DOC19/852116-3

Mr Anthony Ko
Senior Environmental Assessment Officer – Resource Assessments
NSW Department of Planning, Industry & Environment
GPO Box 39
SYDNEY NSW 2001

Dear Mr Ko

Development Application – Proposed Snowy 2.0 Main Works (SSI 9687)

I refer to correspondence dated 16 September 2019, requesting comments from the NSW Environment Protection Authority ("EPA") on the development application lodged with the Department of Planning, Industry and Environment ("DPIE") for the proposed Snowy 2.0 Main Works.

The EPA has reviewed the publicly exhibited Environmental Impact Statement (EIS) for the proposal "*Snowy 2.0 Main Works – Environmental Impact Statement*", prepared by EMM Consulting dated 13 September 2019 and provides the following comments for DPIE's consideration. Attachment 1 to this letter outlines the specific details, with the EPA's recommendations highlighted in ***italics***.

The primary issues identified by the EPA relate to the proposed placement methodology for excavated material. The EIS predicts that within Talbingo Reservoir there will be significant impacts on water quality throughout the entire reservoir for more than two years. There will be a substantial increase in suspended solids (resulting in turbidity and sedimentation) and dissolved aluminium concentration levels which are above the national guideline values of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018). The EPA considers that the waste rock placement option recommended in the EIS will have significant adverse impacts on water quality and the ecology of the reservoir.

The EIS also contains alternative options for the disposal of excavated materials and predicts that this will have lesser impact on the water quality within Talbingo Reservoir. However, the EIS does not contain any details or justification as to why such alternative options have not been selected.

In addition, the EIS also does not provide modelling for the excavated material placement area in Tantangara Reservoir. The EPA has identified that there is a reasonable risk that fine sediment and other pollutants may be released into the reservoir from the proposed emplacement as a result of wetting and drying cycles. The EIS only provides limited information about the placement methodology of excavated material into the reservoir but does not provide any assessment of potential water quality impacts or potential mitigation measures.

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The EPA is available to discuss these comments and to continue to work with the proponent to refine options and/or consider alternative options. Should you have any queries or wish to discuss this matter further, please contact Nigel Sargent on (02) 6229 7002 or via email to queanbeyan@epa.nsw.gov.au

Yours sincerely

Gary Whytcross. 6 December 2019.

GARY WHYTCROSS
Regional Director – South and West
NSW Environment Protection Authority

ATTACHMENT 1

Excavated Rock Management

1. Talbingo Reservoir excavated rock placement

Excavated rock placement method

Talbingo Reservoir supports a range of environmental values and uses, including aquatic ecosystems, visual amenity, primary and secondary contact recreation, and aquatic foods. Downstream waterways are used for irrigation, homestead and drinking water supply. The reservoir generally has good water quality with levels of pollutants typically below guideline values. For example, the *Water Assessment* report (Appendix J) indicates the that background TSS concentrations currently range from <1 to 6mg/L.

The EIS predicts that the proposed Talbingo Reservoir excavated rock placement method will result in:

- substantial increases in total suspended solids (TSS) concentrations (resulting in turbidity levels well above the guideline value)
- sedimentation over the entire reservoir, and
- dissolved aluminium concentrations above the guideline value up to 500m outside the silt curtain.

These changes pose a risk that the environmental values and uses of the reservoir will not be maintained. In particular, the increased turbidity will be visible to recreational users and other water quality and sedimentation changes are likely to be detrimental to aquatic ecosystem health, including impacts on fish targeted by recreational fishers.

The alternative, but not chosen, 'hybrid' Talbingo Reservoir excavated rock placement method is predicted to result in substantially lower, but still potentially significant impacts.

The *Excavated Rock Placement* report (Appendix L) makes the following predictions:

- at Location 11 (500m east of the proposed placement area) the maximum surface TSS concentration is predicted to be 80mg/L under the proposed placement method and 33mg/L under the 'hybrid' method
- the sediment deposition rate is predicted to be 5-30mm/yr in the southern half of Talbingo Reservoir under the proposed placement method compared to 1-8mm/yr under the 'hybrid' method
- the predicted total mass of fines discharging from Talbingo Reservoir to Jounama Pondage is predicted to be 16,021 tonnes under the proposed placement method and 4,067 tonnes under the 'hybrid' method
- under the proposed excavated rock placement method, dissolved aluminium concentrations are predicted to increase to levels greater than the guideline value (55µg/L) up to 500m outside the silt curtain surrounding the placement area. The report indicates the background aluminium concentrations in Talbingo Reservoir range from 5 to 10µg/L.

The *Environmental Characterisations of Excavated Rocks* report (Appendix L, Annexure C) indicates that if the TSS concentration is greater than expected (e.g. if the excavated rock contains higher concentrations of fines), placement could result in prolonged elevated pH leading to greater dissolved aluminium concentrations.

The water quality and sedimentation impacts of the proposed excavated rock placement method are expected to continue for more than two years and are likely to result in a range of direct and indirect impacts on fish and other aquatic animals and plants within the reservoir, and potentially downstream waterways, including:

- aluminium toxicity in the reservoirs potentially resulting in reduced growth and reproduction and increased mortality of aquatic organisms
- potential harm to fish and other aquatic life due to chronic high turbidity reducing food supplies, degrading spawning beds, and affecting gill function
- reduced light availability due to turbidity, sedimentation and direct placement of material potentially causing death and decomposition of water plants and resulting in decreased dissolved oxygen concentrations – with potential secondary impacts on fish and macroinvertebrates – and increased nutrient concentrations posing a risk of increased microalgal abundance (e.g. algal blooms).

Placement of material will smother benthic animals, plants and habitats. The EIS does not specify the area of the placement footprint under the proposed or 'hybrid' excavated rock placement methods. However, the 'hybrid' method is expected to require a much smaller footprint and is therefore likely to have a reduced impact on the receiving environment.

Appendix L also predicts that more than 16,000 tonnes of fines will be discharged from Talbingo Reservoir under the proposed placement method. The concentration of sediment at discharge is not assessed, but it is considered that there is potential for downstream water quality impacts. The EIS does not include an assessment of potential downstream water quality impacts on Jounama Pondage or the Tumut River.

The *Reservoir Modelling – Commissioning Phase Operation* report (Appendix L, Annexure H) indicates that there is also a risk of resuspension of settled sediment during the operation stage as this material is expected to have low shear strength. The risk of resuspension is predicted to be greater under the proposed than the 'hybrid' placement method due to greater constriction of flow in the reservoir caused by the larger footprint of the proposed placement method. The greater amount of sedimentation under the proposed placement method could also increase the risk of operation stage resuspension.

A) Given the nature, extent and duration of the potential impacts it is recommended that the proponent provides clarity that no further reasonable and feasible options to minimise water quality impacts are available.
These could include, but are not limited to:
- ***using a fall pipe for placement – this could potentially have a dual benefit of placing material in cooler water where aluminium dissolution rates are lower and trapping material below the thermocline***
- ***an additional silt curtain/s installed closer to the placement area and repositioned as placement progresses***
- ***measures to minimise resuspension of settled sediment during construction and operation.***

B) Provide details of the mitigations options that might be used in combination with the 'hybrid' excavated rock placement method

i. Specify the area of the proposed excavated rock placement footprint, detailing how this was determined with reference to the bulked volume of excavated material proposed to be placed.

ii. Provide details of the construction stage monitoring and management triggers and actions that would be implemented to manage the water quality impacts of the excavated rock placement in Talbingo Reservoir. Consistent with the recommendations of Appendix L, Annexure C, the monitoring program should include, at a minimum:
- ***continuous monitoring of general water quality parameters, including pH, electrical conductivity, temperature and turbidity***
- ***monitoring of dissolved aluminium concentrations***

iii. Following identification of additional management and mitigation measures, provide a revised impact assessment based on the final excavated materials management method, including assessment of potential water quality impacts on Talbingo Reservoir and downstream waterways.

Modelling of suspended sediment concentrations and sedimentation

The results of the limited sensitivity testing indicate water quality impacts could be substantially greater if actual conditions differ from the assumptions used in the model.

The *Excavated Rock Placement Modelling* report (Appendix L, Annexure G) states that the assumed placement rate, proportion of fines and percentage of the fines that are entrained in the water column (the 'source term') could significantly influence the magnitude of the sediment plume and presents sensitivity testing confirming this. These parameters could vary substantially from the modelled assumptions.

For example, the model assumes sediment fall velocities based on Stokes law, yet the report states that velocities determined from laboratory settlement testing are less than those predicted by Stokes Law, indicating that settling velocity of critical particle sizes could be less than assumed for modelling.

Sensitivity testing predicted that a 50% increase in the proportion of fines (<63µm) of the excavated material would result in proportional increases in TSS concentrations and sedimentation rates and discharges of suspended sediment from the reservoir. Annexure G also states that an equivalent increase could also be achieved by a 50% increase in either placement rate or 'source term'. This suggests that greater increases might be expected to result from a combination of increased percentage fines, placement rate and/or 'source term'.

The modelling also assumes that impermeable silt curtains will be installed around the excavated rock placement area to control suspended solids. However, Appendix L, Annexure G states, "Final selection of the silt curtain would occur during the detailed design phase. The silt curtains will be suspended from floatation booms on the surface and will minimise and restrict water and sediment movement in the top 12m of the water column depending on permeability." If a permeable silt curtain is used in place of an impermeable silt curtain, the water quality impacts could potentially be greater than predicted.

C) It is recommended that the proponent provides further information to demonstrate that the modelled assumptions reflect the actual conditions that will be encountered during excavated rock emplacement. This includes, but is not limited to, further information and sensitivity testing regarding the:

- ***particle size distribution of the excavated material***
- ***placement rate***
- ***'source term'***
- ***mitigation measures such as the design specifications and management of the silt curtains.***

The modelling and impact assessment should be revised where model assumptions are inconsistent with the proposal (e.g. excavated rock placement method; silt curtain design specifications and placement).

2. Tantangara Reservoir excavated rock placement

There is a risk that as water levels rise and fall in Tantangara Reservoir that fine sediment and other pollutants are released from the excavated rock placement. However, the EIS:

- provides limited information about the placement methods
- does not include an assessment of the potential impact of release of fine sediment and associated pollutants during wetting and drying cycles
- does not provide details of the measures that will be implemented to mitigate potential water pollution risks.

As noted below, there are a range of potential pollutants, including aluminium, that can be mobilised when the spoil comes into contact with water. The *ERP Modelling – Construction* report (Appendix L, Annexure G) states that hydrodynamic models for Tantangara Reservoir have been developed but are no longer required given the proposed dry placement of the excavated rock.

D) It is recommended that the applicant:

- ***provides details of the proposed excavated rock placement methods and mitigation measures for Tantangara Reservoir***
- ***assesses the potential for release of sediment and other pollutants (e.g. aluminium) associated with wetting and drying of the Tantangara Reservoir rock emplacement as the level of the reservoir rises and falls. If a risk is identified, the potential impact on water quality should be assessed and any appropriate mitigation measures identified. This assessment should be supported by appropriate hydrodynamic modelling of plume behaviour under a range of scenarios***

3. Characteristics of excavated rock/reservoir water mixtures

The CSIRO's *Environmental Characterisations of Excavated Rocks* report (Appendix L, Annexure C) includes details of testing of release of substances from representative rock samples into reservoir water samples. The report indicates that:

- turbidity and concentrations of metals and metalloids (e.g. aluminium) are likely to increase as a result of placement in Talbingo Reservoir
- fine rock particles are likely to result in much greater water quality impacts than coarse material
- higher TSS concentrations and pH are likely to result in higher dissolved aluminium concentrations
- lower water temperatures will result in lower dissolved aluminium concentrations
- placement could increase pH (temporarily >9) and conductivity (>60µS/cm).

Appendix L, Annexure C states that the tests used 'new reservoir water' and that longer-term tests were not undertaken due to time constraints. The report notes that the excavated rock placement activities may occur over years and cautions that pollutant concentrations may become significantly higher where waters are already impacted by previous cycles of rock placement. Appendix L, Annexure C recommends further testing of the release of substances from the excavated rock.

E) Consistent with the recommendations of Appendix L, Annexure C, it is recommended that the following testing is conducted:

- ***longer-term release of substances from fine (<2-6.3µm) excavated rock particles***
- ***effects of cycling water exposure to excavated rock materials (wetting/drying)***
- ***longer-term effects of water pH on attenuation of dissolved aluminium release, including potential cycling from dissolved and precipitated forms if pH cycles up and down.***

The results of the testing should be used to inform appropriate management of potential water pollution risks.

4. Settlement testing

The *Laboratory Assessment – Settlement Characteristics of Fine Crushed Rock* report (Appendix L, Annexure F) states, "Whilst surface turbidity levels generally appear to reduce over time, it may take an extremely long time to reach the background levels of 1 to 5 NTU…". The report indicates:

- the settlement velocities of the excavated material samples might be slower than those predicted by Stokes Law (the expression used to predict settling velocity in the suspended sediment modelling)
- placement near the bed minimises turbidity in the water column
- vertical mixing is less likely where material is placed below the thermocline (summer only)
- management measures that reduce the release of fines may reduce turbidity
- disturbances such as currents and wave action are likely to disrupt settlement.

F) Clear justification for not adopting the potential measures identified to mitigate impacts associated with placement of excavated material in both Talbingo and Tantangara Reservoirs Laboratory Assessment – Settlement Characteristics of Fine Crushed Rock report should be provided.

5. Ecotoxicology of excavated rock/reservoir water mixtures

The CSIRO's *Ecotoxicology Assessment of Excavated Rock* report (Appendix L, Annexure D) investigates the toxicity of excavated rock material on microalga and the invertebrate species. The report indicates placement of excavated rock has potential to result in varying levels of toxicity to aquatic organisms, stating:

- 'raw leachates' ('raw scenario') of 'enriched excavated rock materials' from some of the tunnelling zones exhibited high toxicity
- '12-day settled leachates' of rock from some of the tunnelling zones exhibited moderate toxicity

Excavated rock mixed with or placed on top of reservoir sediments generally exhibited no toxicity to low toxicity, however

- excavated rock material from some tunnelling zones exhibited low to moderate level toxicity when mixed with reservoir sediment
- 'neat enriched excavated rock' ('rock scenario') from all tunnelling zones (as a worst-case scenario) exhibited moderate to high toxicity

The report states that the toxicity is caused by multistressors including increased turbidity, metals and metalloids. The report states that the 'raw scenario' (24 hour settled leachates tested to determine the toxicity of a combination of contaminants and turbidity) and the 'rock scenario' (excavated rock becoming the dominant substrate in an area) represent the 'worst case' scenario and that this is unlikely to be encountered during placement activities.

However, the report also states, "the placement of excavated rock material was assumed to be in deep waters within the reservoirs, possibly via placement methods that result in rock material dropping through the water column with the intent of depositing them within a specific range of placement depths." Given that the current proposal involves tipping excavated rock into a relatively shallow near-shore area of Talbingo Reservoir, these scenarios appear more likely to occur.

Appendix L, Annexure D recommends laboratory and field investigations of potential impacts of turbidity on fish larvae, adult fish, invertebrates and microalgae.

The EIS does not include these investigations. TSS and dissolved aluminium concentrations are predicted to be elevated for more than two years in Talbingo Reservoir, however, the duration of the ecotoxicology testing was no longer than 28 days.

G) ***Given the potential for ecotoxicity and the level of uncertainty in the predictions of impacts it is recommended that clear justification for not adopting further measures to mitigate and minimise water quality impacts is provided. Specific measures for each reservoir are discussed in the Talbingo and Tantangara sections above.***

Process water, wastewater and groundwater management

6. Process water, wastewater and groundwater discharges

It appears the process water systems at Talbingo and Tantangara reservoirs will supply and manage water for construction activities, including subsurface construction, concrete production and dust suppression. This process water will be predominantly sourced from groundwater inflows and topped up from groundwater bores or reservoirs. Process water quality will be affected by groundwater inflow quality and wastewater from construction activities. The treated process water systems will discharge to the reservoirs when net inflows exceed net usage. The EIS states that in areas where construction is complete, groundwater intercepted by excavations could potentially bypass the treatment system and discharge untreated into the reservoirs.

Wastewater produced at construction camps and facilities will be treated at wastewater treatment plants and discharged into Tantangara and Talbingo Reservoirs.

The EIS does not provide sufficient information on the following matters to provide environmental protection requirements:

- the proposed treatment plants and other measures to minimise potential impacts of discharges
- the quality of discharges from each proposed discharge point with reference to the relevant guideline values
- demonstration of how each proposed discharge stream will be managed to ensure the NSW Water Quality Objectives (WQOs) will be met by the edge of the near-field mixing zone
- the practical measures that will be taken to prevent, control or mitigate pollution including contingencies that will be implemented if WQOs are not met.

It should also be noted that a mixing zone is only permitted when all options to avoid and reduce discharge to receiving waters have been exhausted and options for improving effluent quality through additional treatment processes have been explored and exhausted.

Other water quality issues relating specifically to process water, wastewater or groundwater discharges are discussed below.

Process water: The EIS states that all process water will be treated prior to discharge to the reservoirs. Details of the level and type of treatment and the exact location of the proposed discharge points has not been determined.

The EIS characterises the quality of the proposed treated process water discharges based on the characteristics of the groundwater and the treated process water (presumably this means the quality of process water treated for reuse). It is unclear how the discharge water quality was determined without treatment details, however the data provided indicate that:

- electrical conductivity of discharges to Tantangara and Talbingo reservoirs would range up to 300 and 1,800µS/cm respectively as treatment will not remove dissolved solids. This is 10 and 60 times the relevant guideline value [30µS/cm] and the baseline electrical conductivity is typically below the guideline value in both reservoirs.
- pH would be within the range of 6.5 to 8.5. The guideline range is 6.5 to 8.0 and the baseline pH is typically within the guideline range in both reservoirs. Note that the EIS adopts the incorrect guideline range as WQOs.
- turbidity would range up to 25NTU. The guideline range is 1-20NTU and the background turbidity is typically 1 to 1.5NTU in Talbingo Reservoir and 1.1 to 3.0NTU in Tantangara Reservoir. Note that the EIS adopts the incorrect guideline range as WQOs.
- ammonia concentrations would range up to 100µg/L. This is 10 times the guideline value [10µg/L]. Ammonia concentrations are typically 10 to 15µg/L in Talbingo Reservoir and below the guideline value in Tantangara Reservoir.

This indicates discharges could potentially result in water quality that does not maintain the environmental values of the receiving waters at the edge of the near-field mixing zone. A discharge impact assessment is required to demonstrate that process water will be appropriately managed.

Wastewater: Wastewater produced at construction camps and facilities will be reticulated or trucked to a wastewater treatment plant (WWTP), treated and discharged to Tantangara and Talbingo reservoirs via diffuser arrangements. The WWTPs are expected to include biological and chemical treatment, filtration, disinfection and either enhanced tertiary treatment or reverse osmosis. The EIS indicates that the most suitable treatment processes and plant configurations will be established at detailed design.

Biological treatment can be unreliable in cold climates due to the low reaction rates and it is unclear how the treatment plants would be designed and managed to ensure reliable performance.

Environmental values for both reservoirs include primary and secondary contact recreation and consumption of aquatic foods. Depending on community access during construction and potential ongoing impacts it is necessary to consider the impact of treated wastewater discharges on these values.

Untreated groundwater: The EIS states that, in areas where construction is complete, groundwater intercepted by excavations could potentially bypass the treatment system and discharge untreated into the reservoirs, provided that:

- it can be practically separated and reticulated to the reservoirs
- contamination from the 'broader construction activities' can be avoided
- the water quality is 'similar' to that of the treated process water.

The groundwater is known to have elevated electrical conductivity and metals concentrations, however, the EIS does not provide details of management of this potential discharge or a discharge impact assessment.

H) It is recommended that for each proposed discharge point the proponent provide details of treatment and other practical measures that will be implemented to avoid and minimise potential impacts.

When all options to avoid and reduce discharge to receiving waters have been exhausted and options for improving discharge quality through additional treatment have been explored and exhausted, the applicant should demonstrate that the NSW WQOs will be met by the edge of the near-field mixing zone for any discharges.

The discharge impact assessment for each proposed discharge point must include, at a minimum:

- ***a characterisation of the expected quality of the discharge in terms of the concentrations and loads of all pollutants present at non-trivial levels***
- ***predictions of water quality at the edge of the near-field mixing zone under a range of operational conditions, including typical and worst-case scenarios***
- ***an assessment of the potential impact of the proposed discharge on the environmental values of the receiving waterway with reference to the relevant Australian and New Zealand Guidelines for Fresh and Marine Water Quality guideline values.***

Combined discharges (e.g. mixed process water and wastewater discharged at one location) are a single discharge and should be characterised and assessed accordingly.

7. Process water emergency storage

The *Water Management Report* (Appendix J, Annexure D) states that the process water system will enable emergency discharge to stormwater basins to minimise the risk of untreated process water entering a watercourse. No further details of the proposed stormwater basins are provided. Details are required of which stormwater basins would receive these emergency discharges, and how this would impact on capacity to manage stormwater. A standalone emergency storage is likely to pose a lower risk to the receiving waterways as this would allow stormwater and process water to be managed separately.

I) It is recommended that the proponent considers alternative emergency storage options to allow process water to be managed separately and appropriately. If emergency discharges to stormwater basins are proposed the applicant should demonstrate how this will not adversely impact on capacity to appropriately manage stormwater.

8. Process water re-use

The *Water Assessment* report (Appendix J) states that all process water will be treated to a suitable quality for re-use within the process water system. The report indicates the process water will also be re-used outside the process water system (e.g. dust suppression). It is important that this water is of a suitable quality and does not pose a risk to waterways or soils.

Figure 4.1 of the *Water Management Report* (Appendix J, Annexure D) indicates that the process water system could potentially be topped up with groundwater when required but it is unclear if it would be treated prior to re-use and if this could affect the quality of water re-used outside the process water system.

Details of the quality of treated process water for re-use outside the process water system are not provided.

J) It is recommended that the proponent provide details of how process water re-used outside the process water system (e.g. dust suppression) will be managed to ensure it is of a suitable quality and does not pose a risk to waterways or soils. Details should include:

- ***a characterisation of the quality of process water proposed for re-use outside the process water system***
- ***treatment and other practical measures that will be implemented***
- ***management of the proposed re-use to avoid potential impacts on waterways and soils***

9. Groundwater drawdown

It is unclear whether the tunnels will be fully lined. The Water Management Report (Appendix J, Annexure D) states that groundwater inflow to tunnels will be mitigated using (at a minimum) excavation sequencing, pre-grouting, post-grouting and segmental lining. The report indicates that the exact locations of these mitigation measures have not been determined and states that the groundwater model assumes no groundwater inflow mitigation. It is unclear to what extent this influences the inflow and groundwater drawdown predictions presented in the EIS.

The EIS predicts that the project will cause groundwater drawdown during construction and operation, resulting in reduced baseflow and some sections of waterways drying out at times. The greatest baseflow reductions are predicted for Gooandra Creek (28.8%) and Eucumbene River (12.5%). During operation, Gooandra Creek is predicted to change from having a perennial streamflow regime to being ephemeral (with days with 'no flow' increasing from 0% to 9% at 'Site 3'). The EIS does not assess the potential water quality impacts of these reduced flows, such as eutrophication of disconnected pools during the summer months.

Design, management and mitigation measures should be employed to minimise groundwater inflows, limit groundwater drawdown, limit streamflow reduction and reduce the volume of groundwater requiring treatment and discharge.

K) It is recommended that the applicant:

- ***confirms that the tunnel will be fully lined and provides details of the circumstances in which will pre- and post-grouting will be implemented***
- ***models groundwater inflow and drawdown under the proposed scenario (i.e. with groundwater inflow mitigation measures)***
- ***assesses the potential water quality impacts of reduced flows due to groundwater drawdown (e.g. potential eutrophication of disconnected pools)***
- ***identifies management triggers and responses to manage groundwater inflows and drawdown.***

10. Management of groundwater inflows

It is unclear how initial groundwater inflows will be managed during at the time when the Tunnel Boring Machine (TBM) will be in operation. The descriptions of the expected geology that is to be encountered when boring the tunnel is anticipated to range for non-water bearing hard rock, to fractured igneous intrusions with a high likelihood of unexpected yields. Though the effective sealing of the fractures will limit the ongoing inflow of groundwater into the tunnel, the expected flow of groundwater into the tunnel at the time of tunnel boring is not mentioned in the water mitigation processes. Treatment plants for wastewater are proposed around the project site, but it in unclear if

inflows into the excavations are considered by the proponent for treatment prior to their eventual, but unknown, discharge back to the environment.

Table 10.2 of the *Snowy Hydro 2.0 Main Works EIS Appendix J.1 - Water Assessment* report also states an ongoing inflow of groundwater during the operational stages of the project, so it is anticipated inflows will still be collected over the life of the project. The proponent is not clear on the characteristics of low-quality groundwater ingress to the tunnels during the operational phase and of any ongoing impacts to receiving water sources.

L) Further information is requested from the proponent regarding the treatment and discharge of groundwater created during the construction and operation phases of the project.

11. Baseline groundwater data

Monitoring bores used to collect the baseline were drilled between September 2017 and March 2019. The earliest of these bores (3 bores: BH1116, BH1117, and BH2102) were drilled in proximity to the shoreline of Tantangara Reservoir, with the remaining bores along the plateau drilled from September 2018 to March 2019. This equates to 42 out of 45 monitoring bores not having the sought 2 years of baseline data.

The time between the drilling, installation and completion of the monitoring network, and the time of which the EIS was submitted, is an insufficient timeframe on which to establish baseline conditions. Considering the altitude in which the project is located, and the current climatic variables across NSW, the potential from summer influences has been excluded in the current characterisation of groundwater baseline data. This limits the groundwater data to one summer of information, critical for validating transpiration effects on overlying ecosystems such as the plateau swamps and bogs, as well as the assessment of impacts to terrestrial flora reliant on access to shallow groundwater. At this point in time, results from recent and future sampling events are needed to establish a credible baseline.

M) *Further sampling and monitoring event information be undertaken to establish a more representative baseline groundwater characteristic in the project vicinity.*

Other instream works

12. Dredging, channel excavation and underwater blasting

Dredging and channel excavation is planned for construction of a barge launch facility in Tantangara Reservoir. Dredging and excavation, and potentially underwater blasting, is also planned to remove the rock plugs and facilitate the inlet structures in Tantangara and Talbingo reservoirs. These activities have potential to result in elevated turbidity and release of pollutants from suspended sediments. In Talbingo Reservoir, there is a potential risk of release of metals from sediments that have been contaminated by historical mining activities. The impact assessment for instream works requires additional information to assess this risk and provide environment protection requirements if necessary:

- the proposed locations and methods of dredging, channel excavation and underwater blasting
- assessment of the potential water quality impacts with reference to relevant guideline values
- the measures that will be taken to prevent control or mitigate potential water pollution.

The *Water Assessment Report* (Appendix J) refers to the *Snowy Hydro 2.0 Exploratory Works, Dredging and Dredging Impact Assessment* (RHDHV 2018). This report is not provided within the EIS.

Tests of sediment and water from the Yarrangobilly Arm of Talbingo Reservoir indicated that a 25:1 dilution (reservoir water: sediment) will likely be required to avoid exceedances of guideline values (note it is assumed the '1:25' dilution stated in the *Water Assessment Report* is a typographical error). No sediment samples were collected upstream of Middle Bay in the Yarrangobilly Arm or in

the vicinity of the historic copper mine. It is unclear whether there will be any instream works, dredging or changes to flow velocities in these areas. Additional sampling and assessment of sediment quality is required if there is potential for sediments upstream of Middle Bay to be disturbed.

Sediment metal concentrations were not considered bioavailable as dilute acid digestible metal concentrations were 'below sediment quality guidelines'. However, the dilute acid digestible metal concentration results were not provided. It is unclear:

- whether dilute acid digestible metal concentrations were assessed against the lower sediment quality guideline. The ANZG (2018) guidelines state the higher guideline value is to be used as an indicator of potential high-level toxicity problems, not as a guideline value to ensure protection of ecosystems.
- whether potential metal transformation and mobilisation into bioavailable forms (such as changes to pH, or flow disturbance resulting in oxidation of previously anoxic sediments) were assessed
- what particle sizes were used for laboratory analysis. The ANZG (2018) guidelines state that the <2mm sediment particle size fraction should be used for chemical analyses so that the potential risk posed by contaminants is not diluted by a large mass of larger materials [gravel and other debris. The <63µm sediment particle size fraction [clay and silt] is considered a suitable representation of the sediment materials that are mostly readily resuspended or potentially ingested by organisms.

Additional details of the sediment quality assessment are required to ensure that any proposed disturbance of sediments does not present a risk to fish and other aquatic animals and plants.

It is noted that different sediment quality guidelines are adopted in the various reports. Appendix J, Attachment G adopts the National Assessment Guidelines for Dredging (NAGD) whilst Appendix J, Attachment F adopts the ANZECC/ARMCANZ (2000) guidelines. The ANZG (2018) sediment quality guidelines should be adopted.

Details of management of proposed dredging, channel excavation and underwater blasting and an assessment of residual impacts (after mitigation measures are implemented) are required to demonstrate that the water pollution risks will be appropriately managed.

N) It is recommended that the proponent provides further information on the management of the proposed dredging, channel excavation and underwater blasting to demonstrate that the water pollution risks will be appropriately managed. This should include:

- ***the proposed locations and methods of dredging, channel excavation and underwater blasting***
- ***the specific measures that will be implemented to mitigate the water pollution risks of these activities (e.g. specifications and locations of silt curtains, monitoring and management responses)***
- ***details of the sediment quality assessment.***

The proponent should carry out an assessment of the potential impact of these proposed activities after mitigation measures have been implemented. This assessment should include predictions of the level and extent of water quality changes, the potential impact of these changes on the environmental values and uses of the reservoirs (with reference to the relevant guideline values) and potential sedimentation impacts.

Further surface water issues

13. Construction stage stormwater management

The *Water Management Report* (Appendix J, Annexure D) defines construction stage minor works as *'areas disturbed by the construction of roads, service trenches and minor works, with disturbances typically less than 3 months'*. No sediment retention basins are proposed for minor works.

The report characterises the expected quality of stormwater discharges from minor works but does not provide details of how this was determined, simply stating that likely pollutant ranges were *"...based on a review of available data and the effectiveness of the proposed controls and considers*

the spatial variability of contributing factors, such as soil characteristics." The report predicts stormwater discharges from minor works to exceed relevant guidelines values for aluminium (100x), copper (500x), total nitrogen (20x) and total phosphorus (50x) concentrations. Similar discharge quality is expected for sediment basin overflows from major works. At these concentrations, discharges could potentially be acutely toxic to aquatic organisms, posing a significant risk to aquatic ecosystem health. Further details are required of how the estimates were derived. If the estimates are accurate, further consideration of mitigation measures is required to address potential risks to receiving waters.

The EIS proposes that sediment retention basins would be sized to achieve the required water quality for storms up to the 85th percentile 5-day rainfall event. *Managing Urban Stormwater, Soils and Construction Volume 2C* (DECC, 2008) recommends that where the duration of disturbance will be greater than three years and there is a sensitive receiving environment (such as discharges to a waterway in a national park – e.g. Yarrangobilly River) sediment retention basins should be sized to achieve the required water quality for storms up to the 95th percentile 5-day rainfall event. For standard environments such as the reservoirs, the 90th percentile 5-day rainfall event is recommended.

It is understood there is a need to modify erosion and sediment controls in the context of terrain constraints and to minimise vegetation clearing. DECC (2008) recommends that where space does not allow the recommended sizing, enhanced erosion controls should be implemented to reduce the risk of erosion. Justification is required for the design storm sizing in the context of site constraints and enhanced erosion controls.

O) It is recommended that the proponent:

- ***clarifies the methodology used to characterise the quality of construction stage stormwater discharges***
- ***provides justification for the sediment retention basin sizing with reference to Managing Urban Stormwater, Soils and Construction Volume 2 (DECC, 2008) and in the context of site constraints and enhanced erosion controls***
- ***where stormwater is expected to contain pollutants other than 'clean' sediment at non-trivial levels (e.g. metals), considers additional or alternative treatment measures to mitigate potential water pollution risks.***

14. Resuspension associated with commissioning and operation stage transfers

The *Excavated Rock Placement* report (Appendix L) states that sediment downstream of intake/outlet works will be disturbed by post construction generation and pumping flows until a long-term equilibrium is established. Flow rates of up to 372m^3/s will occur during commissioning.

Sediment scour and erosion can result in water quality impacts including elevated turbidity and release of pollutants from suspended solids. The EIS does not provide an appropriate assessment of the potential water quality impacts associated with sediment mobilisation during commissioning and operation and additional details on the sediment quality assessment are required.

Appendix L commits to preventing scour of the approach channel and surrounding areas of the reservoirs and the formation of vortices and reducing the mobilisation of sediment. However, the EIS does not specify the measures that will be implemented to achieve this or assess any residual water quality impacts.

The EIS recommends further sediment studies, including analysis of:

- sediment mobilisation, to understand the extent of underwater excavation and inform mitigation
- the structure outlet velocity profiles in pump and generation mode using Computational Fluid Dynamics (CFD), to optimise head and eliminate scour and erosion issues.
- Details are required of sediment characterisation, sediment mobilisation analysis, outlet velocities, measures to mitigate sediment resuspension and an assessment of residual

impacts (after mitigation measures are implemented) to demonstrate that any potential water pollution risks will be appropriately managed.

P) It is recommended that the proponent:

- ***Confirms demonstrates that the inlet/outlet works will be designed to minimise scour and erosion issues in both pump and generation mode (including sediment mobilisation and Computational Fluid Dynamics studies)***
- ***provides details of mitigation measures to minimise sediment mobilisation, erosion and scour associated with operation stage transfers and assesses residual impacts after mitigation.***

15. Wastewater storages

The EIS does not provide details of the design of the proposed wastewater storages, however, the *Water Assessment Report* (Appendix J) lists "*seepage from wastewater storages to the watertable or spill from storages to watercourses…*" as potential risks. Wastewater storages should be appropriately lined to prevent seepage and sized to minimise spills.

Q) It is recommended that the proponent clarifies that design specifications of wastewater storages including liners (i.e. liner type, permeability, thickness) and design storm sizing are sufficient to prevent seepage and minimise spills.

16. Water quality assessment

The EIS does not characterise existing water quality or assess potential impacts on waterways downstream of Tantangara and Talbingo reservoirs. These assessments are required, particularly in relation to the substantial sediment discharges from Talbingo Reservoir predicted to result from the proposed excavated rock placement method.

The *Water Management Report* (Appendix J, Annexure D) assesses stormwater discharge impacts by categorising results in terms of the magnitudes of change from relevant WQOs (no change, 0 – 10 %, 10-50%, 50-100%, and greater than 100% increase). Consistent with ANZG (2018), for physical chemical parameters the median concentration of test data should be compared to the relevant guideline, while the 95th percentile of test data should be used for toxicants. It is noted that Table 8.4 (*Water Management Report,* Appendix J, Annexure D) has rows missing from the bottom of the table. As a result, the poorest water quality results '*Percentage of time concentrations of suspended solids, nutrients of metals in receiving waters may increase by more than 100% of WQO values'* is not presented within the report.

Combined impacts of treated wastewater, process water and stormwater discharges to Tantangara Reservoir and the Yarrangobilly River arm of Talbingo Reservoir were described. However, it is unclear whether the assessment sites are appropriate (e.g. edge of the near-field mixing zone) as their exact locations are not specified.

The EIS does not assess the cumulative water quality impacts of construction stage activities, including those of rock emplacement, dredging, and stormwater, treated wastewater, process water and groundwater discharges.

R) It is recommended that the proponent:

- ***potential impacts on the environmental values of waterways downstream of Tantangara and Talbingo reservoirs***
- ***the potential cumulative water quality impacts associated with all construction activities.***

17. Surface water monitoring

A surface water monitoring program will be included in the applicants Water Management Plan. Details of proposed surface water monitoring are also required to inform the conditions of the environment protection licence. It is noted that:

- there has been no baseline water quality monitoring within the Tumut River, downstream of Talbingo Reservoir
- there is limited baseline wet weather monitoring data.

The water quality monitoring results presented in the EIS indicate that Limits of Reporting (LOR) are above the ANZG (2018) guideline values for arsenic, cadmium, chromium, cobalt, mercury, selenium, silver, vanadium, and zinc. Where appropriate analysis methods are available, LOR should allow comparison to the relevant guideline values.

S) It is recommended that the proponent:

- ***provides details of the proposed surface water monitoring program, including sampling sites, timing and frequency and parameters***
- ***identifies management triggers and responses to manage potential water quality impacts***

18. Temporary waste rock stockpiles

It appears to be unclear how water infiltration through the proposed waste rock emplacements around the project site will be managed. The potential for acid mine drainage, due to acid forming minerals in the excavated rock, to leach from emplacement zones close to surface water bodies was considered a low to moderate risk in the EIS. Mitigation measures for waste rock leachates were not found in the adjoining contamination report. It was detailed that a construction environmental management plan would be prepared for the project, but no detailed remedies were provided for leachate confinement. Further information is sought regarding the capture of leachate prior to its potential discharge in the subsurface or into adjacent water bodies.

T) The proponent provide further information on leachate formed form the temporary waste rock stockpiles.

Noise and Vibration

19. Blasting activities

The EPA notes the proponent is seeking to carry out construction blasting activities on a 24 hour per day, 7 day per week basis, where it can be demonstrated that the effects of blasting are not perceived at noise sensitive sites, Section 4.5.3 and Section 5.2.2 of the *Snowy Hydro 2.0 Main Works EIS Appendix R – Noise and Vibration Assessment* (NVIA). To this end, the NVIA has assessed air blast overpressure predictions against relevant sleep disturbance criteria to justify 24/7 blasting (Section 6.4.1 of the NVIA).

U) The proponent should also assess in the NVIA ground vibration effects from proposed blasting to establish whether they will meet relevant human perception thresholds at surrounding sensitive locations, to justify proposed 24/7 blasting activities.

20. Exceedance of construction noise at Rock Forest logistics site

The EPA notes that the proponent predicts potential exceedances of the construction noise management levels for some activities at location R6 (6560 Snowy Mountains Highway, Adaminaby) due to its proximity to the proposed Rock Forest logistics site. This includes an exceedance of 6 dB above the sleep-disturbance screening criteria for night-time construction.

V) As outlined in Section 6.1.1 of the NVIA, the EPA recommends that the proponent implements all feasible and reasonable noise mitigation and management measures, including those outlined in Section 6.1.1 and Table 7.1 of the NVIA.

21. Road traffic noise calculations

The road traffic noise calculations shown in Table 6.6 of the NVIA indicate an increase in daytime noise level due to the project of 49.6 dB at location ID 8, however it appears that the noise level from existing movements is 30.6 dBA and the noise level from existing plus project movements is 53.4 dBA at this location, a difference of 22.8 dB. Although this is a significant increase over existing road traffic noise levels, it is less than the applicable Road Noise Policy criteria.

W) The proponent should review this data and amend if necessary, otherwise provide an explanation for the results shown in the Table 6.6 of the NVIA.

22. Road traffic noise exceedances

The road traffic noise assessment in Section 6.5 of the NVIA indicates some predicted exceedances of the relevant criteria at location ID 'Cooma 1' and 'Cooma 2', noteably:

i. While the project-related traffic volumes in Table 4-1 of the traffic assessment broadly reflect those in Table 6.6 and 6.7 of the NVIA, further detail on how the project traffic volume data in the NVIA has been calculated would be useful.
ii. The Construction traffic volume maps in Appendix D of the traffic assessment identify one-way movements only, which could mean that actual vehicle movements are twice as high as the data in Table 4-1 of the traffic assessment if vehicles return along the same route(s). This should be clarified.

X) The proponent should review the traffic data assumptions used to predict road traffic noise and consider feasible and reasonable noise mitigation and management measures to manage road traffic noise impacts.

23. Cumulative road traffic noise impacts

The proposed project be associated with the proposed segment factory at Cooma, with both these project components to operate concurrently. This will result in cumulative changes in noise levels in certain areas and locations, including Cooma. The EPA advises that the community will hear and likely be affected by noise at difference times during the overall Snowy 2.0 project. In particular, proposed changes in traffic volume and composition increases in road traffic noise (even when these comply with relevant criteria) is likely to be the major cause of this.

As a result, the acoustic environment is likely to change and activities associated with the Snowy 2.0 project will be audible, particularly as the project progresses.

Y) The EPA recommends that DPIE carefully consider the cumulative changes to the acoustic environment and the potential for this to impact upon on the amenity of the community that live in and around the Snowy 2.0 project areas.