Fingerboards mineral sands project – Supplementary Expert Witness Statement (Hydrogeology)

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10th March, 2021

1. Introduction

This statement is supplementary to my earlier expert witness statement of 29th January, 2021, on hydrogeology matters associated with Kalbar's Fingerboards Mineral Sands proposal. I was requested to prepare the statement by Environmental Justice Australia, according to the attached Letter of Instruction (Appendix A). This followed the release of supplementary information on the development proposal, including changes to the method of managing mine tailings, outlined in the Technical Note: "Implementation of centrifuges for water recovery and tailings management."

My relevant qualifications, experience and CV are outlined in my original statement.

2. My Opinion

1) Regarding groundwater impacts associated with the project, the major effects of the plan to use centrifuges to process fine mine tailings, compared to the original groundwater and surface water impacts assessment, are:

   a) a moderate decrease in the anticipated volumes of water which would seep to the water table from the sand tailings deposited into mine voids, due to the updated/revised water balance

   and

   b) an increase in the anticipated volumes of water that can be recovered from the fine tailings, which would (accounting for other discrepancies in the original water balance) very slightly reduce the anticipated volumes of water that would be required from the borefield and/or surface water (i.e., from 3 GL/year to 2.9 GL/year).

Impact of changes to water table seepage

2) As outlined in my first expert witness statement, one of the major risks associated with the proposed mine is the potential for mounding of groundwater in the water table aquifer below the site. This is anticipated to occur due to seepage of water through the coarse/sand-sized tailings to the water table, through the mine pit voids. This seepage, and the associated water table rise (which was simulated in the

groundwater modelling in the EES) is likely to increase rates of flow of poor-quality groundwater in the Coongulmerang Formation away from the site, towards potentially important and sensitive receptors, including the Mitchell River floodplain. Creating a new pathway for poor quality groundwater to flow to the floodplain creates a risk of harming ecological communities, such as groundwater dependent ecosystems (GDEs) on the floodplain, and water users accessing alluvial groundwater in this area. As noted in my first expert witness statement, this risk is primarily related to the fact that groundwater within the water table aquifer (Coongulmerang Formation) contains elevated concentrations of multiple potentially harmful contaminants, including heavy metals and cyanide (see paragraph 33 of my expert witness statement). Without the effect of water table mounding (caused by mining), there is limited or no pathway for this poor-quality groundwater to flow to the floodplain, and as such this would be a new risk created by the proposed mine. This risk may be considerable, and it has not been adequately examined in the groundwater and surface water impact assessment – e.g. through detailed source-pathway-receptor modelling.

3) The plan to centrifuge fine tailings is anticipated to moderately reduce the amount of seepage to the water table from the mine voids, in the updated site water balance. This reduction would be on the order of 30% of the originally modelled seepage volumes, associated with the coarse, sand-sized tailings material deposited in the mine voids. The original seepage volumes were anticipated to result in significant water table mounding close to the Mitchell River floodplain (e.g., see Figure 7.8 of Appendix A006AppB, Groundwater modelling report). Seepage from the sand tailings at the somewhat reduced rates indicated in the updated water balance, would still be likely to result in significant water table mounding. The plan to centrifuge fine tailings therefore does not remove this risk; at best, it may slightly delay the arrival of contaminated groundwater at the receptor(s) and/or reduce the overall rates of flow associated with mounding, compared with the previously modelled scenario.

4) The level of risk from this new pathway associated with groundwater mounding in the water table aquifer is currently unclear, due to a lack of consideration/analysis of this issue in the original groundwater and surface water assessment (see paragraph 4 and 23 of my original expert witness statement), as well as the following uncertainties:

   a) the extent to which seepage from the mine voids, through the sand-sized tailings, may dilute contaminants present in the pre-existing Coongulmerang Formation groundwater,

   b) whether the arrival of seepage from mine voids at the water table may lead to unpredicted changes in the chemistry of the groundwater in the aquifer - e.g., due to secondary geochemical reactions when the two different waters mix (this was

not analysed in the groundwater impact assessment or supplementary information).

c) whether water that is entrained within the fine tailings fraction would remain trapped within this material or mix and migrate along with seepage from the sand-sized tailings and other recharging groundwater.

5) I note that in the Technical Note (Document 43) it is stated: 'the centrifuge dewaters the cake to the absolute point of practical dewatering and any remnant water will remain entrained due to the capillary action between the water and solid particles. This means that any water that remains in the cake will not drain freely from the material, even when it is deposited back into the void with overburden'.

   My view is that it is unlikely all residual water would remain permanently entrained within this material once it is deposited into the mine voids (following centrifuging). It is likely that this water would, over time, mix with recharging groundwater passing through the mine voids before reaching the water table (albeit diluted by rainfall, and moving at lower seepage rates than water passing through the sand tailings).

6) As a result of the issues outlined above, there is currently limited basis to thoroughly assess risks associated with mounding of the water table, including with the revised mine plan and water balance. Such an assessment would require:

   - Further field-based studies to understand the current recharge rates and vertical seepage velocities within the unsaturated zone below the site (i.e., between the base of the mine voids and the water table in the Coongulmerang Formation).
   - Further data to inform an in-depth analysis of how modification of the landscape by mining, and emplacement of both fine and coarse sized tailings in the mine voids would impact on rates of seepage below mined areas – i.e., beyond the relatively simplistic assumptions adopted in the groundwater modelling to date.
   - A greater amount of baseline hydrochemical and water level data from the site, particularly in the region between the proposed mine site and the Mitchell River alluvial aquifer (where significant mounding is likely to occur).
   - Detailed studies to establish the origin of elevated heavy metals and other constituents (e.g., cyanide, nutrients) observed in the current baseline data collected from the water table aquifer.
   - Geochemical and solute transport modelling, incorporating the above information and data, to simulate the flow of groundwater and contaminants within the water table aquifer under future scenarios associated with mining, incorporating updated estimates of seepage, changes to water table patterns (e.g. mounding), and the mixing of water draining from the mine voids and pre-existing groundwater in the Coongulmerang Formation.

Use of flocculants in tailings management

7) The revised tailings management plan, involving centrifuging of fine tailings, would make use of flocculants to remove fine particulate matter from the centrifuges. I was asked to address concerns regarding the potential toxicity of flocculants and risks they may pose if they (or their degradation products) enter groundwater, and migrate to receptors, such as GDEs. I have limited knowledge of the health and ecological risks and/or chemical behaviour of flocculants in groundwater. I note the concerns raised in Dr Jasonsmith's expert witness statement regarding this issue, and agree with her opinion that risks associated with flocculants should be carefully examined using a source-pathway-receptor model, in line with the National Environmental Protection Measure (NEPM).

Impact of changes to water recovery on water supply requirements

8) The updated estimate of water requirements that would need to be sourced from groundwater (Latrobe aquifer borefield) and/or surface water (Michell River) following re-evaluation of the water balance (incorporating the centrifuging of fine tailings) is 2.9 GL/year. This compares to an estimated 3 GL/yr in the original project's EES. This is a very minor reduction in water volume, and probably within the range of uncertainty in current water balance estimates. As such, the proposal to centrifuge tailings has negligible effect on the level of impact associated with borefield pumping, which was discussed in my previous expert witness statement. My original conclusions in this regard thus remain unchanged.

Impact of eliminating temporary tailings storage from mine plan

9) In paragraph 59 of my expert report, I mentioned a need to assess potential risk to localised groundwater near Perry Gully, where tailings were originally proposed to be temporarily stored in the early stages of mining. If centrifuging would remove the need to store tailings in this area, then modifications to the groundwater levels and quality related to temporary tailings storage would no longer be likely to occur.

Questions posed in my Letter of Instruction

10) Environmental Justice Australia, acting for their client (submitter No. 813) posed a series of questions in my Letter of Instruction (attached as appendix A to this supplementary statement). These questions are the same as those which were asked in my original Letter of Instruction for my first expert witness statement, and they were addressed in Section 2 of my first expert witness statement. The proposal to centrifuge mine tailings does not have any significant material impact on my responses to these questions.

Statement: I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.

Environmental Justice Australia

23 February 2021

Associate Professor Matthew Currell
Chemical and Environmental Engineering
School of Engineering
RMIT University

By email only: [redacted]

Dear Associate Professor Currell

Fingerboards Mineral Sands Mine Project, Glenaladale, Victoria

We continue to act on behalf of [redacted]

We advise that the proponent has notified the Inquiry and Advisory Committee (IAC) of a number of changes to the project, in particular the addition of centrifuges for water recovery and tailings management. We enclose by hyperlink:

- Letter from the proponent dated 18 January 2021 (Document 42);
- Technical Note which details the implementation of centrifuges for water recovery and tailings management dated 18 January 2021 (Document 43);
- Updated EES Chapter 3: Project Description dated 8 February 2021 (Document 122);
- Supplementary Statement of Georgiou (Groundwater) dated 7 February 2021 (Document 133);
- Supplementary Statement of Middlemis (Groundwater) dated 4 February 2021 (Document 129);
- Supplementary Statement of Sweeney (Water impacts) dated 8 February 2021 (Document 135);
- Supplementary Statement of McAlister (Surface water quality) dated 8 February 2021 (Document 138); and
- Expert Witness Statement of Ivan Saracik on proposal to use centrifuges dated 8 February 2021 (Document 130).

The purpose of this letter is to seek a Supplementary Statement to address how the proposed changes impact the findings and conclusions contained in your Expert Witness Statement dated 29 January 2021.

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Environmental Justice Australia is the environment's legal team. We use our specialist legal skills to take cases to court and advocate for better environment laws.

Instructions

1. Our client seeks a Supplementary Statement to address how the proposed changes impact the findings and conclusions contained in your Expert Witness Statement dated 29 January 2021.

2. We request that you undertake a review of the documents above (albeit only those sections of relevance to hydrogeology) and prepare a Supplementary Statement providing your opinion on:

    a. The compliance of the hydrological components of the EES (as amended by the documents above) with the relevant key policies and guidelines in Victoria.

    b. The adequacy of the baseline data collected by the project proponent to confidently describe pre-development conditions of groundwater, and any further baseline data that should be collected.

    c. The appropriateness of the methods, including modelling, to identify and evaluate the effects of the project and relevant alternatives on groundwater.

    d. Whether the actual or likely risks are identified and or appropriately assessed in terms of their level of risk, including the changes to groundwater quality and changes to groundwater availability.

    e. The adequacy of the proposed environmental monitoring and protocols to adequately protect groundwater and any further monitoring or protocols which should be required.

    f. Any appropriate qualifications or conditions that should be attached to findings or conclusions, such as uncertainties or gravity of threats or impacts.

    g. Any other matters you identify which you consider relevant within the limits of your expertise.

3. Further to the matters set out at paragraph [2], we request that specific consideration be given to potential water quality impacts on Groundwater Dependent Ecosystems (GDEs) arising from the flocculants to be used in association with the centrifuges.[1]

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[1] Dr Jasonsmith identifies that polyacrylamides can be broken down into smaller, toxic chemicals called acrylamides in low-air environments, with these chemicals highly mobile and toxic in aquatic environments (*Expert Witness Statement of Dr Julia Jasonsmith*, 19 January 2021, 13[40] (Document 91)).

4. As an expert you are able to consider any such material you consider relevant to your enquiry. Please identify in your report any further materials you consult outside of the briefed materials.

Expert Witness Code of Conduct

5. In preparing your Supplementary Statement, please ensure that you comply with the *Guide to Expert Evidence provided by Planning Panels Victoria* (April 2019), including by:

    a. setting out all instructions that define the scope of the statement (i.e. attach this letter of brief dated 23 February 2021); and

    b. making the following declaration:

    'I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.'

Important dates

6. To enable us to meet the Inquiry and Advisory Committee's filing deadline, we request that your Supplementary Statement be provided by **noon** on **Wednesday 10 March 2021.**

Confidentiality

7. This request for a Supplementary Statement, as well as any correspondence relating to this request, is for the purposes of the Fingerboards mineral sands mine project EES process, including the public hearings before the IAC. It is therefore confidential and is protected by legal professional privilege.

Fees and Terms of Engagement

[redacted]

Please contact Virginia Trescowthick if you have any questions or require further information.

Yours faithfully

[redacted]

Virginia Trescowthick

Lawyer