported to display status over time in relation to trigger values.

Inconsistent water quality objectives are presented. The proponent refers to National Environmental Protection Measures guidelines for livestock and to the 97.5th percentile of the available baseline data. Conversely, laboratory results are tabulated against “groundwater assessment criteria”, being the national water quality guideline default values for drinking, irrigation and freshwater-species protection (Appendix D of Appendix G of Appendix B).

Multiple water-quality populations are clearly distinguishable for most hydrostratigraphic units by their dissolved major-ion ratios but have not been considered in defining baseline. A broad water-quality analytical suite is being monitored at existing operations, including field-based measurements of temperature, electrical conductivity and pH, and a number of laboratory measurements that may be critical condition indices that should be considered.

Time-series charts have not been provided to clearly display reference (baseline) state, variability, and change and trends in relation to trigger values for each water-quality objective since monitoring commenced in 2007. Only summary statistics and charts of electrical conductivity (as box plots and time-series) and dissolved major-ion ratios (Piper diagram) are presented.

The conversion between electrical conductivity and total dissolved solids has been performed inconsistently and should consider the major ionic composition of the waters.

TARPs

An existing Groundwater Response Plan for the mine is proposed to be reviewed and updated for the project modification and would describe any additional measures and procedures that would be implemented over the life of the project to respond to any exceedances. These should be developed in consultation with DPIE Water.

Quality Assurance and Control

A data-quality assurance plan, detailing appropriate quality assurance procedures for all types of measurements including historic data, has not been referred to in the EIS or included as part of the currently active water management plan or extraction plan. Accordingly, data reliability has not been assessed and quality control measures have not been integrated to provide confidence in data interpretation.

Sample collection procedures are not given in the EIS and, for current operations, are inadequately described in the water management plan to enable independent repeatability and a data-quality assessment. Bore purging records were not provided. The use of an in-line flow-through cell for EC, pH and temperature measurements, and equipment decontamination method, have not been specified. Measurements from bailed groundwater samples, with undisclosed purge volumes, have been accepted as being fully representative and usable. Quality control data for field-based measurements have not been provided; field-based measurements of temperature, EC and pH have not been verified against laboratory measurements or the reasons for any difference identified. The earliest electrical conductivity measurements from many sites are an order of magnitude lower than subsequent measurements. Measurements from the Hoskissons Coal Seam are highly variable over time (site P18). These measurements require verification.

Vibrating wire piezometer data were assumed, without providing evidence, to be sufficiently accurate according to their given description: “appears to be of good quality and not prone to the long equilibration periods...”.

Post approval recommendations

- The Water Management Plan (WMP) be updated to reflect additional monitoring, metering and management measures to report on groundwater inflows and potential impacts to water sources due to the underground development. Where existing monitoring bores are to be impacted, suitable alternatives need to be installed with baseline data collection commenced prior to mining activities. The WMP update should include:
 - a. an appropriate data-quality assurance plan based on relevant standards or guidelines:
 - i. for water levels – see WMSTC (2019).
 - ii. for water quality – see US EPA (2006) and Mueller (2015).
 - iii. for other measurements – apply the most applicable industry standard or guideline available.

The plan must include a rigorous approach for testing the accuracy and drift of vibrating wire piezometers.

- b. clear procedures for the establishment and updating of site-specific baseline status, and the early detection of state trends and change for sensitive receptors (aquifer integrity, groundwater dependent ecosystems, third-party bores, subsidence-related impacts):
 - i. as per ANZG (2018) for water quality.
 - ii. with uncertainty, estimated from quality-control data and integrated with reported results and interpretations.
 - iii. including control charts, or other appropriate time-series statistical method, in annual reports.
- c. additional groundwater monitoring sites as follows:
 - i. West, south and east of the project where there are either no monitoring bores at all, or none along nearby water courses and related alluvium, for the early detection of impacts on any field-verified groundwater dependent ecosystems and third-party bores.
 - ii. In the Namoi Valley alluvium where any field-verified groundwater dependent ecosystem is >1 km from existing monitoring bores.
 - iii. In the Hoskissons Coal Seam, Arkarula Formation, Digby Formation, Purlawaugh Formation, and the Pamboola Formation and older Permian units directly beneath the alluvium, to provide a more representative set of water-quality data.
 - iv. In any other geological units for which multiple distinct water-quality populations are clearly recognised from major-ion ratios.
 - v. Up- and down-flow from the proposed new mine-water storage to monitor potential leakage.
 - vi. At sites suitable for monitoring subsidence-related impacts via borehole extensometers and vibrating wire piezometers installations as recommended in EIS Appendix A Section 12.
 - vii. At sites suitable for verifying the principal groundwater recharge areas.
 - viii. In areas suitable for verifying the hydrological significance of geological faults.
 - ix. Any sites necessary to address spatial uncertainty in model predictions.
- The ability to accurately meter and monitor water take from surface and groundwater sources will need to be developed with ongoing review of actual versus modelled predictions. This will

be a key component to confirm impact predictions, the adequacy of mitigating measures and compliance for water take.

- the Groundwater Response Plan (TARP) be updated in consultation with DPIE Water.
- all data on groundwater levels, quality, and data quality control be provided in a csv format to accompany the release of Annual Reviews.

6.0 Water balance and approvals

- A comprehensive water balance for the underground operations will be required to validate groundwater take predictions and to inform model updates and licence requirements. This will need to include accurate metering of water pumped into and out of the mine combined with modelled inputs and outputs. The groundwater level monitoring program will assist in verifying groundwater level changes associated with inflows to the mine and to identify any changes inconsistent with predictions.
- Based on a review of current approvals held for this project under the *Water Management Act 2000* it is evident a number have expired and consideration needs to be given to relevant exclusions due to the State Significant Development status of this project.

Post approval recommendations

- The proponent must report on water take at the site each year (direct and indirect) in the Annual Review. This is to include water take where a water licence is required and where an exemption applies. Where a water licence is required the water take needs to be reviewed against existing water licences.
- The proponent must ensure that relevant nomination of work dealing applications for Water Access Licences proposed to account for water take by the project have been completed prior to the water take occurring.
- The proponent must comply with the rules of the relevant water sharing plans.
- The proponent discusses with NRAR the necessary regulatory arrangement for water supply and take infrastructure for the Narrabri Coal Mine in consideration of applicable exclusions under the *Environmental Planning and Assessment Act 1979*.

END Attachment A