Comments for Namoi Water on Vickery Extension Project EIS Groundwater Assessment

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1.0 Introduction and Scope of Works

Department of Planning is currently exhibiting Whitehaven Pty Ltd's Environmental Impact Statement (EIS) for the Vickery Extension Project (the Project) for public consultation.

Namoi Water has asked for my opinion on the Groundwater Assessment by NPM Technical Pty Ltd (trading as HydroSimulations) (HS). This involved reviewing the following documents:

- Vickery Extension Project Environmental Impact Statement - Appendix A Groundwater Assessment (Parts 1 & 2) (NPM Technical Pty Ltd t/a HydroSimulations, Report No. HS2018g, August 2018)
- Vickery Extension Project Environmental Impact Statement - Appendix M Geochemistry Assessment (Geo-Environmental Management, April 2018)
- Vickery Extension Project Environmental Impact Statement – Attachment 4 Peer Review Letters (2018)
- Vickery Extension Project Environmental Impact Statement – Attachment 6 Aquifer Interference Policy Considerations and Water Licensing Addendum (2018)

The following documents were also read for background information:

- Letter reports responses from State and Federal Government to EPBC Referral (2016)
- Department of the Environment's Statement of Reasons for a Decision on Controlled Action Under the *EPBC 1999* (2016)
- Vickery Extension Project Environmental Impact Statement - Appendix A Groundwater Assessment (Heritage Computing Pty Ltd, Report No. HC2012/15, January 2013)
- Briefing Paper for the Vickery Coal Mine – Jon-Maree Baker, EO, Namoi Water

The following sections provide comment on HydroSimulations (HS) Groundwater Assessment (2018) which included a groundwater model, water balance and model predictions. I will cite their report as HS GA (2018). My comments refer to figures from the HS GA (2018) report and should be read in conjunction with those reports unless I have altered or annotated the figures in which case I have included them here.

2.0 Background and Previous Studies

Figure 1 shows the location of the Vickery Extension Mine (the Project) and the proposed water supply borefield consisting of 10 bores (Figure 1 is annotated by GSI). The location of the mine within Upper Namoi Zone 4 and the mine layout is presented in Figures 1 and 2 of HS GA (2018).

The Project includes the approved Vickery Coal Project (the Approved Mine), and is owned by Whitehaven Coal Limited (Whitehaven). The Approved Mine includes the former Vickery Coal Mine (1986-1998) and the former Canyon Coal Mine (ceased in 2009). Both these mines have been rehabilitated following closure. Whitehaven also operates the Tarrawonga and Rocglen Coal Mines located approximately 10km to the north and 5km to the east, respectively. All the coal mines access the Maules Creek Formation coal seams.

Whitehaven contracted HS to prepare a Groundwater Assessment which forms part of the Environmental Impact Statement (EIS). The objective of HS GA (2018) was to provide an assessment of potential impacts to groundwater associated with the Project, in line with the NSW Department of Planning and Environment (DP&E) Secretary's Environmental Assessment Requirements (SEARS) for the Project (Appendix 1).

HS GA (2018) includes the cumulative effects of operating all mines including the Project, Tarrawonga and Rocglen Coal Mines between 2018 and 2044; including pumping 600 ML/year from all 10 bores planned to be installed in the Gunnedah Formation of the Upper Namoi Alluvium, Layer 2 of the HS GA model (pumping at a combined rate of 1.64 ML/day).

Section 2.1 of HS GA (2018) presents an overview of previous groundwater assessments and monitoring programs. There have been a number of water quality and groundwater level assessments undertaken since the early to mid-1980s which has produced a reasonably representative dataset for the formation of the hydrogeological conceptual model of the Project area. However, little monitoring data exists for the area to the north of the Project in the Driggle Draggle Creek area and associated alluvium. In addition, while there have been many investigations in the Project area, Whitehaven have never undertaken any surface water studies of flow in the onsite drainage areas and the impact they have on recharging the adjacent Namoi Alluvial aquifers.

The DOI Water has a comprehensive groundwater monitoring network for the Namoi Alluvial aquifer to the west and south of the Project site, but not in the north. Hydrographic data from these bores allow the HS GA (2018) model to be calibrated for transient state conditions allowing the model to be more robust and enable groundwater level predictions to be made in the Namoi Alluvial aquifers in the west and south of the Project area.

A groundwater monitoring bore network was established for the Upper Namoi Alluvium and Maules Creek Formation in the Vickery South area in 2011/2012. These are discussed in Section 2.1 HS GA (2018).

A groundwater assessment for the Approved Mine was conducted by Heritage Computing (now part of HS) in 2012 and this provides the basis for HS Groundwater Assessment (2018). Whitehaven contracted Exploration Services Pty Ltd to carry out a Groundwater Investigation Program to the immediate south of the Approved Mine area. This include downhole geophysical logging, a transient electromagnetic (TEM) survey (Groundwater Imaging Ltd) and a pumping test at a new bore. Please refer to Section 2.1 and Figure 16 in HS GA (2018) for further details on all the monitoring bores used by HS in their Groundwater Assessment (2018).

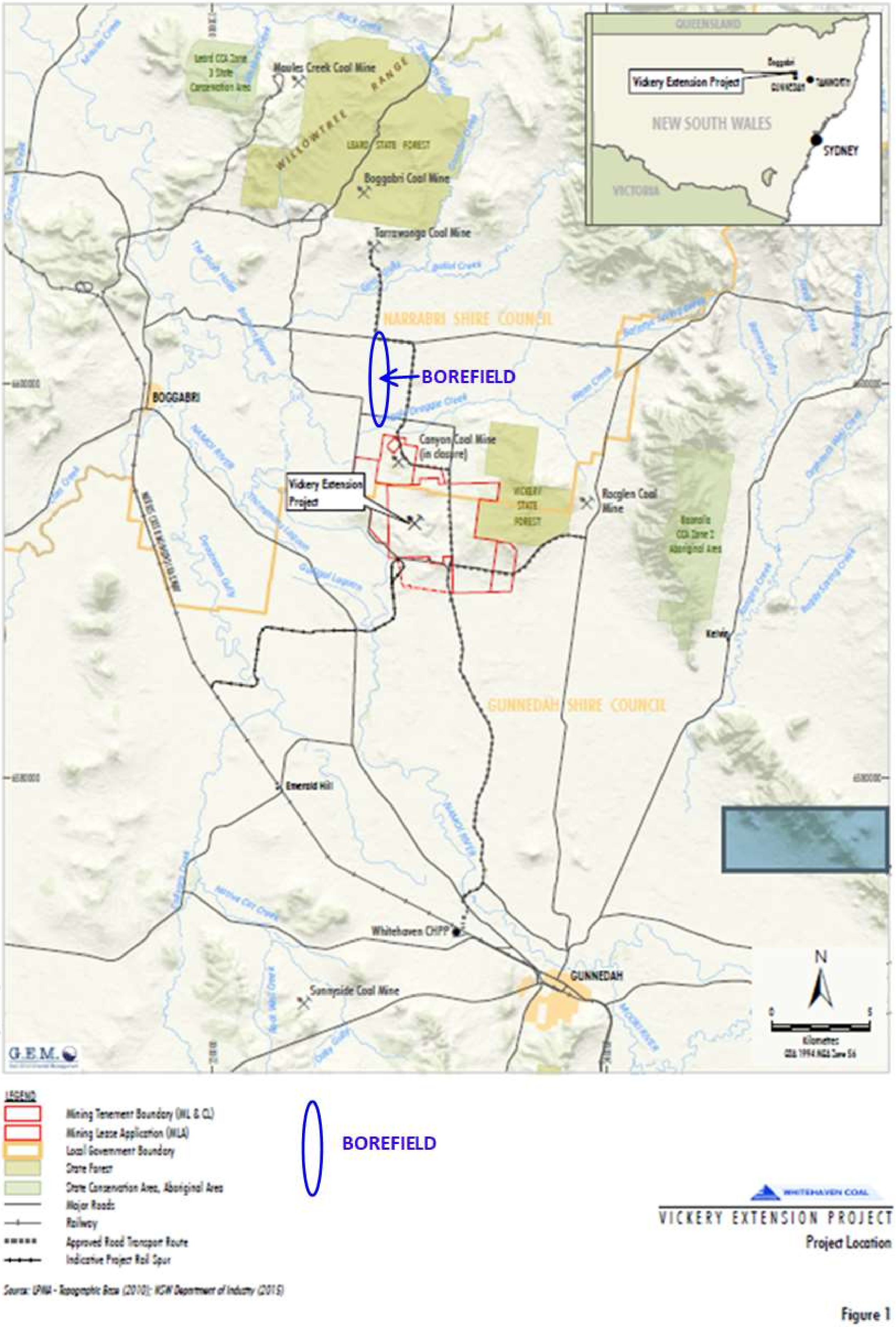
As part of the HS GA (2018) the following was undertaken:

- Review of groundwater and surface water monitoring data.
- Revision of the groundwater conceptual model developed for the Approved Mine to account for changes in the mine plan for the Project.
- Revision of the Approved Mine groundwater numerical model, and conversion from MODFLOW-SURFACT with an irregular cell mesh, to MODFLOW-USG with a regular cell mesh.
- Recalibration of the impact assessment groundwater model.
- Predictive modelling and sensitivity and uncertainty analysis.
- Impact assessment and reporting.

HS GA relied on the following two reports in developing their conceptual groundwater model and numerical model inputs:

- **Alluvial Drilling Report (ENRS, 2016)** Vickery Extension Project Appendix A Groundwater Assessment: Appendix A
- **Geochemistry Assessment of Overburden, Interburden and Coal Rejects (G.E.M., April 2018)** Vickery Extension Project Environmental Impact Assessment Appendix M Geochemistry Assessment**.**

HS GA (2018) was Peer Reviewed by Dr Frans Kalf of Kalf and Associates Pty Ltd. I will provide comments on Dr Kalf’s Peer Review as part of this report.



QUEENSLAND
Vickery Extension Project
NEW SOUTH WALES
SYDNEY
VICTORIA
Maules Creek Coal Mine
WILLOWTREE RANGE
LEARD STATE FOREST
Boggabri Coal Mine
Tarrawonga Coal Mine
NARRABRI SHIRE COUNCIL
BOREFIELD
BOGGABRI
NAMOI RIVER
Canyon Coal Mine (in closure)
Vickery Extension Project
VICKERY STATE FOREST
Rocglen Coal Mine
GUNNEDAH SHIRE COUNCIL
Emerald Hill
NAMOI RIVER
Whitehaven CHPP
GUNNEDAH
Sunnyside Coal Mine
N
Kilometres
G.E.M.
LEGEND
Mining Tenement Boundary (ML & CL)
Mining Lease Application (MLA)
Local Government Boundary
State Forest
State Conservation Area, Aboriginal Area
Major Roads
Railway
Approved Road Transport Route
Indicative Project Rail Spur
BOREFIELD
WHITEHAVEN COAL
VICKERY EXTENSION PROJECT
Project Location
Figure 1

3.0 Conceptual Hydrogeological Model and Data Input

3.1 Overview

HS GA (2018) included the following datasets as inputs into the conceptual model. I have provided brief comments below:

- **Rainfall and Evaporation:** Boggabri Post Office and Boggabri (Retreat) have records since the late 1880s; Keepit Dam (from 1955); a meteorological station was installed at the Project site in 2013. Good data has been collected but HS has assumed a long term average for the data up until 2015 (please refer to Section 2.2, Figure 3 and Table 1 in HS GA 2018) and applied it as a constant for modelling purposes. I believe this is naïve.
- **Topography and Drainage**: The model has good data coverage. Please refer to Section 2.3 and Figure 4 HS GA 2018).
- **Geology**: A comprehensive discussion is given in Section 2.5 HS GA 2018.
  Maules Creek Formation: good data coverage; excellent data quality; excellent discussion on stratigraphy and lithology, although down played the complexity and possible role of overburden and interburden layers; good structural data; little discussion on the role of faulting planes exposed in the Project active pit walls and how this may affect long term seepage.
  Namoi Alluvium: good data coverage for southern and western adjacent areas; poor data for the northern area including Driggle Draggle Creek alluvium. Modelled alluvium thickness is given in Figure 10 HS GA (2018). HS has re-defined the alluvium boundary between the Project and the closest reach of the Namoi River, which I agree with (please refer to Figures 11, 12 and 18 in HS GA (2018)).
  Colluvium: some data collected for western area adjacent to the Project area (Figure 12 in HS GA 2018). Not well understood for the remainder of the Project site.
  Overall there is enough geological data, and understanding of relationship between the geological layers to develop the conceptual groundwater model and to set up the numerical model layers. I do have concerns as to why HS did not present any discussion on the possibility of the Karu and Woodlands Faults acting as groundwater conduits allowing seepage into the pit via the exposed Project mine pit walls. I also would have liked to have read more in the HS GA (2018) document on the role of the underlying Boggabri Volcanics fractured rock aquifer in the groundwater conceptual model other than it is considered to be basement. This infers that the Boggabri Volcanics underlying the Maules Creek Formation has a no flow boundary condition. Clearly HS believe some through flow is expected to occur to the upper Maules Creek Formation as they have included this in Figure 33 Conceptual Groundwater Model in HS GA (2018) for the western area. However, for some unknown reason HS do not believe this flow exists below the Project emplacement area to the west or under the mine void.
- **Hydraulic Data:** Overall the hydraulic data is limited for all model layers but HS still considered the dataset to be a *'suitable basis for the development of a regional numerical groundwater* model' (HS GA, 2018).
  Maules Creek Formation: moderately good spatially for the coal measures and insitu interburden and overburden; no storativity or leakage data determined from the slug tests, etc.
  Namoi Alluvium: good spatial and temporal data for the adjacent areas to the south and west of the Project area; limited for the alluvial areas to the north of the Project area.
  Colluvium: poor dataset spatially. Figure 12 indicates that HS discovered the water table to be deeper than the thickness of the colluvium and given the high clay content HS does not seem to believe the colluvium is a major component of transmitting groundwater throughflow from the exposed and weathered regolith of the Permian Maules Creek Formation to the Namoi Alluvium and adjacent creeks and Namoi River. Please refer to Section 3.1 and Tables 7 and 8 in HS GA (2018). However the underlying highly weathered conglomerate

in the Upper Maules Creek Formation could allow groundwater throughflow as evidenced in the borelogs in HS GA, Appendix A (2018).

- **Land Use:** Good understanding and data coverage. Please refer to Section 2.4 HS GA 2018.
- **Groundwater Users:** HS discuss groundwater users in Section 2.6 in HS GA 2018. The data used for the conceptual model water balance is of moderate quality as HS couldn't access data from 2010 onwards so assumed constant average groundwater abstraction from 2010 which provides uncertainty into the groundwater model.
- **Groundwater Dependent Ecosystems:** HS discusses GDEs in Section 2.8 and basically say there isn't any.
- **Groundwater Monitoring and Baseline Dataset:** There are considerable amounts of data presented from studies carried out since 1986. The most relevant to this EIS is from Canyon and Vickery Mines, although the model also needs to take into account cumulative effects from Tarrawonga and Rocglen.
  The monitoring bores are presented in Figure 16 in HS GA 2018. Please refer to Section 2.9, 2.10 and 2.11 for an in-depth discussion on water quality and water level data. Good spatial and temporal groundwater level and water quality datasets were obtained from DOI Water Namoi Alluvial monitoring bores to the south and west of the Project area, but absent to the north of the Project area. Good spatial and temporal groundwater level and quality dataset for the Maules Creek Formation were collected within the Project area. A robust discussion was given by HS on water level trends as a result of mine dewatering and rainfall. Water quality was well discussed with respects to identifying groundwater types and environments. Even though there was good discussion on groundwater evolution in terms of major ion chemistry and salinity, there was little discussion on groundwater mixing and the use of isotope analysis to help determine and quantify groundwater flow components in the groundwater model. Trace metals were discussed and HS identified some metals were elevated above ANZECC (2000) Freshwater 95% protection. This is mostly due to the natural chemistry and low transmissivity of the Maules Creek Formation but it highlights the need to ensure this groundwater does not end up in the Namoi Alluvium, Namoi River and creeks. I have noted that groundwater samples collected from monitoring bores located between the Canyon Coal Mine and Driggle Draggle Creek are high in EC and pH. Temporal changes in groundwater quality, specifically EC and pH for monitoring sites in the Canyon, Rocglen and Tarrawonga Coal Mines were discussed in Section 2.11.5
- **Regional Mine Inflow Data:** HS discusses Rocglen and Tarrawonga Coal Mine inflow data from the Maules Creek Formation. They conducted regional numerical groundwater modelling as part of the assessment for the Tarrawonga Coal Project in 2011. HS has based their inflow model on their earlier groundwater model for the Approved Mine in 2012 and has used it as a basis for developing the mine inflow for the 2018 modelling of the Project area. For further discussion please refer to Section 2.12 of HS GA 2018.

3.1 Hydrogeological Setting

HS undertook a thorough overview of previous groundwater assessments and monitoring programs. A Groundwater Assessment was undertaken by Heritage Computing (now HS) in 2012, which is still the basis for HS Groundwater Assessment (2018) report. The previous investigations and HS 2018 review state there are two groundwater systems operating in the Project area:

- Unconsolidated alluvial aquifer of the Namoi River including the shallow Narrabri Formation and the deeper Gunnedah Formation which includes productive paleochannel alluvial deposits.
- Permian Maules Creek Formation which includes porous rock aquifers including multiple water-bearing, fractured coal seams and interburden/overburden deposits.

Figure 33 presents the Conceptual Groundwater Model pre-mining and towards the end of mining (in HS GA 2018).

However, there is a third groundwater system, the Permian porous and fractured rock aquifer of the Boggabri Volcanics. HS has not considered this aquifer in any detail. This groundwater system will underlie areas of the bottom of the mine void quite closely by the end of the active mining phase. HS consider the Boggabri Volcanics to be basement rock.

The Project is located within the topographically higher exposed areas of the Maules Creek Formation immediately west of the Vickery State Forest (Figures 4 and 5 in HS GA 2018). The mine area is surrounded by the Namoi Alluvium (Upper Namoi Zone 4) to the south, west and north (Figures 1 and 8 in HS GA 2018). Figure 9 in HS GA 2018 presents cross sections clearly showing the relationship between the final pit walls and the exposed coal seams where groundwater will seep into the final pit void. The cross section also shows the base of the weathered layer within the Maules Creek Formation near the ground surface; the basement Boggabri Volcanics; and the Karu and Woodlands Faults.

The Project's active mine is located solely within the Maules Creek Formation. HS has thought about connectivity between geological units to the west of the mine's waste rock emplacement area, where the closest reach of the Namoi River is within 500m of the Project. HS relied on a report commissioned by Whitehaven to undertake a drilling investigation to determine the extent and nature of unconsolidated alluvial and colluvial deposits within the Vickery Extension Project (ENRS Pty Ltd, 2016). Based on this work HS has concluded that there will be no direct drawdown effect on the Namoi Alluvial aquifers as a result of the active mine. HS do say they believe there will be indirect drawdown effects as a result of dewatering in the Maules Creek Formation which will induce insignificant flow from the overlying alluvium.

The location of the investigation bores is given in Figure 6. ENRS successfully used the geological logs to 'ground truth' the TEM survey undertaken in December 2015 by Ground Water Imaging Pty Ltd and interpreted by Dr David Allen as shown in Figure 7 in HS GA 2018 (please refer to ENRS report for details). ENRS undertook detailed geological logging of all boreholes, geophysical logs and water quality from samples taken from the monitoring boreholes. I agree with the re-defined Namoi Alluvium boundary to the west of the Project area (the closest reach of the Namoi River) which is presented in Figure 8 in HS GA 2018.

However, contrary to HS I believe there is a direct drawdown effect on the Namoi Alluvium as I believe there is a groundwater flow component through the unconsolidated material that spans between the Maules Creek Formation in the Project area and the Namoi Alluvium. The degree of hydraulic connectivity between these deposits will determine how great an effect there will be on drawdown in the Namoi Alluvial aquifers (especially the shallow Narrabri Formation). The sediment that spans between the Maules Creek Formation and the Namoi Alluvium consists of the clayey regolith and gravelly clay colluvium. The former is a layer of unconsolidated solid material covering the Maules Creek Formation formed from weathering and the latter are the deposits of the weathered Maules Creek Formation, or regolith, which has been deposited on the lower slopes of the Project area outside the active mine void. This information is important for the conceptual groundwater model as it will determine how great the effects of removing the Maules Creek Formation in the active mine area will affect rainfall recharge to the colluvium, the Namoi Alluvium, the Namoi River and Driggle Draggle Creek.

No comment is made by HS as to the possible role of the exposed Kura and Woodlands faultlines in the pit and final void wall to conducting groundwater seepage into the mine pit and final void.

The following sections discuss the hydrogeological setting and whether the data was temporally and spatially representative.

Figure 4 in HS GA 2018 shows the surface water drainage in the Project area. Namoi River is located to the west; Driggle Draggle Creek is located to the north and South Creek is located to the south of the Project area. Three drainage lines have been identified within the Project area – North Drainage Line (which is an upper reach of Driggle Draggle Creek), North-west Drainage Line (which is almost solely within the Project area), and West Drainage Line. HS report states that the North Drainage and West Drainage Lines will be bunded/diverted away from the active mine pit area. The North-west Drainage Line will be completely removed. The Project Extension area, which includes water storage ponds for seepage from the mine void, comes within 500m of the Namoi River.

HS discusses rainfall and evaporation data and trends in the Project area. Rainfall is the main source of groundwater recharge to the Project area. HS have assumed a long term average for modelling which I believe is naïve.

HS stated there were only pumping records up to 2010, as they (or the public) couldn't access data since. Therefore HS assumed from 2010 that average pumping from the Upper Namoi Alluvium groundwater system continued at a constant rate. I believe this is unsatisfactory and introduces more uncertainty into the groundwater model.

4.0 Numerical Groundwater Model Setup

4.1 Appropriateness of Numerical Model Package and Confidence Level

HS don't say why they converted from MODFLOW-SURFACT with an irregular cell mesh, to MODFLOW-USG Beta with a regular cell mesh. I understand the latest model MODFLOW-USG has a more powerful modelling package which allows better re-wetting of ephemeral streams, evolution of drainage from waste rock emplacement, drainage from the mine pit and the mine void.

HS GA 2018 state they believe the model has a confidence Level of Class 2 to Class 3 (medium to high confidence). Please refer to Table 2-1 in Appendix 1. This is largely to do with the model inputs, calibration and verification status. I agree with this confidence level. However, the Australian Groundwater Modelling Guidelines (Barnet et al., 2012) does not seem to allow for sensitivity and uncertainty analysis in determining the confidence level. This groundwater model has not had a robust PEST-type sensitivity analysis carried out on the model parameters. HS did find during the calibration process that the model was very sensitive to changes in vertical and horizontal hydraulic conductivity of the model layers. A high-level assessment of model uncertainty was conducted by HS to analyse the effect of vertical hydraulic conductivity on predicted pit inflows. These were increased and decreased by an order of magnitude (multiplied by 10 and divided by 10, respectively) which resulted in an estimate of pit inflows of -8% an +16%. HS considered these model results to indicate negligible uncertainty. I believe this is unsatisfactory for this groundwater model which has been developed to predict the effects of groundwater level drawdown as a basis for Whitehaven's EIS. A robust sensitivity and uncertainty analysis is considered to be essential in the determination of whether the model is sensible and realistic.

Barnett et al (2012) stated in the Australian Groundwater Modelling Guidelines that:

'Care should be taken to choose increments in parameters that are sensible. It is not uncommon to vary hydraulic conductivity by an order of magnitude (a factor of 10), but each parameter should only be adjusted by an amount commensurate with its likely range.

During automated model calibration, the search algorithm computes sensitivities of the objective function to changes in all parameters and uses them to guide the search. When the best estimates are found, these sensitivities are used to estimate the uncertainty in the best estimates. This type of sensitivity can be examined using PEST and similar software to gain insights into the calibration process.'

4.2 Model Extent, Layers and Geometry

HS stated in Section 4.2 in HS GA 2018 that the Tarrawonga Coal Mine regional numerical groundwater model (Heritage Computing, 2011) demonstrated that drawdown influence from the Tarrawonga, Maules Creek and Boggabri Mines would not reach the Vickery Coal Mine. They surmised therefore the Project mining effects would not propagate to the Tarrawonga Coal Mine and therefore focused the development of their model on the Vickery Coal Mine for assessing the environmental effects of the Approved Mine.

I believe the model layers are relevant, and are not overly simplified or too complex. The model extent incorporates sufficient relevant Zone 4 and Zone 2 groundwater sources in the WSP for the Upper and Lower Namoi Groundwater Sources 2003; significant agricultural extraction from bores accessing the Upper Namoi Alluvium; and the adjacent coal mines of Tarrawonga to the north and Rocglen to the east.

HS developed 14 model layers including:

Layers 1 and 2: Narrabri and Gunnedah alluvial formations, regolith or overburden (the alluvium is consistent with the DPI Water groundwater model for the Upper Namoi Alluvium).

Layers 1 to 12: represent the multiple layers of coal seams and interburden and in recognition of vertical hydraulic gradients. Layers 10 and 12 are the targeted

Layer 13: Underburden.

Layer 14: Basement Boggabri Volcanics.

HS GA 2018 should have included a cross section showing how the 14 layers, including the 'dummy' layers, related to each other.

4.3 Model Stresses and Boundary Conditions

Please refer to Section 4.6 and Figure 35 in HS GA 2018 for a full description of the model stresses and boundary conditions. The boundary conditions are sensible. The river bed conductance values applied are reasonable. The equivalent leakage coefficients decrease in order of magnitude from Namoi River to Driggle Draggle and to other creeks, which is an acceptable approach when there is little river bed conductance data for the smaller creeks. The ephemeral creeks are able to re-wet. The Namoi River and Driggle Draggle Creek are able to become gain or lose water along the reaches modelled.

HS do not discuss how the rainfall recharge cells around the contact between the Namoi Alluvium and the Maules Creek Formation were determined. I believe they have used this as a proxy for rainfall recharge into the exposed Maules Creek Formation which then recharges the colluvium and Namoi Alluvium via runoff and throughflow.

The model stresses are based on constant average values for the initial steady state calibration and prediction phases. There could be a reasonable error in assuming constant average values but that is the reason why a robust uncertainty analysis should have been undertaken.

4.4 Numerical Groundwater Model Calibration, Verification and Sensitivity Analysis.

Initial Steady State (pre-mining and pre-pumping) calibration was undertaken using derived 'initial groundwater levels' contour plots of groundwater levels and hydrographs from DOI Water Namoi Alluvial aquifer monitoring bores and data collected from monitoring bores from the Project area. The effects of pumping and mining were modelled out. HS achieved good initial steady state calibration for the Project area by replicating regional groundwater levels in the Upper Namoi Alluvium. The initial calibration and water balance is discussed in detail in Section 4.8 in HS GA 2018.

Transient State Calibration was achieved moderately well for the Project area based on monthly stress periods from 2006 to 2011. The fit between the Model versus Measured hydrographs was best in the Vickery Project area, not so much for the other mines within the model area. This is discussed in detail along with Transient Water Balance in Section 4.9 in HS GA 2018.

Verification of the groundwater model was achieved using six monthly stress periods from 2012 to 2017. This and the Verification Water Balance is discussed in detail in Section 4.10 in HS GA 2018.

Transient prediction and recovery simulations were undertaken, including for cumulative effects of the Project, Rocglen and Tarrawonga Coal Mines operating at the same time. These are discussed in Section 4.7 in HS GA 2018. Figure 37 in HS GA 2018 summarises the stress period setup in the model; sequencing of open cut operations, waste rock emplacement and timing of establishing the final void.

The Sensitivity Analysis is discussed in Section 4.8, 4.9 and 4.11 in HS GA 2018. They undertook a manual (trial and error) calibration and verification where they state the following:

'...the groundwater model was calibrated by varying a large number of parameters related to rock mass permeability and storage to match groundwater level and mine inflow time-series data. The model run time (10+ hours) precluded a full PEST-based sensitivity analysis. However, information on parameter sensitivities was obtained through observations during the calibration process. The most sensitive parameters with respect to calibration of measured groundwater levels and mine inflows were found to be:

- Vertical hydraulic conductivity of the coal measures (Kv).
- Horizontal hydraulic conductivity of the coal measures (Kh).
- Specific yield in the alluvium (for transient calibration of hydrographs).'

However in the Australian Groundwater Modelling Guidelines Barnett et al (2012) state:

'During trial-and-error calibration, sensitivity analysis involves changing a model parameter by a small amount to establish how model predictions are affected by that change. Manual sensitivity analysis requires changing a single model parameter, re-running the model to obtain a new set of predicted heads and fluxes and observing the effect of the change, either by eye or numerically by differencing. In this context, a true sensitivity (derivative) is never calculated. The emphasis is on determining how sensitive the model is to each parameter, using a non-technical interpretation of 'sensitive''.

Dr Kalf in his peer review (Attachment 4 in Whitehaven's EIS) noted 'it would have been possible to reduce this cell mesh count considerably given that it had already been established that there would be no drawdown influence by the Extension or the 'Approved Mine' at the Tarrawonga mine and vice versa'.

When the best estimates are found, these sensitivities are used to estimate the uncertainty in the best estimates. This type of sensitivity can be examined using PEST and similar software to gain insights into the calibration process (Barnett et al., 2012). However HS stated the model run times precluded a full PEST-based sensitivity analysis. I believe this is inappropriate given today's ability to 'hire' large computers in the cloud to undertake these large data analyses.

5.0 Model Results

5.1 Introduction

HS stated 'the transient prediction simulation was operated in two different modes:

1. Baseline scenario – Rocglen and Tarrawonga Coal Mines operating without the Project.
2. Cumulative scenario – the Project, Rocglen and Tarrawonga Coal Mines operating at the same time.

In Section 5.1 HS discussed the Mining Schedule for the Project, Tarrawonga and Rocglen Coal Mines. The hydraulic properties from the model transient calibration were run from January 2018 until December 2044. The Project commenced in 2020 and finished in December 2044. The only time-varying stress in the prediction was the mining. All other stresses, namely, rainfall (constant long-term average rates), average river levels and average irrigation pumping rates (July 2009-June 2010) were assumed to be constant. The water balance was also averaged over the 25 years. The predicted groundwater inflow into the Project mine pit is shown in Figure 49 and Table 21 in HS GA

2018. HS state the porous rock groundwater within the coal measures of the Maules Creek Formation is the only groundwater source for pit inflows. I am not convinced of this as little regard has been given to:

- the underlying fractured Boggabri Volcanics
- the possibility of leakage through diverted/bunded onsite drainage systems
- exposed fault planes in the mine pit walls

5.2 Predicted drawdown of Groundwater Levels

HS discusses the predicted drawdown of groundwater levels in Section 5.4 in HS GA 2018. HS concludes the predicted 1m groundwater drawdown contour stays entirely within the Maules Creek Formation and does not impinge on the Upper Namoi Alluvium. However, given the model is highly sensitive to the hydraulic properties of the model layers, and no robust uncertainty analysis has been undertaken, I am not convinced the 1m drawdown contour presented in Figures 50 and 51, and in Appendix E in HS GA 2018 is realistic.

5.3 Predicted groundwater flow

HS stated in Section 5.3 that ‘up to the end of mining there would be a continuous loss of water from the groundwater system to the mining void’ of between 0.01 and 1.42 ML/day. The groundwater source would be from the ‘porous’ rock (matrix and fracture porosity, that is, dual porosity) within the coal measures of the Maules Creek Formation, and that was the only source. HS state that ‘after the end of mining there would be long-term groundwater inflow from these coal bearing rocks, including the Project waste rock emplacements, with **no direct contribution of groundwater from the Upper Namoi Alluvium**’ (bold emphasis placed by this writer). HS stated in Section 5.5.2 that **‘there could be incidental loss through enhanced leakage from the bordering alluvium to the underlying Maules Creek Formation’**. This increase in flux from the alluvium to the Maules Creek Formation was investigated by HS for Zone 4. ‘The average increase in total flux of about 0.1 ML/d is predicted from 2073 to 2094 post-mining. The drawdown from the Project will continue to extend post-mining due to the low permeability of the Maules Creek Formation. This will result in an increasing flux from the alluvium to the hard rock, post-mining.’

HS discussed there was potential for groundwater seepage from the Western Emplacement to an underlying thin alluvium embayment to the north-west of the open cut. HS estimated during the mining operation the average groundwater seepage to the alluvium is 0.013 ML/d for the cumulative scenario. The average flow increased to 0.032 ML/d during the initial 20 years of recovery, before reaching a long-term equilibrium flow of 0.022 ML/d from the emplacement to the alluvium (please refer to Table 19 in HS GA 2018). HS state the long-term flow is restricted by the residual final void, which operates as a strong sink.

The main concern is the quality of the groundwater seepage and whether there will be any environmental effects to any bores capturing recharge from this part of the Zone 4 catchment.

The Project will irreversibly change the groundwater flow direction from westwards to eastwards. Any recharge that would have occurred in the future, from rainfall runoff or groundwater throughflow from the Maules Creek Formation, in the Project mine void area will not recharge the Upper Namoi Alluvium, the Namoi River and Driggle Draggle Creek. In fact it will induce flow from the Namoi River to the alluvium with the change in hydraulic gradient with the depressurisation of the Maules Creek Formation (and removal of most of the Formation in the Project area) and the mine void which will act as a strong sink.

If the mine void is a strong sink where will this groundwater flow to given HS believe the underlying Boggabri Volcanics is more or less a no flow boundary?

5.4 Predicted baseflow changes

HS state in Section 5.6 that there will be a possible increase in leakage of about 0.0002 ML/ay for the cumulative mining scenario from the 4km reach of the Namoi River. They consider this to be insignificant compared to ‘normal river flow'. The Namoi River is a losing river along this stretch and so this leakage could prove to impact the Namoi River during drought periods, affecting GDEs down gradient.

Likewise, Driggle Draggle Creek will also experience 'insignificant' leakage of about 0.001 ML/day (cumulative mining scenario) from the creek to the underling alluvium due to the indirect effects of depressurising the Maules Creek Formation. HS state that Driggle Draggle Creek is also a losing stream with a constant baseflow discharge of about 0.026 ML/day.

These flow loses may seem 'insignificant' during 'normal' flow periods but this modelling has not taken climate change into consideration where long and more intense droughts are predicted.

5.5 Blue Vale Void Water Storage impact on Namoi River

HS discuss this in detail in Section 5.7 in HS GA 2018. HS stated that during the period of mining, water storage in the void would mitigate the effects of mining which would otherwise cause the predicted insignificant Namoi River leakage. The outflow from the void to the Namoi River is expected to be around 0.015 ML/day. This may or may not be the case depending on the sensitivity of the vertical and horizontal hydraulic conductivities of the model layers.

Water quality from leakage from the Blue Vale Void is not expected to impact the 4km stretch of the Namoi River. HS computed the mass of dissolved solids that could migrate from the water storage and distributed across the 10 model layers would be about 38 kg/day (about 14 t/year). I agree with HS that the baseflow to the Namoi River will occur in the upper few layers of the model. The hydraulic gradient beneath the river is downwards to the deeper layers. Therefore the risk to the Namoi River will only be in the top two layers of the model (alluvium, colluvium/regolith). HS presented computations of salt load on the Namoi River in Section 5.7.2 based on median flows at the Boggabri gauging station and a worst case scenario for salt load the increase in salinity would be approximately 0.007%. This is less than the NSW Aquifer Interference Policy requirement of 'No increase of more than 1% per activity in long-term average salinity in highly connected surface water source at the nearest point to the activity'. I would be interested in seeing how this might change after a robust Uncertainty Analysis is carried out so that optimal hydraulic parameters are used in the HS model groundwater flow predictions.

6.0 Climate Change and Model Uncertainty

Please refer to Section 7.1 in HS GA 2018 for HS discussion on Climate Change. HS conducted one single transient predictive simulation for rainfall recharge, altered according to the drier of the predictions. There was found to be <1% reduction in pit inflows for the small (3%) reduction in rainfall during the Project period.

HS stated in Section 4.11 Sensitivity Analysis that 'the long model run time precluded a full PEST-based sensitivity analyses. It is good that the modeller observed parameter sensitivities during the calibration process for groundwater levels and mine inflows, as this is part of the modelling process. However it does not replace a robust PEST-based sensitivity analysis.

HS conducted a 'high-level' uncertainty analysis which increased the hydraulic conductivity in the model layers by one order of magnitude (multiplied hydraulic conductivity values assigned to each hydrostratigraphic unit in each model layer by 10) and decreased it by one order of magnitude by dividing each hydraulic conductivity values assigned to each hydrostratigraphic unit in each model layer by 10. The result in the estimated pit inflows was -8% to +16% which HS considered to have negligible uncertainty.

I do not consider this Uncertainty analysis to be robust enough for a predictive model which is to be used in decision-making. For a Class 2 or Class 3 numerical groundwater model Barnett et al (2012) expect a stochastic analysis to be undertaken to determine the range of possible outcomes the model can predict for a range of possible hydraulic parameters – i.e. a Monte Carlo type analysis.

7.0 Impacts on the Groundwater Resource

HS provide a potential impact assessment on groundwater, surface water bodies and Matters of National Environmental Significance in Sections 6.1, 6.2 and 6.3 in HS GA 2018.

HS have concluded as a result of modelled cumulative effects from the operation of the three Whitehaven coal mines:

- There will be an increase in hydraulic conductivities for waste rock emplaced in the Western Emplacement.
- A void acting as a sink permanently changing the groundwater flow direction from westerly to easterly towards the void as shown in Figure 60 in HS GA 2018. The final equilibrium groundwater levels are expected to be 100m lower than the current groundwater levels near the void.
- The final void water quality is expected to have a median EC of 4,200 microSiemens/cm and salinities of about 2,600 mg/L.
- There will be induced, but insignificant, water losses from connected water sources: Upper Namoi Alluvium Zone 4 and Namoi River (please refer to Table 21 HS GA 2018).
- There will be no adverse water quality impacts from the Western Emplacement into the alluvium embayment (not greater than is currently naturally occurring). Please refer to Table 20 in HS GA 2018.
- There will be no adverse water quality impacts from the overburden and interburden materials from the proposed open cut as these are mostly expected to be non-acid forming (please refer to GEM (2018) Appendix M of the Vickery Extension Project EIS). Some material close to the coal seams are potentially acid forming and management measures including co-disposal with non-acid forming material will allow for an overall non-acid forming material.
- There will be less than 0.2m drawdown experienced in privately owned bore except for bore RB1 (0.61m) located to the east of the Vickery State Forest, near the Rocglen Coal Mine. Please refer to Table 22 and Figure 15 for bore locations.
- There are no outstanding GDEs in the area.
- There will be no adverse impact on Matters of National Environmental Importance.

All the above conclusions are based on a groundwater model that has not had a robust PEST-type Sensitivity Analysis undertaken on the model hydraulic parameters, even though the model has been found (‘manually’) to be highly sensitive to small changes in hydraulic conductivity in all model layers. No robust Uncertainty Analysis has been undertaken to determine the effect this has on the model predictions.

A discussion was also presented on the proposed Water Supply Borefield which is to include ten bores located within the Gunnedah Formation and located to the north of the Project area between Driggle Draggle Creek and Bollol Creek. This seems like an afterthought, as HS has stated the groundwater model was developed and calibrated for the Vickery Project mine area, and that there are no DOI Water Namoi Alluvial monitoring bores to calibrate the groundwater model in the borefield area. I do not place a lot of confidence in the predicted cumulative groundwater level drawdown predictions for the Namoi Alluvium.

8.0 Management and Mitigation Measures

8.1 Groundwater and Surface Water Licensing

HS presented Table 25 below which summarises Attachment 6 of the EIS:

Table 25 Project Licensing Summary

Water Sharing Plan		NSW Murray Darling Basin Porous Rock Groundwater Sources 2011 (ML/year)	Upper and Lower Namoi Groundwater Sources 2003 (ML/year)	Upper and Lower Namoi Regulated River Water Sources 2016 (ML/year)
During Project	Average	308	<1	2
	Maximum	517	5	11
Post-Mining	Maximum	< 500	9	27

* Refer to **Figure 49** and **Table 21** for predicted groundwater inflows over the life of the Project.

Table A6-2
Estimated Water Licensing Requirements for the Project – During Mining

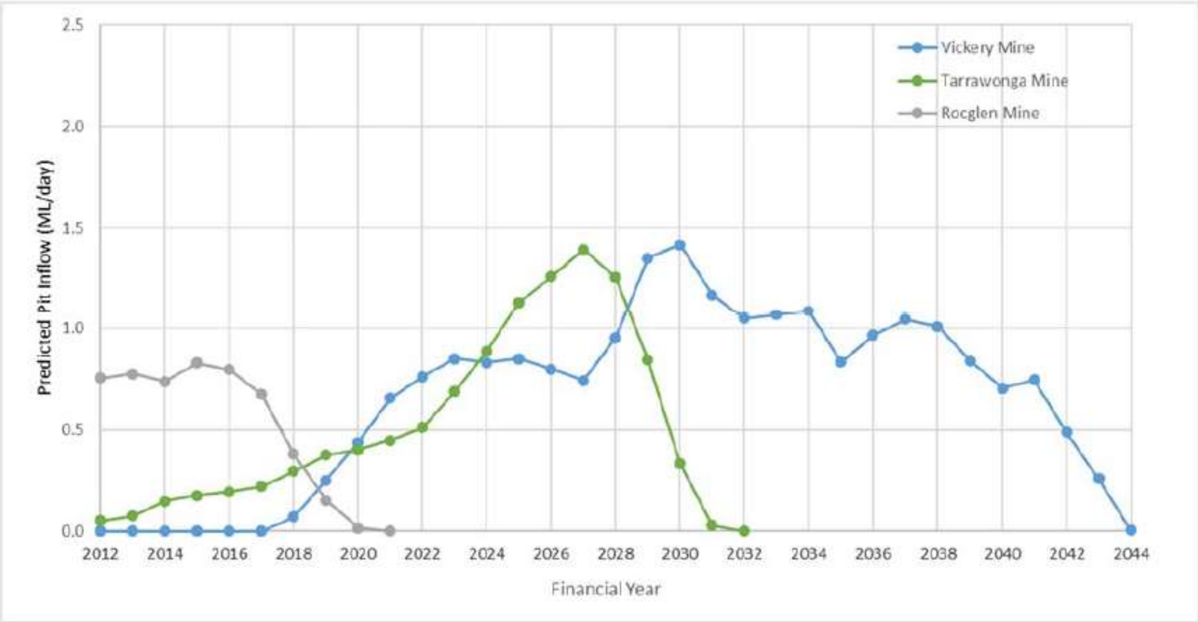
Water Sharing Plan	Water Source	Allocation (Shares)	Maximum Project Licensing Requirement for Groundwater Inflows (ML/year)[1]	Residual Whitehaven Allocation Available for External Water Demands (Shares)[2]
Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011	Gunnedah-Oxley Basin MDB Groundwater Source	600	517	83
Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003	Upper Namoi Zone 4, Namoi Valley (Keepit Dam to Gin's Leap)	396	5	391
Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016	Lower Namoi Regulated River Water Source	*50 (High Security)* *1,638 (General Security)* *63.5 (Supplementary River)* Total: 1,751.5	11	*39 (High Security)* *1,638 (General Security)* *63.5 (Supplementary River)* Total: 1,740.5

1 Licensing requirement for groundwater includes direct pit inflows from the porous rock and induced leakage from the Namoi River and alluvial aquifer.

2 Assuming a 1 ML entitlement per share. External water demands are net of water captured in on-site storages.

The Project has enough licenses to account for groundwater usage during the mining and post-mining phase of the project, if Figure 49 below is accurate. This is assuming the model hydraulic conductivities for the coal seams and alluvium are representative. The hydraulic conductivities used in the modelling will affect the computed seepage/inflows from the coal seams into the mine pit and the induced drawdown in the alluvium into the porous rock which will ultimately end up flowing into the mine pit. A full PEST sensitivity and a Monte Carlo uncertainty analysis would have investigated whether the modelled inflows are realistic.

[redacted]



NB. Inflows are average annual rates and the year ticks refer to June of each year

Figure 49 Simulated Pit Inflows at All Mines from 2012 to 2044

8.2 Proposed Groundwater Monitoring Program

HS state in Section 8.4.1 that 'the existing network is considered adequate for providing information on groundwater flow and a basis for groundwater model calibration and verification and could be continued for the Project'. I presume HS means all the monitoring locations shown in Figure 16 in HS GA 2018.

HS presented the proposed groundwater monitoring program in Table 26 in HS GA 2018.

I agree with HS that at least *'two additional monitoring bores for water levels and quality should be installed in the waste rock to validate the predicted level of groundwater mounding and to check on the water quality of the leachate'*.

I agree with HS that the results of the monitoring program for drawdown should be used to validate modelling predictions every 5 years following Project commencement, as per the *Australian Groundwater Modelling Guidelines* (Barnett et al, 2012).

9.0 Conclusions

I believe the conceptual hydrogeological model is based on good data and model inputs, with the exception of the lack of discussions on the fault traces and fractured Boggabri Volcanics role in groundwater seepage.

The numerical model is based on sound boundary conditions and model layers. It has been well calibrated for transient conditions for the Vickery Project area only, using groundwater hydrographs between 2006 and 2011. HS has verified the model based on 5 years of data (2012-2017). It is not well calibrated for predicting the effects of the proposed water supply borefield.

I am concerned that the model is based on constant long term averages for rainfall and evaporation; constant averaged river flows and constant irrigation pumping based on water usage for 2009-2010.

The model has not had a robust Sensitivity and Uncertainty analysis which could lead to different predictions of groundwater drawdown impacts on other groundwater users. This should be undertaken before the Vickery Extension Project goes ahead.

I believe HS needed to undertake more impact analysis for Driggle Draggle Creek as it feeds the Barber Lagoon and associated GDEs. Monitoring bores located between the former Canyon mine and Driggle Draggle Creek indicate there is poor groundwater quality. If Whitehaven do not effectively divert the stream flow around the eastern side of the Project then this may lower water quality in the creeks lower reaches, and the Namoi Alluvial aquifers it recharges to the north of the Vickery Extension Project.

Appendix 1. Table 2-1: Model confidence level classification – characteristics and indicators (*Australian Groundwater Modelling Guidelines*. Barnett et. al., 2012)

Table 2-1: Model confidence level classification—characteristics and indicators

Confidence level classification	*Data*	*Calibration*	*Prediction*	*Key indicator*	*Examples of specific uses*
Class 3	• Spatial and temporal distribution of groundwater head observations adequately define groundwater behaviour, especially in areas of greatest interest and where outcomes are to be reported. • Spatial distribution of bore logs and associated stratigraphic interpretations clearly define aquifer geometry. • Reliable metered groundwater extraction and injection data is available. • Rainfall and evaporation data is available. • Aquifer-testing data to define key parameters. • Streamflow and stage measurements are available with reliable baseflow estimates at a number of points. • Reliable land-use and soil-mapping data available. • Reliable irrigation application data (where relevant) is available. • Good quality and adequate spatial coverage of digital elevation model to define ground surface elevation.	• Adequate validation* is demonstrated. • Scaled RMS error (refer Chapter 5) or other calibration statistics are acceptable. • Long-term trends are adequately replicated where these are important. • Seasonal fluctuations are adequately replicated where these are important. • Transient calibration is current, i.e. uses recent data. • Model is calibrated to heads and fluxes. • Observations of the key modelling outcomes dataset is used in calibration.	• Length of predictive model is not excessive compared to length of calibration period. • Temporal discretisation used in the predictive model is consistent with the transient calibration. • Level and type of stresses included in the predictive model are within the range of those used in the transient calibration. • Model validation* suggests calibration is appropriate for locations and/or times outside the calibration model. • Steady-state predictions used when the model is calibrated in steady-state only.	• Key calibration statistics are acceptable and meet agreed targets. • Model predictive time frame is less than 3 times the duration of transient calibration. • Stresses are not more than 2 times greater than those included in calibration. • Temporal discretisation in predictive model is the same as that used in calibration. • Mass balance closure error is less than 0.5% of total. • Model parameters consistent with conceptualisation. • Appropriate computational methods used with appropriate spatial discretisation to model the problem. • The model has been reviewed and deemed fit for purpose by an experienced, independent hydrogeologist with modelling experience.	• Suitable for predicting groundwater responses to arbitrary changes in applied stress or hydrological conditions anywhere within the model domain. • Provide information for sustainable yield assessments for high-value regional aquifer systems. • Evaluation and management of potentially high-risk impacts. • Can be used to design complex mine-dewatering schemes, salt-interception schemes or water-allocation plans. • Simulating the interaction between groundwater and surface water bodies to a level of reliability required for dynamic linkage to surface water models. • Assessment of complex, large-scale solute transport processes.
Class 2 *Cont'd overleaf*	• Groundwater head observations and bore logs are available but may not provide adequate coverage throughout the model domain.	• Validation* is either not undertaken or is not demonstrated for the full model domain. • Calibration statistics are generally reasonable but may suggest significant errors in parts of the	• Transient calibration over a short time frame compared to that of prediction. • Temporal discretisation used in the predictive model is different from that used in transient	• Key calibration statistics suggest poor calibration in parts of the model domain. • Model predictive time frame is between 3 and 10 times the duration of transient calibration. • Stresses are between 2 and 5 times greater than those	• Prediction of impacts of proposed developments in medium value aquifers. • Evaluation and management of medium risk impacts.

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[redacted]

Confidence level classification	*Data*	*Calibration*	*Prediction*	*Key indicator*	*Examples of specific uses*
Class 2 *Cont'd*	• Metered groundwater-extraction data may be available but spatial and temporal coverage may not be extensive. • Streamflow data and baseflow estimates available at a few points. • Reliable irrigation-application data available in part of the area or for part of the model duration.	model domain(s). • Long-term trends not replicated in all parts of the model domain. • Transient calibration to historic data but not extending to the present day. • Seasonal fluctuations not adequately replicated in all parts of the model domain. • Observations of the key modelling outcome data set are not used in calibration.	calibration. • Level and type of stresses included in the predictive model are outside the range of those used in the transient calibration. • Validation* suggests relatively poor match to observations when calibration data is extended in time and/or space.	included in calibration. • Temporal discretisation in predictive model is not the same as that used in calibration. • Mass balance closure error is less than 1% of total. • Not all model parameters consistent with conceptualisation. • Spatial refinement too coarse in key parts of the model domain. • The model has been reviewed and deemed fit for purpose by an independent hydrogeologist.	• Providing estimates of dewatering requirements for mines and excavations and the associated impacts. • Designing groundwater management schemes such as managed aquifer recharge, salinity management schemes and infiltration basins. • Estimating distance of travel of contamination through particle-tracking methods. Defining water source protection zones.
Class 1	• Few or poorly distributed existing wells from which to obtain reliable groundwater and geological information. • Observations and measurements unavailable or sparsely distributed in areas of greatest interest. • No available records of metered groundwater extraction or injection. • Climate data only available from relatively remote locations. • Little or no useful data on land-use, soils or river flows and stage elevations.	• No calibration is possible. • Calibration illustrates unacceptable levels of error especially in key areas. • Calibration is based on an inadequate distribution of data. • Calibration only to datasets other than that required for prediction.	• Predictive model time frame far exceeds that of calibration. • Temporal discretisation is different to that of calibration. • Transient predictions are made when calibration is in steady state only. • Model validation* suggests unacceptable errors when calibration dataset is extended in time and/or space.	• Model is uncalibrated or key calibration statistics do not meet agreed targets. • Model predictive time frame is more than 10 times longer than transient calibration period. • Stresses in predictions are more than 5 times higher than those in calibration. • Stress period or calculation interval is different from that used in calibration. • Transient predictions made but calibration in steady state only. • Cumulative mass-balance closure error exceeds 1% or exceeds 5% at any given calculation time. • Model parameters outside the range expected by the conceptualisation with no further justification. • Unsuitable spatial or temporal discretisation. • The model has not been reviewed.	• Design observation bore array for pumping tests. • Predicting long-term impacts of proposed developments in low-value aquifers. • Estimating impacts of low-risk developments. • Understanding groundwater flow processes under various hypothetical conditions. • Provide first-pass estimates of extraction volumes and rates required for mine dewatering. • Developing coarse relationships between groundwater extraction locations and rates and associated impacts. • As a starting point on which to develop higher class models as more data is collected and used.

(*Refer Chapter 5 for discussion around validation as part of the calibration process.)

NATIONAL WATER COMMISSION — WATERLINES 21

Namoi Water

Submission to the Review of Environmental Impact Statement –

Whitehaven Pty Ltd - Vickery Coal Mine Extension
2018

Photo : Lake Keepit

Namoi Water : Supporting sustainable water use in the Namoi Catchment and representing water users in the Peel, Upper and Lower Namoi Catchment Area

Executive Officer : Jon-Maree Baker

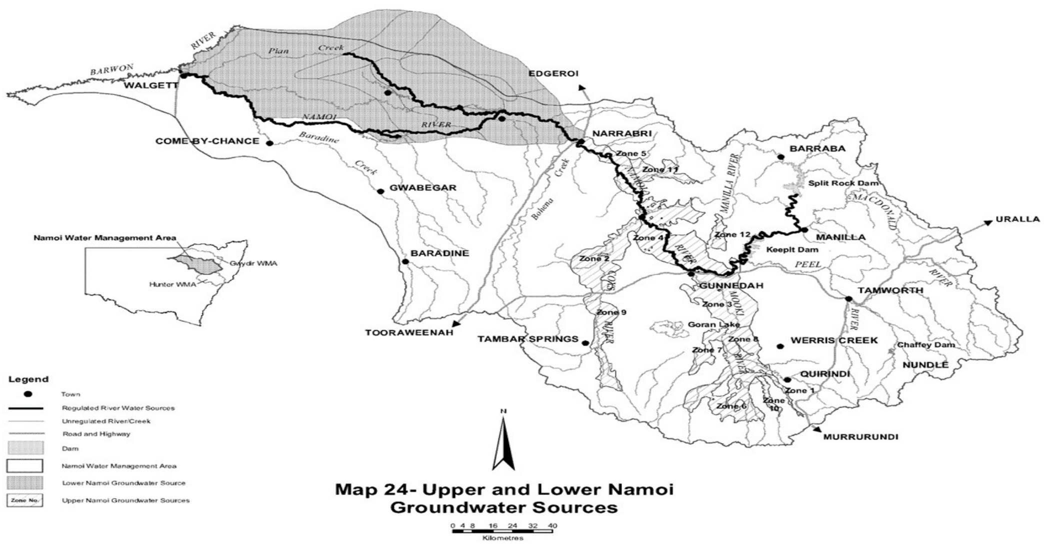
[redacted]
Web: www.namoiwate.com.au

Introduction

Namoi Water represents Water Access licence holders in the Namoi Catchment, we are a non-profit, nonpolitical organization supporting our members to achieve a sustainable irrigation industry that meets the environmental, economic and social needs of our local communities. Namoi Water represents 800 members these entitlement holders within the catchment vary in size from single employee operations to businesses employing seventy employees. The crops grown range from grains and pulses, cotton, vegetables, intensive animal production, Lucerne and niche market food crops. The direct contribution to our economy is in excess of $800 million per annum. This is based on a secure supply of high quality irrigation water both surface and groundwater.

Namoi Water has a breadth of experience in relation to Water reform and assessment of water resources in relation to extractive industries impact. Water reform has occurred over the last two decades, the Achieving sustainable groundwater entitlement program reduced groundwater entitlements by 50% across the Upper and Lower Namoi. This submission is made based on Namoi Water's current policy positions that are ratified at the Annual General Meeting each year. However we note that members are entitled to their individual views in relation to this project.

Namoi Catchment area Figure 1.



Introduction :

Namoi Water represents over 800 members within the Namoi Region, we are making this submission on their behalf collectively. This submission does not preclude an individual member making a submission, however we note our policy positions are endorsed by members annually and through the provision of draft submission points to our members.

Namoi Water requests that if the Department of Planning and Environment (DoPE) is balancing input into a project it clearly considers the weighting of submissions from groups such as Namoi Water who make a technical submission collectively on behalf of many members.

We request clarification on the use of submission numbers to demonstrate social licence for a project. If this project is using the number of submissions as one way of determining the level of community support we ask that our submission is considered in terms of the number of members that we represent. Further *if this is not possible* then we request the opportunity for our individual members to submit, expressing their objection to the project proposal.

The first proposal for the Vickery coal mine (4.5 mt pa) came on the back of three other large projects and was one of the first mines to go through the new Planning Assessment Commission process. In our view as a project, it slipped under the radar. During the assessment and subsequently approval it is clear there was not the level of scrutiny applied to the original Vickery project as others. We would not consider the lack of interest and attention to the original project as a representation of anything other than that the community had reached both saturation and fatigue in terms of engagement on mining project assessment process at that time.

Recommendation :

On the basis of our review of the project, Namoi Water does not support the extension project and the following technical comments are made regarding the proponent's Environmental Impact Statement.

Key Issues;

Social Licence

- Clear process for the determination by the DoPE and the Independent Planning Commission (IPC) regarding factors that indicate social licence.

Surface Water

- A full review of all Whitehaven projects and their water licences to ensure adequate licences are held to cover projected water use under various climate scenarios.
- All volumes that are required to offset impacts from seepage of surface water are set aside or surrendered to the NSW Government to ensure these licences are not used for consumptive purposes.
- Further assessment on the impacts on the Boggabri Demonstration Reach for fish and riparian habitat as a result of contamination/reduced water quality.

- Impact of discharges from contaminated mine water, seepage, acid mine water is assessed on worst case scenario and reassessed with additional modelling
- Impact on Driggle Draggle creek and Station Creek has not been fully assessed.

Ground Water

- Continued use of final voids against international best practice standards and Narrabri Shire Council Policy and should not be allowed to continue
- PEST sensitivity analysis must be undertaken
- **See technical document from Groundwater Solutions International (attached)**

Infrastructure

- Proposed surface Infrastructure location and risk in relation to surface water contamination, increasing the embankment, disturbance area, changes to noise, dust and other impacts
- Development of rail loop facilitates continued expansion of mining surrounding Boggabri township and is a risk that should be fully assessed

Rail Link

- Lack of information in the EIS
- Impact on Namoi River and creek systems
- Floodplain redistribution, changed flow velocities, impact on neighboring properties not provided in detail. Project cannot proceed without transparency of detail.

Agriculture

- Cumulative Agricultural impacts from mining footprint and purchase of surrounding farm land due to incursive offsite effects of operations above predictions within EIS and should be assessed.

Planning process

- Transparency regarding the weighting of risk and issues within the planning process which is designed to approve projects.
- The capacity of government agencies to review technical issues during restructure and significant reform processes.

Social Licence

The community has learnt from firsthand experience over the last few years since the commencement of mining at Maules Creek, that the capacity of PAC recommendations to be translated into consent conditions to effectively mitigate impacts is lacking. Further, the adherence to consent conditions by the proponent and the ability of the compliance agents to hold them to account resulted in suboptimal outcomes for the community. The translation of recommendations from a genuine Planning Assessment Commission (PAC) intent to proposed mitigation through the writing of consent conditions by the Department is a major risk in projects such as this. The use of the words “reasonable”, “feasible”, “facilitate” and “generally in accordance with” are abhorrent to the community. These words mean a proponent to can simply attempt to meet a condition and this is seen as being a sufficient outcome to meet the original mitigation proposed. The subsequent modifications of original conditions of approval often result in small wording changes which change the entire effect and intent of the requirement. This continual watering down continues to erode trust in both the planning process and Department.

In short there is little social licence for this proponent and consequently the project, outside those that stand to benefit from some form of direct financial gain. Many of the supporters do not live in the local area and are fly in fly out staff. We request the Department clarify the exact numbers of staff that live in the region and how this is quantified – having a post office box does not qualify you as living in the region and contributing to the community. The shift in support amongst the Boggabri community more generally should be well heeded by the Department in the consideration of this project.

The questions to the Department at the information session in Boggabri, the social media videos with local community members speaking out about the negative impacts, and the litany of failures by the proponent to fulfil its current consent conditions and commitments in other projects all stand as evidence that this extension is not in the best interest of the impacted community.

We note that many farmers have received survey calls from companies clearly working for Whitehaven asking leading questions to gain either support or indifference of opinion to the project – this is not proper quantitative/qualitative assessment to be used as evidence to support the proponent or their activities. In the last few years we have undertaken a poll of main street businesses to ask about Whitehaven and mining in general and its value to the community and in the majority, it is generally a negative view from those downstream of the mine.

The relationship with councils is also skewed to the proponent given the VPA system. If all of the agricultural sector was allowed to VPA our rates under one agreement we could negotiate a very different outcome regarding what civil works and infrastructure was undertaken and determine where splash cash went in the community as well. This would significantly change our relationship and power balance with Council from price taker to price maker.

Mining has a long history of operation near Boggabri, undertaken in many cases by proponents who have lived and operated locally. The Boggabri community has supported these mining operations as they were in balance with the broader community and other industries.

Namoi Water members have noted the responsiveness to community and neighbor relations were generally well managed, historically. Our members are not anti-mining and have engaged in the process with open minds regarding previous proposed developments. However this current project follows on from many negative experiences of the Maules Creek project, often given as the prime example of the failure of the planning system.

Unfortunately our experience to date is that Whitehaven have over-promised and under-delivered. An example of this was the requirement to provide funds for Boggabri Medical Centre annually which was only undertaken after community pressure, many years after the original promise.

The VPA's presented in the project are somewhat tainted with the proponent's own staff threatening the Boggabri projects to be withdrawn if there was not community support for the EIS. This form of intimidation has been part and parcel of the company's approach to the local community.

It is concerning that the footprint of the physical mine whilst relatively small in comparison to other land uses, has resulted in a significant expansion of mine owned land around the mine precinct means the footprint is in essence, considerably larger. The buy-out of the surrounding farmland is estimated at 78 farms with either direct buyout or an agreement in place. This has resulted in yet more farming families being removed from the district that once contributed to the local economy and community.

The economic impact to agricultural production should be assessed cumulatively given Whitehaven own 4 of the 5 mines currently in the region. The subsequent impact of their total operations on the regional economy and community should be considered holistically.

It is inappropriate to suggest that the history of mining in the region is an example of successful coexistence and whilst we acknowledge that there are many farmers that will attest to a good working relationship with mining companies, there are equal numbers who have been affected and/or have been forced to leave.

The existing project approval for 4.5 mt/pa is accepted by the local Boggabri community and farmers, the impacts whilst likely to be negative for some are viewed as being approved and unable to be changed. The positioning of the infrastructure, the transport (with rail overpass) near Gunnedah and the general impact of the mine was all part of the reason for its original approval. In this context the existing approval should not be viewed by the department as support/approval for the extension from the community.

The proximity of the site to the Namoi River, the value of the regional ground and surface water and the proponent's track record with its other projects contribute to the significant dissatisfaction with the extension project amongst the local community.

Rail link and Floodplain Impacts

The complete lack of detail about the rail line in the EIS is completely insufficient. There is no detail on which sections are at ground level, which are raised embankment, culverts or bridges. It is impossible to check the validity of the modelling results without this detail. A significant part of the Collygra creek catchment area has been missed or ignored when the modelled flows were calculated. It is particularly concerning that the modelled flow does not assume that all creek inflows to the modelled area arrived at once. This in practice, does occur regularly. Further it is clear that the modelling of a 1 in 100 year flood event is not large enough to test the true impacts on the floodplain. There is evidence from all around the world and Brisbane/Grantham in 2011, that much larger floods are now occurring.

Namoi Water is particularly concerned that the modelling showed that there were significant areas downstream of the rail line where the flow depth was increased by 0.1m or more. It is likely the rail line will redirect flows and have a major effect on flow distribution downstream. This requires further assessment, the information provided within the EIS on the structure is totally insufficient. As a result our consultant was unable to assess the veracity of the modeling results presented in the report. The river/creek crossings on the floodplain are restricted by hills on both sides, there is no room for extra water to flow around the proposed infrastructure and this is not reflected in the EIS assessment. The floodplain flow will need to flow through or over the works. There is no indication in the EIS whether any allowance was made for any partial or full blockages of culverts/bridges due to the inevitable debris created during flood events. Existing bridges and culverts regularly get blocked by debris and allowance for this needs to be included to properly assess the true impact on flow redistribution on the floodplain.

A major concern in the assessment of the value of the rail spur is the benefit in removing trucks from the haul roads, particularly in light of the use of these job creations as the justification for many of the current mining projects.

For those that live within the zone of affection and more generally any Boggabri resident, there is genuine concern that this rail line crossing proposal could facilitate a loop around the town in the future. For a community who has personally experienced regular project modifications, this outcome is not unlikely and would impact the access to passenger rail services for locals. There are concerns that this rail crossing proposal has the potential to substantially increase rail movements and serve to justify further expansions or extensions of mining in the region, using cost of the existing infrastructure as a justification.

The prediction that there will be a maximum of 8 rail movements per day does not add up and it is likely that the proponent has utilized this as a stepping stone to a full loop and further extension projects in the near future.

Water Impacts

From our perspective, one of the key considerations of the project is its impact on water resources. Namoi Water has recently contracted an additional review of the risk assessment, focusing particularly on the impacts of surface water contamination and risk of spills and discharges as a result of the changed infrastructure plans from the current approval. We expect that the Department will also undertake a similar review of the risk assessment and make this available to the community.

The Maules Creek project is an example of what could transpire at Vickery if the extension proceeds with more intensive mining over a shorter period. Maules Creek provides a living assessment of the capacity of the proponent to manage impacts. A review of the Conditions of Approval for the Maules Creek mine in terms of water and its associated Water Management Plan was undertaken by Namoi Water in 2018. It revealed concerning issues that have eroded our confidence in the proponent's ability to fulfil the approval conditions in a way that is satisfactory.

The proponent for this project has already been given a licence to operate for the last five years at Maules Creek. If they cannot fulfil the conditions for this mine approval, they should not be able to be considered for another mine approval given the proximity to the Namoi River of the Vickery Extension project.

Our review found that once approved, Maules Creek mine's rigor of groundwater quantity monitoring, transparency of water management plan updates and water model currency is inadequate for the consent conditions.

All but one, groundwater monitoring bore at Maules Creek mine has been destroyed by the process of mining. Whilst replacement bores have been added over time (some of which have also been destroyed by mining and others have remained without any readings since installation) the reporting of these makes it virtually impossible to compare original baseline data of groundwater quantity with current levels of groundwater, at various levels. Right now, there is only one monitoring bore in the critical, alluvium aquifer that has not been dry since installation. Monitoring the true impacts to groundwater at Maules Creek has become almost impossible.

The Water Management Plan (WMP) is a key tool in determining how water will be used and monitored at the Maules Creek mine. The conditions of approval sought that the WMP be updated at least nine times since the mine began and there are no public records of it being updated a single time. We have been told since August 2018 to expect a new WMP, but this is still not publicly available so the current WMP is being used, and its currency expired in 2016.

The Water Model was approved on the basis that new data would be used to update it when possible, to ensure it was an accurate model of the actual impacts. According to the conditions of approval, the Water Model should have been recalibrated at least twice and an independent review of it undertaken at least four times since mining began at Maules Creek. It appears that the Water Model has not been updated nor reviewed at all over the life of the mine. Once again we have been told for a few months this will be available, but still we are operating on a very out of date water model. The accuracy and currency of both the water model and the Water Management Plan are critical in ensuring transparency and accuracy about the water impacts of the mine, therefore giving us confidence in the proponent.

The 2016 Annual Review for the Maules Creek coal mine indicates that total inflows to the mine from rainfall and runoff in 2016 were 1,860ML. However, a search of Water Access Licences (WAL) from Land and Property Information indicates that Maules Creek mine holds only a single WAL for surface water take in the Maules Creek water source, being WAL41585, with a share component of just 30ML. The Maules Creek Coal Mine in 2016 captured rainfall and runoff of 1,860ML, as recorded in the Annual Review, but was licensed to take just 30ML. This is a substantial amount of water given it is more than the total licenced surface water shares in the Maules Creek water source, which is just 1,200ML.

Whilst there is a harvestable rights exemption which gives landholders rights to take 10% of runoff on land which they hold (this right is only on held titles, not leased land), analysis suggests that the Maules Creek mine far exceeds its harvestable rights. Using the government's harvestable rights calculator we estimate Maules Creek harvestable rights at 791.3ML based on the total area of land of the mine and offsets. This concern has been lodged with the Natural Resources Access Regulator and they are investigating this matter further.

This example is relevant to the Vickery project, particularly given the potential impact on Driggle Draggle creek and Stratford creek. The potential of the proponent to install effective infrastructure, monitoring, accounting for water take, mitigating known impacts such as intense rainfall events, has not been well implemented at Maules creek and as a result this project should be considered in context of this as high risk. A direct comparison is worthy of note – Idemitsu (Boggabri Coal) in the last flood event requested departmental approval to discharge water from the pit after significant inflows jeopardized operations. Whitehaven on the other hand discharged the water with contempt for the department and took the subsequent fine for environmental pollution.

The capacity of the proponent to manage discharge offsite under relevant guidelines is questioned. The consequences of this will be borne by the community in the sensitive environment of the Boggabri demonstration reach where a multi-million dollar Federal Government program has been implemented. The demonstration reach was established along 120 km of the Namoi River between the tributaries of Boggabri and Narrabri Creeks. The project involved undertaking on-ground works to protect and rehabilitate habitat and manage threats to aquatic species, and engaging over 20 landholders and the local community.

Since 2007, works that have been achieved include: Re-snagging (100 snags reintroduced), Revegetation (planting of riparian zones and 2000 native aquatic plants), fencing, weed control (including willow removal), providing off-stream stock watering points, implementing a wetland management program. The Boggabri area has been a critical focus and it is where the Commonwealth Environmental Water Holder is focusing their annual watering plan to ensure this stretch of the river maintains flow thresholds required for fish.

Waterways in the Boggabri area now have excellent remnant habitats that are being linked by rehabilitation efforts of landholders such as those that are now likely to be neighbours to the proposed Vickery mine. The Boggabri demonstration reach is currently being restocked with Silver Perch which are currently a vulnerable species in NSW and all of the restocking in the Namoi River occurs within the demonstration reach between Gunnedah and Boggabri.

Any contamination into the river at the proposed Vickery mine site from potential discharge of water, including heavy metals and salts, would adversely impact the local water quality. A range of pollutants need to be monitored independently. The capacity for runoff to be managed given the proposed mine infrastructure being less than 400 m from the river is a high risk. Whilst there may very well be the capacity for management of impacts, we have not seen this included in the risk assessment.

This is not the Hunter Valley, we do not have dilution flows nor the volumes in storage to provide a dilution flow if there is a discharge into rivers at an inappropriate time. We have two dams in the Namoi Catchment (Split Rock and Keepit Dam) of which the general security reliability has been less than 39% in the last 12 years, indicating a low ability to generate discharges on call if required to protect the River zones from surface water contamination. *Note the Peel catchment has it's own Water Sharing Plan arrangements including management of Chaffey Dam.

Furthermore, the irrigation industry pays for the substantive costs (97% of user share) associated with maintaining the catchment infrastructure. It is unacceptable to have the jobs and economic value of downstream industries impacted as a result of cumulative mid-catchment mining expansion. When these industries and jobs' only protection lies with; consent conditions that include weasel words ("reasonable feasible" and "generally in accordance"), a poor process of compliance (e.g. noise monitoring consultants being required to ring the company before they undertake random audits) and insufficient penalties (such as a recent $1,500 fine) provides little confidence. Many of the consent conditions designed by the planning commission to mitigate impacts on the community never physically translate in the real world! This is the planning model in practice, and we request that the Department undertakes a review of the failures in the system to manage projects, given the multiple agencies responsible for compliance.

The proponent suggests that overtopping or discharges will only occur after significant rainfall which will have enough water to dilute the concentrations. Further the EIS states that discharge from the final void will never happen. There are multiple examples of where this type of risk assessment has been woefully inadequate and it should be reassessed to include worst case climatic events. It is utterly unacceptable to have discharge of dirty mine water in this part of the River given it is immediately upstream of the demonstration reach. The impact on the smaller ephemeral creek systems is difficult to remediate.

Monitoring of surface water quality has been wound back by successive governments and we consider it is inappropriate for the proponent to undertake their own self reporting on water quality. There must be some independent assessment undertaken by government agencies. Namoi Water is currently funding additional independent monitoring down stream of Maules creek following our recent review, due to missing elements in the company's annual reports.

We aim to ensure that the reporting by the proponent is compared to a valid sample that is reporting all issues and not just samples that fit with the guidelines. We are unable to see where the proponent will monitor the ephemeral creek catchments in terms of water quality impacts from any discharge where the impacts could be higher due to the flashier nature of this system.

The issue of water storage for dirty water in its design and permeability should seek to implement the same standard as the Santos water storage at Leewood. The lining of the storage should prevent seepage into the alluvial groundwater systems to ensure that other ground and surface water users are not impacted. In relation to storage and final voids it is not clear how the management of poor quality water seepage will be monitored.

In recent dry conditions, the use, capacity and level of regulated water by the mining industry in the Namoi has been questioned. We understand that the Maules Creek mine has a 3,000 meg High Security licence and an ability to store 60 days worth of their water needs on site. It would seem that this is insufficient for the mine's increased water needs. Further when the River becomes completely dry due to climatic conditions and Whitehaven requires the delivery of their High Security water, it becomes a highly inefficient delivery method. A mine does not have a guarantee for the delivery of their High security water every year. In 2015 year the mine had water delivered out of the irrigation season during a dry period, to deliver the water from Keepit dam to Whitehaven's pumps downstream of Boggabri. This took 3,000 megalitres of released water to deliver 300 megalitres. Over 1,000% losses.

This situation is unacceptable within the operating constraints for the dam, the current loss account was established based on 25% losses and is socialized amongst users. This inefficiency is impacting those who fund the dam infrastructure and this practice will not continue due to third party impacts.This season the mine is unlikely to receive any further delivery outside the bulk water delivery. If Walgett town water supply cannot be delivered, if the domestic and stock water cannot be delivered, the mine also will not have further High Security regulated river water delivered. This is not taken into account in the EIS.

The addition of the proposed bore field for Vickery appears to have been added on, based on the above realization after 2015 water delivery issues. The predicted cumulative groundwater drawdowns are not well calibrated with any DOI Water monitoring bores. The interaction between Zone 12 and Zone 4 is also of concern. Given the continued drainage between the zones and the bore field, it may well exacerbate pressure from zone 4 on upstream groundwater sources.

Groundwater Model

Attached to this report is a review of the EIS Groundwater Chapters undertaken by Groundwater Solutions International (GSI). Summary points of concern are noted below.

The Model assumes a long term average use and has applied it as a constant in the modelling purposes. The below table shows that groundwater use is not average in Zone 4. It has highly activated use within the current sustainable limits. The current average being used is incorrect and will result in the model misrepresenting impacts.

The Achieving Groundwater Reform program has resulted in consolidation of water licenses to service existing infrastructure. This has resulted in extraction remaining consistently at 70% of LTAAEL.

Year	**Zone 4 AWD**	**Usage**
2006/07	38192	30653
2007/08	36803	23453
2008/09	35414	20290
2009/10	34025	19278
2010/11	32636	15663
2011/12	31209	9519
2012/13	29858	23328
2013/14	28464	26660
2014/15	27078	21141
2015/16	21032	17471
2016/17	21033	15138
2017/18	20312	19592

Again similar to the Santos project, the proponent appears to ignore faulting within the EIS report. The Karun and Woodlands faults have not been assessed for their capacity to act as conduits to allow seepage into the pit via the exposed pit was.

There are several key points in the attached report by GIS to be regarding the groundwater assessment to be reviewed. However the critical gap is the lack of PEST-type sensitivity analysis or "monte-carlo" assessment on the hydraulic parameters. The model has been found "manually" to be sensitive to small changes in hydraulic conductivity in all model layers and given there is no robust uncertainty analysis, there can be no confidence in the model predictions. This is supported by the review of the EIS undertaken by the Independent Expert Scientific Committee provided to the Department of Planning.

The IESC advice states that "*the specific storage values used in the alluvial areas of model layer two could be unrealistically high. This may cause the predicted extent and magnitude of drawdown to be underestimated and could result in non-compliance with the NSW Aquifer Interference Policy*."

We understand that this point may relate to a report by Gabriele Rau et al released in July 2018 that questions the coefficients used to calculate the specific storage values. We believe more work needs to be done on how this advice relates to the water model and assumptions used for Vickery before this application for approval can be further considered.

The Vickery project will result in a change to the groundwater flow direction form westwards to eastwards and any recharge that would have occurred in the future from rainfall runoff or groundwater through flow. The project mine void area will induce flow from the Namoi River to the alluvium with the change in hydraulic gradient with depressurisation of the Maules creek formation and the mine void acting as a strong sink. This is predicted as possible small increase in leakage for the cumulative mining scenario.

These predictions do not appear to recognise that the Namoi River from Gunnedah to Boggabri has the highest losses in the entire Namoi River reach. In a dry climate over 80% of the losses accounted in the delivery of the regulated river system occur in this stretch of the river. This year the river losses were in excess of 120%. If there are more intense dry periods in the future the impact of any losses through seepage will exacerbate this situation.

The discussion on the void water storage and seepage into the Namoi River is considered by GIS to be relevant in the top few layers of the model. The computations of salt load on the Namoi River based on low flows appears to be less than the Aquifer Interference thresholds, however this may change under a different uncertainty analysis carried out with an optimal hydraulic parameter used in the model flow predictions.

Cumulative impact in the addendum requires further assessment. Particularly the assumption that Tarrawonga Coal Mine would not be influenced by Maules Creek and Boggabri mines and therefore the assumption that these impacts also would not reach Vickery. Given the mine operation is within Zone 4 and the alluvium, modelling by the Department is of one resource we would request following additional robust sensitivity analysis of the cumulative impacts.

The model has primarily used average assumptions, due to a lack of data since 2010 for groundwater, average river flows (hydrographs and dam storage levels clearly demonstrate this to be incorrect), average rainfall (haven't seen that in a while!).

Whitehaven have had more than five years in which to collate data and input quality, actual data into the model. Given they have operated other mines in the region for many years, there is no reason for their use of averages instead of actual data.

The number used in the EIS as average annual take is 31 ML/day (or 11,300 ML/year) when actual use over the last few years has ranged between 18,000 ML/yr to 23,000 ML/yr. It is highly concerning that such a basic data set could not have been accurately inputted, given the existing pre 2010 dataset. There could have been a replication of this information based on current usage to estimate in percentage terms usage based on past extraction history. This approach brings even more uncertainty into the model. This translates to our conclusion that the model is not fit for purpose.

Porous Rock (Maules Creek Formation) – Part 10 Model Limitations in the EIS notes "As there is limited knowledge of formation interface elevations and geometry in the Maules Creek Formation groundwater system (i.e. beneath the Upper Namoi Alluvium groundwater system) outside the mining leases, predications for the Maules Creek Formation in these areas should be regarded as indicative only".

Upper Namoi (Zone 4) Alluvium – The project is located on an "island" encircled by the alluvium (pg 43) even though the Part 10 Model Limitations notes "At this stage the model has adopted laterally uniform properties in distinct lithologies within model layers…". Which indicates that groundwater will not be directly from the alluvium to the pit, but there could be incidental loss through enhanced leakage from the bordering alluvium to the underlying Maules Creek Formation. The report also concludes that the 1m drawdown contour stays entirely within the Maules Creek Formation and doesn't impinge on the Upper Namoi Alluvium. Given the uncertainty analysis we suggest the model cannot predict these changes reliably enough to inform a proper decision on the project.

There is recognition that drawdown from the Project will continue to extend post-mining – however this has not been identified in the Chapter on this issue. Only the increase in flux from the alluvium to the porous rock (for the flux, the impacts only begin around 2035 (15 years into the mine life) and peak around 2055 (15 years after the mine life) and continues at the same level ongoing (Figure 52). There seems to be some confusion between flux and leakage in this section.

The Induced Losses from Connected Water Sources is tabled in Table 21, however this is only documented for the 25 year lifespan of the project.

Nowhere is it documented what the Alluvium impacts will be post-mine, when the full GW impacts from the mine will occur.

Western Emplacement Seepage

Where overburden is dumped (Western Emplacement) there is an overlap with the alluvium. "there is potential for seepage to occur from the emplacement to the alluvium in this area" (pg 43 Appendix A Groundwater Assessment). During mining this is estimated at 0.013ML/day (4.7ML/yr) to 0.032ML/day during the first 20 years after mining and long term equilibrium of 0.022 ML/d (8ML/yr) ongoing.

These predictions threaten the high quality alluvium water source that is critical to our members.

River Leakage

Water exchange is expected to occur on a 4km stretch of the Namoi River to the west of the Project. A "small increase in river leakage" is predicted during the project life of a maximum of about 11ML/yr. After the mine life Pg 44 states that the peak is less than 0.075ML/day (27ML/yr) but this is not documented in the EIS. Given the Namoi River is a losing river along this stretch and so this leakage could prove to impact the Namoi River during drought periods, affecting GDEs down gradient. These flow loses may seem 'insignificant' during 'normal' flow periods but this modelling has not taken climate change into consideration where longer and more intense droughts are predicted.

Blue Vale Void Water Storage

The proponent plans to use the remaining Blue Vale Void as an intermittent water storage, however the model uses a constant half-full level. It would be more useful to model a worst case and best case scenario. If the Void is used as a storage it is modelled "mitigate the effects of mining… (i.e with water storage in the Blue Vale void, the 4km Namoi River reach is predicted to have no significant water exchange)" Pg45.

However, the downside is the estimated 38kg/day (14t/year) of dissolved solids that could migrate from the water storage (in the Void) to the River, we would seek that the Department provide context as to how this is insignificant.

Bore field

The bore field model uses the assumptions including the incorrect 2010 data averaging. We would question if the proponent would be issued with an approval for the bore field given current trade assessment condition. The production bores use is almost 50% of the actual data, proving the inaccuracy of the model. The EIS admits that "there is less data available about the Upper Namoi Alluvium at the location of the proposed bore field" (pg 56) and "it is recommended that field investigations are carried out to assess the thickness and hydraulic conductivity of the alluvium" (pg 56). Again this does not include broader assessment of the impact of actual pumping and effects on Zone 12 upstream groundwater zone.

The bore field scenario predicts an average increase of 0.17ML/d (62ML/year) leakage from the Namoi River to the groundwater (pg 57). Whitehaven states they have sufficient licences for the Namoi River to account for this predicted leakage, however Table A6-1 states they have 50ML of High Security River licence. Further allocations to high security are not always guaranteed so the volume of water required may need to be reviewed, particularly how the licence is allocated to the seepage – is it surrendered?

Groundwater Impact Monitoring
Namoi Water is concerned that although the Vickery Groundwater Investigation Program installed 58 new monitoring bores in 2012 including Vibrating Wire Piezometers, however Pg 17 of Appendix A calls into question the reliability of some of these (VWP VKY41 – 5 depths – see the Hydrographs on Pg 93) stating "it is also likely that pressures at this VWP site have not yet equilibrated since installation. Further data should be collected before trends from this location can be considered reliable".

Planning process
Namoi Water has participated on numerous occasions in mining PACs, Community Consultation Committees and presentations from the department.

We have for some time requested a decision tree matrix. How does a planning commission/Department consider the risk of a project and weigh this against objective criteria?

The Department of Planning has for some time admitted the process is an approval process; ie that it is designed to give approval to mining projects. We have seen successive occasions where a mine may not be approved in the first instance but eventually with enough money and wearing down of the community concerns it is approved.

The broader Namoi Water users are primarily concerned with the impacts on water resources cumulative impact in a risk assessment sense. We had a Catchment Management Authority that provided a risk based assessment tool that intended to use our resilience cap to provide input into these types of processes. We were informed the Department undertook their own risk assessment tool, however there is no transparency around this assessment. Further how does the IPC plan to look at these issues in context?

Ultimately this project has not demonstrated sufficient evidence regarding the predicted impacts on ground and surface water resources despite having significant time to do so.

The community support of the project requires additional consultation and consideration. We would ask that the videos on Save our Sunburnt Country are viewed as indicators of the dissatisfaction with the behavior of Whitehaven in the local community.

Namoi Water will be disappointed if again the proponent rehashes existing information in the response to submissions stage of the assessment process. This is a highly unsatisfactory part of the planning process.

If the community has taken the time to review the substantial document of the EIS and respond, then there should be the courtesy extended that a project is not approved where there are significant uncertainties until sufficient data and analysis is undertaken to quantify the impacts and considered there of risk and the track record of the company.

Submission ends.