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Re. This is a submission to the Hume Coal Project EIS SSD 7172 and the Berrima Rail Project EIS SSD7171.

This is an addendum to my signed submission (dated 17 June 2017) opposing the coal and rail development proposed by Hume Coal.

I object to both of these submissions and recommend that both be rejected. My main objections are summarised below.

The EIS is a long and convoluted document (some 107 volumes and more than 8,000 pages). Due to the size of this document it is not possible for me to assess all aspects of the EIS. Therefore, my focus is only on water quality. I have spent the last 30 years of my career quantifying the impacts on the aquatic environment of anthropogenic activities. This experience has been gained in Australia, in Antarctica and overseas working in government, consulting and research organisations.

The EIS document is highly repetitive, emphasises the potential benefits of the project without properly assessing the downsides or risk, it demonstrates no quantifiable risk assessment, uses a language that is, at best, ambiguous and misleading.

My greatest concern centres on water quality. There is considerable reporting in the EIS on agriculture and ecology, but there is only passing reference to the fact that this whole area forms part of the drinking water catchment area for about 5 million people. The consequences of ignoring, or not emphasising, drinking water quality could be catastrophic. The proposal places at risk the drinking water of Sydney's population.

Quantifiable risks

The EIS does not quantify the risks. It simply states them as "insignificant" (e.g. page ES.4 of J12055RP1) or "negligible" (e.g. J12055RP1, page 52, 194 and other places of the EIS). These terms are ambiguous and will have different meanings to different people. Risks need to be quantified then assessed by an independent body to determine whether these risks are acceptable.

Quantifiable risk assessment techniques have been conducted for more than two decades (e.g. Hallenbeck, 1993). In December 2012, the Environmetrics Journal of the International Statistical Institute published an entire volume dedicated to quantifying environmental risks (ESI, 2012). To properly assess and know the quantifiable risk of any activity is critical to the health of the population and the environment. Hume Coal must be required to quantify the risks associated with their proposed activities.

Transparency

As part of my professional activities, I have written and reviewed the technical information that supports EIS documents. This EIS has a lack of detailed information despite being of large size; much of the work being repetitive and generic. In attempt to find the basis for these generic statements, I requested relevant technical documents referred to in the EIS (my email to Hume Coal on 26 April 2017). I received a reply asking for the "page numbers in the EIS where you obtained the references". I responded via email on 27 April 2017 detailing the relevant volumes and page numbers, but I have yet to receive any further information on this matter. This lack of transparency is of concern to me and should also be of great concern to the government stakeholders (who represent the people of NSW). Hume Coal must show complete transparency in their dealing with the stakeholders.

Guidelines

The guidelines, to which there are many references in the EIS (e.g. HRC, 1998; ANZECC, 2000; NHMRC, 2008), are based around contributions from all sources of contamination – both natural and anthropogenic. Unfortunately, as with many other groups that discharge waste products to the aquatic environment, the EIS states that because their discharges are below the guideline values, everything will be satisfactory. The problem arises when all companies use the same argument and it transpires that the combined concentrations and loads far exceed the guidelines. Hume Coal must estimate their proportional contribution to contamination, then reduce the guideline value by at least this same proportion. Only then, can the intent of the guidelines be met.

The HRC (1998) guidelines identify potential problems with underground coal mining activities (Section 8A.9). Specifically, the guidelines state *"Bond or bank guarantees should be required, at the time of granting the authority, commensurate with the scale of the potential impacts."* (HRC, 1998; Section FL11 Mitigating the Impacts of Underground Coal Mining, p.145). Hume Coal must provide bond or bank guarantees to protect against potential impact. This is in addition to any requirements for rehabilitation of the land once operations cease. The potential impact includes contamination of Sydney's water supply. The cost of this potential impact might be: 5 million people x 250 L of water per day x 365 days x 20 years of operation x $2 / 1000L (Sydney Water, 2016-17 water usage charge) = $18 billion.

The State Environmental Planning Policy (Sydney drinking water catchment) states that the "consent authority must not grant consent to development under Part 4 of the Environmental Planning and Assessment Act 1979 on land in the Sydney drinking water catchment unless it is satisfied that it would have a neutral or beneficial effect (NorBE) on water quality. The potential impacts (which form one basis of the NorBE assessment) rely on the predictive modelling. Models are only approximations to the real world – not all processes are included in a model, the equations representing the processes are approximations to the real world, solutions to these equations are only approximate, the input data to the models have variability and uncertainty associated with them hence the output has (at least) that same variability and uncertainty, the same model run on different computers may give different results. What if the model predictions are found out to be incorrect?

Numerical modelling

The MUSIC model has been used to assess impacts on water quality. MUSIC is a model to assist in the design of "urban stormwater" systems. I question whether the model MUSIC is the correct model to be assessing impacts on the aquatic environment. The environment in which the proposed activities will take place is neither urban nor stormwater based. There are many other integrated catchment, hydrodynamic, water quality, ecological response models available e.g. TUFLOW/AED, MIKE, DELFT, RMA and so on. Perhaps one of these would be more suited to this application.

The MUSIC model results are presented as means (e.g. Table 8-3 in J12055RP1). However, it is the extreme values (not the means) that cause environmental harm. The assessment and modelling must be undertaken again using extreme values, which also need to be reported. Only then can we fully understand the potential environmental impacts of the proposal on water quality.

The groundwater modelling has been peer reviewed, the results presented in Appendix J of the water quality assessment. The peer reviewers have inserted a table which appears to reflect the headings in the report. Against almost every item in the table there is a "missing" and /or "deficient" notation. Yet the next two columns usually state that it is "adequate" and / or "very good". There is something very amiss with this review. It is not possible that items can be missing or deficient and yet be regarded as adequate or very good. Even if this is an error it demonstrates a lack of quality and attention to detail that appears throughout much of this EIS.

Table 10.4 (p.184 of J12055RP1) states an 84% reduction in TSS, a 93% reduction in TP and an 87% reduction in TN "due to smaller area of the agricultural catchment draining to Oldbury Creek during operation". However, on p.7 of J12055PR1 the EIS states that the project area is about 5,057 ha, while the "direct surface disturbance area of up to 117 ha". This represents only 2% of the area yet the modelling is indicating a (about) 90% reduction in concentrations. These figures are inconsistent and need to be clarified.

The EIS states that the models have been calibrated and validated. However, there is no indication of the quality of the calibration / validation – the EIS does not present any acceptance criteria for the models. The accuracy of numerical model calibration and validation must be quantified. Common, objective quantification of numerical models can be found in Moriasi et al (2007). Specifically, the Nash-Sutcliffe coefficient of model efficiency (Nash and Sutcliffe, 1970) is one method that is often used to quantify the acceptance of a model.

J12055RP1 (page 28) states: "The WTP is included in the project infrastructure as a provisional item only. In all climate sequences modelled, the water balance model indicates that the PWD has adequate capacity to store excess supply and that treatment and release will not be required". Water balance modelling can be very broad brush and subject to large uncertainties (e.g. Zhang et al, 2002). If the water balance modelling is incorrect and the PWD does not have adequate capacity, how long will it take to build the WTP and what will the environmental impacts be during the time that it takes to build the WTP?

Appendix A or Appendix E (Surface Water Quality Assessment) details the results of the observed (baseline) monitoring. However, there is no direct comparison of the model statistics against these observations. This would enable a much clearer assessment of the potential impacts on water quality.

Monitoring program design

The waters in the Wingecarribee Shire provide the source waters for a population of about 5 million people as well as for agriculture and livestock in the regional areas. It is not possible to survive without water. It is a critical resource and even a small risk (as stated in the EIS) could have devastating consequences.

Hume Coal has inappropriately used data and cannot make the claims purported in the EIS. Background data are collected and used by Wingecarribee Shire Council to provide a general state-of-the-environment picture. This data collection program is not designed to quantify impacts from a specific activity, such as described in the EIS. However, Hume Coal has used these data believing that

it will suffice as their baseline data. This is simply incorrect and will never enable impacts to be quantified and attributed to the appropriate source.

Designs of impact monitoring programs are complex and must be specific to the proposed activities (e.g. ANZECC, 2000; Krogh and Koop, 1996). The existing data should be used to help design the monitoring program, not be part of it (Krogh and Koop, 1996). The monitoring program needs to firstly identify the types, concentrations and variability of the contaminants that will be discharged to the environment. These substances should form the basis of (but not be limited to) the monitoring program. Based on what is discharged to the environment, the effect size needs to be estimated (in conjunction with the relevant authorities). The monitoring program must be designed around this estimated effect size. This includes replicated sampling at multiple times and scales, before the activities commence, during these activities and after the operations have ceased. The monitoring programs must protect against making a Type I or Type II statistical error. None of this has been considered in their water quality program design and hence it will not be possible to determine whether an impact has occurred.

ANZECC (2000) recommends that at least 3 years of baseline monitoring be undertaken. Baseline monitoring is critical because we have only one chance at a baseline. Given, say, 6 months to review the existing data, design the monitoring program, engage relevant consultants to undertake the work plus 3 years of baseline monitoring, the construction must not commence for at least 3.5 years. As it stands, the water quality monitoring program described in the EIS will **NOT** enable impacts to be quantified or attributable to a particular source or activity. Their water quality monitoring program design does not follow the recommendations of effect size and the protection against making Type I and Type II as detailed in ANZECC (2000).

Hume Coal must undertake a baseline, ongoing and post closure monitoring program that is properly designed to measure an effect size (agreed to be the stakeholders) on all aspects of the environment and human health.

Based on the above, I urge you reject any application to mine for coal in the Southern Highlands, particularly the present application by Hume Coal.

Thank you for your consideration

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