Expert Witness Statement of Joel Georgiou

IN THE MATTER OF THE FINGERBOARDS MINERAL SANDS PROJECT EES

Prepared for Kalbar Operations Pty Ltd
February 2021

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In the matter of the Fingerboards Mineral Sands Project EES

Client

Kalbar Operations Pty Ltd

Date

2 February 2021

Final

Prepared by

Joel Georgiou
Associate Director | Hydrogeologist
2 February 2021

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1 Name and address

1.1 Personal details

My name is Joel Georgiou, and I am an Associate Director in the area of hydrogeology with EMM Consulting Pty Limited (EMM).

1.2 Business Address

My principal place of work is located at EMM's Adelaide office, being Level 4, 74 Pirie Street, Adelaide 5000.

2 Qualifications and experience

2.1 Area of expertise

I am an experienced hydrogeologist, groundwater modeller and project manager with over 18 years' industry experience across New South Wales, Victoria, Queensland, South Australia, and Western Australia. My key areas of expertise are in designing and implementing monitoring programs, pumping tests, impact assessments and groundwater modelling (including solute transport and plume modelling) to inform various baseline studies and environmental impact assessments.

In regard to mineral sands expertise, I have been a consultant to numerous mining companies and also worked in-house as a senior mining hydrogeologist for Iluka Resources Limited between 2011 to 2016. I have provided strategic advice and support on hydrogeological issues for operating mines and for project teams developing new mineral sand mining prospects throughout Australia and Sri-Lanka.

My Curriculum Vitae is provided in Appendix A.

2.2 Qualifications

- Master of Hydrogeology, University of Western Australia, 2016.
- Bachelor of Science (Hons I), Flinders University, 2002.
- Bachelor of Science (Hydrogeology and Geophysics), Flinders University, 2001.

3 Scope and method

3.1 Role in preparation of the EES

My role in the environment effects statement (EES) was to manage the groundwater modelling and reporting component, which was used as the basis of assessing potential impacts arising from the Fingerboards Mineral Sands Project (the Project) on the groundwater system. As part of this component, I also led the conceptualisation of both the regional and local aquifer and aquitard systems, working closely with Kalbar geologists and in consultation with Coffey's (lead environmental consultant) water team.

The study also included supervising a hydrogeological field study in 2018, with the primary objective of the initial drilling program to verify the existence of water-bearing gravel sequences within the deep aquifer system associated with the Latrobe Group. A follow-up 4-day pumping test program, which was overseen by myself, involved establishing a production and nested monitoring bore site in 2019 to estimate the aquifer properties and yields (EMM, 2020b).

3.2 Expert witness statement instructions

I have been engaged by White & Case on behalf of Kalbar to prepare an Expert Witness Statement (this report) and potentially also present evidence at the enquiry hearing to be held in relation to the EES prepared for the Project.

My instructions to prepare this statement are set out in Appendix B.

3.3 Review process

Information reviewed and relied upon related to the numerical groundwater modelling and some aspects of the water supply are provided in the following EMM reports:

- EES Appendix A006/B- EMM, 2020a. Fingerboards Groundwater Modelling Report. In support of the Environmental Effects Statement. Report prepared for Kalbar Operations Pty Limited, April 2020.
- EMM, 2020b. Fingerboards Project- Water Supply Options Study. Technical Groundwater Assessment. Report prepared for Kalbar Operations Pty Limited, April 2020.

Reports that I reviewed and relied upon in preparing this statement include:

- EES Appendix A006- Coffey, 2020. Fingerboards Mineral Sands Project. Environment Effects Statement. Appendix A006- Groundwater and Surface Water Impact Assessment, August 2020.
- EES Appendix A006/D- EGi, 2019. Geochem Testing of Fingerboards Tailings and Overburden. Memorandum to Kalbar Operations Ltd. February 2019.

Additional information, which was requested in preparation of this statement (ie post EES submissions) included:

- the development of depth to water plots based on the VAF spatial database to assist with GDE related submissions; and
- resource drilling database to illustrate the considerable number of drillholes (totally 648 sites) and data that has been collected to date. As part of Kalbar's drilling procedures, 'depth to first water cut' is logged and this data used to assess occurrences of moisture above the water table to assist responding to perched water related submissions.

3.4 Review method

The method used to review all submissions and develop a logical structure outlined in my Section 5 statement findings, was as follows:

- Step 1: Summarise the Independent Review findings of EES Appendix A006/B (Section 5.1).
- Step 2: Summarise the key concerns raised by the TRG during preparation of the EES along with my response (Section 5.3). At the time, these concerns were progressively responded to, and the technical reports were updated accordingly.

The information provided in this statement consolidates the previous responses given to the TRG and also provides some further content which considers the nature of submissions received:

- Step 3: All submissions were downloaded and placed into four main categories including:
  - Government agencies and authorities';
  - Inquiry and Advisory Committee (IAC);
  - local landowners; and
  - community submissions.

All submissions were tabulated in Excel, and divided into the following themes and sub-themes (including but not limited to):

- groundwater flow directions and risk to Woodglen ASR site;
- perched aquifers;
- impact to spring fed dams;
- tailings seepage estimates and related impacts; and
- consistency between groundwater and surface water models .

All themes and sub-themes have been addressed within this statement (Section 5.4). Submissions have been addressed using a cascading approach whereby only new sub-themes which have not been addressed by the previous submission category, are addressed. For example, new sub-themes identified with the Government agencies submissions, that were not addressed within the TRG findings (Section 5.3), have been directly addressed (Section 5.4.2). Likewise, new sub-themes identified within the IAC submissions, that were not addressed within the previous Government agencies findings (Section 5.4.2), have been directly addressed (Section 5.4.3) and so on, following the category order outlined in Step 3 above.

A copy of the Excel spreadsheet is provided in Appendix C.

Within Section 5, conclusions have been bolded where relevant and recommendations made to be undertaken post approval of the EES have been highlighted with a blue box to assist the reader.

3.5 Other persons who assisted

Persons who have assisted in the preparation of the EES groundwater numerical modelling report (EES Appendix A006/B) included:

- Thomas Neill - Tom is a senior hydrogeologist and modeller at EMM, located in the Adelaide office. Tom undertook all numerical modelling for the project;
- Dr Douglas Weatherill - Doug is EMM's national technical leader in groundwater modelling, located in the Adelaide office. Doug conducted internal review of the groundwater modelling report; and
- Hugh Middlemis, a Principal Groundwater Engineer at HydroGeoLogic Pty Ltd (HydroGeoLogic), was engaged to conduct an independent peer review of the groundwater modelling report.

Persons who have assisted myself in the preparation of my expert witness statement include:

- Tavis Kleinig - Associate Hydrogeologist and co-author, located in EMM's Adelaide office;
- Dr James Tuff - Associate Geochemist, located in EMM's Brisbane office. James provided a geochemical review of leachability studies, tailing seepage impacts and addressed some general groundwater quality aspects;
- Paul Gibbons - Director at EMM's Adelaide office. Paul provided peer review of this statement;
- Katharine Bond - Associate Environmental Scientist, located in EMM's Sydney office. Katharine provided support with reviewing and organising community submissions into water themes; and
- Nina Baulch – Senior Hydrogeologist, located in EMM's Sydney office. Nina provided support with reviewing and organising community submissions into water themes.

Doug and Tom also helped me respond to submissions related to the groundwater numerical modelling within this statement.

The following individuals assisted by providing additional information used in preparing this statement:

- Matthew Golovanoff - Kalbar Geologist, located in Kalbar's Bairnsdale office. Matthew provided resource drilling information to assist with answering submissions related to perched aquifers.

3.6 Key assumptions

This statement only relates to hydrogeological aspects of the Project, and areas which myself and my supporting groundwater team are qualified to review. Specifically, aspects related to hydrostratigraphy, groundwater flow, general conceptualisation, groundwater modelling, groundwater supply, groundwater receptors, groundwater quality, management plans, mitigation, and some aspects of tailings seepage are reviewed within this statement.

The review comments presented in this statement are based on my extensive experience with preparing similar numerical groundwater modelling reports to support environmental impact assessments and my involvement with several proposed and operating mineral sands mines throughout Australia.

Other water-related aspects such as site water management, water balance, and impact assessment to downstream surface water receptors are being addressed by other water quality experts.

3.7 Summary of findings

I am of the view that the information provided within the EES Appendix A006 and its supporting studies generally meets the typical standard of groundwater studies within Australia, and that the groundwater impacts have been adequately captured and the risks have been identified. The management and mitigation measures which have been identified are holistic at this stage and represent standard practises for mineral sand mines across Australia. Notwithstanding, there is opportunity for future improvement to reduce data gaps and refine the hydrogeological understanding related to key aspects including GDE identification, groundwater conditions in data-poor locations and at receptors, refine the understanding of seepage rates and how infiltrating water behaves in the unsaturated zone, refinement of the hydrogeological understanding at the borefield and associated groundwater modelling. A comprehensive list of recommendations to be undertaken post conditional approval of the EES have been made throughout Section 5 and are summarised in Section 7.

4 Project summary

4.1 Overview

The Fingerboards Mineral Sands Project is located in East Gippsland, Victoria and involves mining of mineral sands from the Fingerboards resource, which lies within the more extensive Glenaladale deposit. Kalbar proposes to mine areas of enriched grades of mineral sands occurring close to the

ground surface within the project area. Kalbar proposes to construct, operate, rehabilitate and (ultimately) close the mineral sands mine and associated infrastructure that form the project.

The Glenaladale mineral sands deposit occurs within unconsolidated sediments and contains heavy minerals such as zircon, rutile, ilmenite, and rare-earth bearing minerals (monazite and xenotime). The project area is approximately 1,675 hectares (ha) and, of this, approximately 1,350 ha will be mined.

The Fingerboards resource contains an estimated 1.19 billion tonnes (Bt) of ore at 0.5% zircon, 1.4% titanium minerals (rutile and ilmenite) and 0.05% rare-earth minerals. Kalbar plans to use open cut mining methods to extract ore enriched in these minerals that occurs close to the ground surface.

Over eight million tonnes (Mt) of heavy mineral concentrate (HMC) will be produced from 170 Mt of ore for up to 20 years, including two years for construction and commissioning, 15 years of production at full capacity, followed by closure activities (decommissioning, rehabilitation, and post-closure). Final closure may require an additional five years of management to meet closure objectives.

4.2 Geology and Hydrogeology

4.2.1 Geology

The Glenaladale Mineral Sands Deposit lies on the extreme northern margin of the Gippsland Basin with Palaeozoic basement exposed a few kilometres to the north and wide expanses of the Haunted Hill Formation covering the southern part of the project area.

The mineralisation is hosted within a thick sequence of over 90 metres (m) of the Coongulmerang Formation (Pliocene); a uniform, well sorted, fine silty sand formed in a shallow marine setting which tends to increase in clay content towards the base of the sequence.

Enriched horizons are noted in the Lower Sands, with the most notable layer occurring towards the top of the sequence. This unit is referred to as the Sub-Marker Horizon which is unconformably overlain by the Upper Marker Horizon. The areas of most significant mineral concentration lie at the intersection between the Sub-Marker Horizon and the Prominent Marker Horizon. The unconformity suggests that the Lower Sands were exhumed for a short time period, becoming part of the immediate coastal geology flanking primarily the Palaeozoic with some older Tertiary sediments. The unconformity represented the maximum extent of the Tertiary marine transgression in the area. Rapid subsequent erosion of these soft sediments led to their recycling into the next depositional sequence, with a marked accumulation and concentration of heavy mineral on the unconformity by a transgressive sea to form the Marker Horizon.

Unconformably overlying the Glenaladale Mineral Sands Deposit in the southern part of the project area are wide expanses of Quaternary Haunted Hill Formation consisting of mixed gravels with rounded cobbles and layers of gravelly sands and clays.

The Latrobe Valley Group and, in places, the Palaeozoic basement underlie the Pliocene sands, and are exposed in river cuttings a few kilometres to the north and are intersected at depth in several

drillholes. To the south-west of the deposit, the Pliocene sands are underlain directly by the northern extent of the Seaspray Group marls.

The generalised stratigraphy within the Gippsland Basin is summarised in Table 4.1.

Table 4.1 Generalised stratigraphy of the Gippsland Basin

Period	Epoch/ Series	VAF	VAF	Formation/Group		
		Aquifer Name	**Code**	**Lakes Entrance and Study[1] area**	**Latrobe Valley area**	
Quaternary	Pleistocene/ Pliocene	Quaternary Aquifer	QA	Alluvial clays, silts, sands & gravels, terrace deposits, swamp deposits, colluvium Dunes, beach deposits, shell beds	Alluvial clays, silts, sands & gravels, terrace deposits, swamp deposits, colluvium Dunes, beach deposits, shell beds	
Tertiary (Upper)	Pliocene/ Miocene	Upper Tertiary/ Quaternary Aquifer	UTQA	Haunted Hill Gravel Coongulmerang Formation[2]	Haunted Hill Gravel	
		Upper Tertiary/ Quaternary Aquitard	UTQD	Jemmy's Point Formation Boisdale Formation (Nuntin Clay)[3]		
		Upper Tertiary Aquifer	UTAF	Boisdale Formation (Wurruk Sands)	Boisdale Formation	
		Upper Tertiary Aquitard	UTD	Tambo River Formation Bairnsdale Limestone	Lake Wellington	Boisdale Fm/ Hazelwood Fm
Tertiary (Middle)	Miocene	Upper/Middle Tertiary Aquifer	UMTA	Latrobe Valley Group (Yallourn and Morwell coal seams)	Balook Formation	Latrobe Valley Group (Yallourn and Morwell coal seams)
Tertiary (Middle)	Miocene	Upper/Middle Tertiary Aquitard	UMTD	Wuk Marl Gippsland Limestone Formation[4]		Yallourn Formation Morwell Formation (M1A)
Tertiary (Middle)	Oligocene		UMTD	Lakes Entrance Formation Seaspray sand[4]		Morwell Formation (M1B-M2C)
Tertiary (Lower)	Eocene	Lower Tertiary Aquifer	LTA	Latrobe Group	Traralgon Formation (Latrobe Group)	
Pre-Tertiary	Ordovician to Carboniferous-age bedrock (Strzelecki Group)					

Notes: 1. Study area associated with the Fingerboards EES
2. Coongulmerang Formation hosts the heavy mineral ore and is the target of the Fingerboards Project.
3. Collectively known as the Sales Group.
4. Collectively known as the Seaspray Group.

4.2.2 Hydrogeology

The four main on-shore hydrostratigraphic systems are summarised below.

i Upper System

The Upper System comprises of:

- undifferentiated Quaternary sediments, including the Mitchell River alluvial system. Comprising of sands, gravels and clays, these sediments often contain the water table aquifer in the lower coastal plain regions. This aquifer is mostly developed along the Mitchell River floodplain located east of the project site;

- the Haunted Hill Formation, an upper Tertiary to lower Quaternary unit composed of sands, gravels, and clays, which conformably overlies the older Tertiary units across most of the Gippsland Basin and the East Gippsland coastal plain;

- the Boisdale Formation, an extensive fluviatile system that is typically described as comprising of two sub-units, the Upper Clay Unit (the Nuntin Clay) and the Lower Sand Unit (the Wurruk Sand). The Nuntin Clay consists of typically interbedded clays, silts, and sands, with minor coal seams and gravels. The Wurruk Sand is primarily sands and gravels. The Boisdale Formation is the recognised groundwater resource in the Sale region. The Wurruk Sand unit of the Boisdale Formation is thought to be up to 70 m thick south of the project site but thins and becomes discontinuous towards the Lakes Entrance Platform (north of the Princes Highway); and

- Jemmys Point Formation, a marine based unit comprising of sands, marls, and limestone, generally considered to be of low permeability and low yielding.

ii Middle System

The Middle System can be broadly classified into two main sub-systems:

- the Latrobe Valley Coal Measures (LVCM)/Balook Formation. In the Latrobe Valley, located to the west of the project site, the LVCM units have been differentiated (ie classified into distinct beds of stratigraphic horizons) largely as a result of the dewatering operations undertaken at a number of the open cut coal mines. The terrestrial sub-units of the LVCM, namely the Yallourn and Morwell Formations, consist of interbedded sands, silts, clays and coals. Within the study domain, the LVCM only exists within the north-western area and laterally grades into the barrier sands of the Balook Formation and other Seaspray Group units. Both the Balook Formation and lower M2C unit of the LVCM are regionally extensive. In a strict sense, the Balook Formation falls within the Seaspray Group however it has been discussed collectively with the LVCM owing to its naturally high yield (GHD 2015); and

- the Seaspray Group is sometimes applied as the collective nomenclature for the Wuk Marl, Lake Wellington, Gippsland Limestone and Lakes Entrance Formation. These carbonate units are typically 100 to 500 m thick on-shore, increasing off-shore towards the south and east.

iii Lower System

The Lower System comprises the Latrobe Group, specifically the Traralgon Formation (onshore) and its offshore equivalent, the Cobia Subgroup. The Traralgon Formation is a non-marine unit, consisting of sandstone, claystone, and coals. However, thick horizons of unconsolidated gravels are known to occur.

Within the study domain, the Latrobe Group pinches out at the southern extent of the Fingerboards project site boundary based on the Victorian Aquifer Framework or VAF (DSE, 2012) and recent delineation drilling undertaken by Kalbar, and gives way to the underlying basement fractured rock system.

The upper part of the Latrobe Group is a recognised groundwater resource.

iv Basement

Pre-Tertiary age basement bedrock underlies the entire East Gippsland region and comprises sedimentary, metamorphic, and igneous rocks of the Ordovician, Silurian, and Devonian ages. The Strzelecki and Avon River Group are the main basement units, with the Avon River Group outcropping across the emerging highlands to the north of the deposit. These indurated mudstones and sandstones function as a fractured rock aquifer system but are generally low yielding and not used for development purposes.

4.3 Conceptual model

Figure 4.1 illustrates the regional conceptual hydrogeological model orientated from the north-west to the south-east, and includes the following major processes and features:

- Multi-layered Quaternary and Tertiary aquifer and aquitard system, with the bedrock outcropping to the north.
- All geological units generally dipping towards the ocean, with the middle Tertiary units (Seaspray Group) increasing in thickness.
- The Seaspray Group grades into the Latrobe Valley Group (LVG)/Balook Formation towards the north.
- The Coongulmerang Formation hosts the heavy mineral ore at the Fingerboards project site, and is overlain by the Haunted Hill Formation (HHF) and is underlain by the LVG/Balook Formation.
- Significant groundwater extraction occurs from the Boisdale Formation (Sale WSPA), Mitchell River alluvials (Wy Yung WSPA), as well as potentially unlicensed extraction from the dune systems near the Gippsland Lakes in the south.

Figure 4.2 illustrates the local-scale conceptual hydrogeological model for the Project orientated south-west to north-east, outlining the main pre- and during-mining related processes as follows:

- Open cut pits will be used to dry-mine the ore, with depth ranging from approximately 50 metres below ground level (mBGL) to just a few metres.
- The pre-mining water table is hosted within the basal section of the Coongulmerang Formation, with pre-mining groundwater levels ranging from approximately 39 m Australian Height Datum (AHD) at the centre of the project site to approximately 27 m AHD within the Mitchell River floodplain.
- Groundwater depths range between 5 m and 59 m at the monitoring bore locations, however groundwater depths >80 m can occur in higher topographic regions of the project site.
- Groundwater levels measured within the underlying LVG/Balook Formation are lower, with site-based measurements of around 22.3 m AHD being recorded.

- Local groundwater flow direction is roughly west to east, with groundwater discharging to the floodplain and supporting baseflow to the Mitchell River.
- Groundwater levels indicate groundwater does not discharge to the west towards the Perry River.

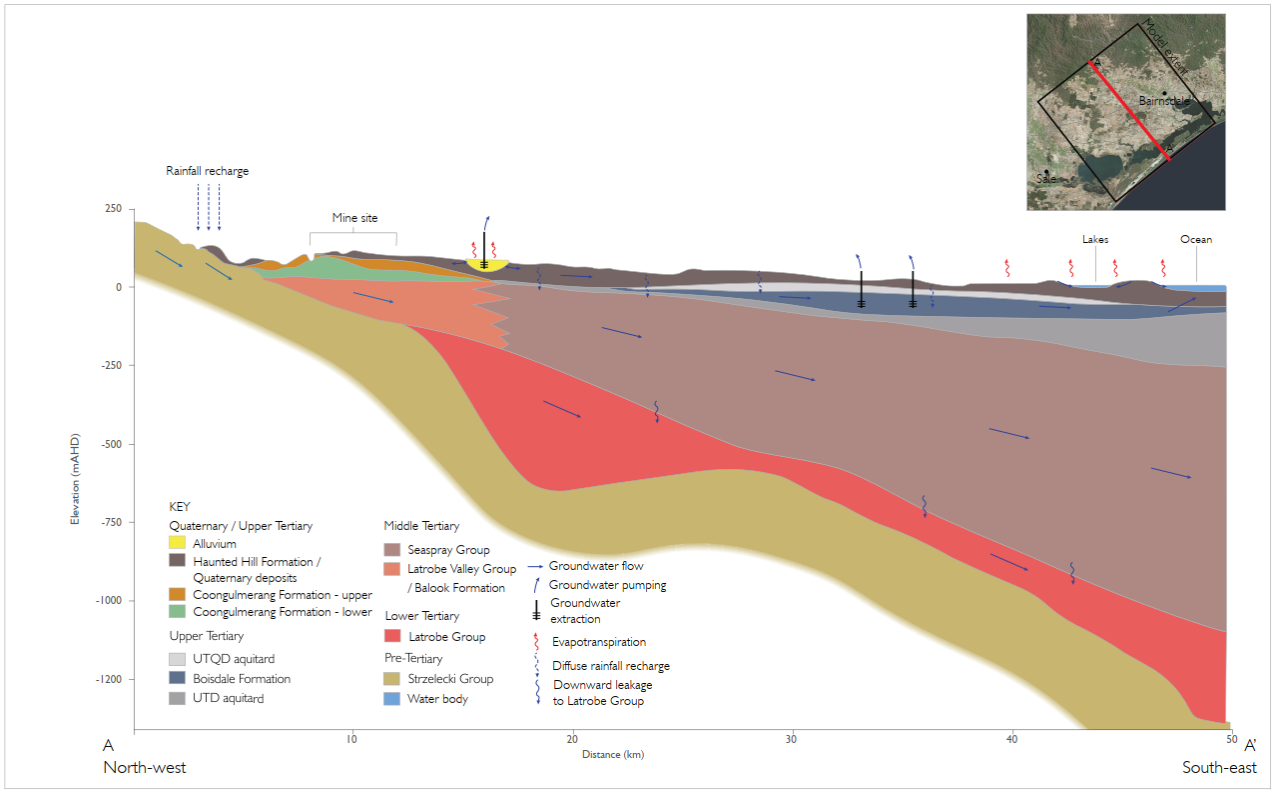


Figure 4.1 Regional conceptual model

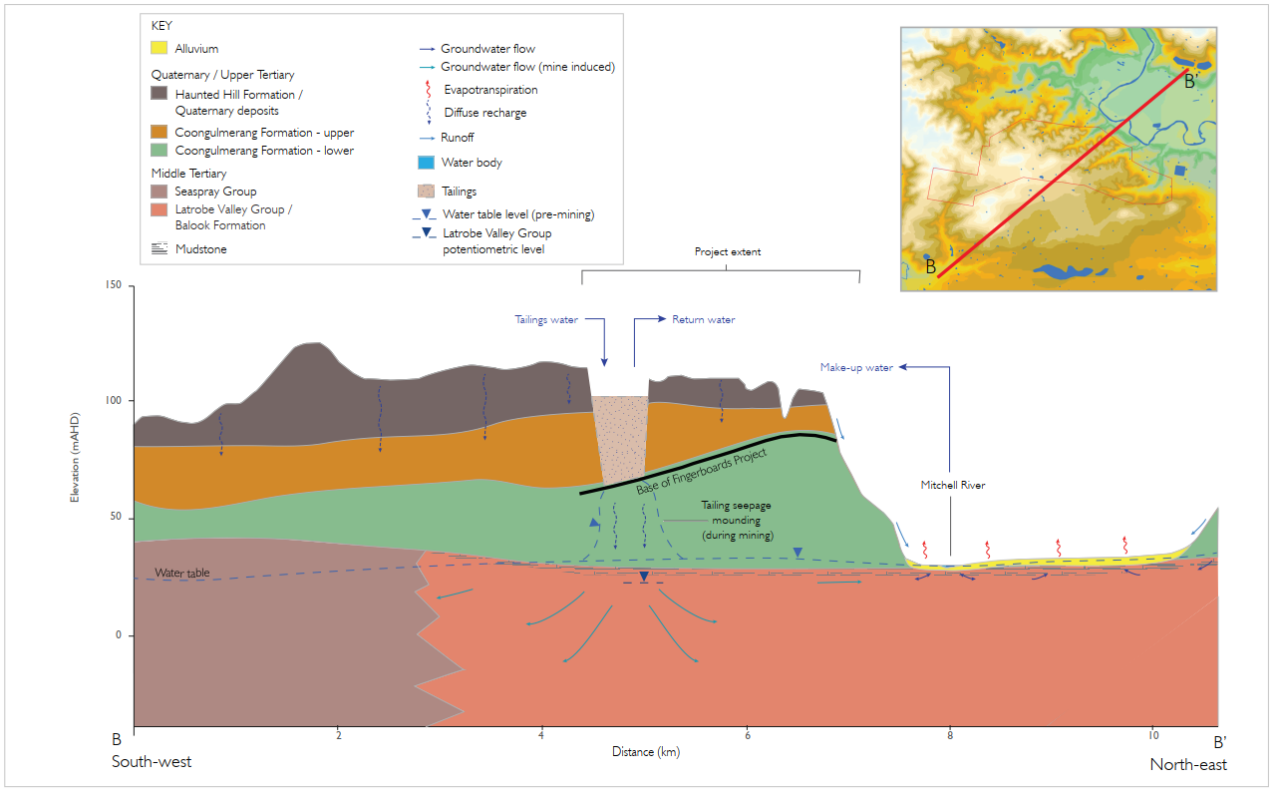


Figure 4.2 Local conceptual model

4.4 Groundwater receptors

The main groundwater receptors and groundwater dependant ecosystems (GDEs) identified and assessed as part of the EES include:

- gaining regions of the Mitchell River, located directly east of the Project;
- Mitchell River alluvium system;
- areas of vegetation associated with tributaries and gullies of the Mitchell River;
- lower reaches of Moilun Creek, north of the project site;
- Providence Ponds, a chain of ponds system, located south-west of the Project;
- the Ramsar listed Gippsland Lakes, located 25 km south of the Project;
- the Woodglen aquifer storage and recovery (ASR) system, located a few kilometres to the north-east of the Project; and
- landowner bores, more notably the irrigation bores associated with the heavily utilised Boisdale aquifer, located to the south of the Project.

A number of the EES submissions from government agencies, local landowners and members of the community also mentioned the presence of chain of pond systems and spring-fed dams located within and close to the project boundary.

4.5 Water affecting activities

Project activities that were identified and assessed as part of the EES which have potential impacts on groundwater quantity or quality during construction, operation, decommissioning, and post-closure include:

- infiltration of tailings water into the aquifer beneath the tailings storage facility (TSF), which will operate for the first few years of the mine life;
- infiltration of water from deposited tailings within the unlined mine voids and Perry Gully;
- permanent change to surface topography, altering groundwater flow directions, groundwater flow rates and availability to GDEs;
- infiltration of water from engineered storage impoundments; and
- groundwater extraction from the Latrobe Group borefield for mine water supply.

5 Findings

5.1 Approach

As discussed in Section 3.3, the review of the submissions and my findings have been structured as follows:

- summary of the Independent Review of the groundwater model (Section 5.2);
- review and consolidation of the main TRG comments raised during the EES preparation (Section 5.3); and
- review of all submissions received, based on submission category and sub-themes (Section 5.4).

Within Section 5 of this statement, bolded text highlights my conclusions and recommendations to be undertaken post EES approval have been highlighted using a blue border.

5.2 Independent review findings

An independent review of the groundwater model was undertaken by Hugh Middlemis of HydroGeoLogic on 4 February 2019. The summary of Hugh's independent review is as follows:

- It is my professional opinion that the Fingerboards groundwater modelling investigation has been conducted with a high degree of professionalism and consistent with best practice, notably the MODFLOW-SURFACT modelling, and the related deterministic predictive scenario sensitivity/uncertainty assessments.
- The Fingerboards groundwater modelling studies are suitable for supporting environmental impact assessments and management and mitigation strategies, and for supporting engineering designs and costings and risk management.

The review confirmed compliance to best practice principles and procedures of the Australian Groundwater Modelling Guidelines (Barnett et al. 2012) and guidance on uncertainty analysis (Middlemis and Peeters, 2018). This was detailed with a checklist of compliance and a detailed review of model elements corresponding to a confidence level classification, determined as Class 2 for the model.

Middlemis also recommended ongoing hydrogeological investigations to provide additional data for future model refinements and improvements in performance and for further uncertainty analysis to guide monitoring and management programs.

I agree with Hugh Middlemis' findings and recommendations.

5.3 Common concerns raised during EES preparation

During the preparation phase of the EES, thirteen meetings were held with the Technical Reference Group (TRG) between March 2017 and March 2019, which allowed Kalbar and its nominated

technical specialists to present the outcomes of studies in a progressive manner. The TRG had the opportunity to offer statutory and technical advice during and post each meeting, and this was considered.

The following sections (Sections 5.3.1 to 5.3.5) summarise the key concerns raised by the TRG during preparation of the EES along with my response. At the time, these concerns were progressively responded to, and the technical reports were updated accordingly. The information below consolidates the previous responses given and also provides some further content which considers the nature of responses received.

5.3.1 Groundwater flow directions & risk to Woodglen ASR site

The potential for tailings infiltration to migrate towards the Woodglen ASR and adversely affect the quality of potable water supply was assessed through numerical groundwater modelling and 'particle tracking'. This modelling approach traced the transport of groundwater originating from multiple points beneath the mine site as the mound develops and throughout the life of the mine. Modelling considers the significant pressure changes that would occur in response to the injection of surface water and subsequent extraction as part of the ASR program.

Modelled particle tracking results are discussed in Section 7.7.4 of the EES Appendix A006 and in more detail in Sections 7.8.1 and 7.11.1 of the EES Appendix A006/B. The results indicate that groundwater beneath the site is predominantly transported vertically to the underlying Balook Formation aquifer where it migrates to the south and east. Although the deeper aquifers beneath the project site and the aquifers beneath Woodglen are likely hydraulically connected, modelling predicts that mining activities will not result in the transport of groundwater in the direction of the Woodglen ASR wells.

Proposed management measures include groundwater monitoring in the Balook Formation/Latrobe Valley Group Aquifer between the project boundary and the Woodglen ASR so that potential groundwater quality impacts can be detected in advance and appropriate remedial actions implemented (EES Appendix A006). This type of monitoring and associated mitigation strategies are developed as part of the Tailings Management Plan, GDE and Groundwater Management Plans, which would form part of Kalbar's overall Environmental Management Framework (EMF).

The Woodglen ASR site is considered a high value groundwater receptor, and the management plans would be expected to outline the setting, conceptualisation, management steps, procedures, and mitigation strategies similar to the steps outlined below:

1. Undertake a comprehensive GDE and groundwater sensitive receiver identification program and assess level of groundwater dependence and develop conceptual models using such guidelines as the national IESC guidelines (Doody et al. 2019) and the Victorian GDE Ministerial Guidelines (Victorian Government, 2015).

2. Installation of a groundwater monitoring bore network at regional locations and at key risk areas, including groundwater users and GDEs. Bores located between the water affecting activity and the sensitive receiver may also be required to allow for advance warning of potential impacts.

3. Develop a conceptual model at each sensitive receiver location using publicly available data and any information collected during the field survey and bore installation program. The conceptual models would be used to illustrate potential causal pathways of impacts and determines the groundwater dependence.

4. Undertake several groundwater and GDE monitoring events before mining commences to inform baseline conditions and setting of water quality objectives and trigger levels. For anthropogenic sites such as 3rd party bore locations or the Woodglen ASR site, an understanding of the bore usage, such as volumes pumped, is also required. Guidelines such as DSITI (2017) describes how to use both Australian standards and site-based monitoring data to assess groundwater levels, quality, potential environmental impacts and how to determine statistically valid groundwater objectives.

5. The outcome of Step 4 would be a set of groundwater level and quality objectives at each site, which aims to reduce potential environmental impacts. Ideally, a three-tiered or traffic-light system would be developed for the leading indicators (such as levels, pH, TDS, and some dissolved metals) such as:

    a) **Green** - normal operating range with data indicating no unacceptable risk to the environment. Continue to monitor and assess leading indicators and trends.

    b) **Amber** - normal operating range, however this tier is designed to inform Kalbar of possible future issues to allow time for adequate investigation and/or intervention.

    c) **Red** - this operating range indicates a breach of acceptable operating conditions, and thus mitigation actions are required to reduce the risks, allowing the mine to return to accepting operating conditions as soon as practical.

6. For each site, list the GDEs and sensitive receptor sites most at risk, how are they at risk and what are the potential consequences.

7. Determine the avoidance and mitigation measures for each site and establish an ongoing monitoring plan to test for impacts and effectiveness of mitigation. Mitigation measures and other actions associated with the management of the sites become progressively more severe depending on whether breaches are observed within the 'Green', 'Amber' or 'Red' zones as discussed in Step 5. Using the Woodglen ASR site as an example, upward trends of groundwater levels at monitoring sites between the mine site and the ASR site may indicate that a seepage mound is growing, with a potential for seepage water to be directed towards the ASR bores. Actions and mitigation examples may include:

    a) For groundwater levels which are heading towards or are in the 'Amber' zone, determine whether these levels are caused by any other local phenomenon or others not related to Kalbar.

b) Undertake monitoring to confirm results and review the water balance, the latest available groundwater modelling results/particle tracking and local tailing monitoring bores to ascertain the likely source of seepage.

c) If seepage is causing a mound to rise to unacceptable levels, review tailings dewatering works. Engineering actions might be to intensify dewatering, adjust flocculant, tail to a different location, and review sub-drainage design and spacing.

d) If mounding starts to subside then no further action is required. However, if mounding were to continue or actions within the 'Amber' zone were not successful, more drastic actions would be required, especially if groundwater levels are trending towards or are in the 'Red' zone. This might include the installation of a groundwater curtain using either trenches or groundwater interception bores.

More information related to managing sensitive receptors and related management plans are found in Sections 5.4.2iv and 5.4.2v of this statement.

5.3.2 Perched aquifers

For the purpose of this statement, the following definitions apply when describing different groundwater system types with a conceptual diagram shown in Figure 5.1:

- Perched aquifers - aquifers that occur above the regional water table and are not laterally extensive or connected. These occur when there is an impermeable or poorly permeable layer of rock or sediment that occurs above the water table but below the land surface. Within the context of the Fingerboards Project, localised perched aquifers could occur within the quaternary and upper tertiary sediments of alluvials, Haunted Hill Formation and Coongulmerang Formation.

- Shallow aquifers - the upper surface of saturation is called the water table and the saturated sediment immediately beneath the water table is called the water table aquifer, or in this context, the shallow or unconfined aquifer. Shallow aquifers that host the water table within the EES project area are associated with the 'upper' onshore hydrostratigraphic systems as described in Section 4.2.2i of this statement. At the mine site, the Coongulmerang Formation is the shallow or unconfined aquifer.

- Deep aquifers - these are aquifers that are found beneath the shallow aquifers and are generally separated or isolated from the shallower systems by a confining bed. For this reason, they are also known as confined aquifers, and groundwater is under pressure within these systems. Groundwater levels within these systems are defined by the potentiometric surface and, sometimes, these levels can be above the ground surface, which then results in artesian wells or artesian springs, commonly found in the Great Artesian Basin for example. Within the Fingerboards project area, the deep aquifers are associated with the 'middle' and 'deep' onshore hydrostratigraphic systems as described in Section 4.2.2ii and 4.2.2iii respectively.

Resource definition drilling has continued since the submission of the EES. Figure 5.2 shows all 648 exploration boreholes drilled to date, which were drilled using a combination of air core, diamond and sonic drilling techniques. In total, 10 holes or 1.5% of the holes logged any saturation (ie perching) above the water table (ie shallow aquifer), with 7 of these holes (or 1.0%) located within the mine area. Of the holes which logged saturation, the depth to where the first water cut was observed has also been added to further assess perching characteristics. In addition, Kalbar has installed one monitoring bore, known as MW07, which is installed across a localised perched system.

Based on the water cut characteristics of the exploration hole database, the data support the conceptualisation that perching is a localised phenomenon and clay layering within the Coongulmerang Formation, which controls the development of perched groundwater lenses, is likely to be sporadic and localised. The data also suggest that dry holes were logged in the Perry River catchment areas, with one hole noting saturation at 24 m below groundwater surface. Systems that rely on perched water, such as chain of ponds and sections of the Perry River, are likely to be dependent on localised hydrostratigraphy and heterogeneity, and not indicative of regionally extensive and continuous “layering” of shallow clay strata.

Although the data to date suggest that the chain of ponds and sections of the Perry River are likely supported by a perched system, this is not totally consistent with the VAF dataset shown in Figure 5.3. This figure shows the depth to the water table (hosted within the shallow aquifer system) and was created by subtracting the VAF water table contours from the topography. Shallow depth to water table is inferred throughout the Perry River catchment, which contradicts site-based studies (ie resource drilling and GDE studies undertaken by EHP) and the numerical groundwater model (EES Appendix A006/B).

To reduce uncertainty, new monitoring bore sites, preferably in close proximity to the surface water monitoring gauges, are recommended to be installed to refine the hydrogeological conceptualisation in this area. Further assessment and recommendations related to GDEs is found in Section 5.4.2iv.

5.3.3 Impact to spring fed dams

Potential impacts to spring fed dams were brought up by SRW and various other agencies during the TRG meetings, however exact locations were never resolved during this time. A review of the landowner EES submissions summarised in Section 5.4.4 suggests that there are up to five spring fed dams and two shallow bores located on one property alone, which rely on shallow aquifer discharge (submission 568). A landowner submission (number 691) also mentions that parts of Moulin/Stoney Creek never dry out.

Referring to Figure 5.3, the depth to water table map based on the VAF datasets suggests the potential for a few spring locations to occur due to shallow water table areas including:

- down-gradient areas of the gullies draining towards the Mitchell River;
- upper areas of the Lucas Creek area. Figure 5.2 also shows resource drilling in this location which noted shallow saturation, and thus the potential for a localised perched system to exist in this area; and

- various other locations which could have shallow depths and thus groundwater dependency, including Long March Gully, Moulin Creek, and the Mitchell River floodplain itself.

Within EES Appendix A006, groundwater was noted to be not effervescent and, based on the Victorian Mineral Springs Database (VVG, 2019), there are no mapped mineral springs in the groundwater study area. The phenomenon of effervescence occurs when groundwater discharges to land surface under natural or anthropogenic conditions, causing carbon dioxide and potentially other gases, through depressurisation, to manifest as bubbles or sometimes froth.

For further due diligence, Figure 5.4 shows the depth to the potentiometric surface of the deep confined aquifer, the Latrobe Group Aquifer, which is the target for borefield development. This figure shows no areas of artesian conditions where groundwater pressures are above topography, and thus any springs in the region cannot be supported by this deep system.

In conclusion based on the data assessed, the conceptualisation supports that perching is a localised phenomenon and clay layering within the Coongulmerang Formation, which controls the development of perched groundwater lenses, is likely to be sporadic. Any springs that support dams are likely to be supported by these local and finite systems, and not supported by deeper artesian groundwater.

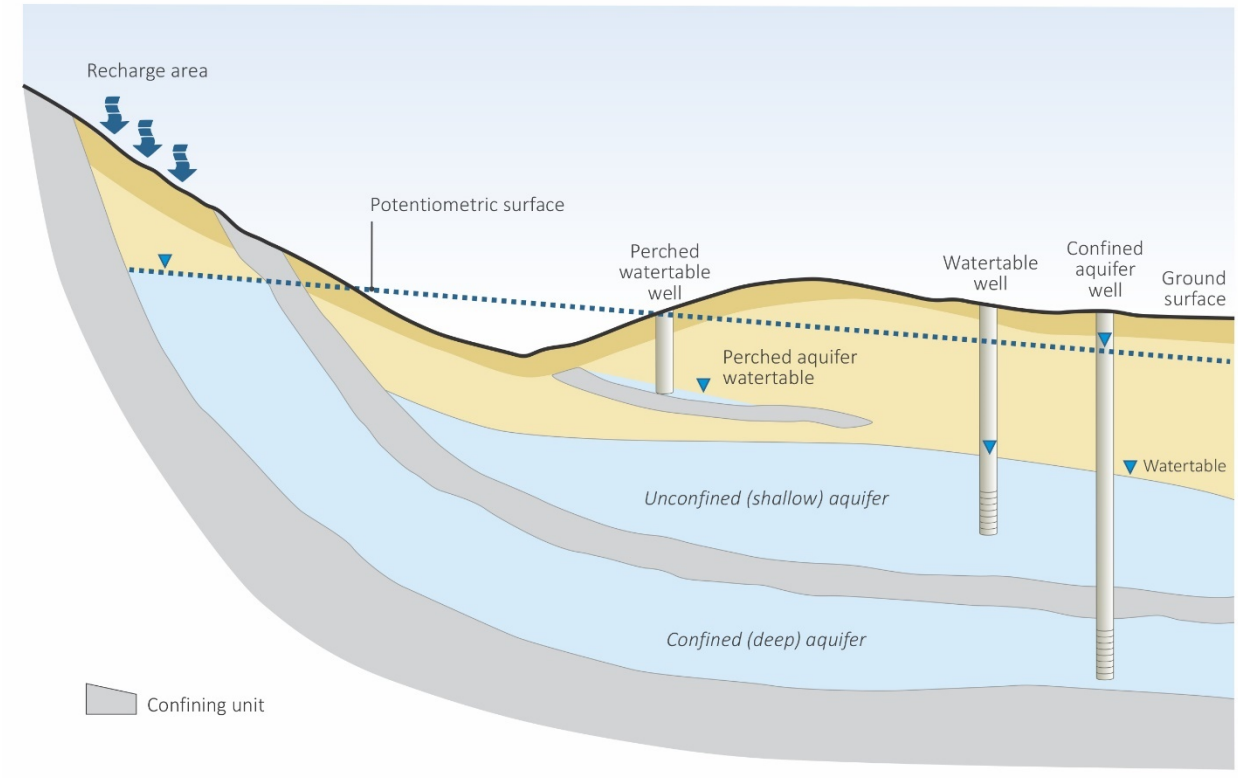
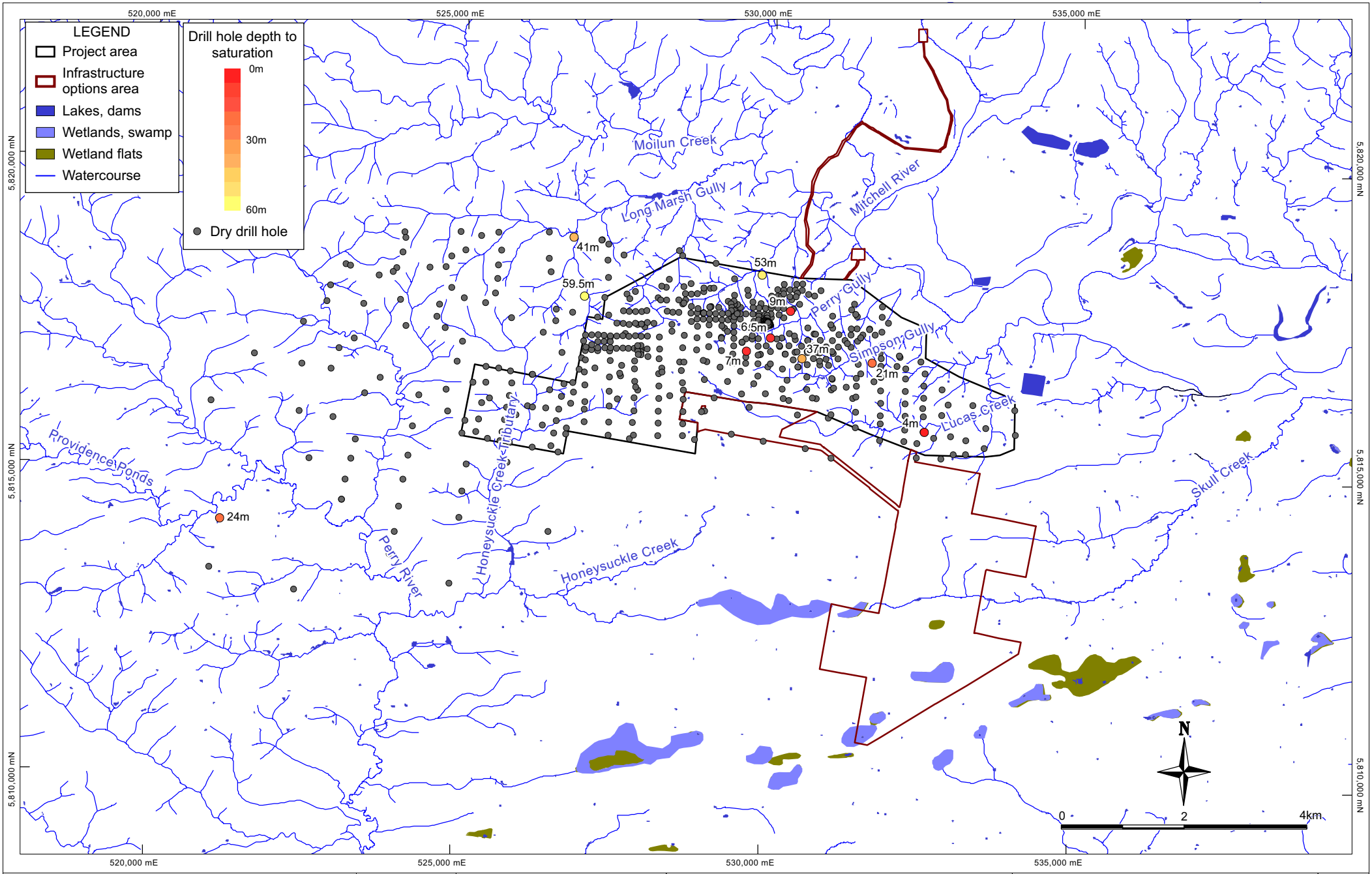


Figure 5.1 Aquifer types



Source:
Project area, infrastructure options area, drill holes from Kalbar.
Waterbodies and watercourses from Vicmap.

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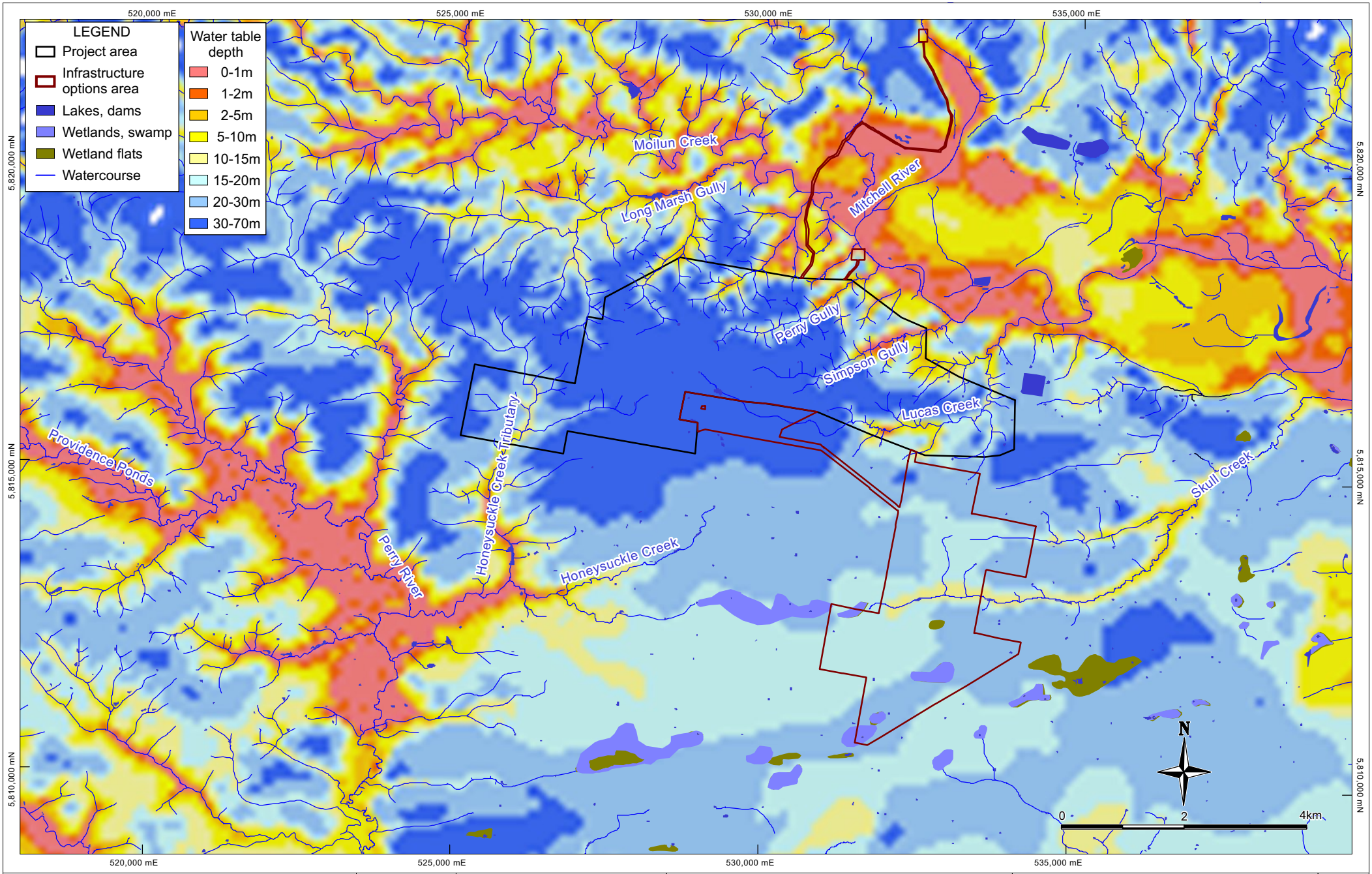
Depth to first water cut (m)

Figure No: 5.2

WOR Reference: EMM_07-01-2021



Source:
Project area, infrastructure options area from Kalbar.
Waterbodies and watercourses, Victoria Aquifer Framework from Vicmap.

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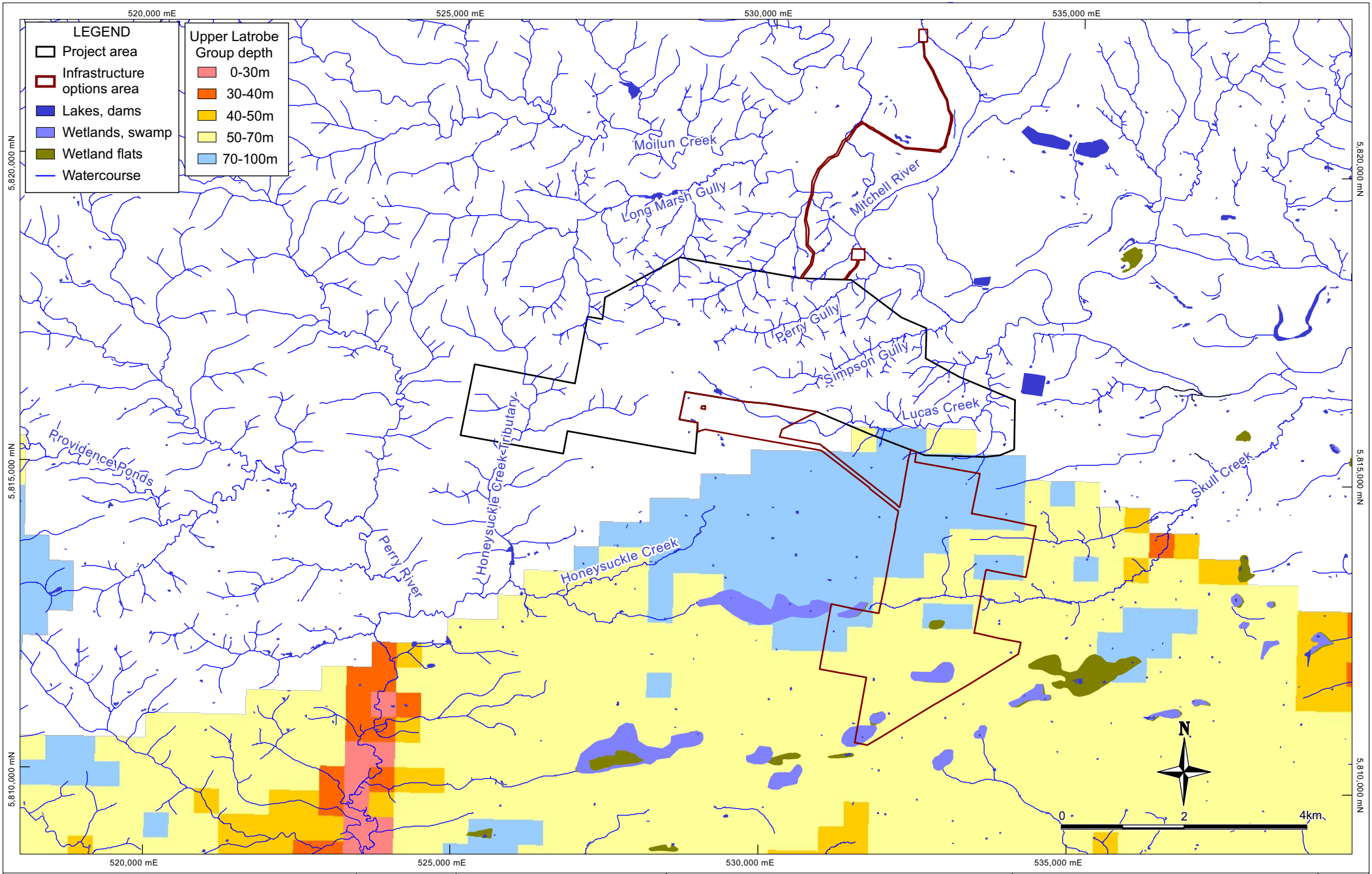
Depth to water table based on the Victorian Aquifer Framework

Figure No: 5.3

WOR Reference: EMM_07-01-2021



Source:
Project area, infrastructure options area from Kalbar.
Waterbodies and watercourses, surface elevation from Vicmap.
Upper Latrobe Group surface from Bioregional Assessment Programme (2015) Gippsland Basin potentiometric surfaces.

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Project Number: 754-ENAUABTF11607
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Fingerboards Mineral Sands Project
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Depth to Upper Latrobe Group potentiometric surface (m)

Figure No: 5.4

WOR Reference: EMM_07-01-2021

5.3.4 Tailing seepage estimates and related impacts

Uncertainty related to seepage estimates from the various site dams, TSFs and mining cells was raised as a common topic during the TRG meetings.

Mineral Technology developed the original mine plant processing water balance, which estimated that 1.7 Gigalitres per year (GL/y) or ~53 Litres per second (L/sec) would be lost via the sand tailings stream, assuming that underfloor drains would be 40% efficient. The EMM numerical groundwater model documented in EES Appendix A006/B, assumed the following, with the intent to simulate a conservative approach to the impact assessment (ie encourages groundwater mounding to occur):

- All water within the sand tailings reaches the regional water table instantaneously.
- No seepage is impeded by the vadose zone ie free drainage conditions are applied.
- No evaporation occurs from the beached material once it is deposited within the pit.

EMM acknowledges that there are sensitivities within the mine plant water balance itself which affect the tailing seepage estimates. Both the EMM groundwater (EES Appendix A006/B) and surface water (EES Appendix A006/A) models do not vary the seepage rate. The models vary other factors to understand the predictive uncertainty associated with the local climate and the receiving environment. From a groundwater modelling perspective, the model varied aquifer properties to determine a range of mounding extents and impacts resulting from seepage, and a range of drawdown extents resulting from operation of a water supply borefield.

Regarding uncertainty related to tailings seepage, in my experience this is usually reduced by undertaking additional work post approvals. Such activities include (but are not limited to) test pits, unsaturated modelling and extended groundwater monitoring. Unsaturated modelling using such programs as VADOSE (by Geoslope) can simulate TSFs, tailing cells and deeper soils at an operational scale for further analysis of seepage rates (using soil data specific to unsaturated conditions), flow directions and pore pressure impacts. Other phenomena such as tailing cell floors, which become progressively less permeable under consolidation, can also be simulated.

From a tailings water quality perspective, tailings characterisation was conducted by EGi (EES Appendix A006/D) and was further developed following the Coffey Groundwater and Surface Water Impact Assessment (EES Appendix A006). Using the results from elemental composition assays and leachate studies employing the Australian Standard Leaching Procedure (ASLP) on fine tailings and coarse sand tailings, the Coffey assessment considered the infiltration of tailings seepage into the groundwater to not pose a risk to the potable water supply after applying the proposed tailings management measures, which consist of the construction of a lined TSF to contain the initial fine tailings disposal, dewatering of sand tailings prior to disposal in the unlined mine voids and tailings supernatant removal post-disposal (EES Appendix A006).

The EGi ASLP testing used de-ionised water and a 1:20 solid tailings:water ratio (EES Appendix A006/D). An additional study by Kalbar investigated leaching of Mitchell River water as a proposed candidate for process water; however, the Kalbar testing was conducted under different laboratory conditions (1:5 solid:liquid ratio) and the solid sample consisted of composite ore, rather than solid tailings (EES Appendix A006). Submission 716 raised concern regarding the representativeness of the testing, given the potential to use Latrobe Formation groundwater as an alternative to Mitchell River water as process water, and the difference in water quality of the potential process water sources (SLR 2020).

Although Coffey has highlighted that Latrobe Formation groundwater generally falls within the range of groundwater observed across site, differences in water quality have been noted by Council and in light of this I think it would be prudent to investigate the effect on leachate water quality using Latrobe Formation groundwater to reduce residual risk.

It is recommended that additional studies are conducted post EES approval including:

- ASLP-derived 1:20 tailings:Mitchell River water; and
- ASLP-derived 1:20 tailings:Latrobe Formation groundwater.

5.3.5 Consistency between groundwater and surface water models

The numerical groundwater model (EES Appendix A006/A) uses the water balance version which assumes:

- densification of sand slurry to 75% solids by weight, with supernatant water returned to the process plant; and
- 40% of sand tails emplacement water recovered by underfloor-drains.

As previously stated, the water balance model shows 1.7 GL/year lost from sand tailings. This same volume is applied in the numerical groundwater model as direct seepage into the groundwater system, assuming no lag-time (due to a wetting front), evaporation or permanent loss caused by perching phenomena.

The conceptual site-wide water balance model shown within EMM's surface water report (EES Appendix A006/A) illustrates the unrecovered water from the sand tails with an arrow pointing to a box labelled 'entrainment'. This unrecovered water is not likely to remain entrained permanently, but rather a significant portion is expected to seep to the water table. Regardless, the losses from tailings in the groundwater and surface water balance models is consistent.

5.4 Review of submissions

5.4.1 Submissions received

I have read the public submissions to the EES that have been identified as relevant to my area of expertise. The submissions fall into four main categories including:

1. Government agencies and authorities' submissions;

2. Inquiry and Advisory Committee (IAC);

3. Local landowners; and

4. Community submissions.

5.4.2 Response to submission issues raised by Government agencies and authorities

The following submissions were received:

- Submission 291 - Southern Rural Water.
- Submission 358 - West Gippsland Catchment Management Authority.
- Submission 514 - Environment Protection Authority.
- Submission 552 - East Gippsland Catchment Management Authority.
- Submission 716 - SLR on the behalf of East Gippsland Shire Council ('Council').

Set out below are my responses to the issues raised by written submission by Government agencies and authorities. The responses have been categorised into themes. A full list of individual questions submitted, based on submission number, is provided in Appendix C along with a brief response to each.

i Chain of ponds

A summary of the key issues related to the identification and protection of the chain of ponds systems includes:

- there have been 27 previously mapped ponds, some just located south of the TSF. Concerns raised permanent loss of geomorphic features (submission 358); and
- 14 ponds associated with the upper reaches of Honeysuckle Creek would be permanently lost due to construction of the proposed dam locations within the mine footprint (submission 358).

Kalbar engaged environmental consultants EH Partners (EHP) and their research specialists Austral Research and Consulting, to improve the understanding of GDEs which may exist in the immediate vicinity of the Project. The GDEs identified were largely associated with riparian vegetation and low-lying reaches of various tributaries to the Mitchell River draining the eastern and northern project area. Valley grassy forest and plains grassy forest vegetation communities were also identified as moderate likelihood GDEs. GDEs associated with chain of ponds and spring feed dams (initially raised by the TRG in section 5.3.3, and also with landowner submissions, Section 5.4.4) were not identified during the site surveys and thus further work may be required.

I recommend that additional studies are conducted post EES approval including:

- undertake a survey to identify chain of pond areas as outlined by West Gippsland CMA (submission 358). Survey should be extended to include a health/condition assessment, whether water within the ponds is observed and GDE likelihood.

ii Perched and shallow systems

A summary of the key issues related to perched systems raised by the West Gippsland CMA (submission 358) includes:

- assumptions within the EES highlights the importance of perched water tables in and around the project area. Consequently, it is questioned whether the importance of ecosystems potentially reliant on perched water tables has adequately been addressed in the assessment;
- shallow aquifer impacts from the mine have not been adequately assessed or addressed; and
- the CMA recommends a comprehensive review of all potential GDEs within the potential impact area to assess which ones are likely to be fed by perched aquifers or the regional water table aquifer. This can then guide impact assessment and, if necessary, mitigation strategies.

The potential for perched aquifers in the vicinity of the project area has been addressed in Section 5.3.2 and recommendations related to further GDE assessments are found in Section 5.4.2iv of this statement.

Regarding assessing impacts to the shallow aquifer beneath the mine site, this has been adequately addressed within the EES and associated groundwater modelling. The shallow aquifer in this context, is the Coongulmerang Formation and the modelling shows that mounding may occur due to tailings seepage which is relatively localised and dissipates over time. Potential impact to perched systems, as discussed in Sections 5.3.2 and 5.3.3 of this statement, will be unlikely due to these systems being localised and disconnected. However, known spring fed dams should be investigated further to refine the hydrogeological understanding. If the risk of impact exists, then mitigation strategies such as applying mining buffer zones around these systems or offset strategies to substitute the landowner's water supply can be implemented.

Further water quality impacts to this system (ie causing by tailings seepage) are discussed in Sections 5.3.4, 5.4.2xi and 5.4.2xii and concludes that the risk of impacting the beneficial use category of the receiving groundwater system is unlikely, however further work is recommended.

I recommend that post EES approval:

- Kalbar continues to log for water cuts during any future resource drilling program.

iii Conceptualisation

A summary of the key issues related to the conceptualisation and suggested improvements, all from submission 716, includes:

- the Boisdale Formation sands and gravels are reportedly under the deposit (page 40) and are shown in Table 3-4 of the EES Appendix A006, but these are not shown on the cross-section through the site (figure 3-3), nor discussed on page 46;
- Table 8.2 (within EES Chapter 8) does not mention Balook Formation/Latrobe Valley Group. This is inconsistent with EES 8.3.3.1 (Figure 8.3) and the groundwater modelling which assumes Balook Formation/Latrobe Valley Group occur beneath the site (bore MW09d) and receive seepage (if seepage occurs) from tailings in mine voids (Figure 8.17). If not present, the seepage from mine voids would only be to the Coongulmerang Formation;
- include data from groundwater monitoring bores on the site on a north-south hydrogeological cross section that extends from south of the proposed bore field, north through the site;
- prepare a west-east hydrogeological cross section extending through the whole site to beneath the Woodglen ASR; and
- a west-east hydrogeological cross section through the whole site, showing the variation in lithology in the Coongulmerang Formation (this is modelled with uniform properties, see Table 5-1 of ESS Appendix A006/B).

The Boisdale aquifer is not located beneath the project site, and thus text on page 40 of Appendix 006 is incorrect. However, the text on page 46 is correct and states that the Boisdale aquifer is absent north of the Princes Highway. Figure 2.51 of the numerical groundwater modelling report (EES Appendix A006/B) clearly shows the extent of the Boisdale aquifer in relation to the Project.

The geology described in Table 8.2 of the EES Main Volume has been written from a resourcing perspective and does not really consider stratigraphy beneath, or laterally beyond, the mineral resource. Strictly speaking, Table 8.2 could be updated to reflect more recent drilling and interpretation undertaken in 2019, paying particular attention to cross section 1 as outlined in Section 2.13 of the groundwater modelling report (EES Appendix A006/B).

The Council's recommendation (submission 716) to provide further cross-sections with accompanied bore data, although beneficial to the reader, would not change the outcomes of the groundwater modelling. It is noted that the groundwater modelling report already provided five cross-sections based on the model's framework (Figures 2.51, 2.52, 4.3, 4.4 and 4.5). Updated geological cross sections based on the 2019 drilling program (Figures 2.45 to 2.50) were also considered within the numerical model. In saying this, EMM has provided two modelling cross-sections in Section 5.4.2vii, which show the modelled hydrostratigraphy along a north-west to south-east cross section originating from north of mine site towards the Gippsland Lakes (Figure 5.10), and a south-west to north-east section (Figure 5.11) through the upper part of the model domain, which transects through the project site and the Woodglen ASR site.

iv Groundwater Dependant Ecosystems (GDEs)

A summary of the key issues, sourced from submissions 358 and 716, related to the identification, monitoring and protection of the project GDEs includes:

- a program is suggested to be undertaken to further assess and monitor the health of the GDEs;
- a comprehensive review of all GDEs in the immediate vicinity of the project to identify which ones rely on shallow perched systems and/or the regional water table system; and
- greater understanding is required of the source water for Providence ponds.

Figure 5.5 shows the depth to the regional water table based on the VAF dataset with the potential GDE vegetation classes and the riparian vegetation areas identified by EHP overlaid. As discussed previously, the GDEs identified were largely associated with riparian vegetation and low-lying reaches of various tributaries to the Mitchell River draining the eastern and northern project area. These areas show good correlation to inferred shallow depths to the regional water table. Valley grassy forest and plains grassy forest vegetation communities were also identified as moderate likelihood GDEs.

GDEs associated with chain of ponds and spring fed dams (initially raised by the TRG in section 5.3.3, and also with landowner submissions, Section 5.4.4) were not identified during site surveys. Furthermore, as discussed in Section 5.3.2, although data to date suggest that the chain of ponds and sections of the Perry River are likely supported by a perched system, this is not totally consistent with the VAF dataset shown in Figure 5.3.

To address this inconsistency and to establish a comprehensive baseline of GDEs for the purpose of developing mitigation and management plans as recommended in Section 5.4.2v, I recommend a comprehensive GDE survey and assessment be undertaken for those sites which could be potentially impacted by mining activities, which should consider the observations made by the government, local landowners, and the general community. The framework should follow the guidelines outlined within the IESC Information Guidelines Explanatory Note: Assessing groundwater-dependent ecosystems (Doody et al. 2019), provided in Figure 5.6.

I recommend that Kalbar:

- undertake a further GDE identification study to assess level of groundwater dependence and develop conceptual models using the IESC guidelines (Steps 1 to 3);
- undertake a sensitive receiver field census (including third party bores) with local landowners and government agencies; and
- develop preliminary framework groundwater and GDE management plans, with these plans finalised as part of the post approval works. At this stage, the preliminary GDE plans will likely cover off on steps 1 to 3 as outlined by the GDE IESC guidelines (see Section v for more detail).

v Groundwater and GDE Management Plans

A summary of the key issues related to Groundwater Management Plan (GMP) and GDE Management Plan (GDEMP) includes:

- a GMP is required before any licences are issued by Southern Rural Water (SRW) (submission 291), and should include locations of groundwater bores and GDEs, address uncertainties in groundwater and surface water connections, address gaps in understanding of groundwater flow or receptors, monitoring of groundwater level and quality and any groundwater discharge at ground surface, assessment of trends, provide water triggers, detail reporting requirements;

- a Tailings Management Plan (TMP) and Risk Treatment Plan is required to include information on baseline groundwater conditions (level and quality) in the TSF area, groundwater/seepage water monitoring requirements, trigger levels, and mitigation measures (submission 514); and

- a GDEMP is required to assess and monitor the health of GDEs, and should include details and locations of GDEs, environmental values, goals, and triggers for each GDE, list the monitoring program for the pre-mining and during mining phases including how the monitoring will inform mitigation, management, and offset measures, describe mitigation and management measures, and reporting requirements (submission 358).

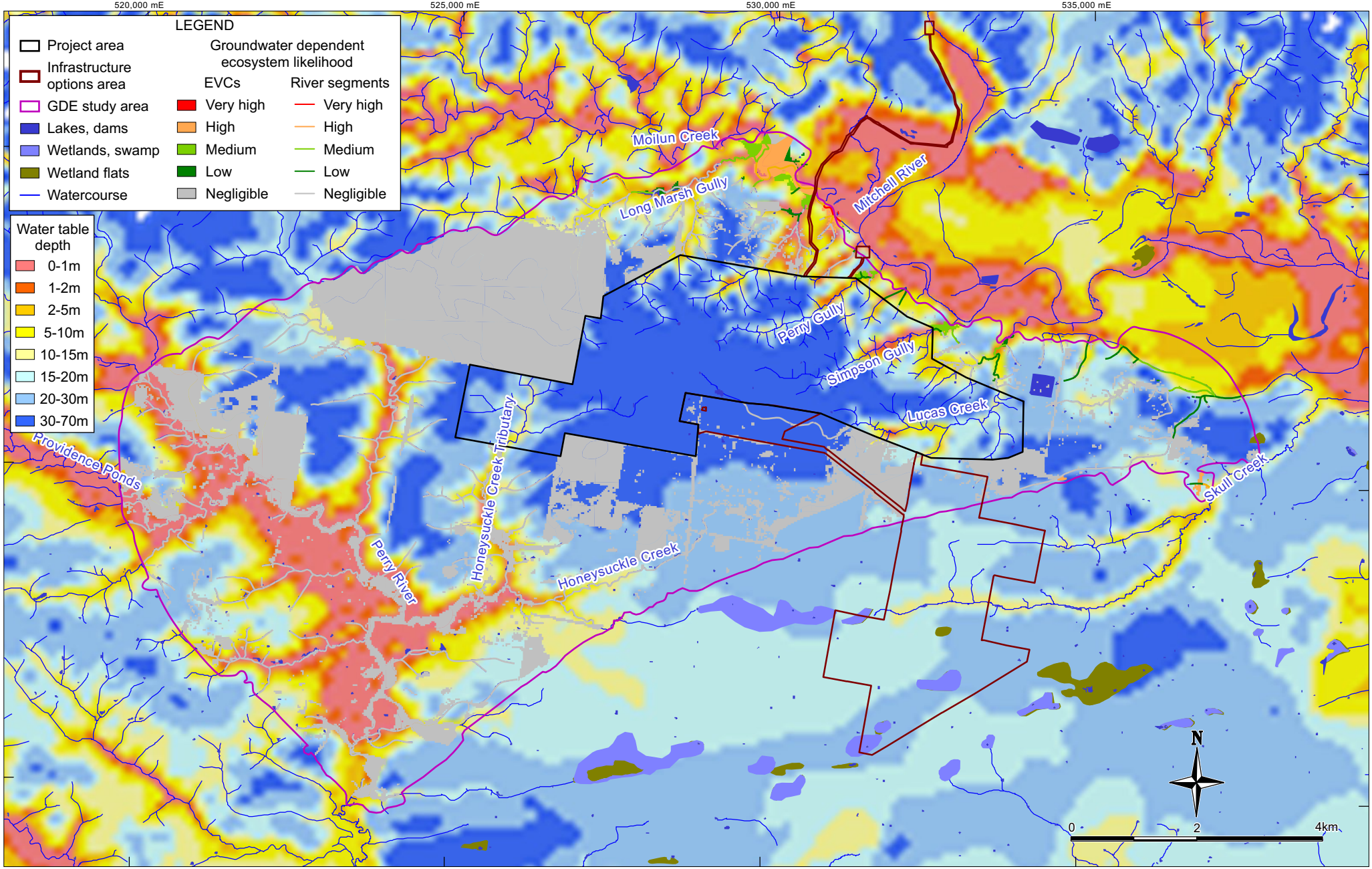
The GMP is related to the GDEMP as it informs interpretation of ecological triggers, monitoring and management through adaptive processes. The Tailings Management Plan includes relevant groundwater details also provided in the GMP.

As noted in Section iv, there are several additional GDE action items recommended including GDE identification, assessment of level of groundwater dependence and development of conceptual models (Steps 1 to 3 of Figure 5.6, Doody et al. 2019), bore and GDE census and development of comprehensive Groundwater and GDE management plans.

Steps 4 to 6 of the Doody et al. (2019) framework build on the previous steps and involve determination of baseline ecological condition and value, risk assessment of impacts and potential consequences, and avoidance and mitigation measures including a GDE management plan.

Before mining commences, I recommend that additional works are conducted to establish the baseline and inform the development of appropriate management plans to mitigate the effects of the Project, if any, on GDEs:

- installation of a groundwater monitoring bore network at regional locations which target key risk areas, including groundwater users and GDEs. Bores at locations between the water affecting activity and the sensitive receiver may also be required to allow for advance warning of potential impacts, although these can be installed at a later date. This recommendation supports the development of conceptual models as outlined in Step 3 of the IESC guidelines and supports Step 4 moving forward;
- installation of in situ groundwater level data loggers at key monitoring bore sites;
- development of preliminary framework groundwater, GDE and tailings management plans, with these plans finalised as part of the post approval works. At this stage, the preliminary GDE plan will likely cover off on steps 1 to 3 as outlined by the GDE IESC guidelines (Doody et al 2019); and
- undertake several groundwater and GDE monitoring events before mining commences to inform baseline conditions and setting of water quality objectives and trigger levels.



Source:
Project area, infrastructure options area from Kalbar.
Waterbodies and watercourses, Victoria Aquifer Framework from Vicmap.
Groundwater dependent ecosystems from Austral Research and Consulting – GDE Impact Assessment, Feb 2019

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Depth to water table based on the Victorian Aquifer Framework with groundwater dependent ecosystems

Figure No: 5.5

WOR Reference: EMM_07-01-2021

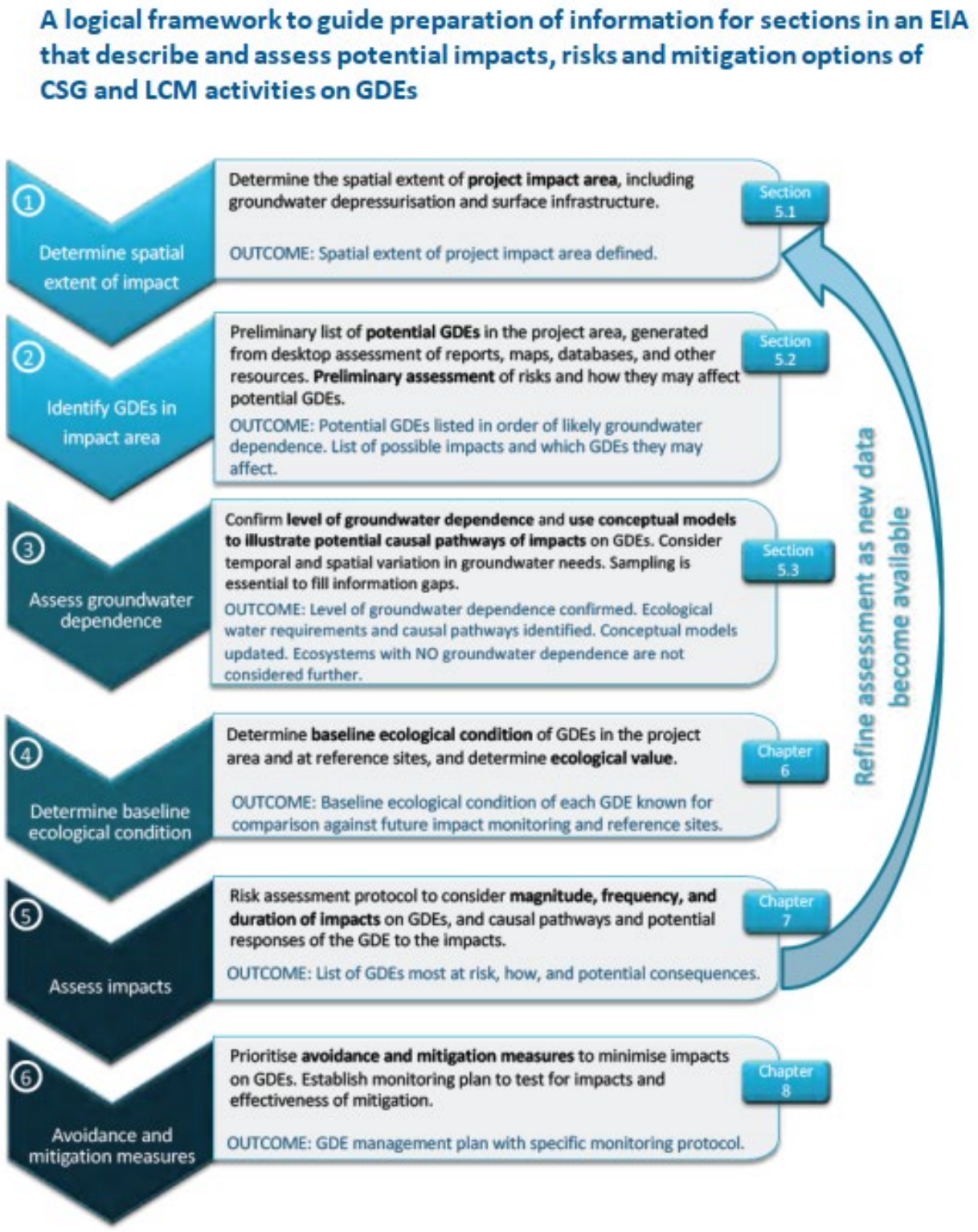


Figure 5.6 **IESC guide for identifying, assessing, and developing GDE management plans**

vi Groundwater flow direction

A summary of the key issues related to the delineation of groundwater flow direction across the project site includes:

- SLR, on behalf of Council (submission 716), questioned the statement that groundwater does not move to the west towards the Perry River catchment. They proposed an alternative interpretation of the data presented, ie that groundwater beneath the east half of site flows toward Mitchell River, and beneath the west half of the site flows toward Perry River. They suggest this possibility does not appear to have been considered in the model conceptualisation and risk assessment; and

- SLR suggests the installation of additional bores west and north of the site to better delineate groundwater flow directions.

Coffey constructed seasonal groundwater contours based on monitoring bores constructed within the Fingerboards project area (EES Appendix A006). I agree that at least two more monitoring bores should be installed further west and north of the project site to further refine the groundwater flow directions. As it currently stands, Coffey's groundwater contours imply the flow directions are directed towards the north-east, with higher groundwater levels measured in the west to south-west. In my view these contours honour the data, but I acknowledge an alternative interpretation could be that the flow directions are localised and are heavily influenced by the discharge feature which is the Mitchell River floodplain.

In my groundwater modelling report (EES Appendix A006/B) I provided a slightly different interpretation of the same dataset used by Coffey, but also considered the groundwater contours from the VAF, which assumes groundwater recharge occurs in the highlands and regional flow originates from the north-west (see Figure 5.7). The pre-mining modelled groundwater contours for the Coongulmerang formation (water table aquifer) are shown in Figure 5.8. This shows consistency with the interpretations shown in Figure 5.7, with groundwater flow, from a local perspective, originating from the north-west and flowing towards the east with some local perturbation towards the Mitchell River floodplain, being the main discharge area locally.

I acknowledge that additional monitoring bores as recommended by SLR would help confirm this and would also provide Kalbar with additional bores away from the site which could be used as control sites, which remain unimpacted from mining activities. However, based on the available data I am confident in my estimates of groundwater flows as presented in Figures 5.7 and 5.8.

I conclude that groundwater contours and flow directions at the Fingerboards site are well understood at a level of detail sufficient to inform the EES.

It is recommended that the following additional works be undertaken post EES approval:

- Kalbar install two additional monitoring sites to the west and north of the project site, as recommended by Council, and incorporate the new monitoring bores into the overall baseline monitoring program.

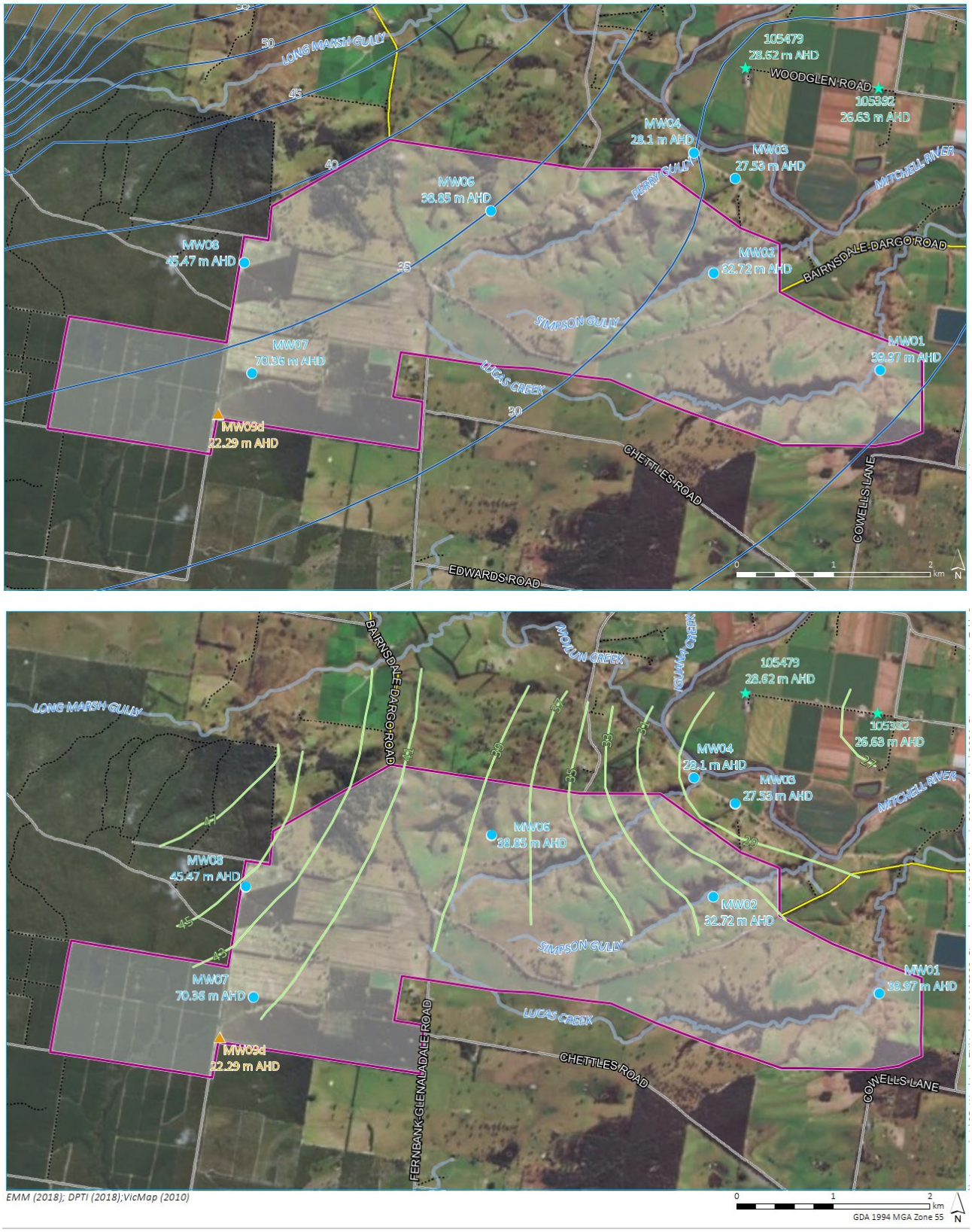
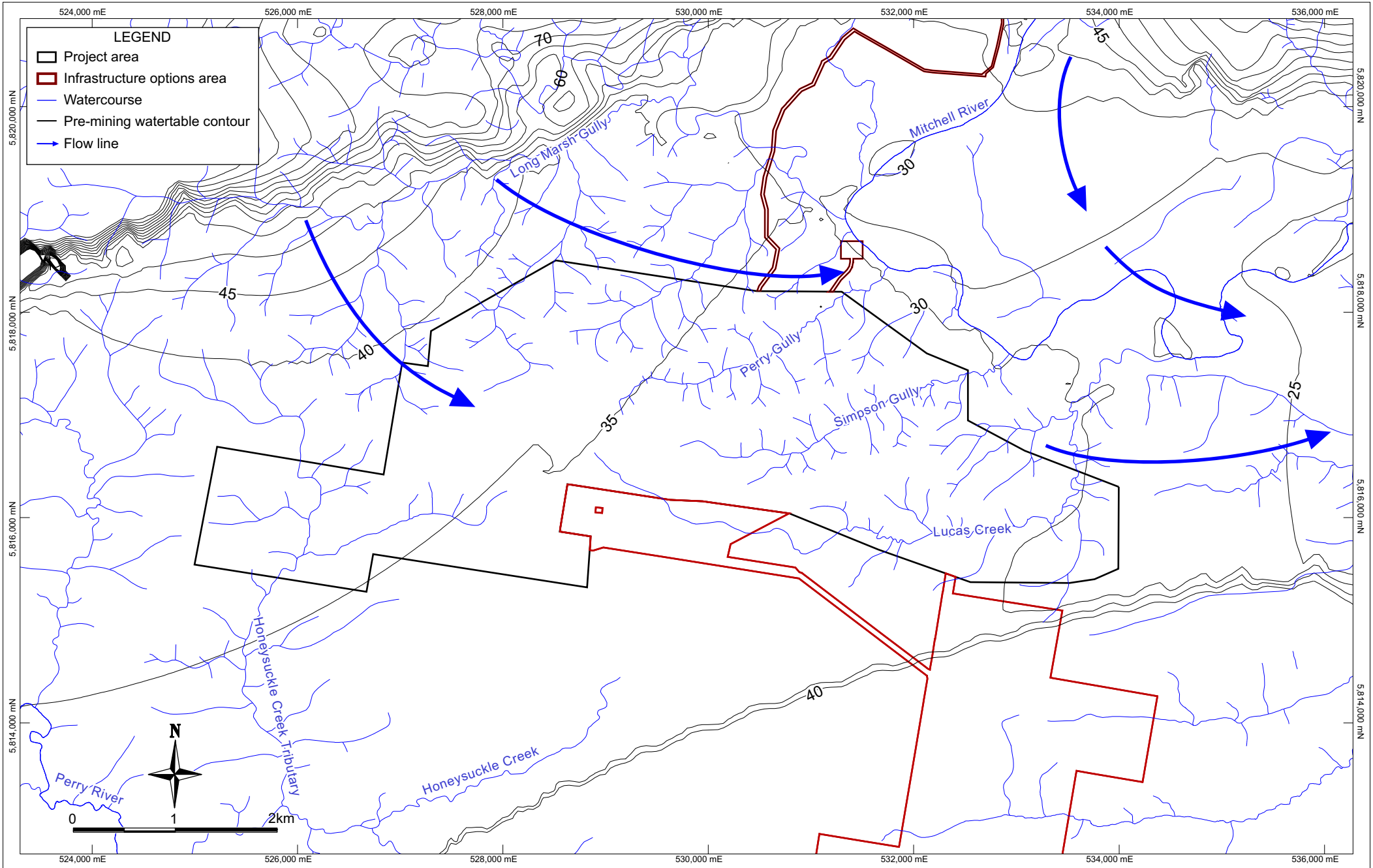


Figure 5.7 **Pre-mining groundwater contours based on the VAF and EMM's interpretation (mAHD)**



Source:
Project area, infrastructure options area from Kalbar.
Watercourses from Vicmap.
Modelled watertable contours from EMM.

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Modelled pre-mining watertable contours (mAHD)

Figure No: 5.8

WOR Reference: EMM_07-01-2021

vii Numerical modelling

A summary of the key issues related to the numerical modelling, as identified by submission 716, includes:

- the choice of modelling software;
- model calibration/history-matching, including the quality of data used and implications of calibration performance;
- chosen boundary conditions and potential influence on model predictions;
- simulation of Mitchell River with a fixed elevation and potential influence on model results;
- the simulation of predicted tailings seepage; and
- the predictive uncertainty analysis, including alternate conceptualisations and further delineation of individual mining impacts.

Queries have been raised concerning the choice of MODFLOW-SURFACT as the numerical modelling software, particularly with regard to the simulation of discontinuous hydrostratigraphic layers. MODFLOW-USG was suggested as an alternative by Council. As the Council submission notes, MODFLOW-USG has geometric advantages, allowing for more flexible model grid/mesh and layer design, including discontinuous layers. Discontinuous layers in MODFLOW-SURFACT (and other finite difference groundwater modelling codes) are handled by assigning a minimum non-zero thickness where the layer is conceptually absent. This places additional computational demands on equivalent MODFLOW-SURFACT simulations, when compared to MODFLOW-USG simulations, but does not alter the underlying governing equations of groundwater flow simulated by the codes, with the development of both modelling software codes led by Sorab Panday.

Cross-sections showing the model layers coloured by hydrostratigraphic unit are presented in Figure 5.10 and Figure 5.11, with locations shown in Figure 5.9. Vertical flow between model layers is handled with a leakance calculated as the vertical hydraulic conductivity of each layer weighted by layer thickness. As a result, model layers with a minimum thickness (0.5 m in the model) have a very small influence on groundwater flow. I do not consider the choice of modelling software to be influential on predictive model results, nor apparently did the independent reviewer. Additionally, discussions during the TRG suggested DELWP's independent reviewer did not have a concern with the modelling code.

Calibration of the groundwater model was undertaken against measured hydraulic head (groundwater level) data from 1970 to 2017 at selected bores, which showed complete and continuous historical records. Stresses applied to the model during this period included groundwater extraction via pumping from wells and regional depressurisation of the Latrobe Group. The accuracy and reliability of the data used for calibration has been discussed in Appendix B of the EES Appendix A006, noting that there is general uncertainty in the well pumping rates and magnitude of depressurisation. Submission 716 also raised the potential influence of groundwater temperature in the Latrobe Group; a simple assessment considering pressure head and water temperature at LA-01

suggests an equivalent temperature-corrected freshwater head difference of less than 1 m (based on the methodology presented by Post et al (2007)), and, therefore, adjustments for temperature are unnecessary to consider in the context of the wider calibration. Model calibration performance is generally good, with an average residual between modelled and measured groundwater levels of 1.7 m, with modelled levels. This is considered reasonable in the context of the range in measured groundwater levels across the model domain, which was greater than 50 m.

Spatial distribution of calibration data is concentrated near the mine site and towards the coast, with few data points in the western part of the model domain and directly south of the project site. I accept that additional data points may help to further constrain the calibration and reduce the uncertainty associated with model predictions.

Boundary conditions have been applied in the groundwater model for simulating regional-scale flow of groundwater into and out of the model. Concerns (submission 716) have been raised regarding the constant head cells to the north of the mine in model layers 6 to 9, representing inflow from high-elevation Palaeozoic bedrock. Analysis of lateral flux via these cells during the model run revealed inflow to the model of a similar scale to rainfall-derived recharge, a reasonable conceptual rate for a low-yielding unit. The inflow rate at this location is comparatively small, and I expect that replacing these cells with a different boundary condition type (eg a general head boundary) or removing the cells would have minimal impact on modelling outcomes.

A question was raised by submission 716 concerning modelled drawdown from the borefield south of the site. The borefield is simulated with 7 bores extracting 3 GL/year for three years. Modelled drawdown from groundwater extraction for the first three years of the Project in the Latrobe Group Gravels recovers by the end of mine year 15. At this time, residual mounding greater than 1 m is present due to modelled seepage from tailings. I do not consider there to be a significant influence on drawdown due to lateral boundary inflow. The submission also queried recirculation of boundary flow at the southern edge of the model from constant head cells in layers 1 to 9 to drain cells in layers 10 and 11. I accept this suggestion and can adjust this for future modelling, removing constant head boundary cells from the deeper layers. This will allow for vertical flow, limited by aquifer properties. However, I do not consider this to be influential on model calibration performance or prediction outcomes. Another concern was raised by submission 716 regarding the predicted drawdown in the Latrobe Group reaching the western boundary. The numerical groundwater modelling report did not consider there to be influence on the predictive model results as this causes an expansion of drawdown within the model domain, and hence giving a more conservative (over)estimate of impacts to environmental receptors.

The boundary conditions representing the Mitchell River were simulated with fixed elevations, using long-term average river levels from sampling sites and applied to the model using linear interpolation between these sites. Questions were raised via submission 716 regarding the suitability of this and the potential influence on model results, as well as noting a measured decline in flows with time. The river (RIV) boundary condition in MODFLOW uses a surface water elevation, with flow to/from the aquifer controlled by a conductance term representing the connectivity of the river and aquifer through the riverbed. EMM simulated the Mitchell River using long-term average conditions, which do not incorporate seasonality or changes arising from climate change. As noted, this may be a source of uncertainty with regard to calculating groundwater level adjacent to the river and resultant

changes in river baseflow/leakage. Seasonality was not included due to the groundwater model using yearly stress periods, and long-term changes were not specified in the boundary condition design as these changes may be arising from groundwater usage which is already accounted for in the model setup. Impacts to the Mitchell River were assessed by analysing modelled water flux via these cells. Uncertainty around river cells conditions (related to river bed conductivity) was addressed as part of the predictive uncertainty analysis in Section 8 of the groundwater model report (EES Appendix A006/B), simulating an approximate range of potential impacts arising from the Project.

Some questions were raised by submission 716concerning the simulation of tailings seepage and the uncertainty of the applied seepage rate. Firstly, it was noted that hydraulic parameters were not altered to reflect the properties of tailings. The groundwater model does not simulate fluid movement through the tailings material. Instead the assigned recharge flux is applied directly to the water table. This flux is estimated from a water balance assessment provided by Mineral Technology and Kalbar (discussed in Section 5.3.4) and is calculated as 'deep drainage' through the vadose zone to the water table. It was noted that the water balance assessment is another source of uncertainty, and that seepage may not occur at all. The submission recommends that alternate conceptualisations/scenarios in the predictive uncertainty analysis for varying (and removing) the modelled tailings seepage to the water table be investigated in future iterations of the modelling. These alternative conceptualisations/scenarios will need to be supported by further tailings test work and possibly unsaturated modelling as discussed in Section 5.4.2xi.

There are also a number of questions from the community (submissions 423, 568, 763 and 813) regarding the groundwater model, most of which are broadly concerning model complexity, data quality and general uncertainty. This is a common theme for groundwater models, as they are a simplification of reality with multiple assumptions and limitations. As such there is no 'true' result - the base case model represents a 'best guess' given the available data, and the predictive uncertainty analysis is designed to provide reasonable upper and lower bounds of potential impacts. Questions have been raised regarding suitability of the data used in the water balance model, aquifer connectivity and potential drawdown impacts, and risks associated with the conceptualisation of perched aquifer systems.

Whilst the water balance model is uncertain (as discussed above), the adopted tailings seepage rate to the saturated groundwater system and required groundwater extraction as water supply were both overestimated to provide a conservative simulation of impacts. This was felt important to ensure the EES did not underestimate the effects of groundwater mounding from tailings seepage. I agree with the recommendation in submission 813 to develop additional uncertainty scenarios that test the uncertainty related to seepage estimates, however this is driven by testing the process water balance in the first instance. I believe the seepage applied to the groundwater model is already overestimating seepage rates and any uncertainty runs may in fact test lower seepage rates which would result in smaller mound development. These scenarios with reduced mounding impacts may allow for the delineation of predicted impacts from the borefield, and potentially increase confidence in model results.

Modelled drawdown impacts and aquifer connectivity has been covered in the uncertainty analysis in Section 8 of the groundwater modelling report (EES Appendix A006/B). Varying the modelled vertical hydraulic conductivity of the Seaspray Group allows for higher/lower modelled drawdown

within the Latrobe Group. Greater hydraulic connectivity to shallower units results in a lower impact to the Latrobe Group, though with greater modelled drawdown in the shallower model layers. Data collected during the pending 2021 pumping test trials will be used to further understand the Seaspray Group, and thus improve understanding of the hydraulic connectivity between the deeper and shallower units.

Concerns regarding the conceptualisation of perched systems, as raised by submissions 423 and 813, are discussed in Section 5.3.2, and an alternate conceptualisation is not considered necessary for the uncertainty analysis of the groundwater model (EES Appendix A006/B).

It is recommended that the following are conducted for future model upgrades post EES approval:

- If thought desirable, implementation of the latest MODFLOW-USG modelling code.
- Alter model boundary conditions at the coast to give a hydraulic separation between static ocean cells and depressurising Latrobe Group cells.
- Include additional scenarios in predictive uncertainty analyses (supported by additional tailings and soil data), including numerical separation of the influence of mine-related tailings seepage and groundwater extraction. This will help further constrain impacts by approximating actual seepage potential rather than assume all seepage reaches the water table. Separation modelling would be used to unpack different mine affecting activities from one another and provide more detail as to whether the simulated mounding and drawdown impacts act as mutually negating stresses.

Source:
Project area, infrastructure options area from Kalbar.
Watercourses from Vicmap.
Cross section locations EMM.

KALBAR OPERATIONS PTY LTD

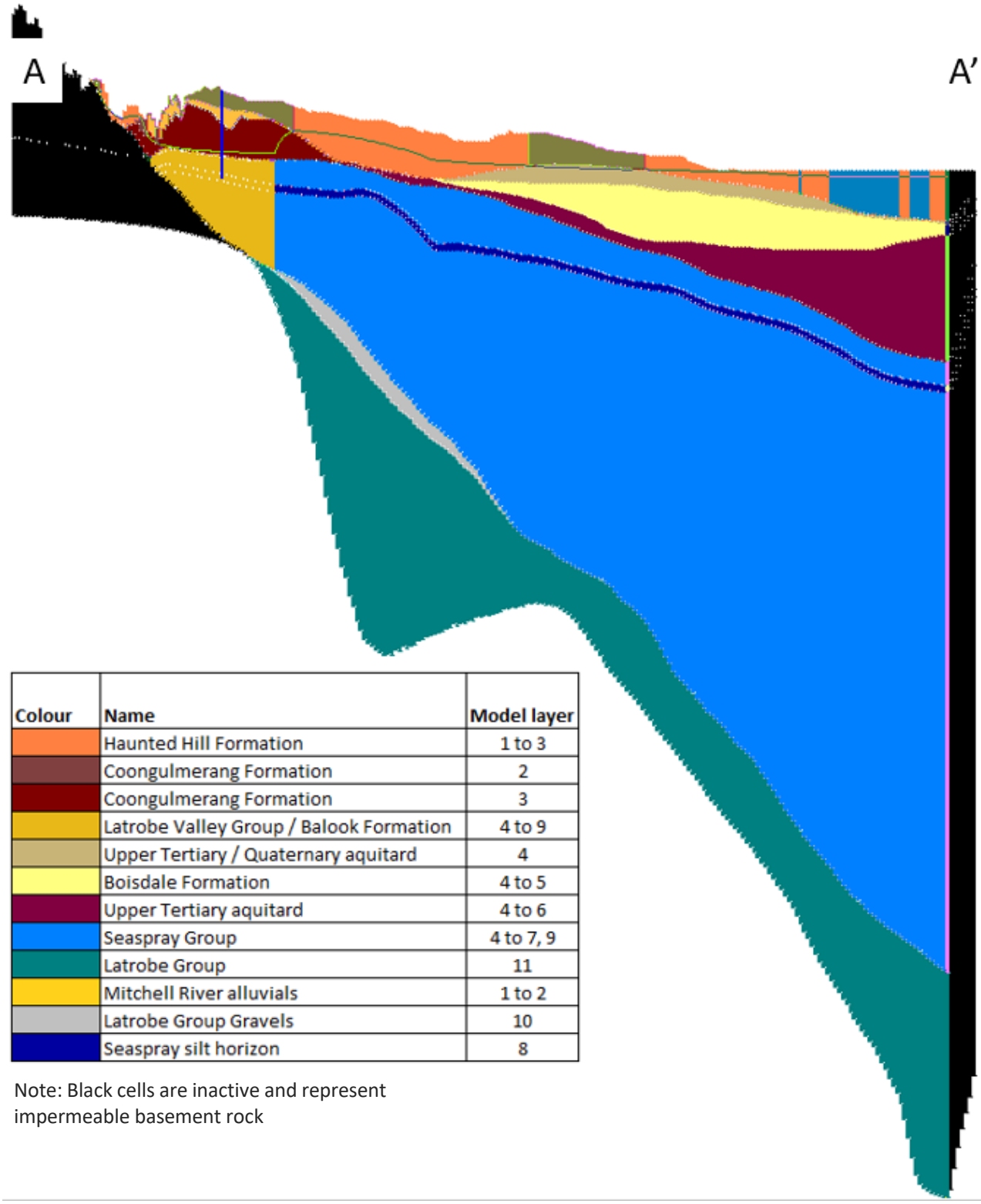
Date: 15/01/2021
Project Number: 754-ENAUABTF11607
File Name: EMM_07-01-2021_F6_v1

Fingerboards Mineral Sands Project
Environment Effects Statement

Groundwater model cross section locations

Figure No: 5.9

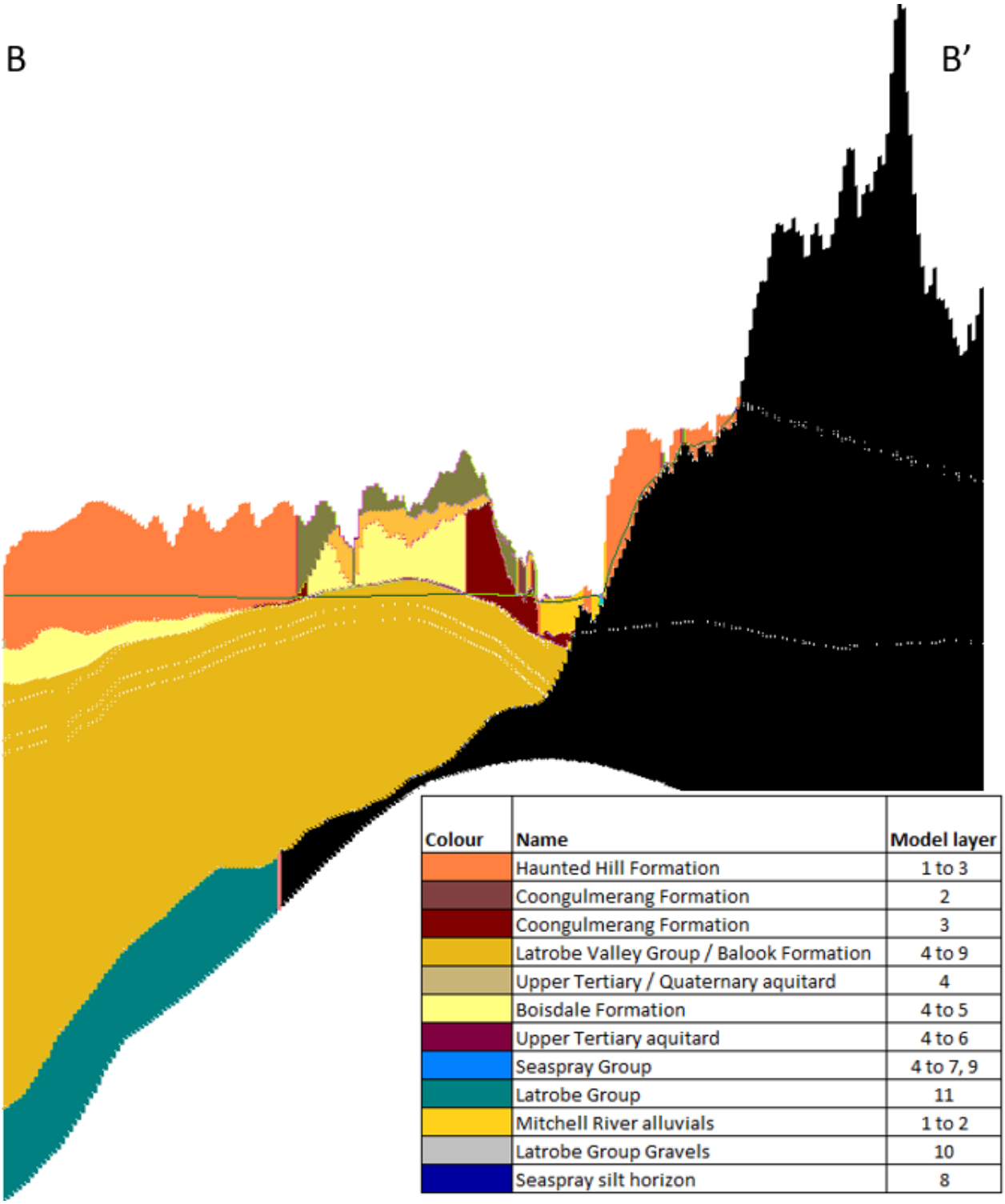
WOR Reference: EMM_07-01-2021



Colour	Name	Model layer
	Haunted Hill Formation	1 to 3
	Coongulmerang Formation	2
	Coongulmerang Formation	3
	Latrobe Valley Group / Balook Formation	4 to 9
	Upper Tertiary / Quaternary aquitard	4
	Boisdale Formation	4 to 5
	Upper Tertiary aquitard	4 to 6
	Seaspray Group	4 to 7, 9
	Latrobe Group	11
	Mitchell River alluvials	1 to 2
	Latrobe Group Gravels	10
	Seaspray silt horizon	8

Note: Black cells are inactive and represent impermeable basement rock

Figure 5.10 Model HSU cross section A-A'



Colour	Name	Model layer
	Haunted Hill Formation	1 to 3
	Coongulmerang Formation	2
	Coongulmerang Formation	3
	Latrobe Valley Group / Balook Formation	4 to 9
	Upper Tertiary / Quaternary aquitard	4
	Boisdale Formation	4 to 5
	Upper Tertiary aquitard	4 to 6
	Seaspray Group	4 to 7, 9
	Latrobe Group	11
	Mitchell River alluvials	1 to 2
	Latrobe Group Gravels	10
	Seaspray silt horizon	8

Note: Black cells are inactive and represent impermeable basement rock

Figure 5.11 Model HSU cross-section B-B'

viii Pumping (aquifer) test

A summary of the key issues raised by submission 716 related to the pumping test at the project site include:

- SLR on the behalf of Council questioned why the production bore, PB01, was pumped at a lower rate than the targeted rate of 15 L/s;
- SLR raised points related to inadequate pumping rate and time, lack of discussion of aquitard vertical hydraulic conductivity, the differences predicted in drawdowns between the analytical model and numerical groundwater model, and no mention of groundwater temperature and changes during the pumping test; and
- SLR noted that further borefield pumping tests and assessments will be needed to optimise bore locations and yield, and to minimise drawdown impacts.

The original production bore (LA-01-PB or PB01) was screened from 314-326 mBGL, with this bore test pumped at a constant rate of approximately 11 L/s for 96 hours. The targeted rate of 15 L/s was not able to be achieved due to bore design inefficiencies which will be rectified in future pumping test programs. Although not specifically reported on, groundwater temperatures remain at or just below 30 degrees and the aquitard was considerable thick enough with inferred low permeabilities as to not observe any drawdown in the shallow aquifer system during the pumping test.

In 2021, Kalbar and EMM have commenced additional groundwater assessment works, including pilot hole drilling, to inform production bore locations, production and monitoring bore (shallow and deep) installations, optimization of production bore design and pumping tests (step rate and 96-hour constant rate). Collection of baseline groundwater level and quality data for any new bores will also commence. The collection of this data will support an update to the groundwater flow model for the site and borefield, including simulation of pumping scenarios.

It is recommended that the following are conducted to support a future water licencing application:

- installation of one or two production bores and associated shallow and deep monitoring bores at the intended borefield;
- pumping tests of new production bores to confirm target supply rate of 15 L/s, with associated minimal drawdown impacts; and
- update the groundwater flow model for the site and borefield, including calibration to the pumping test and simulation of pumping scenarios and assessment of predicted drawdown.

ix Impact assessment

As part of any licence application to Southern Rural Water (SRW), SRW state (in submission 291) that a more detailed impact assessment is required, in addition to the modelling and impact assessment already provided as part of the EES. From a groundwater perspective, the key requirements from SRW includes:

- conceptualisation of the groundwater system around the proposed bore field and particularly further north where the overlying formations become more sandy (more permeable) and the aquifers rise up to the surface on the basin margin;
- test pumping to better inform the groundwater conceptualisation, utilising the additional investigation bores drilled by Kalbar in 2019, and possibly new bores, to provide a more robust assessment of the impacts of pumping and mine water seepage;
- aquifer geometry, aquifer parameters, potential vertical pressure effects and leakage due to pumping (particularly along the basin margin);
- revised modelling and impact assessment; and
- a peer review of the additional work undertaken.

Council also provided comment related to additional risks that should be included as part of the impact assessment. These submissions have been addressed in a separate statement by Coffey (Coffey, 2021).

A considerable amount of additional data has been collected since the numerical model was first constructed in late 2017, which also included minor updates in 2019. At the time of preparing the groundwater modelling report, Kalbar and EMM used all available data to construct the hydrostratigraphy at the mine site and at the borefield. Mine makeup water requirements and assumed tailing seepage was based on the original water balance provided by Kalbar.

To inform the detailed Project impact assessment, development of the work plan and associated groundwater management plans and preparing the licence application to SRW, the numerical models should be updated to incorporate all available datasets, which would at least include:

- additional resource drilling within both the Fingerboards Project and greater Glenaladale deposit area;
- additional monitoring bore data, including new proposed sites located at the borefield;
- updated GDE survey and assessment as discussed in Section 5.4.2 part iv;
- pumping test data from the program planned for Q1 2021; and
- any additional water balance or tailing seepage datasets developed post EES submission.

It is recommended:

- Kalbar update their numerical models and impact assessment using updated datasets to support a licence application to SRW.

x Risk assessment

In submission 716 SLR noted that registered groundwater bores were downloaded from the Bureau of Meteorology (BoM) Groundwater Explorer database in 2018.

It is noted that Council and the EPA also highlighted additional risks in relation to the Tailings Management Plan and Risk Treatment Plan and recommended that further assessment of uncertainties that should be included as part of the risk assessment. These submissions have likely been addressed in in separate statements.

The preferred (primary) Victorian groundwater bore database is the Victorian Water Management Information System (WMIS), with a list of current registered groundwater bores within a 10 km radius of the mine area to be updated in 2021. The Visualising Victoria's Groundwater (VVG) web-portal currently displays data for all of Victoria from a variety of sources, including WMIS. The VVG should be cross-checked with WMIS records to ensure all groundwater bores are reported.

It is recommended:

- Update the list of current registered groundwater bores (to 2021), and source this information from the Victorian WMIS, with cross-checking to be done between WMIS and VVG.

xi Tailings seepage and management

A summary of the key issues related to tailings seepage and management include:

- SRW (submission 291) are concerned that the potential impacts of water seepage from the numerous dams on site, including the proposed tailing storage facility, into the local groundwater system beneath the mine have not been adequately addressed in the EES;
- EPA state in submission 514 that the Works Approval Application (WAA) does not adequately consider groundwater discharge and thus require further information; and
- The Council (submission 716) has asked since Perry Gully naturally discharges to the Mitchell River, why has it been considered to be filled with coarse sand tailings and consideration of an alternative approach does not appear to be discussed in Chapter 4 of the EES.

As discussed in Section 5.3.4, uncertainty related to tailing seepage estimates can be reduced by undertaking additional work post EES approval, keeping in mind that seepage reporting to the water table within the groundwater model are already set to a conservative rate (ie no lag times are applied, additional interception strategies including trenches or extraction bores are not simulated). The regular monitoring, and refining the modelling based on data and information collected by Kalbar, should continue throughout mine operation to determine where the seepage is occurring, whether it represents a potential hazard and then determine what mitigation measures are required. As discussed in the EES (Mitigation Register Attachment H) and more specifically within Chapter 8 of Appendix A006, management of seepage and groundwater discharging activities will be mitigated using various methods, such as decant systems, sumps, transfer pumps and sub-surface drains. In

exceptional circumstances where the seepage mound have the potential to breach relevant site-specific triggers, the installation of groundwater interception bores may be required.

As discussed in Section 5.3.4, the degree of uncertainty in the potential impacts to water quality from tailings seepage may be reduced by further investigating the leaching characteristics of the fine tailings and sand tailings using representatives of both the solid samples and the anticipated process water (eg both the Mitchell River water and Latrobe Group groundwater).

The proposed list of water management measures outlined in Table 8.6 of EES Appendix A006, generally meets the level of detail observed in an EES and other impact assessments that I have participated in across Australia. At this stage, the avoidance, mitigation, and management measures are holistic, with more details to be provided in the various management plans, which are generally provided post environmental approvals. Other tools which can be used as part of these measures and are commonly used on other mineral sand sites includes the maintenance and use of a site water balance model. These models allow mine personnel to understand how much water is being captured, stored, and pumped around the site, will assist with surface water licensing and discharge management, and will also be used to estimate losses from the system, including seepage estimates from the TSF and mine tailing cells. The numerical model should also be updated on a regular basis using the latest data collected to help predict, manage, and avoid groundwater-related impacts.

Mound seepage will be managed in accordance with the Tailings Management Plan and the Groundwater Management Plan (GMP). Based on SRW and the EPA's comments (submissions 291 and 514 respectively), these regulators require more details before water licence applications are considered and the Works Approval Application (WAA) is granted. While I acknowledge this, it is also important to acknowledge that an adaptive management strategy will need to apply to the development of the various management plans. Management plans evolve over time as more data is collected and the understanding of how the mine behaviour interacts with the surrounding environment. Any changes to these management plans must be approved by the relevant government agencies.

I have not reviewed Kalbar's WAA application to the EPA; however it is agreed that groundwater discharge will need to be considered.

I have also have not reviewed tailings location options as this outside my area of expertise.

In conclusion, I believe that seepage impacts can be managed using standard engineering strategies which are commonly used across Australian mineral sand mines. Management of seepage and groundwater discharge activities will be mitigated using various methods, such as decant systems, sumps, transfer pumps and sub-surface drains. In exceptional circumstances where the seepage mound have the potential to breach relevant site-specific triggers, the installation of groundwater interception bores may be required. These activities will be support by the various management plans and it is in Kalbar best interest, to return as much water as possible to the process water dam. Groundwater quality of the seepage is unlikely to breach the beneficial use of the receiving aquifers, although future leachate testing is recommended.

It is recommended that the following are conducted:

- Additional leach testing using representative fine tailings and sand tailings and the anticipated process water candidates (eg Mitchell River water and Latrobe Formation groundwater) should be considered.
- Development of preliminary framework groundwater and tailings management plans, with these plans finalised prior to mine commencement.
- Prior to any licence applications to SRW, update seepage estimates and related impact assessment using the latest available field and tailings data. Unsaturated modelling using such programs as VADOSE (by Geoslope) should be considered in conjunction with MODFLOW-based modelling.
- The inclusion of ongoing groundwater modelling and maintenance of a site-based water balance model to be included as part of the Proposed management measures and Kalbar's Mitigation register.
- Kalbar to consider groundwater discharge as part of their WAA application.

xii Water quality

A summary of the key issues related to tailings seepage water quality and management include:

- Uncertainties in the representativeness of the current geochemical testing used to inform the impact assessment on groundwater quality following seepage from the TSF (submissions 514 and 716).

As summarised in Section 5.3.4, tailings leachate characteristics have been inferred based on ASLP testing conducted on fine and sand tailings using de-ionised water. In addition, testing was conducted using Mitchell River water (a proposed candidate for use as mine process water), albeit on a composite ore sample. However, Latrobe Group groundwater has also been proposed as a process water candidate, and this has not been represented in the testing results undertaken to date.

This uncertainty may be mitigated by conducting additional leaching tests (Section 5.4.2xi), using representative solid tailings samples (fine tailings and sand tailings) and Mitchell River water and Latrobe Group groundwater samples as candidates of the proposed operational conditions. Ideally, these additional leach tests would be conducted as close to the proposed on-site conditions as possible (ie at the proposed tailings solid:liquid ratios expected during tailings deposition); however, replication of the ASLP 1:20 solid:liquid ratio used in the EGi de-ionised water testing would provide a like-for-like comparison on how the tailings seepage water quality varied following infiltration of rainfall (de-ionised water) versus seepage dominated by Mitchell River or Latrobe Group water to better constrain the impact on groundwater.

The Council review (submission 716) also highlighted several minor inconsistencies throughout the EES Appendix A006 (Coffey, 2020) report related to general groundwater quality characterisation, which in my opinion, does not change the overall assessment outcomes.

xiii Acceptance criteria and trigger levels

As part of EPA's review of Kalbar's draft Work Plan (Kalbar, 2020), EPA (submission 514) recommended that the Risk Treatment Plan outlined in Appendix B of the Work Plan, also includes the acceptance criteria and water quality objectives for groundwater in accordance with the SEPP (Waters). This has been included for surface water only at this stage, outlined within Table 6-1 and 6-2 of the Risk Treatment Plan.

I agree that the Risk Treatment Plan could be updated to include the acceptance criteria for groundwater, as outlined in Section 3.5.6 of the EES Appendix A006 document. However, the environmental quality objectives or environmental trigger levels need to consider site-based baseline data collected over a sufficient period and covering a sufficient project area as to allow for a robust statistical analysis. The data also needs to extend to the sensitive receptor locations and will form part of the trigger levels set at these sites which will be detailed in the groundwater and GDE management plans (see Section 5.4.2v).

At this stage, water quality objectives for groundwater can be included based on the criteria outlined by such guidelines including ANZECC 2000, Australian Drinking Water Guidelines (2018), and ANZG 2018. However, in my view these must be acknowledged to be interim objectives only, with development of site-specific groundwater quality objectives (GWQOs) to take place once sufficient site-based groundwater quality data has been collected and analysed using such methods as outlined in DSITI (2017), which describes how to use both Australian standards and site-based monitoring data to assess groundwater quality and potential environmental impacts.

This is consistent with the conditions outlined in part 3b of Section 17 of the SEPP (Waters) (Victorian Government, 2018) which states that: *the environmental quality objectives are not able to be attained due to natural levels in environmental quality indicators, in which case the background level will become the objective for the purposes of this Policy*.

It is recommended that:

- the Risk Treatment Plan be updated with the preliminary acceptance criteria and water quality objectives for groundwater in accordance with the SEPP (Waters), acknowledging that these are interim objectives only, which will be updated by site-specific groundwater quality objectives.

5.4.3 Response to submission issues raised by IAC

The IAC raised five groundwater related issues in their request for information:

- provide details of potential GDEs within the groundwater impact area, and to assess the aquifer 'source' of GDEs;
- provide clarification regarding the risk and potential impacts on the shallow aquifer from dewatering the mine pit;
- provide estimated quantity and quality of tailings seepage entering groundwater;

- provide details of the GMP and GDEMP for the mine site (and borefield) area; and
- provide information on non-registered groundwater users in the area, including spring-fed dams and unregistered bores.

i GDEs

GDEs were identified as part of the EES by EHP and Austral by firstly reviewing the National Atlas of Groundwater Dependent Ecosystems, and then undertaking a site-specific survey in the vicinity of the vicinity of the Fingerboards project area which may be at risk from tailings seepage induced mounding. The GDE survey results are shown in Figure 5.5, with the primary GDEs identified being associated with riparian vegetation and low-lying reaches of the tributaries draining the eastern and northern project area.

As mentioned in Section 5.4.2iv, the key GDE issues identified by Government submissions related to the identification, monitoring and protection of the project GDEs. Several gaps were identified regarding identification of all GDEs in the immediate vicinity of the Project, identification of source aquifer (perched or shallow) and conceptualisation. GDEs potentially impacted by mining activities can be identified and assessed using a framework outlined in Doody et al (2019), provided in Figure 5.6. Recommendations were provided in Section 5.4.2iv, including a more thorough GDE survey and assessment, which should consider the observations made by the government, local landowners, and the general community.

ii Impacts to shallow aquifers from dewatering

As detailed in Section 5.4.2ii, several key issues related to perched and shallow groundwater systems were also raised by the West Gippsland CMA (submission 358), including:

- whether the importance of ecosystems potentially reliant on perched water tables has adequately been addressed in the assessment;
- shallow aquifer impacts from the mine have not been adequately addressed; and
- an assessment of all potential GDEs within the potential impact area to assess which ones are likely to be fed by perched aquifers or the regional water table aquifer.

These issues are addressed in Sections 5.3.2, and 5.4.2iv, and within the EES (EES Appendix A006) and associated modelling (EES Appendix A006/B).

iii Tailings seepage

The third IAC groundwater issue related to tailings seepage (quantity and quality), has been addressed in Sections 5.3.4 and 5.4.2xi. Uncertainty related to seepage estimates and quality from the various site dams, TSFs and mining cells were raised as a common topic during the TRG meetings. Kalbar supplied the original mine plant processing water balance, which estimated that 1.7 GL/y or ~53 L/sec would be lost via the sand tailings stream, assuming that underfloor drains would be 40% efficient.

As previously stated, uncertainty related to tailing seepage estimates and quality can be reduced by undertaking additional work post EES approval – see Section 5.3.3 and 5.4.2x of this Statement for further details.

iv GMP and GDEMP

Section 5.4.2v provides detail on key issues related to the GMP and GDEMP including:

- the need for a GMP before any licences are issued by SRW;
- a TMP and Risk Treatment Plan is required to include information on baseline groundwater conditions in the TSF area, monitoring requirements, trigger levels, and mitigation measures; and
- a GDEMP is required to assess and monitor the health of GDEs.

I agree with the proposed list of water management measures outlined in Table 8.6 of the EES Appendix A006 . At this stage, the avoidance, mitigation, and management measures are holistic, with more details to be provided in the GMP, GDEMP and TMPs, which are normally provided post environmental approvals.

v Groundwater users

Information on non-registered groundwater users is provided in Sections 5.3.3 (spring fed dams) and 5.4.2x (groundwater bore databases WMIS and VVG) of this statement. Potential impacts to spring fed dams were brought up by SRW and other agencies during the TRG meetings, and in landholder submissions, however exact locations were never resolved. Depth to water table maps suggest the potential for a few spring locations to occur due to shallow watertable areas. Based on the Victorian Mineral Springs Database (VVG 2019), there are no mapped mineral springs in the groundwater study area. For the deep confined Latrobe Group aquifer, which is the target for borefield development, there are no areas of artesian conditions where groundwater pressures are above topography, and thus any springs in the region cannot be support by this deep system.

SLR noted that registered groundwater bores were downloaded from the Bureau of Meteorology (BoM) Groundwater Explorer database in 2018. The preferred (primary) Victorian groundwater bore database is the Victorian WMIS, with a list of current registered groundwater bores within a 10 km radius of the mine area to be updated in 2021. The VVG database will also be cross-checked with WMIS records to ensure all registered groundwater bores are reported. Non-registered bores can only be identified if advised by the bore owner or operator, or if assessed as part of a site bore/GDE field census.

5.4.4 Response to submission issues raised by local landowners

The following submissions were received from local landowners:

- Submission 108.
- Submission 123.

- Submission 202.
- Submission 268.
- Submission 369.
- Submission 568.
- Submission 691.
- Submission 693.
- Submission 743.
- Submission 812.

Set out below are my responses to the issues raised by written submission from local landowners in relation to my area of expertise. Aspects related to licensing and competing use are not addressed in this statement. Submissions concerning radionuclides are also being addressed within a separate statement by SGS.

i Chain of Ponds

Submission 812 requests that the chain-of-pond systems must be protected, with the Government having already funded $1.6m to protect and rehabilitate the system by increasing habitat connectivity in the Providence Ponds and Perry River catchment. Submission 812 is concerned that the mine and related activities will impact Honeysuckle Creek which feeds into this watercourse system.

I note that the GDE survey undertaken for the EES did not identify any chain of pond systems within or in close proximity of the project site for reasons that should be addressed within the relevant statements. Nevertheless, I have made recommendations regarding further surveys to validate and update the EES investigations in Sections 5.4.2iv and 5.4.2v of this statement.

ii Adequate monitoring and trigger levels

Submissions 268 and 812 have stated that investigations need to be conducted into the impact of any changes in groundwater quality and/or availability on the Perry River system, which is reliant on shallow aquifers to maintain supply to its chain-of-ponds. Monitoring of groundwater levels and quality must be performed frequently during the project and be publicly available to allow scrutiny. Triggers must be established and published to ensure mitigation measures are enacted to minimise further unacceptable disruption to aquifers.

I agree with the submissions (number 268, 568, 691 and 743) related to adequate monitoring and the development of trigger levels and water quality objectives. See my recommendations in Sections 5.3.1, 5.4.2iv, 5.4.2v, 5.4.2xiii in this regard.

iii Spring fed dams

Landowner submission 568 states that up to five spring fed dams exist on one of the properties, which are sourced from shallow water existing within the shallow gravel and sand seams. Some shallow bores are also used to access the same groundwater. A landowner (submission 691) also claims that three of these springs exist within the mine footprint.

The identification, assessment and protection of spring fed dams has been previous discussed in Sections 5.3.3, 5.4.2iv and 5.4.2v. Spring fed dams, where the source of water is from the groundwater system, are considered GDEs and thus all recommendations made previously which relate to GDEs apply to spring fed dams.

iv Conceptualisation

A landowner submission (number 568) has stated that the use of previous SKM reports for groundwater and surface water studies is not regarded as a reliable source of information in the district, and as such, was not used during the preparation of previous management plans within the region.

EMM and Coffey were asked by the TRG to consider the previous study undertaken by SKM (SKM, 2006) when developing the hydrostratigraphy and conceptualisation of the model domain. EMM and Coffey also considered previous studies undertaken by GHD in 2010 and 2015, which involved the development of a regional groundwater model for the East Gippsland CMA and undertook a groundwater resource study for Kalbar, respectively.

Although previous studies were considered as part of the literature review process, datasets were rebuilt using the most up-to-date datasets from the VAF, and local Kalbar datasets around the mine site and the borefield. I note that EMM's report on page 105 to 106 (EES Appendix A006/B) compares the latest modelling hydrostratigraphic layers with historical datasets from previous studies, highlighting both consistencies and differences.

v Shallow groundwater systems

Submission 691 notes that sections of creeks and tributary systems such as Moilun and Stoney Creek never dry out during the summer periods, and thus are likely fed by shallow groundwater systems. Other concerns (submissions 268, 743 and 812) relate to loss of water supply from the shallow aquifer and impacts they can cause to the Perry River and chain-of-ponds. Submission 812 noted that there seems to be a misunderstanding of the importance and extensiveness of the local shallow water system.

The occurrence of perched systems, defined as water stores that exist above the water table, has been addressed in Sections 5.3.2 and 5.4.2ii. Shallow groundwater systems exist within close proximity of the mine site. As previously stated, the assessment and recommendations outlined in Sections 5.4.2iv and 5.4.2v, suggest a comprehensive review and survey of potential GDEs to mitigate potential impacts, and this survey could incorporate the upper region of the Perry River and associated chain of ponds.

These GDEs will need to be identified, assessed, characterised, and protected in line with best practise guidelines, and will be monitored and managed under the direction of the groundwater and GDE management plans.

vi Borefield impacts

Submission 743 has questioned the impact on local groundwater supply, due to the planned borefield. Submission 743 claimed that local farmers have reported an impact to their water supply bores caused by the 4-day pumping test undertaken by Kalbar and supervised by EMM in 2019.

The water supply option study (EMM 2020b) installed loggers within the shallow bore (LA-01-SM), which screened across a shelly horizon within the Seaspray Group, at depths between 98 and 110 mBGL. No drawdown was observed within this bore and approximately 2 m of drawdown was observed within the deep monitoring bore, screen across the Latrobe Group Gravels, the target for water supply.

Given the small drawdown observed in the monitoring bores installed at the pumping test site, it is considered unlikely that any significant effect occurred at neighbouring landholder bores. Nevertheless, it is recommended that as part of the planned pumping test scheduled for 2021, with their agreement, third party bores should be monitored automatically via dataloggers and manually validated by the field hydrogeologists / pumping test technicians.

5.4.5 Response to submission issues raised by the community

Set out below are my responses to the issues raised by written submissions by the community in relation to my area of expertise. This section aims to address residual themes or comments that are significantly different from those addressed in earlier sections of this statement, and these have been categorised into common themes.

i Climate change

Submissions 355 and 813 raise general comments regarding climate changes impacts, including impacts to surface water, recharge and groundwater.

In the groundwater modelling report (EES Appendix A006/B)) EMM undertook an assessment of the impacts of climate change on groundwater related parameters, based on the framework presented in the DELWP 2016 climate change guidelines (DELWP 2016). EMM (EES Appendix A006/B) detailed the use of predictive uncertainty analysis to explore the sensitivity of model predictions to variability or uncertainty in key modelled hydrogeological parameters. It demonstrated that varying model parameters (including recharge) within plausible ranges, including the effect of climate change, does not result in any significant groundwater related impacts to the key sensitive receptors. Further detail, including the climate scenario used to predict these changes for the South Gippsland region, are provided in EES Appendix A006/B.

Kalbar intends to update the numerical groundwater flow model in 2021 to include updated drilling information, new bore details, pumping test data and other relevant information.

ii Monitoring and mitigation measures

Monitoring and mitigation measures were raised in submissions 344, 813, 837 and 887. Specific aspects of monitoring and mitigation not directly addressed in previous sections of this statement relate to regulation of groundwater monitoring, mitigation measures if groundwater supply runs dry, is contaminated or compromised by mining, and monitoring in the vicinity of stock and domestic bores.

Monitoring and mitigation procedures and measures are covered in detail in Section 5.3.1, with the steps listed to determine the avoidance and mitigation measures for each site and to establish an ongoing monitoring plan to test for impacts and effectiveness of mitigation.

The detail of the GMP, GDEMP, TMP and Risk Treatment Plan is provided in Section 5.4.2v, with tailings seepage and management details provided in Section 5.4.2xi. At this stage, the avoidance, mitigation, and management measures are holistic, with more details to be provided in the various management plans, which are generally provided post environmental approvals.

Groundwater regulation of mining projects in Victoria is undertaken by Earth Resources Regulation in conjunction with DELWP. Examples of mitigation measures are provided in Section 5.3.1, while in addition, if landholder bores are compromised (due to groundwater quantity or quality) due to mining, then Kalbar would be required to enact 'make good' provisions, which may include deepening of bores, drilling of a new bore or provision of an alternative water supply of comparable quantity and quality.

Monitoring in the vicinity of existing stock and domestic bores will be addressed by the GMP. Prior to the GMP, a field bore census will be undertaken in the vicinity of the mine site and borefield to identify and validate receptors. This will include collection of key details such as GPS location, bore depth, groundwater use, groundwater quality, bore and pump specifications, and screened interval (if known). The GMP will then incorporate the field census information and also include locations of GDEs, address uncertainties in groundwater and surface water connections, address gaps in understanding of groundwater flow or receptors, monitoring of groundwater level and quality, assessment of trends, provide water triggers, and detail reporting requirements.

iii Conceptualisation and pumping test

Submission 712 suggests that the EES contradicts and ignores the DELWP's Gippsland groundwater assessment report. Submission 889 suggests that a pumping test be undertaken, comparing actual extraction with modelled values before Kalbar receive a 'conditional licence'.

Conceptualisation and suggested improvements are detailed in Sections 5.4.2iii and 5.4.2ix (impact assessment). A considerable amount of additional data has been collected since the numerical model was constructed in late 2017, with minor updates in 2019. At the time of the EES submission, Kalbar and EMM used all available data for the hydrogeological conceptualisation.

In regard to the comment related to the studies contradicting and ignoring DELWP's Gippsland Groundwater assessment report, which states that every aquifer is in decline from a quality and quantify perspective; I do not believe this has been overlooked to the extent that the submitter suggests. The groundwater model simulated the continual decline observed within the Latrobe

aquifer. Kalbar cannot access more water than is allowed which is governed by the Permissible Consumptive Volume (PCV) from each groundwater resource.

Pending EES approval, I would support the decision to update the numerical models and impact assessment to support licence applications. This would include additional information from relevant reports and pumping test data from the borefield program planned for Q1 2021.

iv Stygofauna

Submission 712 states that there has been no study on the effects on stygofauna and ecosystem health.

Section 3.5.6 of EES Appendix A006 covers potential beneficial uses of groundwater, including water dependent ecosystems which are based on the EHP 2019 assessment. Stygofauna are not considered to be ecosystems dependent on regional groundwater, as there is no recorded occurrence of stygofauna within the project area, and limestone karst conditions that potentially support assemblages of stygofauna are not present in the project area (EHP 2020).

I have addressed GDEs more broadly elsewhere in this statement.

6 Water balance implications

In November 2018, Kalbar supplied an entrainment estimate of 1,110 ML/year within fine tails. In January 2021, Kalbar advised EMM that this rate was incorrect as it assumed 80% recovery of water from the fines slurry using 'Mud Masters', when a realistic estimate was 50% recovery. Changing the recovery rate to 50% would result in a loss of water to entrainment of 2,800 ML/year (ie a significant change to the water balance).

As a result of the fine tails entrainment error, EMM has re-run the site water balance. Based on the median annual rainfall scenario, total make-up water requirement has increased from 3 GL/year to 5.1 GL/yr. The water balance assumes a make-up water split between the Mitchell River and the borefield to be ~ 2.9 GL/year and ~2.2 GL/year, respectively.

Changes to the water balance which are relevant to the groundwater assessment include:

- The groundwater model (EES Appendix A006/B) assumed water entrained within fine tails is not free draining, thus the model never considered seepage from this source. All seepage within the groundwater model is assumed to originate from the sand tails. Thus the error in the water balance does not change the assumption to tailing seepage and the assessment related to tailing induced mounding remains unchanged.

- The groundwater model simulated two borefield scenarios:

    - The first scenario assumed all make-up water (3 GL/year) comes from the borefield for the first three years of operation, at which time, all water comes from the Mitchell River from year four onwards.

- The second scenario assumed that 3 GL/year comes from the borefield for the full 15-year mining operation. This second scenario, originally designed to be a conservative scenario in terms of quantifying drawdown impacts, is now the more plausible scenario, assuming at least 2 GL/year can be secured via a Mitchell River winter fill license. If more than 2 GL/year can be secured from the Mitchell River, then the amount of water from the borefield will reduce from 3 GL/year.

In conclusion, the revised tailing entrainment losses does not change the risk associated with groundwater mounding, since the majority seepage is likely to occur from the sand tails and not the fine tails. From a borefield perspective however, a make-up water requirement between 2 and 3 GL/year would be required for the full 15-year mine operation, assuming that Kalbar can also secure via a Mitchell River winter fill license.

7 Review and recommendations

I am of the view that the information provided within the EES Appendix A006 and its supporting studies generally meets the typical standard of groundwater impact studies within Australia and that the groundwater impacts have been adequately captured and the risks have been identified. The management and mitigation measures which have been identified are holistic at this stage and represent standard practises for mineral sand mines across Australia. Notwithstanding, there is opportunity for future improvement to reduce data gaps and refine the hydrogeological understanding related to key aspects including GDE identification, groundwater conditions in data-poor locations and at receptors, refine the understanding of seepage rates and how it behaves in the unsaturated zone, refinement of the hydrogeological understanding at the borefield and associated modelling.

To reduce data and knowledge gaps, refine the hydrogeological understanding of the project, support license applications, support work approvals and reduce residual risks, it is recommended the following work be undertaken post conditional approval of the EES:

- Undertake a survey to identify chain of pond areas as outlined by West Gippsland CMA. Survey should be extended to include a health/condition assessment, whether water within the ponds is observed and GDE likelihood.

- Consider updating text within the EES and Appendix A006 related to conceptual hydrogeology and groundwater quality to ensure accuracy and consistency between reports.

- Undertake a more thorough GDE identification study to assess level of groundwater dependence and develop conceptual models using the IESC guidelines (Steps 1 to 3).

- As part of the above, undertake a sensitive receiver field census (including third party bores, see dot point below) with local landowners and government agencies.

- Development of preliminary framework for the groundwater, GDE and tailings management plans, with these plans finalised as part of the post approval works. At this stage, the preliminary GDE plans will likely cover off on steps 1 to 3 as outlined by the GDE IESC guidelines.

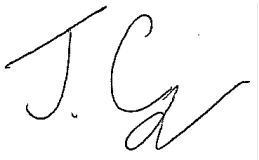
- Installation of a groundwater monitoring bore network at regional locations which target key risk areas, including groundwater users and GDEs. Bores at locations between the water affecting activity and the sensitive receiver may also be required to allow for advance warning of potential impacts, although these can be installed at a later date. This recommendation supports the development of conceptual models as outlined in Step 3 of the IESC guidelines and supports Step 4 moving forward.
- Installation of in situ groundwater level data loggers at key monitoring bore sites should be considered.
- Installation of two additional monitoring sites to the west and north of the project site, as recommended by Council. Incorporate the new monitoring bores into the overall baseline monitoring program.
- Update the list of current registered groundwater bores (to 2021), and source this information from the Victorian WMIS, with cross-checking to be done between WMIS and VVG.
- Additional leach testing using representative fine tailings and sand tailings and the anticipated process water candidates (eg Mitchell River water and Latrobe Formation groundwater) should be considered.
- Update Kalbar's Risk Treatment Plan with the preliminary acceptance criteria and water quality objectives for groundwater in accordance with the SEPP (Waters), acknowledging that these are interim objectives only, which will be updated by site-specific groundwater quality objectives.
- Kalbar continue to log for water cuts during any future resource drilling program.
- Undertake several groundwater and GDE monitoring events before mining commences to inform baseline conditions and setting of water quality objectives and trigger levels.
- Implementation of MODFLOW-USG modelling code for the groundwater model.
- Alter model boundary conditions at the coast within the groundwater model, to give a hydraulic separation between static ocean cells and depressurising Latrobe Group cells.
- Include additional groundwater modelling scenarios in predictive uncertainty analyses (supported by additional tailings and soil data), including numerical separation of the influence of mine-related tailings seepage and groundwater extraction.
- Installation of one or two production bores and associated shallow and deep monitoring bores at the intended borefield.
- Pumping tests of new borefield production bores to confirm target supply rate of 15 L/s, with associated minimal drawdown impacts.

- Update the groundwater flow model for the site (see dot-point below) and borefield, including calibration to the 2021 planned pumping test, simulation of pumping scenarios and assessment of predicted drawdown.
- Prior to any license applications to SRW, update seepage estimates and related impact assessment using the latest available field and tailings data. Unsaturated modelling using such programs as VADOSE (by Geoslope) should be considered in conjunction with MODFLOW-based modelling.
- Once a winter fill license is secured from the Mitchell River the required groundwater make-up supply from the borefield should be simulated via the numerical model.
- The inclusion of ongoing groundwater modelling and maintenance of a site-based water balance model to be included as part of the proposed management measures and Kalbar's Mitigation register.
- Kalbar to consider groundwater discharge as part of their WAA application.

8 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 Inquiry and Advisory Committee.

Yours sincerely



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Appendix A

CURRICULUM VITAE

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Joel Georgiou

Principal Hydrogeologist

Curriculum vitae

Joel is an experienced hydrogeologist, groundwater modeller and project manager with 18 years' industry experience across New South Wales, Victoria, South Australia and Western Australia. His key areas of expertise are in mining impact assessments, designing and implementing drilling programs, monitoring programs, pumping tests, and groundwater modelling (including solute transport and plume modelling) to inform various baseline studies and environmental impact assessments.

Joel has been a consultant to mining companies across various commodities and environments, and worked in-house as a senior mining hydrogeologist. He has provided strategic advice and support on hydrogeological issues for operating mines and for project teams developing new mining prospects.

Qualifications and memberships

- Master of Hydrogeology, University of Western Australia, 2016
- Bachelor of Science (Hons I), Flinders University, 2002
- Bachelor of Science (Hydrogeology and Geophysics), Flinders University, 2001
- International Association of Hydrogeologists – member since 2003
- Australian Institute of Geoscience (RPGeo status) – member since 2014

Career

- EMM Consulting, 2017–present
- Principal Hydrogeologist, Land & Water Consulting, 2016–2017
- Senior Mining Hydrogeologist, Iluka Resources, 2011–2016
- Senior Hydrogeologist/Modeller, RPS Aquaterra, 2003–2011
- Hydrogeologist/Groundwater Modeller, Australian Water Environments, 2002–2003
- Part-time Hydrogeologist, URS, 2001–2002

Area of expertise

- Saturated and unsaturated groundwater modelling and particle tracking for mine dewatering, water supply and salt interception
- Groundwater supply and resource investigations
- Groundwater impact assessment for mining developments
- Hydrologic studies, assessments and modelling, data analysis, conceptualisation and management
- Design and management of hydrogeological field investigations
- Monitoring, production and injection well design and installation
- Pumping test design, execution and analysis
- Development and training of water balance tools
- Project management and reporting
- Solute transport modelling
- Density coupled modelling
- Quality control and auditing

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Representative experience

- Balranald Project, baseline aquifer assessment, installation of monitoring, production and injection wells, groundwater modelling and impact assessment, Balranald NSW (Iluka Resources)
- Lake Cowal Mine expansion, independent review of the underground gold mine and impact assessment and modelling. Project Director responsible for overall hydrogeological delivery of the open cut expansion phase and impact assessment (Evolution, NSW)
- Great Cobar Mine expansion, Project Director responsible for overall hydrogeological delivery of the proposed underground expansion and impact assessment (Aurelia Metals, NSW)
- Cataby Project, mine dewatering and disposal trials and management plan, groundwater dependant ecosystem study, Cataby WA (Iluka Resources)
- Jacinth-Ambrosia Mine, water balance development, baseline assessments and management plan, Eucla Basin SA (Iluka Resources)
- Lang Lang Water Treatment Plant, water supply well installation, detailed screen size/gravel pack analysis and well design, Lang Lang Vic (South East Water)
- Beverly Uranium Mine, groundwater and aquifer characterisation and conceptualisation, groundwater model development and fate transport, Northern Flinders Ranges SA (Heathgate Resources)
- Ashton Coal, aquifer characterisation and conceptualisation, impact and DGRs assessment, Hunter Valley NSW (Ashton Coal)
- Fingerboards Project, Lead hydrogeologist for new mineral sands mine in Gippsland, VIC. Led modelling, impact assessments, field programs and expert witness (Kalbar Resources)

Publications

- Middlemis, H, Georgiou, J, Walker, G, Jolly, I, and Mathers, K 2004, Groundwater modelling to quantify saline inflows to the River Murray and to optimise salt interception schemes near Waikerie, South Australia, in proceedings at *1st National Salinity Engineering Conference*, Perth, Western Australia, 9-12 November 2004.

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Appendix B

INSTRUCTIONS

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WHITE & CASE

15 September 2020

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By email: jgeorgiou@emmconsulting.com.au

Confidential and subject to legal professional privilege

Dear Mr Georgiou

Fingerboards mineral sands project

We act as legal advisors to Kalbar Operations Pty Ltd (**Kalbar**), the proponent of the Fingerboards mineral sands project (**Project**).

This letter confirms and sets out the scope of your retainer to prepare an expert witness statement and potentially also present evidence at the inquiry hearing to be held in relation to the environment effects statement (**EES**) prepared for the Project pursuant to the *Environment Effects Act 1978* (Vic).

1. The Project

Kalbar proposes to develop the Project on an area of approximately 1,675 hectares within the eastern part of the Glenaladale mineral sands deposit in East Gippsland, Victoria. The Project site is located near the Mitchell River, approximately 2 km south of Glenaladale, 4 km south-west of Mitchell River National Park and 20 km north-west of Bairnsdale.

The Project includes the development of an open cut mineral sands mine and associated infrastructure. It is expected to have a mine life of 15–20 years and involve extraction of approximately 170 Mt of ore to produce approximately 6 Mt of mineral concentrate for export overseas.

2. Panel and EES inquiry

The EES and the studies and assessments that underpin it (together with a draft planning scheme amendment and application for an EPA works approval) are presently on public exhibition until the end of October 2020.

The inquiry is scheduled to convene its directions hearing on 13 November 2020, and the inquiry hearing is scheduled to commence on 7 December 2020. We will keep you informed of any relevant directions, including the timetable for filing evidence and, if required, any expert conferences.

3. Scope

This letter is confirmation of your engagement as an independent expert to:

(a) prepare an expert witness statement in which you:

(i) set out your background and relevant expertise;

15 September 2020

(ii) briefly describe and summarise the Groundwater Modelling report prepared in support of the EES and your role in preparing it. In particular, we ask that you detail whether there is anything in the report that you disagree with or wish to elaborate on and set out any additional information that you consider necessary to include, including any additional assumptions; and

(iii) consider the submissions that are relevant to your area of expertise and respond to any issues raised; and

(b) if required, prepare and present expert evidence at the inquiry hearing.

We will provide further instructions on the scope of your engagement and any new instructions as necessary.

4. Form of your expert witness statement

The form and content of your expert witness statement should be prepared in accordance with Planning Panel Victoria's *Guide to Expert Evidence* (**Guide**). We enclose a copy of the Guide for your reference. Please review the Guide and ensure your witness statement addresses the matters set out in it, in particular those matters listed under the heading 'The expert witness statement'. Please contact us if there is anything in the Guide that you do not understand, or if you have questions in relation to it.

Until your expert witness statement is in final form it should not be signed. You should, however, be aware that unsigned documents may need to be disclosed to other parties.

5. Your duties and responsibilities as an expert witness

Even though you are engaged by Kalbar, you are retained as an expert to assist the inquiry, and you have an overriding duty to it. The inquiry will expect you to be objective, professional and form an independent view as to the matters in respect to which your opinion is sought.

6. Timing

The timing for completion of your expert witness statement is to be advised. We will let you know as soon as we can.

7. Conflict of interest

It is important that you are free from any possible conflict of interest in providing your advice. You should ensure that you have no connection with any potential party to this matter that could preclude you from providing your opinion in an objective and independent manner.

8. Costs and invoicing

EMM Consulting will continue to be contractually engaged by Kalbar and Kalbar will continue to be responsible for the payment of your fees. Your accounts should be sent directly to the appropriate person nominated by Kalbar.

15 September 2020

9. Confidentiality

Your engagement and any documents you prepare under it should be marked "Confidential and subject to legal professional privilege".

If anyone other than ourselves, Kalbar or its technical advisers contact you about this engagement or the work you are undertaking under this engagement, please contact us immediately.

If you have any questions about this letter or require any additional information, please contact us.

Yours sincerely,

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Enc: Planning Panel Victoria's *Guide to Expert Evidence* - April 2019

Appendix C
SUBMISSION TABLES

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C.1 Government submission table

Submissi	Who	Section	Page	Comment	Response/notes	Theme	Sub-theme
291	SRW	4	3	More drilling, conceptualisation and modelling around the borefield. Need further info on the geology to the north as well (info from Matt?)	Risk 3.1 is underway, following by conceptualisation and modelling.	Groundwater	Impact assessment
291	SRW	6	4	SRW is concerned that the potential impacts of water seepage from the numerous dams on site including the proposed tailing storage facility, into the local groundwater system beneath the mine have not been adequately addressed in the EES.	Mounding on local ecology and veg communities will be managed via a GMP and appropriate TARP. This may also relate to the other comments regarding tailings seepage and water quality - assessments have been made on a limited set of conditions, which provide a reasonable initial study but may require expanding (for example, the ASLP work on de-ionised water has raised concerns about how representative it is to the proposed operations, which may use either Mitchell River water or Latrobe Group groundwater as process water).	Groundwater	Tailings seepage
291	SRW	7	4	SRW require a detailed GMP (and Surface water MP) before any licenses are issued.	Noted	Groundwater	GMP
358	WG CMA	Intro	1	Chain of ponds are described as a waterway consisting of irregularly spaced, deep pools separated by a grassy depression or shallow undefined channel. Morphology is recognised as a priority environmental value and is a key aquatic asset. Also has cultural significance.	Noted	Groundwater	Chain of Ponds
358	WG CMA	Intro	3 & 4	27 mapped ponds, some just located south of the TSF. Concerns of permanent loss of geomorphic features. Erosion and sediment load highlighted as major risks.	Did EH Partners map these ponds directly south of the TSF? I don't think they recognised these as chain of ponds features	Groundwater	Chain of Ponds
358	WG CMA	Intro	4	Large management dam proposed to be constructed on Honey suckle creek is on top of mapped springs.	Jarrah to address offset strategy	Surface water	Management Dams
358	WG CMA	Groundwater	9 & 10	Need monitoring at the borefield, mainly to protect shallower aquifers	Agreed & part of the Borefield GMP	Water supply	GMP
358	WG CMA	Groundwater	9 & 10	A program to further assess and monitor the health of GDEs	GMP and GDE MP required	Groundwater	GDE MP and GDEs
358	WG CMA	Groundwater	9 & 10	Greater understanding of the source water for Providence ponds	Kalbar may need to commision site specific studies (isotope analysis etc)	Groundwater	GDEs
358	WG CMA	Groundwater	9 & 10	Greater understanding and occurrence of perched/shallow groundwater and influence on GDEs	The only bore at the site with evidence of perching is MW07, depths are still >30 mbgl. Use drilling statisitics to further clarify.	Groundwater	Perched systems
514	EPA	6.2	15 & 16	EPA is concerned that the capture and re-use of process water may cause increases in the concentration of leachable analytes over time. As such, there is potential for the quality of water seeping from the tailings to increase above background levels over time, thereby posing a changing risk profile to protected beneficial uses as the Project progresses.	Discharge via tailings seepage requires a license and the beneficial use is high, hence the scrutiny. Management strategies would include managed discharge to river (before exceedances are measured) and discharge to evaporation basins over time, with sludge eventually disposed over to either an EPA licensed facility or bio-farmed on site for reuse in rehabilitation. Changes in captured process water quality and reuse will be affected by the methods used in treatment - eg settling ponds, exposure to (clean) rainwater etc, so it isn't necessarily the case that water quality will worsen over time.	Groundwater	Water quality
514	EPA	6.2	16	EPA recommends that GW15 in the Water Quality and Hydrology Risk Treatment Plan (Table 7-1) and the Mitigation Register be amended to read: Management techniques, such as underdrains, sumps and water recovery pumps will be used to maximise the recovery of water in the mine void ~~tailings containment cells~~ for both fine and coarse tailings.	Noted	Groundwater	Risk assessment
514	EPA	6.2	16	Monitoring- EPA want a monitoring program outlined about how water quality will be measured /monitored prior to placement within tailing cells. EPA recommends that the Water Quality and Hydrology Risk Treatment Plan (Table 9-2) and the EMF (Table 12.9 Monitoring Programs Groundwater) be amended to include a new monitoring program of water draining from the tailings prior to their placement in the mine void. EPA recommends that the Water Quality and Hydrology Risk Treatment Plan (Table 7-1) be amended to include corrective actions that would be implemented should the results of this monitoring exceed specified risk-based trigger levels.	Related to tailings management plan and Risk Treatment Plan (Appendix B to Kalbar's Draft WorkPlan document).	Groundwater/ Surface water	GMP, Risk assessment
514	EPA	6.2	17	Tables 6-1 and 6-2 of the Water Quality and Hydrology Risk Treatment Plan provides acceptance criteria for surface waters. The Plan does not set out the acceptance criteria for groundwater. EPA recommends that the Water Quality and Hydrology Risk Treatment Plan (Table 6-1 and Table 6-2) be amended to include acceptance criteria for groundwater in accordance with SEPP (Waters) and to make it clear that the background level (as defined in SEPP (Waters)) will become the objective where it is better than the environmental quality objective.	Control charts (DSITI, 2017) will need to be developed based on site data and then also compared to the SEPP (Waters) to determine SSTLs. This is normally done as part of the GMP, but increased pressure to move this forward in the process.	Groundwater	Trigger levels
514	EPA	7	32	The WAA does not consider groundwater discharge and thus EPA requires further info.	Is this referring to discharge into groundwater - ie seepage infiltration into underlying groundwater? If so, this is one of the main focusses of the water quality assessments.	Groundwater	Water quality / tailings
514	EPA	7.1	33	Statement only- Regarding the WAA, EPA will undertake such a technical review with particular focus on whether all reasonable steps have been taken in the proposed treatment of mine water to meet WQO, minimise potential risk from discharges, reduce the size of any mixing zone in the Mitchell River (if such a zone is required) and any groundwater discharge and plume.	Noted	Groundwater	EPA licensing

514	EPA	7.2.2	34	EPA will formally request further information from the Proponent to inform its determination of the WAA. As outlined in section 6.2 of this submission, further information will be sought on the measures proposed to minimise the discharge, the concentrations of any potential contaminants, along with demonstration that either the discharge will not exceed the environmental quality objectives specified in SEPP (Waters) or that risks to beneficial use of groundwater are minimised and are not unacceptable.	Noted	Groundwater	EPA licensing
552	EG CMA	1	2	The Mitchell River is the largest unregulated river in VIC, and is listed as a Heritage River in Victoria (Heritage Rivers Act, 1992)	Noted	N/A	N/A
552	EG CMA	1	3	The Gippsland Lakes was listed as a Ramsar site in 1982 and meets 6 out of the 9 criteria for identifying Wetlands of Internationally Importance.	Noted	N/A	N/A
552	EG CMA	Table 1	Issue P1	EG CMA are concerned that example measures are unquantified. They want sub-plans that require quantifiable and measurable performance standards. They don't like the generic terms such as " where practicable, reduce suspended sediments levels..."	Need considerable amount of baseline data to set initial triggers levels (SSTLs), while also considering the SEPP (Waters)	Groundwater	GMP
552	EG CMA			Overall quite negative- more concerned with surface water, erosion, stability and long term rehabilitation	General statement	N/A	N/A
716	EG council / SLR	Ex Summary	pg 6	Lists briefly the main concerns related borefield and seepage impacts	Noted	Groundwater	N/A
716	EG council / SLR	2.4	22	Brief recommendations on what the GMP should include.	Noted, this is also recommended in Section 3.5.	Groundwater	GMP
716	EG council / SLR	2.5	28	Boisdale Formation sands and gravels are reportedly under the deposit (p.40) and table 3-4, but these are not shown on the cross-section through the site (figure 3-3), nor discussed (p.46).	Agreed. Coffey to address.	Groundwater	Conceptualisation
716	EG council / SLR	2.5	28	EES Table 8.2 does not mention Balook Fm / Latrobe Valley Group. This is inconsistent with EES 8.3.3.1 (Figure 8.3) and the groundwater modelling which assumes Balook Fm / Latrobe Valley Group occur beneath the site (bore MW09d) and receive seepage (if seepage occurs) from tailings in mine voids (Figure 8.17). If not present, the seepage from mine voids would only be to the Coongulmerang Fm.	Agreed. Coffey to address.	Groundwater	Conceptualisation
716	EG council / SLR	2.5	28	Improvements regarding conceptualisation- Include data from groundwater monitoring bores on the site on a north-south hydrogeological cross section that extends from south of the proposed bore field, north through the site.	Suggestions only, not fatal flaws	Groundwater	Conceptualisation
716	EG council / SLR	2.5	28	Improvements regarding conceptualisation- Prepare a west-east hydrogeological cross section extending through the whole site to beneath the Woodglen ASR	Suggestions only, not fatal flaws	Groundwater	Conceptualisation
716	EG council / SLR	2.5	28	Improvements regarding conceptualisation- A west-east hydrogeological cross section through the whole site, showing the variation in lithology in the Coongulmerang Fm (this is modelled with uniform properties, see Table 5-1).	Suggestions only, not fatal flaws	Groundwater	Conceptualisation
716	EG council / SLR	2.5	28	Uncertainties with inferred GW direction- It is stated that groundwater beneath the site does not move west towards the Perry River catchment (report A006, p.144).	Noted. Two additional bores would be useful.	Groundwater	GW direction
716	EG council / SLR	2.5	28	Uncertainties with inferred GW direction- There is insufficient groundwater bore data at the site and vicinity (e.g. see fig 4-14) to support that assertion.	Noted. Two additional bores would be useful.	Groundwater	GW direction
716	EG council / SLR	2.5	29	Uncertainties with inferred GW direction- An alternative interpretation on the data presented, is groundwater beneath the east half of site flows toward Mitchell River, and beneath the west half of site toward Perry River. This possibility does not appear to have been considered in the model conceptualisation and risk assessment.	Unlikley. This assumes a groundwater divide exists at the site. Groundwater contours, at least contoured by EMM, also consides the VAF contours. Granted, the site could benefit from 2 additonal bores located west and north.	Groundwater	GW direction
716	EG council / SLR	2.5	29	There appear to be no figures that show the modelled groundwater elevation and groundwater flow direction pre-mining, and after 15 years operation, at the site and vicinity.	Noted	Groundwater	Modelling
716	EG council / SLR	2.5	29	The figures in Appendix F of the model report do not have sufficient detail in the site vicinity.	Noted	Groundwater	Modelling
716	EG council / SLR	2.5	29	Aquifer test report (A007)-Pumped at a rate significantly lower than potential rate from at bore field.	10 L/s compared to a targrt of 15 L/s. Further tests are planned for 2021.	Water supply	Pumping test
716	EG council / SLR	2.5	29	Aquifer test report (A007)- Maximum drawdown approximately 2 m in Latrobe Group in aquifer test.	Noted	Water supply	Pumping test
716	EG council / SLR	2.5	29	Aquifer test report (A007)- Insufficient pumping rate and time to enable assessment the properties of the overlying aquitard (i.e. vertical hydraulic conductivity).	How long is long enough?	Water supply	Pumping test
716	EG council / SLR	2.5	29	Aquifer test report (A007)- There is no discussion on vertical hydraulic conductivity of aquitard.	Not explicitly, but groundwater levels did not move, implying very tight bulk vertical hydraulic connectivity.	Water supply	Pumping test
716	EG council / SLR	2.5	29	Aquifer test report (A007)- Section 4.2 the potential drawdown (> 50m) could be an underestimate, as this assumes the Latrobe Group is infinite extent. [The groundwater model report indicates significantly less drawdown (up to 14m)].	Analtyical model is overly simplified, compared to numerical model which takes into account boundary conditions, layering and heterogeneity. Futher modelling should simulate pumping test results numerically.	Water supply	Pumping test
716	EG council / SLR	2.5	29	Aquifer test report (A007)- There is no mention of groundwater temperature and whether this changed over the test [geothermal properties is a relevant beneficial use].	Noted	Water supply	Pumping test

716	EG council / SLR	2.5	29	Groundwater users- Registered groundwater bores were downloaded from BoM Groundwater Explorer in 2018 (p.54). The Victorian Water Management Information System is the primary data source and should be checked for current registered bores.	Noted	Groundwater	Risk assessment
716	EG council / SLR	2.5	29	Groundwater users- The groundwater model report states the locations of off-site groundwater extraction used in the groundwater model are from a report dated 2010 (model report Table 2.1).	Data complied by GHD up to 2010. Allocations generally have been met by 2000, and thus appropriate for impact assessment level.	Groundwater	Modelling
716	EG council / SLR	2.5	29	Groundwater users- The location of as of right uses (stock and domestic bores, springs) is subject to error, and it is possible not all are registered. The assessment of groundwater users should be updated, and a bore census undertaken in the inferred impact area.	Bore census and spring fed dams should be located and survey. Receptors should form part of GMP and GDE MP.	Groundwater	GDEs
716	EG council / SLR	2.5	29	Groundwater users- Further testing and assessment will be needed to optimise bore locations and yields, and to minimise drawdown impacts.	Agreed. Plans in place for 2021.	Groundwater	Pumping test
716	EG council / SLR	2.5	30	Groundwater users- Perry Gully (discharges to Mitchell River) is to be filled with coarse sand tailings. Consideration of an alternative approach does not appear to be discussed in EES Chapter 4	Not strictly a groundwater question. More related to tailings management.	N/A	Tailings management
716	EG council / SLR	2.5	30	GDEs- Approach based on public data	Statement only. EH Parters also undertook field surveys	Groundwater	GDEs
716	EG council / SLR	2.5	30	GDEs- Confusion about Perry River. EES says it's a siginificant GDE, but GDE assessment says its not.	Some site survey required, along with a nested bore to characterise local hydrogeology. Also to be used as part of GDE MP. Parts of the Perry River, similar to Chain-of-Ponds, may be fed by groundwater, but likeley from a local perched system, rather than connected to the regional water table. VAF indicated depth to water > 30m in most areas. To be confirmed with updated Figures from Kalbar (EMM to action). Coffey to update text in EES.	Groundwater	GDEs
716	EG council / SLR	2.5	30	Impact- Modelled water table level and water table change are used to assess potential impacted GDE (see comments below on the model).	Noted	N/A	GDEs
716	EG council / SLR	2.5	30	Impact- Uses an arbitrary sliding scale of GDE "sensitivity" based on the type of GDE. This approach does not appear to consider the change in the "quality" of groundwater discharging to the GDE.	Coffey uses the Victoria Government guidelines (2015) for Consequence and Likelihood to inform impact risk. EMM's assessment also considers salinity as well as depth to water (introduces Classes)	Groundwater	GDEs
716	EG council / SLR	2.5	30	Impact- Assessment focusses on the quality of tailings seepage water and does not appear to consider the water quality impact of displacement and increased discharge of "natural" groundwater (groundwater quality is discussed below).	Recommendation to assess these uncertainties more further in the risk assessment	Groundwater	Impact assessment
716	EG council / SLR	2.5	30	Impact- Unclear the impact of increased groundwater discharge throughout the year, and also possible change of drainage lines from intermittent to perennial flow.	Recommendation to assess these uncertainties more further in the risk assessment	Groundwater	Impact assessment
716	EG council / SLR	2.5	30	Mitchell River- There is uncertainty in the current groundwater contribution to Mitchell River. EES 8.3.3.1 reports groundwater to Mitchell River of 14.17 GL/year (groundwater model) and analysis using river gauge indicates 29 GL/year.	The 14 GL/yr is modelled and the 29 GL/yr is estimated. They are consistent as far modelling is concerned and is clearly stated in the EMM report. Perhaps make it clearer in the EES document.	Groundwater	Modelling
716	EG council / SLR	2.5	30	Mitchell River- Mitchell River is modelled with a fixed water level. This means the change in groundwater level adjacent the river might be underestimated.	The primary flux in the groundwater model is the addition of groundwater via seepage. Some of this water is simulated to discharge to the Mitchell River and is effectively removed from the groundwater model. Given that the Mitchell River is primarily baseflow-driven, additional surface water flow is not expected to have a significant impact on groundwater levels adjacent to the river.	Groundwater	Modelling
716	EG council / SLR	2.5	30	Mitchell River- There is a modelled increase in groundwater flow to the river of 0.72 ML/day throughout the year due to mounding (report A006, p.232). The river level is not modelled to change seasonally, and so it is likely that in dry conditions, the additional groundwater discharge to the river will be higher than this amount.	The modelled river level was assigned to represent long-term average conditions. The modelled increase in baseflow to the Mitchell River is 0.72 ML/day for the base case model. An additional 50 model runs were performed as part of the predictive uncertainty analysis, of which induced fluxes to/from the Mitchell River were analysed. The reported increase in baseflow is considered conservative with regards to likely and potential hydraulic parameters, as both the 'worst case' and 'best case' scenarios returned smaller increases in modelled baseflow.	Groundwater	Modelling
716	EG council / SLR	2.5	30	Exisiting Conditions- Appendix A006: groundwater can have high phosphorous and elevated salinity (e.g. p.60 and Table 4-17 MW04 adjacent Mitchell River >2000 mg/L TDS, phosphorous 0.48 to 6.24 mg/L).	Noted	Groundwater	Water quality
716	EG council / SLR	2.5	30	Exisiting Conditions- Table 4-18 - many Coongulmerang Fm groundwater samples exceed beneficial use criteria.	Noted	Groundwater	Water quality
716	EG council / SLR	2.5	31	Exisiting Conditions- Latrobe Group groundwater – bore field LA-01-PB Total-P 0.38 mg/L (A0007; Table 3.5).	Noted	Groundwater	Water quality
716	EG council / SLR	2.5	31	Exisiting Conditions- Appendix A006 section 10.2 refers to fresh water (surface water and groundwater). Groundwater cannot be considered "fresh water" similar to Mitchell River water or rainwater (as Latrobe Group groundwater is >500 mg/L TDS).	Noted	Groundwater	Water quality
716	EG council / SLR	2.5	31	Water quality potential impact- The displacement and increased discharge of groundwater that currently has elevated concentrations that exceed criteria do not appear to be discussed.	Recommendation to assess these uncertainties more further in the risk assessment	Groundwater	Water quality
716	EG council / SLR	2.5	31	Water quality potential impact- The risk of additional impact if mainly Latrobe Group groundwater is used as process water (different quality to Mitchell River) does not appear to have been considered.	While the Latrobe Group groundwater is considered to be within the natural range of groundwater observed across the site, an answer to this is to run additional leach testing to look at Latrobe Group water in relation to tailings seepage. In lieu of additional testing, the 1:5 leach Mitchell River test reports among the higher concentrations and may be considered as the 'worst case', since it is a low dilution test, using real leachate and on an ore sample (which may be considered a source term).	Groundwater	Water quality

716	EG council / SLR	2.5	31	Water quality potential impact- Appendix A006 p.143 Latrobe Valley Group / Balook Fm are recharged from seepage from the Coongulmerang Fm (and shown fig 6-1). The impact on water quality and beneficial uses of Latrobe Valley Group / Balook Fm from seepage from tailings does not appear to have been considered.	Ties back to tailings seepage and water quality- my understanding is that this is fairly limited and given that the Latrobe aquifer is deep, it is not expected to impact drinking water	Groundwater	Water quality
716	EG council / SLR	2.5	31	Leachability Testing- Appendix A006 Table 7-7 shows the 1:5 leach Mitchell River water many analytes are at least one order of magnitude higher than the test with deionised water.	Agree - this may be a function of the lower dilution of the test. Also note that this is on a composite ore sample. EMM have suggested additional testing to improve representativeness.	Groundwater	Water quality
716	EG council / SLR	2.5	31	Leachability Testing- Total phosphorous 1.07 mg/L is not highlighted in the table to show it exceeds ecosystem criteria.	Noted	Groundwater	Water quality
716	EG council / SLR	2.5	31	Leachability Testing- There appears to have been no testing using Latrobe Group groundwater.	Noted	Groundwater	Water quality
716	EG council / SLR	2.5	31	Water balance- The volume of groundwater to be used in operation is not known, and subject to how much is available from the Mitchell River.	Noted	Groundwater	Water balance
716	EG council / SLR	2.5	31	Water balance- The assumed 16 ML/yr. in water balance appears low given the volume needed for processing and the rules / restrictions for the Mitchell River and needs of downstream irrigators.	Noted	Surface water	Water balance
716	EG council / SLR	2.5	31	Water balance- Extraction of groundwater up 3 GL/yr. is modelled for the impact assessment.	Noted	Groundwater	Water balance
716	EG council / SLR	2.5	31	Software & structure- Using MODFLOW-USG allows better representation of discontinuous geological units. Include a cross-section showing the model layers.	Noted	Groundwater	Modelling
716	EG council / SLR	2.5	32	Software & structure- Table 2.1 notes pumping well locations in the modelled area are from a 2010 report – the suitability of that data should be discussed.	Data compiled by GHD up to 2010. Allocations generally have been met by 2000, and thus appropriate for impact assessment level.	Groundwater	Modelling
716	EG council / SLR	2.5	32	Software & structure- Include discussion of the effect of Latrobe Group groundwater temperature on modelled Latrobe Group groundwater elevation.	The USGS states that at 30°C the density of water is approximately 995 kg/m3 (compared to 998 kg/m3 at 20°C). Converting to an equivalent freshwater head using the methodology by Post et al (2007) and data from LA-01 PB (WRK105962), a screen depth of 400 mbgl and a pressure head of 83 mbTOC gives an equivalent freshwater head of approximately 83.7 mbTOC. Considering the magnitude of this difference against the induced pressure changes during the model, groundwater temperature is not considered significant with regards to groundwater pressure and equivalent freshwater heads.	Groundwater	Modelling
716	EG council / SLR	2.5	32	Boundary Conditions- The implication of a constant head boundary at the northern edge of the model (near the site) is not discussed in model report Section 9, nor whether a different boundary would impact the model.	See below	Groundwater	Modelling
716	EG council / SLR	2.5	32	Boundary Conditions- Constant head "… represent groundwater inflow from highlands …" (section 4.8) requires justification - is this from Palaeozoic bedrock?	The constant head boundary conditions at the northern edge of the model allow groundwater flux from approximately 50 m below the surface through the Latrobe Valley Group. This is conceptualised as regional throughflow from higher in the catchment, ie bedrock. Fluxes through these cells are of a similar magnitude to rainfall, suggesting that the removal of these cells from the model would have minimal impact on model calibration and prediction performance.	Groundwater	Modelling
716	EG council / SLR	2.5	32	Boundary Conditions- Table 5.2 shows constant head plus leakage from rivers is major source of water to the model. The modelled drawdown from the bore field north of the site might be underestimated.	Modelled drawdown in the Latrobe Group Gravels is simulated to recover by the end of mine year 15. At this time residual mounding greater than 1 m is present due to modelled seepage from tailings. EMM do not consider there to be a significant influence on drawdown due to lateral boundary inflow.	Groundwater	Modelling
716	EG council / SLR	2.5	32	Boundary Conditions- Figure 5.4 suggests inflow from rivers and constant head increases over the modelled period. The impact on river baseflow due to drawdown from the bore field pumping should be discussed.	Noted. This can be assessed as an alternate scenario as part of future uncertainty analysis modelling.	Groundwater	Modelling
716	EG council / SLR	2.5	32	Boundary Conditions- Using DRN in Layers 10 and 11 and constant head at 0 mAHD for layers 1 to 9 at the southern boundary causes recharge of groundwater from the ocean.	Noted. EMM will adjust in future modelling and remove constant head cells from the deeper layers. This will allow vertical flow limited by aquifer properties. EMM do not consider this to be influential on model calibration or prediction performance.	Groundwater	Modelling
716	EG council / SLR	2.5	32	Calibration- There is no groundwater level data available to assist model calibration west and north of the site. The implications for model uncertainty, and the model sensitivity study should be discussed.	Calibration of the groundwater model would ideally be performed using groundwater level data covering the full extent of the model domain. The model as reported returns a good fit to measured data. The spatial distribution of calibration data points is reasonable, and largely concentrated in the area of highest interest near the site. Additional data points may help constrain the calibration (ie higher statistical sensitivity to parameter values) and provide a smaller range for the predictive uncertainty analysis.	Groundwater	Modelling
716	EG council / SLR	2.5	32	Calibration- Discuss general over-prediction of groundwater levels (Figure 5.3).	The calibration tends to over-predict groundwater elevation, with an average residual of 1.7 m. This is considered reasonable in context of the transient variations in groundwater level.	Groundwater	Modelling
716	EG council / SLR	2.5	32	Prediction- An assumed seepage rate (53 L/s) is used for the tailings based on a "preliminary water balance" (p.128). The properties of the model layer do not change to reflect the properties of tailings.	This is an added complexity.	Groundwater	Modelling
716	EG council / SLR	2.5	32	Prediction- Seepage from tailings is assumed however it is uncertain if seepage will occur (section 7.12). Suggest do a predictive run to assess bore field drawdown, with no seepage from tailings.	Noted, and will be assessed for further modelling efforts.	Groundwater	Modelling

716	EG council / SLR	2.5	32	Prediction- The predicted drawdown in Latrobe Group reaches the layer boundary – discuss the implications for model prediction.	Modelled drawdown in the Latrobe Group reaches the south-western boundary. This is a no flow boundary, so EMM do not consider there to be influence on the predictive model results.	Groundwater	Modelling
716	EG council / SLR	3	69	Drawdown at the bore field is significantly greater than modelled with implications for groundwater availability, and quality.	Additional risks to assess as recommended by SLR.	Groundwater	Risk assessment
716	EG council / SLR	3	69	The bore field is unable to provide the required supply volume and/or a 3 GL/year groundwater licence for Latrobe Group cannot be sourced through trade.	Additional risks to assess as recommended by SLR.	Groundwater	Risk assessment
716	EG council / SLR	3	69	Groundwater extraction from shallow aquifer(s) is required to augment supply.	Additional risks to assess as recommended by SLR.	Groundwater	Risk assessment
716	EG council / SLR	3	69	Seepage from TSF and/or mine void tailings impacts the beneficial uses of Balook Formation / Latrobe Valley Group groundwater.	Additional risks to assess as recommended by SLR.	Groundwater	Risk assessment
716	EG council / SLR	3	69	Impact of groundwater extraction on the geothermal properties beneficial use, at depths shallower than 2500 m Beneficial Uses (p.63 refers to 2500 m to 4000m depth).	Additional risks to assess as recommended by SLR.	Groundwater	Risk assessment
716	EG council / SLR	3	70	Saline intrusion to the Latrobe Group aquifer due to decline in groundwater pressure at coast.	Additional risks to assess as recommended by SLR.	Groundwater	Risk assessment
716	EG council / SLR	3	70	Identify all potentially impacted groundwater users (including spring-fed dams, domestic and stock groundwater users).	Recommendation to assess these uncertainties further in the risk assessment	Groundwater	Risk assessment
716	EG council / SLR	3	70	The long-term water supply from the Latrobe Group is based on a short term, low yield, aquifer test.	Recommendation to assess these uncertainties further in the risk assessment	Groundwater	Risk assessment
716	EG council / SLR	3	70	Layering in the Coongulmerang Fm impedes the downward drainage from filled voids	Recommendation to assess these uncertainties further in the risk assessment	Groundwater	Risk assessment
716	EG council / SLR	3	70	The use of groundwater for processing and implications for mine void seepage water chemistry	Recommendation to assess these uncertainties further in the risk assessment	Groundwater	Risk assessment
716	EG council / SLR	3	70	Increased discharged to GDE and Mitchell River of groundwater with natural concentrations above criteria	Recommendation to assess these uncertainties further in the risk assessment	Groundwater	Risk assessment
716	EG council / SLR	3	70	Shallow water table activates discharge to drainage lines on-site, land salinisation, impact on site structures and adjoining pit(s)	Recommendation to assess these uncertainties further in the risk assessment	Groundwater	Risk assessment
716	EG council / SLR	3	70	The hydraulic connection between sediments under site, the Mitchell River flats and the Latrobe Valley Group at Woodglen is greater than indicated by the groundwater model.	Recommendation to assess these uncertainties further in the risk assessment	Groundwater	Risk assessment
716	EG council / SLR	3	70	Implication for bore field drawdown if tailings seepage is less than modelled.	Recommendation to assess these uncertainties further in the risk assessment	Groundwater	Risk assessment

C.2 IAC submission table

Submission No	Who	Comment	Response/notes	Theme	Sub-theme
47	IAC	The Proponent should provide information on potential GDEs within the groundwater impact area to assess which GDE's are likely to be fed by perched aquifers or the regional water table aquifer.	Noted. Once a list of GDEs are finalised, site specific investigations may be required to further conceptualise these sites and potentially install monitoring bores to assist with the pending monitoring plans, trigger levels etc.	Groundwater	GDEs
48	IAC	The Proponent should clarify the shallow aquifer impacts from dewatering of the mine pit and associated risks.	EMM & Coffey to develop "perched" map showing drilling sites which shallow saturation was noted. EMM believes the risk of disruption to shallow and extensive aquifer systems within the mine footprint is unlikely.	Groundwater	Perched systems
49	IAC	The Proponent should clarify the expected quantity and quality of tailing seepage entering the groundwater system.	Coffey are pretty clear about the risks in their summary sections. Our recommendation is to carry out additional testing to cover the concerns of the representativeness of the current testing. To quantify in the context of the groundwater modelling, geochemiscal modelling would be recommended.	Groundwater	Tailings seepage
50	IAC	The Proponent should clarify the groundwater monitoring plan (including GDE's) within the locality of the project.	Noted	Groundwater	GMP / GDE MP
51	IAC	The Proponent should provide information on the non-registered groundwater users (for example spring fed dams and non-registered bores) in the locality.	Noted. Risk assessment on third party bores and spring fed dams to be undertaken on updated numerical modelling based on updated census and VVG rather than using BoM database.	Groundwater	Risk assessment

C.3 Land owner submission table

Submission No	Who	Section	Page	Comment	Response/notes	Theme	sub-theme
108	Magaret & Max Treasure	N/A	N/A	Very supportive of the project	No action required	N/A	N/A
123	Cedric Francis Waller	N/A	4	Main two issues that they see having the largest impact are 1) Wind and dust; and 2) Extreme Rainfall-East Coast lows with large impacts associated with erosion. How would this be managed on site during dam commissioning etc.?	No response required. Not groundwater related	N/A	N/A
202	Dana Johnston	N/A	1,2	Very emotional response. Mine will effect tourism. Concerns about Aboriginal heritage. Mitchell River main drinking water supply and are concerned about contamination. How is the river going to be protected? Do Kalbar have a priority over water supply in drier years? The mine is short-lived compared to long history of farming. Also concerns with dust travelling long distances and concerns with health. Also have noise concerns, traffic and potential for poor rehabilitation.	There are rules that Kalbar need to abide by, like any other water license. It's a Winterfell license only and flow must be > 1400 ML/d.	Water supply	Water supply / licensing rules / competing use
268	Lyn Johnston	N/A	41, 59, 65	Groundwater levels have significant influence on flow to the Mitchell River and its aquatic habitat, especially during low flow conditions. Protect of the "shallow" aquifers are needed. Competing water use during total bans due to drought (pg 59). Chain of ponds must be protected. Adequate monitoring must take place so Triggers can be established with acceptable mitigation measures (pg 65). Pollution of local groundwater in regards to radionuclides (pg67)	Generally agree with statements and requirements.	Groundwater and water supply	Chain of ponds, adequate monitoring requirements, radionuclides and pollution
369	Raymond Stephenson	N/A	n/a	No specifics. Short emotional appeal to vote against the mine.	General objection	N/A	N/A
568	Geoff Johnston	N/A	8	Geoff mentions 5 x spring fed dams. By the sounds of it, they are fed by shallow water within the small gravel and sand seams. Geoff has 2 x bores relying on this water type, and he is worried that mining will disrupt this flow	Sub surface flows hard to map, let alone predict. Make monitoring and make-good commitments. Drilling to date has shown this to be rare at the mine site itself. Also update modelling every 2-5 yrs, as part of GMP.	Groundwater supply	Landowner supply, springs
568	Geoff Johnston	N/A	9	Geoff does not like the SKM reports as he states there are failings and misinformation and wonders why our studies reference these.	We reference these reports as part of any literature review and update data based on the latest available info.	Groundwater	General conceptualisation
691	Harold Coleman	N/A	3,4	3 x Springs exist within the proposed mine foot print, which have never dried out. Harold acknowledges that the water is an unknown source. Also claims a part of Moilun/Stoney Creek never dries out.	Springs are likely areas of very shallow groundwater, which feeds baseflow to these surface water bodies (dams or creeks). Look at Fig 7.38 of EMM GW report, depth to water plot. This supports shallow systems north of mine, especially in the Moilun Creek area. Project should identify shallow systems and monitor these dams /shallow bores. This also relates to any GDEs in the region	Groundwater	Springs, shallow groundwater systems.
693	Matthew Stephenson	N/A	n/a	General objection	Objections will be addressed via other responses	N/A	N/A
743	Alison Ann Waller	N/A	N/A	impact on local bores and water supply. Claims pumping tests had an impact on local bores previously! Worried that 3GL entitled of the Mitchell River to Kalbar will have financial impacts on agriculture production.	Water supply to be addressed collectively. Pumping test undertaken in 2019 showed no drawdown impacts to the shallower groundwater systems, which are used for stock and dometic use. Future pumping tests will also aim to monitor local 3rd party bores in addition to the Kalbar bores located the the pumping test site.	Water supply	Borefield impacts
812	Frederick Coleman	N/A	N/A	Issues with risk profiles and unacceptable risks. General statement associated with loss of water supply from shallow aquifers and impacts to Perry River and Chain of Ponds. Why is there a misunderstanding of the importance of the extensive, local shallow water system?	Shallow systems and impacts to be addressed	Water supply	Shallow groundwater / springs and GDEs

C.4 Community submission table

Submission No	Who	Section	Page	Comment	Theme	Sub-theme
54	Ian Phillip Campbell		3	Located on high ground above both the Perry and Mitchell Rivers there is a stated risk of leaching from the dam. If there is a 1 in 100-year flood, tailings waste and flocculants could be released into the creeks/rivers, harming aquatic life and aquifers.	Groundwater	Tailings seepage
54	Ian Phillip Campbell		4	It is a matter of record that for significant periods during the drought, irrigation by farmers in the Lindenow Valley was not permitted from river or aquifer. Even the town water supply was restricted. Yet the Kalbar mine would require water all year round. There are environmental and water sustainability reasons for these water restrictions. If Kalbar is given an exemption, as so often happens with mining, there will be environmental and economic impacts. Over 3 billion litres of water (3GL) is required by the mine annually for up to 15 years (the maximum life of the mine) for processing and to control dust.	Water supply	Water supply
54	Ian Phillip Campbell		4	The EES acknowledges that Kalbar's bores could lower water levels in existing bores by up to 5 metres and presents this fact as being inconsequential. The EES simply states that this and other water supply challenges is something for Southern Rural Water to deal with. It is a matter of record that impacts of mining on the Latrobe Aquifer are lowering the water table by up to 1 metre each year. This has had significant impact not only on the cost and ability of farmers to reach water but also the salinity of that water and has led to financial compensation, (though inadequate) being paid by the government to farmers in the southern part of Wellington Shire, near Yarram. It is foreseeable that the Kalbar mine could lead to similar impacts and consequences.	Water supply	Water level decline/ licensing
79	Joanna Aquila		12	Can we risk an entire communities drinking water with contamination - as dams and acid rain, and residential water tanks become contaminated by radioactive particles, that are not visible or detectable with ease by the community?	Water supply	Water quality
79	Joanna Aquila		19	The Latrobe Aquifer is a delicate system of an underwater system, industrial accident, poor at best undetectable abuse, infrastructure violations, can permanently impact the underground water table. Does Gippsland-East Gippsland need a similar natural disaster, as in the Darling Basin, where interests have resulted in a significant change in a once experienced sound water flow that served agriculture and the Australian market?	Groundwater	N/A
79	Joanna Aquila		19	The Latrobe Aquifer is part of an intensive network. It is unacceptable that a singular business venture has such entitlements to both underground and above ground access to our sophisticated and natural correlations of water systems.	Water supply	Access licensing/entitlements
79	Joanna Aquila		19	The impact of the KOPL mining project, with reference to accessing the Latrobe Aquifer, represents the same or similar risk to Coal Seam Gas.	Groundwater	N/A
79	Joanna Aquila		20	What guarantee (other than KOPL's written contractual wording) is there that this is all that will be drawn from East Gippslands water supply and drinking water supply?	Water supply	Water supply
79	Joanna Aquila		20	Should a singular business venture (KOPL) hold such entitlements (for water) above an expansive community and geographical landscape? Can such sought after entitlements be weighted higher than the wellbeing, health and prosperity of Gippsland, beyond a business venture? Generations to come have the right to except good guardianship (of water) in the present.	Water supply	Access licensing/entitlements
79	Joanna Aquila		20	The mines proximity to our drinking water supply and interlinked water systems is one of significant concern. This is a potential natural disaster in the making. KOPL stated dependency is an estimated calculation - what if they need more, rather than less? KOPL should not have such an entitlement, as a business entity that is a transient occupant in East Gippsland.	Water supply	Access licensing/entitlements
79	Joanna Aquila		26	This mining project is a significant environmental foreign intruder, acidic water released from metal mines can drain into surface water or seeps below the ground to acidify groundwater.	Groundwater	Water quality
79	Joanna Aquila		35/36	With large amounts of water used for mine drainage, mine colling, aqueous extraction and other mining processes, this increases the potential for these chemicals to contaminate groundwater. Can we be assured that the tailing dam proposed will not seep into the ground and eventually find a pathway into our water supplies?	Groundwater	Tailings seepage
94	Geoff Banks		1	The amount of water this proposed mine will use is also mind boggling, as a farmer with a water licence we are constantly on water restrictions, this has happened since the 60's.	Water supply	Water supply
157	Judith & Ken Alexander		2	Kalbars demand - 3 GL - 3 billion litres of water, every year, what the hell! The are is so water deprived. What will happen to bores, aquifers and the Mitchell River? There is huge demand on water resources, and the area is growing. Last summer the river was on severe restrictions, farming and households suffered. How can 3 billion litres be justified, whether its from an aquifer, river or both?	Water supply	Water supply
218	Kane Busch		2/3	Water allocations to the tune of 6 gigalitres have been reserved for the expansion of horticulture in Lindenow, but has now been earmarked by Kalbar Operations for use on their project. If that water was utilised in horticulture that would be a more responsible use of water for long term jobs and food security.	Water supply	Access licensing/entitlements
267	Rosemary Constance		3	Kalbar has identified 3 GL as the water allocation required for their mining operation, and they propose to take the majority of the water from the Mitchell River and pump additional groundwater to manage mining operations. The ability of the river flow to meet the pumping capacity for the proposed mine is questionable, where is the water going to come from?	Water supply	Water supply
267	Rosemary Constance		4	The EES assumes the water can be retained in holding dams. Sited on the escarpment my assumption is that all dams will need to be clay lined. This is essential, particularly for the tailings dams to reduce the potential for water and impurities to seep into the rivers and aquifers.	Groundwater	Tailings seepage
267	Rosemary Constance		4	Our aquifers are fully allocated. There is already fierce competition for water. I have been advised that no application to Gippsland Water for an extraction licence has been sought by Kalbar. From where will Kalbar purchase 1 GL of groundwater? Who will see water rights when their own agricultural practise depends on the resource?	Water supply	Access licensing/entitlements
268	Lyn Johnston		41	Subject to granting of Winter fill licence July-October when flows exceed 1.400 MM/day 6 GL could become available but if allowed extraction could result in the threshold being reached quicker.	Water supply	Access licensing/entitlements
268	Lyn Johnston		41	Impact on the 90 m thick Coongulmerang Formation has the potential for low permeability layers and creation of perched system beneath the mine footprint. Less flow into groundwater system that is connected to the Mitchell River ASR.	Groundwater	Conceptualisation

268	Lyn Johnston		41	In the catchment shallow aquifers are well connected to the rivers and all river reaches are generally gaining. Groundwater levels are therefore considered to have a significant influence on the flow and aquatic habitat condition of the Mitchell River during low flow periods. Only a sustained pumping test can establish the sustainable yield of the aquifer and provide and indication of the likely long-term effects on water levels, both locally and regionally.	Groundwater	Conceptualisation Pumping test
268	Lyn Johnston		41	The contribution of the shallow aquifers to the health of the Mitchell River is demonstrated by the fact that during drought the river gauge at Glendale can register significantly lower flow rates than the gauge at Hill side. The additional flow is supplied by the shallow aquifers. Water percolates back into the aquifers during the wet seasons from the river and from groundwater recharge areas such as Glendale.	Groundwater	Conceptualisation Shallow aquifers
268	Lyn Johnston		67	Catchment Planning and Management…is to assist the protection and restoration of catchments, water bodies, groundwater and the marine environment. The volume of water excluded from the water bodies will have long term significant impacts on the salinity of the lakes, groundwater dependent ecosystems, riparian vegetation and climatic systems.	Groundwater	GDEs
268	Lyn Johnston		67	Pollution of local groundwater supplies and river systems through leakage from settling and evaporation ponds.	Groundwater	water quality
268	Lyn Johnston		87	Polluted groundwater seepage from unlined reservoirs or failing liners is often hard to detect and treat.	Groundwater	water quality
268	Lyn Johnston		28	Mining though shallow groundwater, streams and damming gullies will restrict discharge to streams and rivers. Ecological processes influencing the Gippsland Lakes systems include river flows of freshwater, groundwater inflow and marine inflows.	Groundwater	Conceptualisation Shallow aquifers
268	Lyn Johnston		73	Designs and processes are needed to demonstrate how the topography of the site will be restored during rehabilitation, including restoration of the shallow aquifers. These shallow aquifers are crucial to the ongoing health of the river, to the endangered ecosystems in the valley floors and to the long-term viability of the grazing enterprises in the area.	Groundwater	Rehabilitation Shallow aquifers
268	Lyn Johnston		65	Investigations need to be conducted into the impact of any changes in groundwater quality and/or availability on the Perry River system, which is reliant on shallow aquifers to maintain supply to its chain-of-ponds. Monitoring of groundwater levels and quality must be performed frequently during the project and be publicly available to allow scrutiny. Triggers mist be established and published to ensure mitigation measures are enacted to minimise further unacceptable disruption to aquifers.	Groundwater	Water quality Shallow aquifers Trigger levels
319	Angelique Stefanatos		7	Over 3 billion litres of water is required by the mine annually for up to 15 years for processing and dust control. We are concerned about the loss of the water for the environment and water available for farmers.	Water supply	Water supply
319	Angelique Stefanatos		7	We object to the potential toxic dust impacts on bores, aquifers and the Mitchell River	Groundwater	water quality
355	Jane Hildebrant		6	The EES fails to take adequate regard for the climate change impacts, which not only include the amount of greenhouse emissions during construction and the mines life, but also the impacts on the health of waterways, aquifers and other environmental assets.	Groundwater	Climate change impacts
355	Jane Hildebrant		6/7	The planned water infrastructure described - dams, pipelines, offtake structure, pumping stations, diversion bunds, in-ground septic systems and a water treatment plant - seems excessive, complicated and expensive and will surely disrupt existing water and land assets. The Latrobe Group (aquifer) should a long-term regional decline which would be exacerbated by water diversions to this mine.	Groundwater	Water level decline
355	Jane Hildebrant		7	SRW estimates that groundwater in Southern Victoria contributes approximately $275 million p.a. to Victoria's economy by supporting agribusiness and industry. Environmental impacts both in the vicinity of the site and further afield will affect the viability of existing tourism business based on the regions environmental assets.	water supply	Economic impact
344	Jenny & John Leggatt		3	Many properties in my local area have been approached and continue to be approached for the exploration of water by Kalbar. This has brought a division in our community as neighbours have different views.	Water supply	Water supply
344	Jenny & John Leggatt		3	The supply and amount of water is another concerning issue that is integral to the mining operation. Over the mine life it is anticipated that 3 billion litres of water will be required. This will impact on the farming, businesses and households in our local area who are reliant on the water supply. Considerations need to be made on how our local residents and farmers will not be compromised. How will this be monitored? Who will hold Kalbar to account? What happens if in time, local resident find that the water supply is not the same quality and that is has been contaminated or compromised by the mining operations?	Water supply	Monitoring and mitigation measures
344	Jenny & John Leggatt		3	For my direct local area there are quite a few properties who have put in bores to help with the watering of cattle and for crop growing. Many have the notion that this will help when we are threatened by bushfires. If our underground water supply is compromised it may be to the detriment of the safety of properties in this locality. How will we know that out water supply will not be compromised? Which body of authority can give us this reassurance? Will we have enough water to accommodate out needs?	Water supply	Bushfire management
355	Jeanette Vola Wagner		3	Water for dust suppression would come from the water that supplies the drinking water for the entire region. It also supplies the vegetable farmers for their crops, which they say is never enough. Kalbar estimates it will require a minimum of 3 billion litres of water per year, this compares to the current consumption of 3.75 billion litres per year for the region. Therefore mining will impact water availability for food and meat farming. This could be devastating for the entire region as has the severe drought we have just experienced, as well as the fires.	Water supply	Water supply
358	Martin Fuller		9/10	The challenge with groundwater and GDE assessments lies in testing and monitoring the validity of the important assumptions under what will be a unique and significant change to the hydrogeology of the area. The impact assessment for the Groundwater extraction and drawdown transmitting to overlying surficial alluvial aquifers leading to reduced groundwater availability for GDEs was rated as unlikely with minor consequence. If the assumption breaks down under increased stress then the consequence could rapidly become significant. If the assumption of maximum drawdown in the Latrobe Group Aquifer breaks down then even a small propagation of the drawdown could have significant implications on other users and GDEs.	Groundwater	GDEs

358	Martin Fuller		10	The same assumption has been applied to mapped potential GDEs (ie ecosystems are not supported by the regional groundwater system, but rather shallow perched systems), which were subsequently declassified with the project area. This is an important assumption that should be explored further with on going monitoring and research to establish and monitor the function and health of these GDEs. The assumption also highlights the importance of perched watertable in and around the project area, and it is questioned whether the importance of ecosystems potentially reliant on perched watertable has adequately been addressed in the assessment.	Groundwater	GDEs
358	Martin Fuller		10	There is commentary in the EES that the Perry River Ponds are charged from some subsurface flow, which were identified as possible localised perched aquifers. This is an assumptions that required either further investigation or monitoring during works to test the assumption.	Groundwater	Perched aquifers
358	Martin Fuller		10	Page 8-71 states that 'perched groundwater was not identified at similar depths at other drill locations nearby, suggesting that perched groundwater at MW07 is a localised anomaly'. Due to this ambiguity we recommend a comprehensive review of all potential GDEs within the potential impact area to assess which ones are likely to be fed by perched aquifers or the regional water table aquifer.	Groundwater	GDEs Perched aquifers
358	Martin Fuller		10	The altered surface topography and a lowering of the ground surface in the Honeysuckle Creek catchment was assumed to have no groundwater impact. This assessment did not include shallow aquifers which are critical for the chain of ponds GDE and is therefore incomplete.	Groundwater	GDEs Perched aquifers
358	Martin Fuller		10	Shallow aquifer impacts from dewatering of the mine pit have also not been included in risk assessments. The assessment identifies groundwater mounding likely to be present at 7 km radius from site but does not include shallow aquifer impacts in that risk assessment.	Groundwater	Risk assessment Shallow aquifers
358	Martin Fuller		10	The EES acknowledges that seepage from tailings storage in the mine void may result in localised rises in groundwater mounding within shallow aquifers, along with seepage from the unlined temporary tailings storage dams. The tailings seepage will be contaminated with aluminium, arsenic, chromium, copper. The impact of neither the quantity nor quality of tailing seepage have not been considered in the EES.	Groundwater	Tailings seepage
358	Martin Fuller		10	The hydrogeological setting in the region is extremely complex and unique, and our current knowledge is insufficient to completely rule out the potential for impacts on GDEs. The groundwater monitoring plan does not appear to include any specific monitoring of GDEs in or near the project area. A greater emphasis on local GDE assessments and ongoing monitoring must be completed at potential GDE sites in order to fully understand the interactions and reliance on groundwater prior to final approvals for the project and any work commencing.	Groundwater	GDEs
365	Allanna Margaret Knight		3	The mine requires extremely large amounts of water from surface water and groundwater sources. East Gippsland has endured four years of drought and further drains on reserves should be of great concern.	Water supply	Water supply
365	Allanna Margaret Knight		5/6	Over 3 billion litre of water is required by the mine annually for up to 15 years (the maximum mine life) for processing and to control dust. What will the impact of this be on bores, aquifers and the Mitchell River? According to irrigation data, if the 3 GL of water was redirected to the horticulture industry, 3 times more jobs could be created than proposed by the mine.	Water supply	Water supply
375	John Alexander		4	As a primary producer we depend on clean and reliable water supply. Kalbar plan to mine to a depth of up to 60 meters which will be a source of water contamination to our stock and domestic bores, which are drawing water from the similar depth. Kalbar EES does not properly address the risks to domestic and stock bores, and the risk to irrigation water supplies for local agricultural industries.	water supply	water quality
375	John Alexander		4	There is an option for Kalbar to pump 3 GL/yr from the Mitchell River through Winter Fill Licence. This Winter Fill Licence has not been released and not been made available for other irrigators in the area. Kalbars water requirements will create further water restrictions for irrigators in the area and reduce water supply for our farm and surrounding producers farms. This will have a direct impact on our business and others ability to make a viable income from agriculture.	Water supply	Water supply
384	Ursula G Alquier		5	Im concerned the mine could impact not just the local area but all surrounding farms….We rely on water from the aquifer for our stock water, as do many other farmers. It is also really important resource for irrigation. If this was to be compromised either due to contamination or a drop in the water table, this would impact us all.	water supply	water quality
389	Daniella Lanteri		4/5	Kalbar states that it is anticipating on acquiring water that has not yet been allocated, but when we have inquired about the same water we have been told it is not available at this stage. If farming families have had to struggle for years with the lack of water, how can it be that Kalbar has water at its disposal...	Water supply	Access licensing/entitlements
390	Domenic Galati		3	Nearly every summer we have grown vegetables, we have had to endure water restrictions imposed on us during summer. We cannot see how Kalbar can operate a mineral sands and rare earth mine with 3 GL of water without impacting farmers.	Water supply	Water supply
390	Domenic Galati		5	Drilling for water and accessing the shallow aquifers will be detrimental to the flow, accessibility, availability and quality of water. To quote what was said by Kalbar in the EES ' we propose to destroy the shallow aquifer which may impact on stock and domestic bores'. They are accepting responsibility for damaging a natural water source and have no intention of being able to repair such damage.	Water supply	Shallow aquifers
390	Domenic Galati		5	Potential problems that can arise when the water table decreases include: - Salinity will increase leaving the quality of the water questionable - Filters and jets becoming blocked with excessive mineral and dirt deposits - Pump and flow rates becoming less effective - Stock not being able to drink due to salinity levels - Irrigation of the vegetables jeopardised because the water quality would be compromised. We use this water supply for our stock, domestic needs and household living and it is a vital part of our survival as a farming business. Where is the guarantee that this water source will be safe and will not contaminate us...?	Water supply	Water quality
391	Allen Frederick Sheridan		1	Our farm, approximately 2,000 acres, has 63 stock water troughs, during the past three years to earlier this year, despite having many dam empty, we could have run no stock without the bore water.	Water supply	Water supply

423	Nicholas John Barton		3	There are several deficiencies in the water investigation, including: - The bore field set up that was modelled falls outside the designated bore field. If Kalbar is unable to source water from the Mitchell and must rely on bores in the designated bore field this could lead to bore interference. - Groundwater modelling is considered to be oversimplified, with the possibility of perched aquifers above the base of the mine downplayed. Thus the model may significantly underestimate the impacts of the mine on groundwater mounding and effects on GDEs. The response of the proponent was to disagree, as many of Kalbars bores didn't strike water. However, Visualising Victoria's Groundwater shows numerous aquifers along the northern edge of the project area. The 'chain of ponds' characteristic of the significant GDE of Providence Ponds is seen in some of the small streams in the project area. All this would indicate that there are numerous shallow aquifers within the project foot print. The effects of disruption of these on farmers stock bores and GDEs are either downplayed or not considered.	Groundwater	Numerical modelling Perched aquifers GDEs
423	Nicholas John Barton		3	The EES ties itself in knots trying to downplay the impact to a significant portion of the catchment of this system. Firstly, the statement made (main report table 4.8) that the Boisdale aquifer supports the GDE of the Providence Ponds is not supported by reference and is contradicted by the EES. Coffee Appendix p 51 further demonstrates the middled thinking regarding Providence Ponds: 'Type 2 GDE that is highly dependent on the surface expression of groundwater.' However available info on local groundwater indicates the depth to the regional groundwater system in the area is in the order of 30 m (EMM), suggesting the ponds are not supported by groundwater. Coffee (appendix) states the Perry River and Providence Ponds are not considered GDEs in the vicinity of the project rea as they rely on shallow, perched groundwater systems that are disconnected from the regional Coongulmerang Formation. Stating the GDEs rely on shallow, perched groundwater systems, but are not GDEs defies logic. If the mine goes ahead they cannot avoid disrupting these shallow aquifers.	Groundwater	GDEs
423	Nicholas John Barton		4	Some process water is expected to infiltrate the Boisdale aquifer once tailings are placed in the mine. Except for Al and Cu these are not expected to pose a risk (Coffee 2020 p162). This conclusion is based on the results of analysis of the solubility of metals in the ore using the Australian Standard Leaching Procedure (ASLP). However, these leaching tests generally have very limited application as they only provide information about the leaching potential of solid materials under specific chemical conditions.	Groundwater	Tailings seepage
423	Nicholas John Barton		5	In addition to seepage from dams there will also be seepage from tailings and ore. EEM (2020a) have not included an allowance for water seeping from the mine floor. This seepage is expected to cause groundwater mounding in the vicinity of the mine. Although the process water is expected to contain a number of toxic elements (Coffee p162) they consider that all except aluminium, copper and iron are associated with particles which will be filtered out as the water seeps to the aquifers, and hence are of low risk. The risk to Providence Ponds is rated as low (Main Report p9.77).This is unproven, especially given the potential for failure of a water management dam, or less likely but potentially disastrous, the failure of the TSF.	Groundwater	Tailings seepage
423	Nicholas John Barton		5	If the full 3 GL was required from the borefield this would require 8 bores. As pointed out in AECOM peer report this could lead to problems due to bore interference. This aquifer is fully allocated; no further licences for extraction will be issued. It is not known whether Kalbar would be able to purchase licences from existing users to enable them to access this water.	Water supply	Access licensing/entitlements
429	Ian Magee (Bendigo District Environmen	Section 4 - Water requirements and s	20	Southern Rural Water have developed a history of sustainable water allocation for agriculture and the environment. The requirement of this project, to substantially increase the current extraction rate from the Mitchell river and/or the Latrobe Group aquifer, is in direct conflict with sustainable allocation. The conflict derives from the risk of over allocation, the risk of withdrawal of allocations from existing producers, the inherent demand for a constant volume of water to be present within the processing circuit of the mine, the risks to water quality (turbidity and altered chemistry) and the long term risk to the future beneficial use of a ground water resource. Kalbar and their consultants, EEM and Coffey, have presented a flawed, conflicting and incomplete narrative for the sourcing of water and for their estimation of the volume required for the mines operation.	Water supply	Water supply
429	Ian Magee (Bendigo District Environmen	Section 5 - Loss to the Ecological Value of the Gippsland Lakes RAMSAR Wetland, Lakes National Park and Corner Inlet RAMSAR Site.	22	The Gippsland Lakes would be impacted by the dust loading that the Kalbar project would place on the lower Mitchell river catchment, by an increase in water turbidity and by a change in water chemistry. The Lakes ecology would be affected by increased extraction from the Mitchell river or from the aquifers interconnected with the Lakes and possibly by unseasonal water release from dams on the project site.	Groundwater	General potential impacts
429	Ian Magee (Bendigo District Environmen	Section 6 - Loss of Native Vegetation and Ecological Connectivity.	26	Some of the processes or evaluations which should have been present, or have been provided with suitable recognition, in an ecological assessment would include - … # The pollution of aquifers by the annual leaching of many tonnes of flocculants.	Groundwater	Water quality
442	Steven Andrew Stagg		3	The tailings dam will contain waste and flocculants which can be very harmful to aquatic life. The EES states this risk to be low and yet the document contains no details about the dam- so how can it be low? There are many documented examples (Benambra) of tailings leaching into rivers directly and via aquifers. this is a serious risk to our rivers/lakes and the many who depend on their health.	Groundwater	Tailings seepage
457	Kristopher James Woodward		6	American Engineering firm Aecon (authors of the East Gippsland Water Drought response plan) state the following regarding Kalbar's proposed surface water extraction: '[t]he surface water and groundwater supply scenarios did not consider all matters listed in Section 40 of the Water Act 1989, as required in a Take & Use Licence application'. Put simply, Kalbar does not meet ministerial requirements to remove any water & does not properly address local impacts.	Water supply	Access licensing/entitlements
484	Joanne Eastman		9	Water is one of the most contentious issues with the mine – not just the amount they need for operations but also the damage they intent to do to local groundwater by digging up the fingerboards site, and the damage that is unavoidable for local creeks and rivers.	Groundwater	General potential impacts

484	Joanne Eastman		9	Kalbar have used dated figures in their reports and models, have failed to acknowledge the impact of climate change and have completely ignored the long term water figures put out by DEWLP last year that show a 10-15% decline in flows in the Mitchell since 1975. Why has that been allowed?	Groundwater	Numerical modelling
484	Joanne Eastman		10	Kalbar consistently deny the presence of groundwater in the project area to try to give the impression that they won't be interfering with it. They have studiously avoided acknowledging the presence of perched aquifers. Even the selection of locations for their bulk samples was very cleverly designed to avoid those. However there are many spring fed (i.e. groundwater fed) dams across the project area that persist through the worst droughts – including one at the back of the tailings dam. And in their most recent webinar the water expert admitted that the ore will be damp when dug up due to groundwater. What are we to believe?	Groundwater	Perched aquifers
488	Michelle Barnes	Water	18	Kalbar's mine project area exists in and will impact major catchments and aquifers within East Gippsland and Wellington shires. These include at the broad scale - The Mitchell River Basin to the east, the Thompson River Basin including the Perry River to the west, the La Trobe Group aquifer and the Ramsar listed Gippsland Lakes system which they discharge into at Jones Bay, Lake King and Lake Wellington. Rivers and surface and groundwater systems in the Gippsland Basin are intricately connected by complex interrelationships. Digging a 13 square km mine pit 45 meters down through layers of stratigraphy which contain aquifers will affect water drainage and movement patterns in recharge and discharge zones. This can have far reaching impacts long distances from the mine scar, such as at the Gippsland Lakes and other irrigation districts. Deep open-cut mining in this landscape will likely cause permanent hydrogeological changes in Gippsland and East Gippsland. This is not a gamble we should be willing to take.	Groundwater	General potential impacts
488	Michelle Barnes	Water	18	Kalbar's proposed annual extraction of 3 to 5 GL of surface water under winterfill license could lead to a 1.7% reduction in river flow rates, in addition to reduced seasonal recharge to the Mitchell River alluvial aquifer. (EES Vol 2, p. 9-83)	Water supply	Water supply
488	Michelle Barnes	Water	21	Every drainage line and tributary within the project area will be dammed, resulting in reduced flows in to the Mitchell River and changes to surface water distribution. Water flows and quality will be impacted, while dam walls pose a constant threat of failure, leakage and siltation. Permanent damage to geology, stratigraphy, landscape structure, geomorphology, hydrology, fluvial / alluvial processes and aquatic health will occur locally within the mine site, the Mitchell River and downstream in the Gippsland Lakes and Perry River system. Changes to regional aquifers are likely, especially in, but not limited to the La Trobe Group aquifer. **This mine poses an unacceptable risk to the Mitchell River, Gippsland Lakes, La Trobe Aquifer, Perry River, Providence Ponds and Woodglen water storage facility.**	Groundwater	General potential impacts
488	Michelle Barnes	Water	22	Several important conservation reserves exist near the proposed mine, including Providence Ponds Flora & Fauna Reserve, Saplings Morass Flora & Fauna Reserve, and nationally significant Deep Water Morass wetland, all of which are Groundwater Dependent Ecosystems (GDE) or contain GDE elements. The mine's impact on groundwater which keeps these ecosystems alive and healthy is of grave concern, despite being played down by the EES.	Groundwater	GDEs
488	Michelle Barnes	Water	22	As mentioned, Kalbar needs 3 to 4 GL of water to run their mining operations, including ore processing and dust suppression. To do this they will need to extract surface water from the Mitchell River winterfill and/or groundwater from the La Trobe Group Aquifer. Water extraction licenses from Southern Rural Water (SRW) have NOT been secured. The Groundwater and Surface Water Impact Assessment states (Appendix A006, Appendix F, p 25): *Discussions with Kalbar Operations Pty Ltd have acknowledged the challenges in accessing surface water from the Mitchell River under current licensing arrangements.* When the Mitchell River doesn't meet the flow threshold for winterfill, allocation of groundwater will be used. These purchases will be arranged POST EES APPROVAL. **How can a project that relies so heavily on water resources be approved when there is no guarantee of water supply?**	Water supply	Access licensing/entitlements
488	Michelle Barnes	Water	22	All of the potential impacts on surface and groundwater are only modeled, so how can we really know what will happen?	Water supply	Numerical modelling
488	Michelle Barnes	Water	25	The 90 ha, 40m deep and 20m high temporary tailings facility (TTF) can't be guaranteed not to fail during high rainfall and flood events, or to leach toxins into surface and groundwater under any conditions. In such events the Mitchell River, Perry River and Gippsland Lakes will be contaminated with toxic flocculents and mine tailings waste [radioactive chemicals, heavy metals and silt]...	Groundwater	Tailings seepage
488	Michelle Barnes	Health risks	34	Risks to drinking water quality and security posed by the mine are a very real and present danger. Leaching and run off form the mine pit and tailings facility, associated gully erosion, mounding above aquifers, and permanent alterations to hydrology such as flow volumes and direction all pose an unacceptable risk to ground and surface water quality. Populations of people and animals will suffer health consequences from contaminated water supplies and reduced water availability.	Groundwater	Water quality

488	Michelle Barnes	Health risks	35	***Increased radiation levels as a result of mining is an unacceptable risk to our community.*** There is a cancer cluster along the Tambo River, below the Stockman Mine failed tailings dam (pers. com – source: Peter Mac Cancer Centre). We can expect a similar scenario downstream of Kalbar's toxic mine. The EES states, 'Post mining seepage from coarse sands and fines tailings in the backfilled and rehabilitated mine voids will continue post-closure. Potential infiltration to the underlying aquifers will continue to be monitored' (Vol. 2, p 9-89). How is this acceptable?	Groundwater	Water quality
506	Rhys Waller		3	The proposed mine threatens the my immediate and extended family's wellbeing. We are massively concerned that the family farm will be adversely effected by ; … - reducing groundwater runoff to our livestock. Several of the proposed mine dams would restrict water from running through to my Dad's farm. Over the last few decades we have witnessed less rainfall. Some people would attribute the hotter and extended summers, and reduced rainfall to climate change. The mine is reducing groundwater which would end up in my father's dams and therefore will affect the amount of livestock he can hold.	Water supply	Water supply
509	Tom Lightfoot		3	3 gigalitres of water required to process ore and suppress dust means 3 gigalitres less for the Mitchell River catchment and the Gippsland Lakes. The Mitchell River irrigators that already rely on the system do so knowing that the Summer months are often unreliable, and pumping restrictions are the norm, not the exception. I'm told it is the same for those who use the aquifers. It would seem that the water required by Kalbar for processing as well as dust suppression is not an option, but a necessity, and must be available no matter what conditions the year provides. Even in drought years the mine presumably must continue to operate, and I can only assume this is at the expense of all other river users. While Kalbar says they will construct a dam and fill it using a winterfill license, this also will come at the expense of the existing irrigators. What happens in the years when river flows are insufficient to allow winter fill pumping (More than 1400ML per day flow)?	Water supply	Access licensing/entitlements
514	Lily Taylor (EPA Victoria)	6.2 Groundwater	17	The Project has assessed the potential quality of the process water, with results suggesting that the quality will be within natural background levels for the upper aquifer. However, EPA is concerned that the capture and re-use of process water may cause increases in the concentration of leachable analytes over time. As such, there is potential for the quality of water seeping from the tailings to increase above background levels over time, thereby posing a changing risk profile to protected beneficial uses as the Project progresses.	Groundwater	Tailings seepage
514	Lily Taylor (EPA Victoria)	6.2 Groundwater	17	EPA considers that the seepage of water from the tailings to groundwater may constitute a direct waste discharge to an aquifer by means of excavations, and therefore clause 53 of the SEPP (Waters) applies, which states (among other things) that: *(1) A person must not directly discharge waste to an aquifer by means of a bore, underground mine workings, infiltration basin, evaporation basin, excavations, or other similar structures, unless the Authority or other relevant protection agencies approve that discharge.* EPA considers that this is an issue to consider as part of the WAA and any approval would be given via a WA and Licence (if any) issued for the Project. If, however, a decision is made after the New EP Act commences, SEPP (Waters) will no longer apply but EPA expects that the discharge to groundwater will be regulated by a development / operating licence (as per item 26 (A18—Discharge of waste to aquifer) in the Exposure Draft Environment Protection Regulations).	Groundwater	EPA licensing
514	Lily Taylor (EPA Victoria)	6.2 Groundwater	18	The quality of the proposed discharge appears to present a low risk to beneficial uses, however, due to the Project's predictions that a noticeable impact from the tailings water plume would extend significantly off-site, and the potential that water quality would decrease over time, EPA has some concerns regarding potential impacts to protected beneficial uses of groundwater and therefore seeks further information. **EPA requests that further information be provided to EPA (in response to a formal s 22 notice which will be issued in due course) and the IAC on the measures proposed to minimise the discharge to groundwater, the concentrations of any potential contaminants, along with demonstration that either the discharge will not exceed the environmental quality objectives specified in SEPP (Waters) or that risks to beneficial uses of groundwater are minimised and are not unacceptable.**	Groundwater	Tailings seepage
514	Lily Taylor (EPA Victoria)	6.2 Groundwater	18	It is not clear from the EES whether the recovery of water draining from tailings will be applied only to the containment cells holding the fine tailings, or whether recovery also includes water draining from coarse tailings. EPA recommends that water recovery is to be maximised from the mine void (from all placed tailings), not just the containment cells within the mine void. **EPA recommends that GW15 in the Water Quality and Hydrology Risk Treatment Plan (Table 7-1) and the Mitigation Register be amended to read: "*Management techniques, such as underdrains, sumps and water recovery pumps will be used to maximise the recovery of water in the mine void ~~tailings containment cells~~ for both fine and coarse tailings .*"**	Groundwater	Tailings seepage

514	Lily Taylor (EPA Victoria)	6.2 Groundwater	18	EPA considers it is important to understand the quality of water likely to seep from the tailings placed within the mine void into the groundwater and how that quality may change over time. EPA recommends that a monitoring program should be implemented to monitor the water draining from the tailings to ensure the quality of this water remains within risk based trigger levels designed to ensure that the water seeping from the tailings would not lead to an unacceptable risk to protected beneficial uses of groundwater. This should include sampling and analysis. EPA considers that the most proactive form of monitoring would be for this monitoring to occur prior to placement of the tailings into the mine void. However, if this is not technically feasible, then a more reactive form of monitoring would be to monitor the water draining from the tailings after placement into the mine void (ie water collected as part of the recovery of water in the mine void). This monitoring program is distinct from the monitoring of the process water dam as EPA considers it is possible that the process water dam is influenced by water collected from other parts of the system and would not be a good representation of water which may drain from the tailings. However, if there is consistency between the two monitoring programs over time, then the monitoring may be reduced. EPA may review and provide comment on the Proponent's proposed trigger levels once specified. **EPA recommends that the Water Quality and Hydrology Risk Treatment Plan (Table 9-2) and the EMF (Table 12.9 Monitoring Programs – Groundwater) be amended to include a new monitoring program of water draining from the tailings prior to their placement in the mine void.** **EPA recommends that the Water Quality and Hydrology Risk Treatment Plan (Table 7- 1) be amended to include corrective actions that would be implemented should the results of this monitoring exceed specified risk-based trigger levels.**	Groundwater	Tailings seepage
514	Lily Taylor (EPA Victoria)	6.2 Groundwater	19	Tables 6-1 and 6-2 of the Water Quality and Hydrology Risk Treatment Plan provides acceptance criteria for surface waters. The Plan does not set out the acceptance criteria for groundwater. **EPA recommends that the Water Quality and Hydrology Risk Treatment Plan (Table 6- 1 and Table 6-2) be amended to include acceptance criteria for groundwater in accordance with SEPP (Waters) and to make it clear that the background level (as defined in SEPP (Waters)) will become the objective where it is better than the environmental quality objective.**	Groundwater	Trigger levels
514	Lily Taylor (EPA Victoria)	7 EPA's Assessment of the WAA	34	With regard to the discharge of seepage water (as discussed in section 6.2 above), the EES predicts and models a groundwater mound establishing underneath the mine following the placement of wet tailings within mine voids. The predicted modelling indicates that this mound would extend into the aquifer and off-site. EPA considers that this off-site discharge is an issue to consider as part of any WAA and any approval would be given via any WA and Licence issued for the Project (or development / operating licence under the New EP Act). To date the WAA, has not considered such a groundwater discharge and EPA will be requiring further information from Kalbar on this discharge.	Groundwater	Tailings seepage
514	Lily Taylor (EPA Victoria)	7 EPA's Assessment of the WAA	34	Key issues which EPA will assess as part of the WAA assessment process include: • ... • discharges to groundwater due to seepage from wet tailings disposed into the mine void; • potential for radionuclides to be present in the above discharges, as well as in any solid wastes settling out within the DAF and the appropriate consideration of radiation5; • ...	Groundwater	Tailings seepage
514	Lily Taylor (EPA Victoria)	7.2 Water Discharges	35	SEPP (Waters) relevantly requires that: • Surface and groundwaters must be maintained so that the protected beneficial uses of the waters are protected; • ... • An applicant must apply for a mixing zone if it is not reasonably practicable to meet the objectives and minimise the risks; • Direct discharge of waste (such as from tailings) to groundwater is prohibited, unless risks posed to protected groundwater beneficial uses by the mine rehabilitation are minimised and do not pose an unacceptable risk to the beneficial use of the groundwater. ... The Project proposes an uncontrolled discharge of process water entrained within the mine tailings on disposal into the mine void. Information on this discharge is currently lacking within the WAA, such that EPA will formally request further information from the Proponent to inform its determination of the WAA. As outlined in section 6.2 of this submission, further information will be sought on the measures proposed to minimise the discharge, the concentrations of any potential contaminants, along with demonstration that either the discharge will not exceed the environmental quality objectives specified in SEPP (Waters) or that risks to beneficial use of groundwater are minimised and are not unacceptable. Once received, EPA will undertake an assessment of this discharge to establish if protected beneficial uses of the groundwater will be (unacceptably) affected.	Groundwater	Tailings seepage
514	Lily Taylor (EPA Victoria)	7.3 Radiation	37	In considering whether the works the subject of the WAA are a "radiation source within the meaning of the Radiation Act 2005", EPA will need to consider whether: • ... • radionuclides may be present within the discharge of water into the aquifer beneath the site and the potential to affect the beneficial uses of that groundwater resources; and • ... EPA will be seeking further information from the Proponent on any potential radiation associated with the surface water and groundwater discharges and the DAF treatment plant.	Groundwater	Water quality
523	Charles Becket			No specific comment made about groundwater	N/A	N/A
530	Kim Martin (Frais Farms)		5	No specific comment made about groundwater	N/A	N/A

533	Ken White (Riviera Farms Pty Ltd)		1	In essence, as vegetable growers who have invested in, and rely on, a reliable water supply, our key concern is the potential impact on water resources. Kalbar is proposing that its primary source would become an off river water storage fed from winter fill taken from the Mitchell River, and secondly water extracted from a bore field targeting the Latrobe Group aquifer...The potential use of Latrobe Aquifer water we have concerns with. This aquifer is an enormous body of water which has significant use by large licence holders to the South and West of the Lindenow Area. The interaction between the Lindenow/Mitchell Catchments and the Latrobe Group Aquifer was considered in a Sinclair Knight Merz report in 2008/09 - attached that report for your reference. In that report it is considered that "the interaction between the Mitchell River, Quarternary Aquifers and the deeper aquifers in the study area are not well understood". This specifically refers to the interaction of the Lindenow area to the Latrobe Group aquifer. This report also states (Item 2.8) "The groundwater trends in the deeper aquifers are declining, and this could potentially impact groundwater levels in the shallow aquifer and river levels". The extraction of large volumes of water from an unstudied and declining aquifer we believe will impact shallower aquifers above and therefore we do not support Kalbar's borefield option of water use. The majority of agricultural use of aquifer water is in the shallow aquifers above the Latrobe Group aquifer and with the inherent uncertainty of the interaction between aquifers we need more certainty of no impact before we could support the use of Latrobe Aquifer water.	Water supply	Shallow aquifers
534	Tom Crook (East Gippsland Conservation Management Network)		1	We also have serious concerns around the impacts to several groundwater dependant ecosystems and other rare plants which could result from changes to ground water hydrology due to insufficient understanding of the relationships between various aquifers, aquitards and extraction regimes.	Groundwater	GDEs
546	Robyn Anne Grant		2	Groundwater extraction will affect the Mitchell River and Groundwater Dependent Ecosystems (GDEs). The proponent has failed to identify many of these GDEs and has ignored the importance of these for sustaining agriculture, in times of drought and aiding survival of threatened species.	Groundwater	GDEs
546	Robyn Anne Grant		6	The horticulture industry and other current water users will be competing with the proposed mine for water. Will the horticulture industry be guaranteed supply of water if the proposed mine goes ahead? Other agriculture industries which include beef, dairy, wool production, fat lambs, vineyards, orchards, and stock fodder, will all be affected by the proposed mine development. Bores used by agricultural producers will also be affected by the extraction of underground water.	Water supply	Water supply
564	Carolyn Cameron			No specific comment made about groundwater	N/A	N/A
568	Geoff Johnston		5	Haul road Haul road from Chettels Lane to the container loading facility at Kennedy's Crossing (Fernbank East) crosses as well as the land drains into the head of Scull's Creek which enters the Mitchell River flats 3.5k east of the eastern end of the project area and meanders through the middle of the vegetable growing area on the Mitchell River flats. Any spills or run off from this haul road or container loading area will contaminate waterways and more valuable land as well as passing through many hill country properties along the way and the listed wetland of Sapling Morass. There is no mention of this waterway system being contaminated in the case of an accident or spillage at the loading facility or along the haul road in the EES why? As the soils in this area as well as the project area hold a huge quantity of water which also seeps underground eventually reappearing in soaks and underground streams, creeks, and dams on its way to the river flats. Along these roads and loading facilities, you will not be able to stop seepage in this type of country because where haul roads and loading facilities are placed is some of the wettest country in the area.	Groundwater	Water quality
568	Geoff Johnston		8	Mining activity will cut through the gravel and sand seams that carry ground water within this project area. Kalbar say in their studies there are not any permanent surface water dams or ponds on the project area. In actual fact there are 5 reliable spring fed dams at least within the project area and in my lifetime I have never seen these ponds and dams dry, even surviving the last 3 years of drought maintaining quality reliable stock water for animals when all other dams in the area were well and truly dry. These small gravel and sand seams carry the ground water which gradually gravitate East and North to the River flats supplying the ground water and base flows for the Mitchell River, this water is always reliable through droughts and dry times. Why haven't the proponent's studies not noticed these reliable water sources within the project area, rather than dismiss them or are they missing the fact that there are other small aquifers within the project area that they know nothing about? My two irrigation bores (registered with Southern Rural Water) on the flats are noted in the EES as being stock and domestic bores, the mining operations on the South and South-West will more than likely impact these bores as they are fed from shallow seams and gravel beds running to the river which will be mined through as the mine progresses east ending my properties reliable water supplies.	Groundwater	Shallow aquifers
568	Geoff Johnston		8	My two irrigation bores (registered with Southern Rural Water) on the flats are noted in the EES as being stock and domestic bores, the mining operations on the South and South-West will more than likely impact these bores as they are fed from shallow seams and gravel beds running to the river which will be mined through as the mine progresses east ending my properties reliable water supplies.	Water supply	Shallow aquifers
568	Geoff Johnston		9	Groundwater modelling Two bores at Treasures - one which is 50 metres from the River and should be 200 metres at least from the river, the other should be located 300 metres from one another otherwise one will affect the other.	Groundwater	Numerical modelling

568	Geoff Johnston		9	Having worked on the preparation of the Wy Yung Groundwater Supply Protection Plan with Government Hydrologists, DELWP, East Gippsland Catchment Management Authority, Southern Rural Water, water drillers and irrigation farmers from Glenaladale to Bairnsdale and my experience of working land on at least 70% of the farms in the Mitchell River valley and adjacent hill country land, my knowledge of the local groundwater and surface allows me to question the failings and misinformation in some of these surveys. The use of SKM reports for this ground water and surface water studies is not regarded as a reliable source of information for groundwater aquifers in this district and was not used during the preparation for the WGSP Plan. My question is why the specialist would be conducting these groundwater surveys using information that does not relate to the groundwater aquifers in this area?	Groundwater	Conceptualisation
628	Malcolm Ronald Baker		2	No specific comment made about groundwater.	N/A	N/A
652	Ewan Waller			No specific comment made about groundwater.	N/A	N/A
663	Tim Lequeux	6. Impacts on Water and Air Quality	10	Kalbar's own planned water harvesting and management leave many unanswered questions. Its Webinar of 25 June 2020 set out several key claims that deserve closer perusal: • No effect to the availability of groundwater expected ... • Surface groundwater and groundwater monitoring programs and corrective actions identified ... One local estimate is that the mine would require about the same amount of water as used by the 29,000 households supplied by the Mitchell River. Kalbar plans to pipe additional water from the Sale aquifer, but it is fully committed and can only be released by purchasing existing water rights.	Water supply	Access licensing/entitlements
690	Bronwyn Parker		4	The EES provides no consideration of cumulative environmental impacts, which prevents a complete understanding of the combined effect of the Project - competing interests, impacts of sequential or ongoing issues such as associated with ground water and surface water, compounding dust and noise effects, and indirect effects such as new roads that provide new invasion pathways for weeds and pest species. Economic impacts of the Project have not been assessed by the EES either which would add to the cumulative impact.	Groundwater	Cumulative impacts
690	Bronwyn Parker		5	The EES provides no evidence that all potential Groundwater Dependent Ecosystems (GDEs) have been identified. The EES also does not provide sufficient detail on downward draining.	Groundwater	GDEs
690	Bronwyn Parker		5	The EES provides insufficient evidence for the basis of its water quality assessment, the impact of water flow on GDEs, and what contaminants or components will make up the runoff. The EES inadequately addresses the risk of dams overflowing and sediment running into the Mitchell and Perry Rivers and dismisses the issue in its claim that sediment would be released when the Mitchell River is fast flowing. Dilution is not a suitable response to this pollution creation.	Groundwater	Water quality GDEs
690	Bronwyn Parker		5	Over 3 billion litres of water are required by the mine annually for up to 15 years for processing and to control dust. This shows how big a problem dust is. What will the impact of this be on bores, aquifers and the Mitchell River? According to irrigation data, if the same amount of water was redirected to the horticulture industry, 3 times more jobs could be created than proposed by the mine.	Water supply	Water supply
690	Bronwyn Parker		5	I call on the Panel to conclude that the water quality assessment, flood risk assessment, water quality/volume entering the Mitchell River, impact on GDEs, has not been assessed accurately and the recommendation from the Panel should be that the Project does not proceed.	Groundwater	Water quality GDEs
690	Bronwyn Parker		7	Risk assessment • The EES appears to arbitrarily assign risk ratings to certain events e.g. impact of contaminants on water; minor impact on the Ramsar site with no evidence for this assessment provided in the ecology report. • Other events are omitted from risk assessment altogether e.g. impact on the aquatic ecology of water environments; unplanned/temporary mine shutdown. • Kalbar's mitigation strategies in some key areas rely on having an inappropriately conservative risk rating applied. Groundwater and surface water are two examples.	Groundwater	Risk assessment

691	Dr Harold A. Coleman		4	An issue which has not been given appropriate recognition in the EES is the significance of groundwater/springs in the Fingerboards area. During the severest of droughts in recent times, including the most recent, as well as severe droughts such as 1972/73 and 1982/83, water scarcity became a major issue that threatened the continuation of a number of farming enterprises. The saviour for a number of such farms were dams that are supplied by springs. Within 500 metres of the Fingerboards, and lying within the footprint of the proposed mine, are at least 3 dams that have never run dry, even during the worst droughts, due to the springs that feed them. Similar springs in the adjacent Limpyers State Forest and pine plantation have enabled the wildlife in the area to survive these horrendous droughts. Moilun/Stoney Creek, which lies only 1 km north of the proposed project area, has largely dried up during severe droughts. However, and fortunately for me as an owner of 1.7 kms of the creek, some water holes have never dried up, thus enabling my beef cattle enterprise to continue even during the worst and driest of droughts. These water holes are fed by springs, of unknown source. Given the relatively large area of the proposed mine, the presence of ground water there, and its closeness to the creek, it is likely that the groundwater from the proposed mine makes a significant contribution to the permanency of the water holes in the creek. However, the characteristics of groundwater in the area are poorly understood, precluding predictable consequences of the proposed mine. Nevertheless, since the groundwater is so close to the surface in various places throughout the Fingerboards and surrounding areas, it would seem very likely that an open cut mine would destroy this source of water, and it is unlikely that rehabilitation could ever restore it. The Proponent states that the interactions between surface water and groundwater within the mine area are limited to seepage from creeks into the groundwater system during and following periods during which the creeks flow. They also state that creeks do not receive groundwater discharges (section 4.8) 3. In other words, the Proponent does not acknowledge the well-established presence of spring-fed dams and creek water holes in the area. It is significant that the independent reviewer of water-related studies commented on the lack of consideration by the Proponent for nonregistered groundwater users, such as those using and relying on spring-fed dams and non-registered bores.	Water supply	Shallow aquifers
693	Matthew Stephenson		3	The theft of water by the mine proponent is concerning. The construction of 19 sediment traps (otherwise known as dams) on tributaries of the Mitchell River is unacceptable and environmentally dangerous, as is the pillaging of water from our underground aquifers. That water is required to nourish and sustain the natural values of the Mitchell River and the Gippsland Lakes system. We should be saving more water and allowing it to flow into these systems, not taking more of it for wasteful purposes – such as mines in inappropriate areas. ... I am no expert in economics, but I am informed the proposal is not a sound economic venture. What little profits are derived from the project will quickly be absorbed by the cost of obliterating 200 year old trees and paying people to dig up and destroy ancient aquifers.	Groundwater	General potential impacts
712	Scott Dizais		5	Ecological fallacy #1 • The project will have minimal impact to aquifers, local water catchments • ... Ecological reality #1 • The project does not contribute to the water cycle, it despoils it •…	Groundwater	General potential impacts
712	Scott Dizais		6	Conclusions based on analysis of water use and extraction by the consultants are sub-optimal on merit alone. Here are some salient points: - ... - The studies completely contradict and ignore DEWLP's Gippsland Groundwater assessment report which states that every aquifer in the region is in serious decline of both quality and quantity - 'Direct' impacts will have negligible effects to anything….but 'Indirect' effects do not rate a mention and pose more critical importance the functioning environment ... - There has been no study of the effects on stygofauna and its influence on ecosystem health	Groundwater	Conceptualisation GDEs General potential impacts
712	Scott Dizais		6	Once this water is used in the mining operation, it is contaminated. It can't be used again for anything productive. Kalbar wants to take a valuable resource – water (which is part of the global commons, fresh, clean water is everyone's birthright), contaminate it, and keep adding it to the ground within the site, thereby further concentrating any pollutants. This is the lowest value use for the water. It is a poor moral and ethical choice, it's legal standing is arbitrary and capricious, it is strategically unsound, and operationally unsustainable.	Groundwater	Water quality
712	Scott Dizais		6	When different chemical elements are exposed to each other (such as deep soil horizon elements and the air / rainfall/ overland water flow / deep soil seepage – air – soil chemical elements) a chemical reaction occurs. This produces different chemical compounds. This basic scientific tenet has been ignored in the EES. This omission is serious, because: - These new compounds are unknown - Their behaviour in the existing and surrounding ecosystems is unknown - These chemicals behaviour in an interconnected ecosystem that flows into the RAMSAR Listed Gippsland Lakes and ocean is unknown - The effect on the reproductive health of flora and fauna, beneficial insects for agriculture, humans – the elderly, immune compromised, children, the unborn foetus is unknown	Groundwater	Water quality
712	Scott Dizais		6	• Over-pumping groundwater not only depletes the resource but also tends to draw chemical contamination towards bores / aquifers	Groundwater	Water quality
744	Eden Maree Swan			No specific comment made about groundwater	N/A	N/A
745	Grace Waller			No specific comment made about groundwater	N/A	N/A

763	Tom Crook		6	It is essential to ensure mineral sands mines are properly rehabilitated as they are progressively decommissioned after the depletion of ore bodies, or abandoned following low world commodity prices. As there is a particular concern that thorium, the principal radioactive component of monazite, may over time leach from tailings dumps into local water supply systems.	Groundwater	Tailings seepage
763	Tom Crook		7	Available unused ground water allocations currently only exist for water extracted some 200km away at the far end of the Latrobe aquifer, which it is understood takes decades, if not longer, to rechange to the extraction areas allocated as bore-fields by Kalbar. Meaning that if ground water extraction outstrips recharge, other users will be left short of supply in years where river flows alone are insufficient to meet demand and when groundwaters have historically supplemented their supply (for the vegetable industry, for example).	Water supply	Water supply
763	Tom Crook		7	There is also no proof that claims made by Kalbar that the Latrobe and other aquifers are separate to other ground water systems in the area, which in reality may not be separated by an aquitard from the Sea Spray group and could in reality be pervious….meaning drawdown could be vastly more severe than claimed, damaging Lindenow farms for decades.	Groundwater	Conceptualisation
763	Tom Crook		8	Due to the Latrobe group acquirers unconfined nature, if it is used to supply on-going mine needs, the resultant modelled extent and magnitude of draw down could be much more significant than claimed by Kalbar, whose interpretation remains disputed due to modelling showing seepage between aquifers (Woodglen MAR site).	Groundwater	Numerical modelling
763	Tom Crook		8	Mitigation measures and the ground water management plan overly rely on assumptions which are likely to be untrue and no amount of assurances escape the fact that as water demand increases, reliable supplies are put under increasing pressure. A situation that is only likely to accelerate in coming years.	Groundwater	Monitoring and mitigation measures
765	Debbie Carruthers (Gasfield Free Bairnsdale)		4	The tailings dam is in a dangerous location … Located on high ground on the watershed of both the Perry and Mitchell Rivers there is a stated risk of leaching and mounding. If there is a 1:100-year flood, tailings waste and flocculants will be released into the creeks/rivers, harming aquatic life and aquifers and the unique Chain of Ponds. The environmental risks are considerable and foreseeable.	Groundwater	Tailings seepage
765	Debbie Carruthers (Gasfield Free Bairnsdale)		5	Water resources at risk Over 3 billion litres of water (3 GL) is required by the mine annually for at least 15 years (the maximum life of the mine) for processing and to control dust. This shows how big a problem dust will be. What will the impact of this massive water consumption be on bores, aquifers and the Mitchell River? ... Many of the same farmers who were impacted by the threat of fracking are also going to be potentially impacted from the Fingerboards mine project due to contamination risks of aquifers or from threats to their water supply. A borefield that looks to be approximately 1,000 hectares (size not stated) is located outside the project boundary. How is this able to be considered part of the project as it falls outside the project boundary? There are grave concerns by farmers who have no access to other water sources other than from their aquifer that it will become contaminated, that there will be aquifer interference and that their ability to draw water will be impacted due to the high volumes of water the mine requires. Any impact on their access to clean water will have significant detrimental consequences to their farming businesses and livelihoods. Without water from the aquifer they have no farming business as there are no rivers or creeks they can access. There were problems experienced by bore users when tests were conducted on the borefield so if there were problems while testing the bores, this flags that we can expect major issues if full access to water was granted at the extraction rate required by the mine project.	Water supply	Water quality
766	Honor May Waller		4	The Mitchell River catchment and Perry River catchment are at risk from the Fingerboards project. The EES refers to sediment runoff being less than 941 mg/L (almost 1%) during storm events and that spillway discharges will be allowed (for reference saline is 0.9% sodium chloride). Water from dams on site will also be released into the Mitchell (EES chapter 9, page 40). They conservatively estimate an increase in dust in the air of 11% after dust mitigation strategies at the mine. Seepage from tailings dams will get into the groundwater. A lot of these chemicals and elements will end up in the Mitchell River, and from there into the Gippsland Lakes. They will include a mix of heavy metals, radionuclides, processing chemicals and debris from the mine site.	Groundwater	Tailings seepage
777	Kimberley Nightingale		2	As a resident of a nearby town to the proposed mine site, I have strong concerns over: ▯ ... ▯ I have concerns over contamination from dust and particulates into surface and underground waterways, adding further strain on the ecosystem: contamination to the food chain, food crops, insects and food sources for animals, birds and aquatic life, in addition to long term and short term impacts on human health.	Groundwater	Water quality

777	Kimberley Nightingale		4	I have strong concerns of water contamination and impact on surface and ground water levels, volume and quality. The Mitchell River is a vital source of the Gippsland lakes system. It is also a major fish environment right down into the Gippsland lakes. Damage to this water system has wide ranging implications to health of humans, fish and other aquatic life, tourism industry and community lifestyle. As highlighted in the report water levels are expected to reduce over coming years due to climate change, hence the mine has planned for transition towards a heavier reliance on groundwater in later years of the project to compensate for this. Compared to agricultural industries the amount of water that would be used from river/water systems is excessive. Thus earlier and tighter restrictions on users reliant on water from the Mitchell River (such as the horticulture industry) would be highly likely. Furthermore reduced water levels and flow would strongly impact the entire river system right into the Gippsland Lakes impacting towns downstream from the mine site. The fact that this has been recognized by the mine indicates that water quality and ecosystem would be directly impacted by mine operations.	Water supply	Water quality
777	Kimberley Nightingale		5	Recent bush fires demonstrated that water shortage issues where a real problem in fighting the fires. Homes, properties and lives were under threat due to issues with CFA having access to sufficient water. ... According to the EES to reduce dust spread water is used to help settle it (Dust suppression). Bushfires generate extreme heat and unusual wind patterns. Hence assuming mitigating factors could be utilized, a huge amount of water would be diverted from the Mitchell River, Perry River etc, groundwater and dams to defend the mine. This would place an enormous strain on the water system and the community - potentially at the expense of others in the area. Furthermore, water used out of undisturbed/rehabilitated areas and untreated dams on the mine property could contaminate the site and nearby land as well as water currents via runoff from the sight and straight into our waterways.	Water supply	Bushfire management
777	Kimberley Nightingale		7	In addition to earlier made point, I am concerned about the impact of the project on groundwater and its dependent ecosystems. The risk of seepage from the mine site and the possible effects on salinity and plant growth in the immediate and surrounding areas that these water systems connect into is concerning. In particular heavy metals are accumulative they do not dissipate in the system. Adding any extra burden to the ecosystem is unacceptable. Levels in the documents were only for normal conditions not in events of extreme weather conditions and natural disasters.	Groundwater	Water quality GDEs
781	Yvette Waller	Pollution & Potential Health Detrimer	13	Mining is a source of significant water pollution and groundwater contamination. The proposed open cut mine site at the Fingerboards is on the boundary of both the Mitchell River and Perry River catchments. The hills and valleys of Glenaladale run water directly into the river. There is therefore a risk of contamination of both these waterways. Further, mining at the depth stated by Kalbar of 60 meters also puts the underground aquifers at risk through pollution, including of carcinogenic heavy metals. Kalbar's own studies indicate the levels in this ore are at catastrophically toxic levels for residential or industrial exposure. Deceptively, they have not released the full report to the public on the findings. Most stock and domestic bores in the Fingerboards area draw their water from this depth. This is a risk that is unacceptable to primary producers who are dependent on quality water for the health of their stock...	Water supply	Water quality
781	Yvette Waller	Water Supply. employment and existing industries	20	Residents of Glenaladale, Fernbank and Stockdale also rely on bore or tank water for their freshwater supply, it is highly likely that a mine in the area would pollute these water supplies through contaminated dust and groundwater supply - negatively impacting on health of current and future residents. Conveniently in their maps in the EES Kalbar do not clearly show just how close this network of significant water systems within the mining footprint. They routinely fade out waterways, rivers and houses on their planning maps to seduce potential investors!	Water supply	Water quality
787	Robert Neil Barraclough		4	We are not getting the rainfall events to recharge the aquifers that we have got in the past and dryland and cattle farming across Gippsland is becoming totally dependent on bore water for livestock. Allocations of water from any aquifer cannot be even considered for the proposed sandmine at Glenaladale because of the potential for it to deplete the aquifers that will be needed for stock and domestic water. It has been suggested that the mine extract water from the Latrobe aquifer which Sale draws its water supply from, it simply can't even be considered.	Water supply	Water level decline
812	Frederick Coleman (Coleman Partnershi	Executive summary	3	Why is there a clear misunderstanding of the importance of the extensive, local shallow water aquifer system and its critical value in our region's agricultural activities? Not only has this essential natural water resource barely been recognised, its importance has been misrepresented. Why have the risk ramifications of major issues such as these been so ill-considered to the point of trivialisation or omission?	Groundwater	Shallow aquifers
812	Frederick Coleman (Coleman Partnershi	Issues not/inadequately mentioned	14	Section 5.1.6 discusses the loss of landholder's on-farm infrastructure should the proposed project be approved. A number of areas are minimised or not discussed: o Our only permanent supply of water is within the proposed project area. Without access to this groundwater supplied dam our business would lose its drought-proofing. o We would lose all the water reticulation infrastructure o Disruption of the shallow aquifer which supplies our dam would permanently destroy our drought resilience. o ...	Water supply	Shallow aquifers
812	Frederick Coleman (Coleman Partnershi	Conclusion	20	It has an extremely high risk of damaging the shallow aquifer system essential for the supply of water to not only to dams and bores within the project area, but also downstream to other users and the Bairnsdale Water Supply. The risk to the Heritage-listed Mitchell River and the Perry River Chain of Ponds is also unacceptably high.	Water supply	Shallow aquifers
813	Ms Sharon Clerke (Mine-Free Glenalada	Chapter 1 Water	19	The bore field setup that was modelled falls outside the designated bore field. (p10). If the proponent is unable to source water from the Mitchell this could lead to bore interference.	Groundwater	Numerical modelling

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	19	Groundwater modelling is considered to be oversimplified, with the possibility of perched aquifers above the base of the mine downplayed. Thus the model may significantly underestimate the impacts of the mine on groundwater mounding and effects on Groundwater Dependent Ecosystems (GDEs). The response was to disagree, as many of the proponent's bores did not strike water. However, Visualising Victoria's Groundwater (www.vvg.org.au) shows numerous shallow aquifers along the northern edge of the project area. Local farmers (R Coleman, G Johnson (pers. com) have dams which maintain water levels in the absence of surface run off. The "chain of ponds" characteristic of the significant GDE of Providence Ponds is seen in some of the small streams in the project area. All this would indicate that there are numerous shallow aquifers within the project footprint. The effects of disruption of these on the mine itself, farmers' stock water supply, and GDEs such as Providence Ponds and Saplings Morass are either downplayed or not considered. Providence Ponds and the Perry River catchment "Chain of Ponds" are considered to be a unique and significant waterway system. 'Chain of Ponds' systems were once common across South-eastern Australia but are now very rare (West Gippsland Catchment Management Authority, 2017). The mine will impact a significant portion of the catchment of this system. The EES ties itself in knots trying to downplay this inconvenient truth. Firstly, the statement made (Main Report, Table 4.8 p37) that the Boisdale aquifer supports the GDE of Providence Ponds is not supported by reference and is contradicted by the EES itself. Coffey Appendix A006, p51 further demonstrates the muddled thinking regarding Providence Ponds: Providence Ponds is classified as a Type 2 GDE that is highly dependent on the surface expression of groundwater (Richard et al. 2011) and thus can be classified as a Class 1 GDE. This type of GDE relies on groundwater to support aquatic biodiversity by providing habitat and regulation of water chemistry and temperature (Richard et al. 2011) and thus is sensitive to the prevailing groundwater regime. However, the available information on local groundwater indicates the depth to the regional groundwater system in the area is in the order of 30 m. (EMM, 2020b) This suggests that the ponds are not supported by the regional groundwater system. Instead, the likely presence of clayey horizons within the Quaternary sediments form shallow perched systems which support the ponds and the surrounding red gum community. Instructively Coffey states: "Importantly, the Perry River and Providence Ponds are not considered GDE's in the vicinity of the project area as they rely (either completely or partially) on shallow, perched groundwater systems that are disconnected from the more regionally extensive Coongulmerang Formation aquifer". (Coffey International, 2020) Is perched groundwater not actually groundwater? Stating that they rely on shallow, perched groundwater systems but are somehow not groundwater dependent ecosystems defies the most elementary logic. The problem for Kalbar is, as pointed out in the peer review, that if the mine goes ahead they cannot avoid disrupting these shallow aquifers.	Groundwater	Numerical Modelling GDEs Perched aquifers Conceptualisation
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	20	Unlike other significant zircon resources in Victoria in areas, such as the WIM Avonbank resource near Horsham (WIM Resources, 2020) where the topography is flat and overburden shallow, the Glenaladale resource is situated on a plateau, intersected with deep gullies and overlying numerous shallow and deeper groundwater systems, with a considerable depth of overburden. It overlooks the Lindenow flats, one of Victoria's premier vegetable growing areas. It is only 300 m from the Heritage Mitchell River, the largest unrestricted river in Victoria, the health of which is vital to the Ramsar Listed Gippsland Lakes. The climate is characterised both by extended dry periods and irregular very heavy rainfall events. This has necessitated complex engineering to attempt to prevent contaminated water or sediment leaving the site, and poses a risk of contaminated water reaching the underlying groundwater.	Groundwater	Water quality
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	20	Process water will be recovered where possible and re-used. Some process water is expected to infiltrate the Boisdale aquifer once tailings are placed in the mine. Except for Al and Cu these are not expected to pose a risk (Coffey International, 2020). This conclusion is based on the results of analysis of the solubility of metals in the ore using the Australian Standard Leaching Procedure (ASLP). However, these leaching tests generally have very limited application as they only provide information about the leaching potential of solid materials under specific chemical conditions. (WA Department of Environmental Regulation , 2015)	Groundwater	Tailings seepage
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	23	The lime added to the upstream slopes is likely to increase the pH of the water in the tailings. Compounds of arsenic, chromium and vanadium, all highly toxic, are markedly more soluble in alkaline solutions than in neutral. (WA Department of Environmental Regulation , 2015) Hence the conclusion that drainage from tailings into groundwater is unlikely to be harmful is fraught.	Groundwater	Tailings seepage
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	23	In addition to seepage from dams there will also be seepage from tailings and ore. EEM (2020a) have not included an allowance for water seeping from the mine floor. This seepage is expected to cause groundwater mounding in the vicinity of the mine.	Groundwater	Tailings seepage
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	24	Although the process water is expected to contain a number of toxic elements (Coffey p162) they consider that all except aluminium, copper and iron are associated with particles which will be filtered out as the water seeps to the aquifers, and hence are of low risk. The risk to Providence Ponds is rated as low (Main Report p9.77).This is unproven, especially given the potential for failure of a water management dam.	Groundwater	Water quality
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	24	In Section 5, AECOM's review and assessment concluded, "…the quantity and quality of groundwater and surface water information considered as part of the assessment is that in a number of areas it is not sufficient to support the impact assessment under the Environment Effects Act 1978 and Project's Scoping Requirements. Furthermore, the review of the conceptual hydrogeological model suggests that although there is a good level of technical robustness, rigour and a high level of confidence in most interpretations a number of aspects are not fully defendable and bring into question the predicted impacts."	Groundwater	Conceptualisation Impact assessment adequacy

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	27	EMM (2020b), Appendix A006 Appendix B p65 checked the potential of the Latrobe Group aquifer to supply the proponent's water requirements by pumping a test bore at a rate of close to 1 ML/day for 4 days. After an initial rapid drawdown the water level stabilised. It would require 3 such bores pumping continuously year-round to obtain 1GL from this aquifer. If the full 3 GL was required from the borefield this would require 8 bores. As pointed out in AECOM peer report this could lead to problems due to bore interference. This aquifer is fully allocated; no further licences for extraction will be issued. It is not known whether the proponent would be able to purchase licences from existing users to enable them to access this water. This would certainly be a seller's market, and the proponent may be forced to pay a high price for water from this source.	Water supply	Access licensing/entitlements
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	28	Appendix A006 AppA, 1.2.1 EES scoping requirements, V6, page 2 notes, "Develop a water balance model to quantify the project's demand (both quantity and quality) on groundwater and/or surface water resources, including volume to be extracted, stored and released during the construction, operations, rehabilitation, decommissioning and post-closure phases of the project. " The proponent's rainfall data collation to input water balance modelling has already been assessed to be misleading for an annual mean estimation over 117-year period (1900-2017) in contrast to water industry data collation from 1975 to date as more representative of climate change. Consequently, a greater amount of groundwater extraction to make up the water balance would be expected. This could cumulatively have a significant effect on surface and groundwater impact assessments. So, it is fair to challenge the risk rating classification reference to Class 2 included in the following table, p 5, section 3.1 Model Confidence Level Classification for Fingerboards Groundwater Modelling Independent Review by Hugh Middlemis from HydroGeoLogic, Attachment (I) Water Independent Peer Review Report and Proponent Response.	Groundwater	Water balance
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	29	Middlemis claims that the conceptual groundwater modelling can have 'identified limitations' but, overall, he determines the model presented provides enough confidence that "Class 2 is a reasonable classification, confirming the model as suitable for impact assessment scenario modelling purposes." In the following Appendixes A & B, Middlemis provides comments why the conceptual modelling and uncertainly analysis is sufficient and even opines that the project is "a relatively low risk' which is entirely subjective and not backed up if a number of dams on the project site will be subject to ANCOLD guidelines. To understand fully what is 'model confidence level classification' and what the 'identified limitations' are would require researching further how the classification system for Australian Groundwater Modelling Guidelines (AGMG) are viewed. Middlemis referenced his past work (Middlemis and Peeters, 2018)1 "for modellers to justify assumptions and choices in technical reports in a manner that is transparent and open to scrutiny" which is a key guiding principle for effective uncertainty analysis. Yet the proponent did not use or access all available hydrogeological data, existing data is misrepresented, flawed and lacking transparency. Therefore, the conceptual model predicting impacts of mining to inform environmental impact assessments is not robust as it cannot be calibrated in the absence of appropriate data.	Groundwater	Numerical modelling
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 1 Water	31	**Divestment by previous tenement holders** … After a Scoping Study Report prepared on their behalf by RJ Robbins and Associates they also decided not to proceed with the purchase of the rights to the tenement. Key findings from Robbins were that: ...- It would require 4.6GL, and potentially up to 6.2GL per year to operate. This did not include water for dust suppression... It was considered that sufficient water was unlikely to be available, and on that basis Oresome decided that the project would not be viable and relinquished their rights to the tenement.	Water supply	N/A
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 3 Rehabilitation	74	Throughout the entire EES document the existence of a crucial shallow aquifer system in the proposed project has been ignored. In the rehabilitation report the depth to groundwater is consistently referred to a being below the bottom of the mining pit. The Visualizing Victoria's Groundwater (VVG) website clearly shows the existence of this aquifer. It is situated well above the floor of the mining pit in most areas, and in some areas is extremely close to the surface. The VVG map data is validated by the existence of farm dams and springs in the area that never dry up. During the recent three year drought (the most severe and longest drought in Victoria's recorded history) farms within the project area found these aquifer fed dams to be the only available sources of water as all other dams dried up.	Groundwater	Shallow aquifers
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 3 Rehabilitation	74	The proponent's projections are that seepage from the TSF will cause mounding of the groundwater of 2m. This effectively means the groundwater is being contaminated with the water and minerals from the tailings.	Groundwater	Tailings seepage
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 3 Rehabilitation	74	The Perry River is Victoria's best preserved Chain of Ponds. West Gippsland CMA has spent millions of dollars fencing the catchments and restoring habitat along the Perry. The proponent describes the Perry "as a series of ponds which only occasionally flow". This description ignores the subsurface flow through the shallow aquifers along the Perry. The Perry is a shallow aquifer with pools where the groundwater and surface water interact. Contamination and disruption of the shallow aquifers within the proposed project area will lead to contamination of the Perry River.	Groundwater	Chain of ponds Shallow aquifers

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 3 Rehabilitation	74	The shallow aquifers within the proposed project area have a complex interaction with the Mitchell River. In wet periods the Mitchell River acts as a recharge zone and water infiltrates into the aquifers. In dry periods the shallow aquifers feed into the river, and provide an important base for environmental flows. Measurements show there are consistently higher river flow rates at the Hillside gauge than at the Glenaladale gauge – even in periods where there are no other in-flows. Disruption and contamination of the groundwater systems from the TSF, tailings disposal in the void, and the use of tailings in topsoil will leach through the groundwater system into the Mitchell; especially in dry periods of low flow. The impact of this leaching will be exacerbated by the reduced volume of water in the river. This poses unacceptable risks to our community and environment.	Groundwater	Shallow aquifers Tailings seepage
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 4 Tailings Storage Facility	84	EES requirements… The proponent was expected to describe, amongst other things, the direct and indirect loss of vegetation or habitat quality and significant effects on biodiversity values resulting from hydrological change, hydrogeology, water quality (i.e. on water dependent ecosystems), contaminants and pollutants (including nuclides). In those discussions they were expected to use appropriate methods, including modelling to assess the likely effects of the tailing's location and management on such things as: □ Potential for mounding and migration of groundwater from the backfilled tailings material along the mine path during operations, decommissioning and post-closure; □ Effects on groundwater and adjacent surface water; □ Potential for adverse effects on nearby and downstream water environments (including the Mitchell and Perry Rivers, King and Wellington Lakes, and Gippsland Lakes Ramsar wetland of international importance overall) due to changed water quality, flow regimes or waterway conditions during construction, operations, rehabilitation, decommissioning and post-closure. and □ Ore, product, overburden, tailings and mining by-products management, in the context of potential water quality impacts including those arising from sedimentation, release of radionuclides, other contaminants and pollutants, tunnel erosion, acid sulphate soils, acid/metalliferous drainage formation, and salinity.	Groundwater	Impact assessment
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 4 Tailings Storage Facility	85	The Fingerboards area acts as a 'gravel aquifer' that seeps into the Mitchell River, resulting in significantly increased flows as it moves past the curve. The complex series of gullies to north and east of the diagram allow direct flows to the river in any rainfall event.	Groundwater	Conceptualisation
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 4 Tailings Storage Facility	89	The quality and extent of information about the TSF and dam construction generally is insufficient and often conflicting. Areas of concern include, but are not limited to: □ ... □ Ignoring environmental Impacts of the TSF □ Ignoring known groundwater locations □ Inadequate assessment of effects on groundwater dependent ecosystems □ ...	Groundwater	Tailings seepage
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 4 Tailings Storage Facility	92	It is unlikely that the fine tailings will be able to be dewatered enough to return to the voids is in question – at least not without excessive seepage of the toxic contaminants – heavy metals, etc. – to the underlying groundwater.	Groundwater	Tailings seepage
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 4 Tailings Storage Facility	94	Seepage of toxic materials The Workplan indicates an intention to allow deliberate seepage through the base of the TSF to get the fine tailings to a stage where ampherols can be used to dry them out further. The coarse tailings indicate that an unachievable 65% dewatering will be sufficient to enable them to be put back in the mine voids. The tailings will contain increasingly concentrated quantities of toxic heavy metals and other contaminants – including flocculants which are ecotoxic to aquatic life. It seems inconceivable that the EPA would allow contamination to such values as the Chain of Ponds through deliberate seepage of pollutants. The proponent's assessment of the benign nature of the tailings must be challenged. The fine tailings contain known contents that are toxic and hazardous (e.g. thorium, chromium, aluminium, arsenic, vanadium, lanthanum, etc.) In fact, even with the very limited assessment the proponent has done, the fine tailings are shown to have much higher levels of arsenic, Chromium, Copper, Thorium and Vanadium than all the other soil samples. ((Kalbar Operations Pty Ltd, 2020). The concentration of these elements increases through multiple passes of the process water. The proponent has not done the full suite of analyses over sufficient samples to support the contention that the leachate is non-threatening to groundwater and groundwater dependent ecosystems. This makes it impossible to properly assess the impacts.	Groundwater	Tailings seepage
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 4 Tailings Storage Facility	94	Interference with groundwater dependent ecosystems The claim by the proponent that the project is above the water table and not expected to be impacted by groundwater, (Geotechnical assessment p 104) is in direct contrast to the reality. The project area is known to contain a number of springs and dams that are groundwater fed – including one directly beside the proposed TSF site. These springs and dams are well known to locals, located across the project site and are relied on as water sources during dry seasons and extended periods of drought – such as that recently experienced by the people of East Gippsland. It is difficult to understand how a potentially toxic tailings dam, that is designed to enable seepage, is not going to interfere with the ecology of these springs and dams. Particularly when that seepage, due to the recycling of the process water, will include increasing concentrations of heavy metals and flocculants that are known to be ecotoxic to aquatic life. (e.g. Magnafloc)	Groundwater	GDEs Tailing seepage
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 4 Tailings Storage Facility	95	The EPA guidelines are clear with respect to the likes of arsenic in tailings. The EPA needs to be satisfied that the ground water quality objectives are met and that there is no detriment to beneficial uses of groundwater, land or surface waters. (EPA, 2009) Along with these uncertainties, is the lack of credible costing data available.	Groundwater	Tailings seepage

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 4 Tailings Storage Facility	99	Inability to 'dry' tailings There is no real indication that any of the plans for filling voids with fine tailings are achievable. There is also no indication that the proponent will be permitted to allow seepage to the groundwater. The limited analyses show the tailings are far from benign. In fact, the geochemistry and mineralogical report indicates that the thorium levels are higher in the tailings than they are in the ore. It would be prudent to require far more extensive testing before accepting any assurance that the leachate is non-threatening to groundwater and groundwater dependent ecosystems. The proponent intends to use flocculants, which are non-organic and highly toxic and pose a risk to the environment. A study by Simin Khatibi, Missouri University of Science and Technology, in 2016 notes the challenges with TSF management, dewatering and use of Flocculants. Obtaining an almost dry substance from tailings is impossible. Issues around pH changes with the use of Flocculants was also raised. This presents complications when seeking to reinstate tailings into mine voids. When the chemical composition and heavy metal concentration of tailings is considered leaching to the water table compounds these problems. (Khatibi, 2016) ... Should the tailings be stored in cells and then covered, the EES provides no details of means by which seepage and leak will be prevented, or the anticipated structural integrity of the cell in the centuries to follow. Nor does it provide any information about the logistics around moving the tailings, such as pump and power requirements and whether these are in fact practicable and affordable. The EPA guidelines are clear with respect to the likes of arsenic in tailings. The EPA needs to be satisfied that the ground water quality objectives are met and that there is no detriment to beneficial uses of groundwater, land or surface waters. (EPA, 2009) Along with these uncertainties, there is the lack of credible costing data available.	Groundwater	Tailings seepage
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 4 Tailings Storage Facility	111	AECOM continue (pg.15) with the critical report stating "It has been concluded that any significant increase to periods of inundation (from mounding) is likely to impact on ecosystem health and potentially water quality, however no apparent assessment on the implications of this aspect is included in the risk assessment and proposed management and mitigation measures". The proponent review (2.4) is seemingly dismissive of the concerns raised around seepage and mounding impacting on structures, including the TSF. Whilst acknowledging issues with mounding and seepage, revised conceptualized modelling seems to magically minimize the risk. "…but the modelling does not indicate increased risk of impact to environmental receptors from groundwater mounding alone (EMM2019)" The Peer Review with Attachment K is the one most relevant to Landform, Geology and Rehabilitation. A thorough document, within the constraints of the review criteria, the reviewer identifies gaps and deficits in the formulation of risks and Stakeholder engagement. There is clear indication in the review of the need to monitor water seepage from the site, with the response from Coffey (Nov 2019 letter, 8.3) that "Until relinquished, Kalbar will be responsible for achieving and maintaining closure criteria including water quality". 'Until relinquished' provides an opening for interpretation and no parameters, which is an ongoing theme within the Peer Review. What "closure" criteria?	Groundwater	Risk assessment
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 5 Human Health	135	"The Groundwater and Surface Water Impact Assessment report (Coffey, 2020b) noted groundwater within the Coongulmerang Formation of the project area is characterised by concentrations of dissolved metals (i.e., arsenic, nickel, cadmium, copper and zinc) that are higher than commonly encountered in similar (but unmineralised) formations. This result is not unexpected given the presence and composition of heavy minerals in the area, and the slightly acidic nature of the groundwater." This statement is in direct contradiction to the results of independently conducted water testing commissioned by Mine-Free Glenaladale which indicated no elevations of heavy metals in groundwater fed dams in the project area or where the aquifer seeps out to the Mitchell River. (Mine-Free Glenaladale, 2018)	Groundwater	Water quality
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 5 Human Health	156	Blasting has massive implications for noise, vibration and dust. It has a direct immediate health impact as well as an indirect one brought about by changes to the ecosystem the community relies on. Unbreachable and enforceable conditions need to be established in the approvals and ensuing stages to ensure that appropriate mitigations are in place and no irreversible damage has been done to groundwater and other ecosystems.	Groundwater	Monitoring and mitigation measures
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 5 Human Health	214	Monitoring of groundwater levels and quality may also be required where there is a risk of groundwater mounding and/or contamination from the seepage of residues from deposited mine tailings. Monitoring of groundwater quality (pH, total dissolved solids, total acidity, total alkalinity etc) may also be required where there is a risk of direct and/or indirect disturbance of acid sulphate soils.	Groundwater	Monitoring and mitigation measures
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 6 Economics	256	The EES has failed to demonstrate that the Fingerboards Project is economically viable or that it is the best use of available resources or that it is compatible with the State's economic, social or environmental objectives. It does not enhance community well-being and welfare, and actively works against intergenerational equity by leaving an environment that has had its full alternative productive value destroyed for at least an estimated 60 years. And that has destroyed the biodiversity and ecosystem services currently provided by the project area, including the permanent destruction of very important groundwater in and around the project area.	Groundwater	General potential impacts
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 6 Economics	259	...there has been no consideration of the opportunity costs of enduring and/or permanent changes to the landscape such as destruction of groundwater systems.	Groundwater	General potential impacts

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 6 Economics	268	External effects methodology critique table Category: Surface water and groundwater BAEconomic's evaluation approach: Claim defensive expenditure: licence lined up for ongoing access to water, claims adequate. MFG comments: Miner's first call on water will reduce availability to other industries – including horticulture – effect must be included in costs. Removal of gravel aquifer at Fingerboards and capturing water for mine use decreases flows to Mitchell and hastens introduction of water restrictions. – What does 4 extra weeks water mean to irrigators? No allowance for effects on long term rehabilitation due to Haunted Hills formation being used for mine infrastructure. No indication of costs of intercepting water that would normally flow to other farmers or the environment.	Groundwater	Economic assessment
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 6 Economics	269	Costs of project failure What is not considered in the economics report is the cost to the environment and the community if the project fails. These include ▯ ... ▯ Destruction of groundwater and services it provides …	Groundwater	Economic assessment
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 7 Horticulture	303	A summary of RMCG's draft findings was released to all study participants on 21 December 2018 even though all of Kalbar's technical studies used by RMCG to make their assessments were far from being finalised. It was over 6 months after RMCG's report was released that the Independent Review of Water Related Studies, an important study impacting on horticulture, was available. It concluded that, '*the groundwater and surface water study is not sufficient to support the impact assessment and the obligations of the Project's Scoping Requirements*' (AECOM, 2019; Summary). Therefore, how could RMCG have formed a comprehensive view of the impacts from incomplete technical studies and a water study that failed to meet its scoping requirements. RMCG's report also failed to consider the impact of a number of changes that have been made to Kalbar's proposal since those 2018 interviews such as the risks from the nineteen dams on gullies and creeks.	Groundwater	Impact assessment adequacy
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 7 Horticulture	318	13.1 Access to water not to compete with existing users … Kalbar initially stated the mine would need 4 GL of water per year; now the stated requirement is 3 GL per year however they will be consuming much more than that. A more recent addition to the proposal is the creation of 19 dams on creeks and gullies on the mine footprint which will capture additional gigalitres of water thereby reducing what would normally enter aquifers, the Mitchell and Perry River systems and ultimately into the Gippsland Lakes. These dams will considerably reduce water entering the rivers, impacting on environmental flows and water availability for existing users. A number of important questions follow: ... ▯ What impact will the mine's ability to extract water from the large bore field located outside the project boundary have on irrigators as the same aquifer is being accessed? ... ▯ What if the drought continues and there is no winter-fill in a given year or longer? What happens if the mine is approved and there isn't enough water from winter-fill and the bore field? **Clearly, the proposed mine will compete with existing users for access to water and therefore this scoping requirement has not been met.**	Water supply	Water supply
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 7 Horticulture	319	13.2 Minimise effects on water resources and users Draft Evaluation Objective #3 of the scoping requirements: '*To minimise effects on water resources and on beneficial and licensed uses of surface water, groundwater and related catchment values (including Gippsland Lakes Ramsar site) over the short and long-term* .' Records show there have been full irrigation restrictions on extracting water from the Mitchell River during summer periods so it is foreseeable that this will happen again, with the situation being exacerbated by the mine's requirements for water which is estimated to be well over 3 GL annually for up to 15 years. It has been established that Kalbar will be competing for water with farmers and horticulturalists. The industry is already under pressure with water security an extensively documented threat. Lack of water particularly over the last few summers has damaged local horticultural businesses and resulted in loss of revenue. Due to the lack of water security, one of the growers in the group made a decision not to plant resulting in financial losses to the local economy and his business. Some growers made a decision to plant crops outside the region for that summer as a result of water not being available. Higher levels of salinity in bores was also reported during these periods. Extraction from bores had to be at a slower rate to enable water to recharge in the aquifer, slowing the extraction volumes. There is evidence to show that water security is a major issue for the horticulture industry without another major user (the mine) competing for access to the same sources of water.	Water supply	Water supply
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 7 Horticulture	320	13.3 Impact of contamination of water and aquifers What guarantees will be given that there will be no risks of contamination of water resources (rivers and aquifers) and how will horticultural and agricultural businesses be compensated if that occurs?	Water supply	Water quality
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 7 Horticulture	321	Contamination of aquifers: This has occurred by mineral sands mining companies in Australia so there is an unacceptably high risk that this could happen here with significant consequences for all agricultural users. Refer to the South Capel Remediation Project in WA involving Iluka, where an experienced and major mineral sands mining company in this country contaminated an aquifer which will take 10 to 20 years to remediate (Iluka, 2017; p 1). As a company, Kalbar Operations has no experience operating a mine so there are significant reasons to be concerned.	Water supply	Water quality

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 7 Horticulture	321	Shallow aquifers will be destroyed: It is acknowledged by Kalbar that shallow aquifers are going to be destroyed as the mine will be excavated up to 45m deep. These aquifers cannot be recreated. This will have a significant impact on water availability.	Water supply	Shallow aquifers
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 7 Horticulture	321	Rehabilitation concerns: The altered sand after it has been processed and returned to the mine void will be used in rehabilitation of the area. Most importantly, it will not be known how this sand will behave in the future as it has gone through an extraction phase - will it leach elements, will it hold onto nutrients, will this sand still be able to filter water as untouched sand does? These are important questions given the close proximity of the river catchments. There is a high risk that this will impact on ground water which eventually is used by the growers either from bores or from the river. **There was no mention in the RMCG report of how the use of altered sands on the mine footprint during rehabilitation poses a risk.** Victoria has an abysmal track record in relation to rehabilitation of mines as recently confirmed by a Victorian Auditor-General's Office report released in August 2020. There are very serious and foreseeable risks that the mine could go into 'care and maintenance' should the value of the minerals drop or indeed the company could cease operations for a range of reasons leaving behind the tailings storage facility, dams and an open pit with the potential for contamination risks from leaching and flooding events impacting on aquifers and the creeks, rivers and gullies.	Groundwater	Rehabilitation
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 8 Agriculture	362	Water impacts are not mentioned in the HSC report, despite being a pivotal factor in farming and, indeed, essential for the project. The Proponents EES does not properly address the risks to domestic and stock bores, and also how irrigation water supplies will impact local agricultural industries. As noted in the EES "There are also several shallow groundwater bores in the Project Area that are used for stock and domestic use" (Appendix A015 – Agriculture Impact Assessment p.18) "Most of the identified receptors are reliant or partially reliant, on the shallow groundwater regime" and that the "highest environmental risk ranking was identified for the Boisdale aquifer and the mid-tertiary stock and domestic aquifer, which is used locally in the vicinity of the proposed bore field."	Water supply	Shallow aquifers
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 8 Agriculture	362	Domestic and stock bores These shallow aquifers are critical for livestock producers in the area. Livestock farmers with lactating cattle drinking up to 100-120litres per day rely on these shallow bores to have a viable business. (https://agriculture.vic.gov.au/farm-management/water/managing-dams/watersupply-in-stock-containment-areas#h2-2) There were 6975 Registered Stock and Domestic Bores within Gippsland in 2012 each assumed to use 1.3ML/yr. (http://www.srw.com.au/wp-content/uploads/2016/03/GGA_SmallSize-1.pdf) Any impact to these bores would severely impact the local livestock producers who rely on these for drinking water and their own domestic use. Local towns such as Sale and Briagolong also rely on ground water to supply all of its domestic requirement. "The aquifer that supplies Sale is known as the Boisdale aquifer and is covered by the Sale Water Supply Protection Area (WSPA). The Sale WSPA has a maximum extraction limit of 21,212 ML/year and is generally understood to be overallocated." The Sale water supply system supplies the townships of Sale and Wurruk with potable water. The current estimated population serviced by the Sale system is 14,758 people." (Gippsland Water - Water Supply Demand Strategy 2012) Any risk to this aquifer demands further investigation. Briagolong which is 25km from the mine site is also reliant on shallow bores. "The aquifer that supplies Briagolong is known as the Wa De Lock aquifer. Briagolong is serviced by two bores, Bore No. 115384 and Bore No. 136968 which are located approximately 900 metres north of the township. The depths of these bores are 18.4 and 15.7 metres respectively. The aquifer, being unconfined and relatively shallow, is subject to seasonal variation in groundwater level and its levels respond quickly to drought and rain. Other license holders also utilise this aquifer for irrigation, although average consumption is only about half of total licensed extraction. Gippsland Water has undertaken modelling of this aquifer that suggests that full utilisation of these irrigation licenses may exceed natural recharge and therefore may pose a risk to the sustainability of the resource." Value of ground water to local agricultural livestock farmers & horticulture has been underestimated or omitted from the EES. Figures below obtained in 2012 have only increased in value over the past 9 years. Wa De Lock aquifer: 252 Licence holders. Estimated 2012 annualised gross value to Agribusiness of $6,868,000 and Domestic and Stock $593,000 WyYung aquifer: 60 Licence holders. Estimated 2012 annualised gross value to Agribusiness of $2,000,068 and Domestic and Stock $122,000. (Gippsland Ground Water Atlas http://www.srw.com.au/wpcontent/uploads/2016/03/GGA SmallSize-1.pdf p36) This emphasises the considerable importance and relevance these aquifers have to agriculture for their reliance to domestic and stock and irrigation and there has not been enough focus on the impacts the proponents 3-4GL per annum may pose to existing users.	Water supply	Shallow aquifers

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	384	The Swamp Everlasting is endemic to SE Australia and Tasmania. It is listed under the EPBC Act 1999. Saplings Morass is only one of two sites in East Gippsland where it is located. The proposed bore field in close proximity to Saplings Morass could impact this species by altering the hydrology of the area. (Carter, 2011) ...The proponent dismisses any suggestion that the bore field, when in operation, will impact Saplings Morass. The Dwarf Kerrawang is found around wetlands and swamps. A National Recovery Plan was implemented for this species in 2010. Threats to these two species include modification to hydrology, mining, climate change and soil disturbance. During the operation of the Iluka mine the Strathalbyn/Glenelg bore field directly lowered the watertable by 2-3m. It killed off understory in wetland areas and many ancient Red Gums. (Ross, 2020).	Groundwater	GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	406	The proponent did not meet the EES Scoping Requirements for characterising and identifying the Groundwater Dependent Ecosystems; very few were identified in the project area. The change in seasonality of the watertable and rate of change of mounding would normally be assessed.	Groundwater	GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	406	“Potential impacts to GDEs in the project locality are negligible-low as changes in the water table are typically well within seasonal water table variations and risk can be managed through monitoring of the water table and water quality.” The proponent can only manage risk if adaptive management is implemented based on monitoring results. Monitoring in and of itself does not mitigate risk.	Groundwater	GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	407	Appendix 8 page 14 states that “It is assumed that intervening aquitards provide sufficient barriers to protect the shallow alluvial aquifer.” On this assumption they have not assessed potential impacts of groundwater draw-down from groundwater extraction on vegetation that may be accessing the shallow alluvial aquifer.	Groundwater	GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	407	GDEs fall into 3 categories: 1. Ecosystems dependent on the surface – rivers wetlands springs – surface expression. 2. Ecosystems dependent on the sub surface expression of ground water vegetation and riparian areas – phreatotypes. 3. Aquifer and cave ecosystems (subterranean) The proponent’s assessment focused on GDE categories 1 and 2. Category 3 (subterranean) “Springs and caves/aquifer GDEs were not included in the mapping and assessment (none were mapped for the study area in the GDE Atlas)”	Groundwater	GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	407	8.2.2.6 The proponent has made the comment that “... groundwater modelling has inherent uncertainties that arise out of necessary simplifications in model design”.	Groundwater	GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	407	8.3.4 It has also been stated that “... water dependent ecosystems and species GDEs are likely to be limited within the immediate project area due to the elevated topography and significant depth to water”. The topography has not influenced the presence of GDEs as springs are present on the plateau in the project area and provide the only source of water in times of drought (as experienced in 2017-2020). The dams fed by springs support a variety of aquatic species. Drone footage over the landscape during the drought revealed green patches along drainage lines and creeks which indicated a series of GDEs. Does this mean because GDEs were not identified by the proponent that they believe they do not exist? Caves are located on Iguana Creek and in the Mitchell River National Park within the project locality.	Groundwater	GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	407	The Scoping Requirements required that the GDE assessments consider impacts associated with the dewatering i.e. from the pit. This has not been mentioned in this report.	Groundwater	GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	407	It is proposed to monitor the watertable, water quality and riparian/in stream health in lower Moulin Creek and the Mitchell River for mounding. Our question is just who is going to monitor this for the life of the mine? Monitoring for hydrological change to EVCs from groundwater mounding, leading to water logging, is not the answer as soon as impacts become apparent, it may be too late to halt the effects. This mitigation risk is unsuitable.	Groundwater	GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	408	It is an unavoidable consequence of the proposed mine that 2.5 hectares (quantified by Austral Research and Consulting 2020) of the endangered environmental vegetation community, Swamp Scrub/Warm Temperate Rainforest/Billabong Wetland Mosaic (EVC 701) will be destroyed due to permanent (20 years +) water logging caused by groundwater mounding in the lower Moulin Creek. This impact has been acknowledged by the proponent in their risk assessment and in the detailed ecological investigation. It has also been cited in the peer review (Austral) in the groundwater dependent ecosystem impact assessment. This unavoidable consequence cannot be avoided or minimised and as such poses an unacceptable risk. Using the figures supplied by the proponent, pre 1750 there was a modelled extent of EVC 701 of 1812.52 hectares within the project locality which represented 0.054% of the EVCs in the project locality. In 2005, EVC 701 had decreased to only 48.04 hectares in the project locality. Alarmingly this represented only 0.0026% of total EVCs in the project locality. The estimation of the EVC 701 is based on 2005 figures, 15 years old. There is no mention that this EVC 701 may have declined since. This EVC is not listed as occurring elsewhere in the Gippsland Plains Bioregion or the East Gippsland Lowlands Area. This endangered EVC has not been included in the offset figures. The proponent mentions that a section of Moulin Creek has a high risk of impact from ground water mounding (pg 98). Then contradictorily states in the summary that there is a very low likelihood that the project will impact any GDEs.	Groundwater	GDEs

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	408	DELWP commissioned a detailed groundwater condition report two years ago in the East Gippsland region. It acted as a pilot study to roll out across Victoria. The findings showed a trajectory of a major decrease in quality and quantity of water. Also mentioned is the demand for water out of the Latrobe aquifer for the Latrobe Valley open cut coal mines for the next 25 years. The competition for water will be a major issue in years to come. The independent review (ACEOM) of the original water study, and subsequent follow up material supplied by the proponent, has raised questions regarding the conceptualisation of the groundwater systems. Both the nature and extent of impacts have been under estimated. It is also noted that the level of design for key element of water management also limits the assessment of impacts, enhancing risk. The ACEOM review identified a possible oversimplification of the Coongulmerang Formation which could impact modelling results to the extent that potential for seepage to mound from a much higher elevation, with undesirable resultant impacts such as: - Groundwater day-lighting as seeps higher up the escarpment and sub catchments; - Saturate the ore body and flood active mine pit areas, with implications on site water management; and - Potential for mounding to interact with various engineered structures (for example TSF and water storage embankments) with implications on their stability. A second hydrological issue raised by ACEOM relates to the nature of the permeability of the Balook Formation which lies below the Coongulmerang Formation and into which mine seepage water will enter. The ACEOM review suggests that the Balook Formation is dominated by high plasticity clay and as a consequence the hydraulic conductivity would be at least 2 to 3 orders of magnitude lower than that assumed. The potential implications are: - Nature and extent of the local mounding in the Coongulmerang Formation will be significantly greater, and take significantly longer to dissipate; and - Less flow (if any) into the groundwater system that is connected to the Mitchell River ASR scheme.	Groundwater	Conceptualisation
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 9 Biodiversity	415	Has the proponent under estimated the water usage for the construction, processing and rehabilitation of the proposed mine? The 3 g L was a very conservation figure and not inclusive of all water usage. All water extraction from groundwater and the river will add to the existing salinity levels, affecting the ecology of the lakes system and surrounding wetlands.	Groundwater	Water balance GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 10 Climate change and emissions	425	Two things critical to the amelioration of climate change are retention and improvement of vegetation and tree cover and managing soil to retain carbon and water. The mine does the exact opposite to this and in doing so exacerbates climate change on a local scale by establishment of a landscape denude of vegetation, and by capturing gigalitres of water for processing that should have been going to maintaining soils and the ecosystem. At the same time those actions are reducing the capacity of existing landholders to effectively manage the challenges of climate change by depriving them and the environment of precious water. This extends to those users relying on bore water who will find have to manage the additional costs and stress of having to drill bores deeper because of the mining companies massive draw down of the aquifer.4 Interestingly, in the report looking into 'Matters of National Environmental Significance' the company acknowledged that the project would account for 0.07% of Victoria's greenhouse gases but claims that it could not find a 'risk pathway' to allow it to consider the 'risk of exacerbating climate change risks in the local area. This is rather surprising given the very nature of the operation with its removal of more than 700 mature trees and denuding 1100 ha of land over the 15 years operation will in and of itself lead to profound microclimate changes in and around the project area. These will be further exacerbated by capturing of water on site that would normally go to the underlying gravel recharge aquifer (which will be destroyed by the mine), thus reducing downstream flows of the Mitchell (particularly in summer months), and the depletion of the Latrobe Aquifer by up to an estimated 12-14 metres for some kilometres around the project site. 4. Reference 12-14 metres draw down at edge of the aquifer.	Groundwater	Climate change impacts
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 11 Socio-economics	443	The project area is under-laid by shallow aquifers. This is either ignored, dismissed or paid lip-service to with a one line acknowledgement. These existing and essential water bearing gravels/sands yield water this is relied upon by food producers within and adjacent to the project area. They are used for stock and domestic bore supplies, particularly so in drier periods. As the proponent has failed to identify and study these, the impact the mine will have on these shallower aquifers, including draw down, poses a high risk.	Groundwater	Shallow aquifers
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 11 Socio-economics	444	The proposed mine's high water demand for operations such processing and dust suppression, along with the need to acquire a supply of water from sources such as the Mitchell River winter-fill allocation, deep aquifer licences and the removal of surface flows from the watershed of all catchments (within and adjoining the project area) to be stored in storage dams for the mine's requirements is unbelievable and unacceptable. It demonstrates that the proponent has no regard for other users and that serving their own needs is the highest priority. Any water that is to be released back into the creek and river systems will impact on the GDE and aquatic biota with the changes in temperature, sediments, change in pH, algae, bacteria and altered hydrology of the area.	Water supply	GDEs
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 11 Socio-economics	450	Impacts on the land use in the vicinity of the project table Impacts on the land use: Loss of soil nutrients Extent of impact:Horticultural, Agricultural growers, biodiversity, wildlife Duration: 25+ Likelihood: High Implications of effects: Impact on groundwater dependant ecosystems, degradation of soil profiles, sediment loads in river from feeder gullies, dust deposition, reducing production of food, fibre, and flora	Groundwater	General potential impacts

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 11 Socio-economics	455	Impacts on the land use in the vicinity of the project table Impacts on the land use: Waste generated – solid/ liquid/ adequate disposal of Extent of impact: Chemicals, fuel, sewage, packaging, chemical containers, sediment load, accidents, leaching into water table, rubbish carried by wind Duration: 25+ Likelihood: High Implications of effects: Flocculants seeping into groundwater impacting aquatic environment, and groundwater dependant ecosystems, rivers, and streams. Proper storage and disposal of mine produced wastes (carefully following manufacturer's instructions) ensuring there is no contamination to the environment. Extra care taken to avoid chemicals spilling/leaking into soils and groundwater systems.	Groundwater	General potential impacts
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 11 Socio-economics	460	Impacts on the land use in the vicinity of the project table Impacts on the land use: Changed topography - impacts on surface water flow, capturing and drainage Extent of impact: Landowners, residents, Community, recreational users Duration: 25+ Likelihood: High Implications of effects: How can we be guaranteed the permanent changes to landscape topography, despite being engineered and designed to lessen the environmental impacts are successful? Potentially significant impact with sediment/nutrients, toxins, diminished flows of surface and groundwater	Groundwater	General potential impacts
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 11 Socio-economics	466	Impacts from competition for water The EES acknowledges a decline in the water table of up to 5 metres, resulting in increased costs extracting water for irrigating crops. The Latrobe aquifer is already declining by over one metre per year as a result of mining, severely impacting previously viable farms near Yarram and affecting Sale's water supply bores. The EES fails to acknowledge the impact that extraction for the proposed mine's requirement of 6 gigalitres of winter-fill will have on aquatic species, the rivers, aquatic environment and the Gippsland Lakes system. Past water restrictions placed on Lindenow Valley irrigators will see direct competition with the mine for this finite resource if the project is approved. It is concerning that it appears the proponent is not confident about being able to acquire the 3 gigalitres of water it needs for dust suppression. In appendix A008 the size of pipes and type is suited to an anticipated flow rate of 25Ml per day from the Mitchell River. In Appendix A006 the maximum intake of water from the Mitchell River is increased to 37.5 Ml per day to compensate for the days during dry spells when pumping from the river is not allowed. This begs the question of whether they only intend to suppress the airborne dust arising from haul roads. If this is the case, vegetable crops cannot fail to be impacted by dust created during the mining operations. The proponent has also not allowed for the potential impacts of climate change during the planned 15-20 years duration of mining and rehabilitation. Predicted rises in temperature and lower volumes of rainfall over the coming decades should have been taken into consideration. Conflicting information and lack of consideration of consequences are unacceptable; the assessment of the risk cannot be based on flawed information.	Water supply	Impact assessment adequacy
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 17: Planning Scheme Amendment	596	The proposal is intending to industrialise a rural farming area and is completely unacceptable. The mine itself is fraught with problems, including the effects it is going to have on people who rely on groundwater. Economically it is not a sound proposition and environmentally and socially it is a disaster. The amendments were never part of Kalbar's original proposal and there has never been the opportunity for the public to make comment on them.	Groundwater	General potential impacts
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 17: Planning Scheme Amendment	599	How does the amendment implement the objectives of Victoria's planning scheme? Table Rationale: Amendment implements the objectives of Victoria's planning scheme -economic; -sustainable use of land; -providing for its fair and orderly development Effects:Development of land Impact what and why: This is farming land that produces food and fibre that feeds the nation and its produce is exported overseas. Unacceptable risks (residual, potential): Mine cannot co-exist with current land use because of dust, competition for surface and groundwater, biosecurity impacts, increased traffic, destruction of existing biodiversity, changed amenity of landscape, questionable if rehabilitation would be successful.	Water supply	General potential impacts
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 17: Planning Scheme Amendment	600	How does the amendment implement the objectives of Victoria's planning scheme? Table Rationale: Provide protection of -natural; -man-made resources; -maintenance of ecological processes; -genetic diversity Effects: Ecological processes Impact what and why: 20 surface water catchment dams will lessen the downstream flow to other beneficial users including freshwater ecosystems, potential discharge of untreated water into streams increasing turbidity, temperature, and pH Unacceptable risks (residual, potential): Flow regime altered, impacting ecosystems, resulting in less groundwater recharge	Groundwater	General potential impacts

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 17: Planning Scheme Amendment	603	How does the amendment implement the objectives of Victoria's planning scheme? Table Rationale: Groundwater impacts - aquifer draw down Effects: Bore field into deep Latrobe Aquifer (to be utilised for initially the first 3 years- make up water) 4 GL Winter-fill water allocation from Mitchell River yet to be made available Impact what and why: Latrobe Aquifer – drawdown including the overlaid Seaspray Group aquifer. Mounding will impact groundwater dependant ecosystems Unacceptable risks (residual, potential): Mounding and slumping within the water table will render some land unsuitable for existing practises. In dry climatic times groundwater is used by the horticultural industry to supplement their water requirements. Dryland farmers and households use shallow aquifers for stock and domestic purposes – with usually no other alternative.	Groundwater	General potential impacts
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 17: Planning Scheme Amendment	603	How does the amendment implement the objectives of Victoria's planning scheme? Table Rationale: Groundwater impacts - water balance (increased inflow and outflow to River) Effects: Bore field into deep Latrobe Aquifer (to be utilised for initially the first 3 years- make up water) 4 GL Winter-fill water allocation from Mitchell River yet to be made available Impact what and why: Flow rates to River will lessened with dams constructed on all catchments Unacceptable risks (residual, potential): In times of significant rainfall events it is hoped the infrastructure involved with the mine will withstand the impact and not create or exacerbate the event	Groundwater	General potential impacts
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 17: Planning Scheme Amendment	610	Planning policy framework- supporting Agriculture within the Municipality - East Gippsland Planning Scheme: table Clause: 14.02-1S Catchment planning and management Directions: - To assist the protection and restoration of catchments, water bodies, groundwater, and the marine environment. - Strategies ensure the continued availability of clean, high-quality drinking water by protecting water catchments and water supply facilities. - Consider the impacts of catchment management on downstream water quality and freshwater, coastal and marine environments. ... Proposed mine's impact: With the proposed 20 contingency dams to be constructed in the project area and adjoining Planning Scheme Amendment area – the volume of water flowing to downstream beneficial users including, groundwater dependent ecosystems and the environment will be severely reduced...	Groundwater	General potential impacts
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 17: Planning Scheme Amendment	611	Planning policy framework- supporting Agriculture within the Municipality - East Gippsland Planning Scheme: table Clause: 14.02-2S Water quality Directions: -Ensure that land use activities potentially discharging contaminated runoff or wastes to waterways are sited and managed to minimise such discharges and to protect the quality of surface water and groundwater resources, rivers, streams, wetlands, estuaries, and marine environments. - Discourage incompatible land use activities in areas subject to flooding, severe soil degradation, groundwater salinity or geotechnical hazards where the land cannot be sustainably managed to ensure minimum impact on downstream water quality or flow volumes. - Prevent the establishment of incompatible land uses in aquifer recharge or saline discharge areas and in potable water catchments. - Encourage the siting, design, operation, and rehabilitation of landfills to reduce impact on groundwater and surface water. - Use the mapped information available from the Department of Environment, Land, Water and Planning to identify the beneficial uses of groundwater resources and have regard to potential impacts on these resources from proposed land use or development. Proposed mine's impact: Long term presence of thorium residue in tailings can take thousands of years to disperse – 90 ha of tailings dams will be constructed at the head waters of the Perry River System. After 5 years they will be relocated, and additional tailings dams will be constructed within the mined void, but this area is in close proximity to the Mitchell River - All residents within the 2km radius rely on rainwater tanks. Towns including Lindenow, Walpa and Lindenow South have town water. Towns are on permanent water restrictions.	Groundwater	Water quality
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 17: Planning Scheme Amendment	613	This avoidance and mitigation will only be as good as it is regulated and monitored by the relevant authorities. Past examples of failed rehabilitation or the lack of it, tailings dam seepages and collapse, unregulated contaminated water leaving the site entering waterways question whether this proposal can be adequately mitigated. The area contains a vast watershed which feeds into gullies recharging groundwater supplies and delivering surface water flows to streams, rivers, and the Gippsland Lakes system.	Groundwater	Monitoring and mitigation measures
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 17: Planning Scheme Amendment	616	Twenty indicative water managements dams are to be constructed within the project area for water to be captured and utilised in the processing of the resource and for dust suppression. Dams 11,12,13,16,15,14 and 17 are within the Lucas Creek catchment (watershed catchment is within the project area and within the Planning Scheme Amendment area). At times this catchment yields significant volumes of water which is used by downstream beneficial users including groundwater dependent ecosystems and the environment. Lucas Creek also discharges a significant flow into the Mitchell River as shown in the flood photo below taken in 1990. These indicative water management dams will significantly diminish the flow regime to these downstream users.	Groundwater	GDEs

813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 18: Draft Work Plan	630	Misleading data for Kalbar's water balance modelling predicts greater rainfall runoff to increase surface water availability to reduce dust than a more accurate climate projection which was ignored by Kalbar consultants. Consequently, the capacity to source sufficient top-up water - predominantly for external water sources (Mitchell River or groundwater from the Latrobe Group Aquifer) - will need to be reassessed and evaluated.	Groundwater	Water balance
813	Ms Sharon Clerke (Mine-Free Glenaladal	Chapter 19: EPA Works Approval	642	Effects of misrepresentation of rainfall runoff Rainfall runoff has been misrepresented so the proponent would need to access a greater external water source which appears to be via groundwater from the Latrobe Group Aquifer. This aquifer has been in a depleted state for decades with overextraction more than can be recharged. The ability to access more groundwater from Southern Rural Water over the lifetime of the mine including decommissioning cannot be relied upon.	Groundwater	Water balance
837	Lionel Rose		3	Having read large extracts From Kalbar' s Environmental Effects Statement, I have found many mistakes and inaccuracies which are far more than simple typographical errors... The document is full of unsubstantiated statements, assumptions and incorrect facts. These include: • not addressing the issues of the effect of water retention on the proposed mine site on springs and gully ecosystems further down those gullies	Groundwater	GDEs
837	Lionel Rose		3	Having read large extracts From Kalbar' s Environmental Effects Statement, I have found many mistakes and inaccuracies which are far more than simple typographical errors... The document is full of unsubstantiated statements, assumptions and incorrect facts. These include: • claiming that monitoring bores have been sunk to monitor mining impact on groundwater when they are not appropriately located in relation to many farm bores, especially stock and.domestic bores to the south of the project area	Groundwater	Monitoring and mitigation measures
837	Lionel Rose		4	Having read large extracts From Kalbar' s Environmental Effects Statement, I have found many mistakes and inaccuracies which are far more than simple typographical errors... The document is full of unsubstantiated statements, assumptions and incorrect facts. These include: • despite local advice producing modelling which assumes that groundwater seepage can be controlled and that contaminated mine water will not find its way into the Perry or Mitchell systems shows a lack o'f knowledge of the way water and subsoils interact in wet years	Groundwater	Numerical modelling
837	Lionel Rose		5	The heavy use of computer modelling using limited data by both the proponent and their consultants manages to conclude that the project is viable and that problems arising can be mitigated. In many instances not only does this modelling contradict local knowledge but the conclusions reached do so also. I contend that the EES • is manifestly inadequate being too reliant on computer modelling to enable accurate predictions to be made about the likely risk of certain events occurring which may be of threat to existing land use, the environment and the adjacent communities	Groundwater	Numerical modelling
837	Lionel Rose		8	**• Water Retention Dams on Gullies within Project Area** When we constructed a gully dam on our property we had to justify to Southern Rural Water before permission was granted that this infrastructure would not negatively impact on other landowners who had property further down that gully. It seems that this has not been the case with Kalbar as they have not approached us to discuss the impact of their water retention darns on the flows further down these gullies and the effect it will have on our dam to fill. Nor does it seem that they have anywhere in their documentation examined the impact that these dams of theirs will have on gully springs or the ecosystems that are reliant on them.	Groundwater	Shallow aquifers
837	Lionel Rose		9	**• Protection for Landowners if there are Engineering Failures** As much of the plann ing for this project has been done through computer modelling and as demonstrated large tracts of this modelling is suspect, protections need to be readily available and in place to protect the community in the event of there being a failure of Kalbar's systems or if it is found that their predictions are inaccurate and result in threats to the amenity and liveability of the area for nearby residents. It has to be asked what Kalbar' s response will be to protect the nearby sensitive receptors when noise leve ls exceed their predictions or when dust impacts potable water su pplies, pasture or homes or when water flows into farm dams or bores is reduced. At present in the EES there seems to be no proactive policies for these areas.	Groundwater	Numerical modelling
837	Lionel Rose		13	**Increased competition for water** Allocation of additional water for horticulture bas the potential to create far more long term sustainable jobs than does the allocation of that water to mining.	Water supply	Water supply
837	Lionel Rose		15	**Groundwater** While much attention has been paid to the impacts on the deeper aquifers. Nothing shows here to address any issues that may arise from interference with the shallower stock and domestic bores in the area. Although Kalbar has sunk some test bores, none are near any stock and domestic bores which farmers are so reliant on during drier periods. Most of these bores are low capacity in the vicinity of 200-250 gph extracting water from soaks in deep fine sands. Any interference with these soaks caused by disturbing the strata that this water passes through has the potential to deprive farmers of this essential water supply. Kalbar has not established any effective way of monitoring its impact on these systems and this is far from acceptable.	Water supply	Shallow aquifers

837	Lionel Rose		16	**Tailings seepage** Again the proponent fails to understand the geology of the underlying subsoils and strata. The clays in the area are gritty due to sand content and due to sodium content do not bind well. This allows water penetration and therefore a complete seal of the tailings dam cannot be assured. Even with the use of liners which have a limited life. and experience has shown are easily damage by wildlife, a seal cannot be guaranteed. In a wet year where there is natural water movement through the sub soils seepage through the tailings dam is even more likely to occur. The location of the tailings dam will mean that seepage is likely to find its way into the Chain of Ponds, Providence Ponds and the Perry system. Given the ecological importance of this system and despite the proponent's assurance of mitigation measures the risk is much greater than suggested in the Register.	Groundwater	Tailings seepage
837	Lionel Rose		25	**Groundwater draw down affecting shallow aquifers accessed from bores used for stock and domestic needs** This is a serious issue as Kalbar has no way of monitoring impact on stock and domestic bores as it has failed to investigate the issue thoroughly enough. There are no groundwater monitoring bores in the vicinity of these stock and domestic bores to monitor flow or water quality. As these bores are essential for farm survival when dams become too low or safe to access this issue needs further investigation.	Water supply	Monitoring and mitigation measures
837	Lionel Rose		25	**Tailings dam seepage via groundwater or structural failure resulting in discharge into Mitchell and Perry systems** The history of tailing dams failures is substantial. With the soil types and the proposed size and location of Kalbar's tailings dam this issue does not seem to have been taken seriously enough by the proponent. The location of this infrastructure needs to be reassessed in the light of the potential damage that could be done not only to the Mitchel and Perry systems but to the Gippsland Lakes and the RAMSAR wetlands.	Groundwater	Tailings seepage
837	Lionel Rose		26	R**educed runoff into ephemeral gullies caused by damming gully heads and retaining runoff water onsite.** There should be no doubt that water stopped from flowing down gullies into the Mitchell River by mining activities should be directed down ephemeral gullies to the benefit of the ecosystems that exist within them. This reduced flow will impact farm dams as well as ecological communities within these gullies. The fact that during drought conditions these gullies provide a source of green feed for stock and that reduction in flow to the springs and soaks has not even been considered by the proponent.	Groundwater	GDEs
837	Lionel Rose		41	**Irrigation and Water Availability** Data from the consultants suggests that the mine woul d not be given priority for winterfill if and when the six gigalitres of non-allocated water is released. However if this water is put up for auction despite the admittance that it would be of greater benefit to the horticulture industry, the farmers could easily be outbid.	Water supply	Water supply
837	Lionel Rose		58	There is at present a fine balance in the Fingerboards area between water penetration into the recharge areas and aquifers for the shallow stock and domestic bores and runoff into the gullies and alteration of this hydrology will have serious consequences which may not become obvious for a number of years after what may appear to be on the surface successfu l rehabilitation. There is a suggestion in this section of the EES that lime/gypsum be added to the clay subsoils to displace the sodium responsible for the dispersive nature of the clays. However reference to a DPI document, "Tunnel Erosion in East Gippsland" suggests that this is neither a long term nor simple solution with erosion reappearing in the years following the trials. The laboratory testing done in these trial suggests that somewhere in the vicinity of 15 tonne/hectare needs to be applied to suitably stabilize the soils. This amount of lime/gypsum would have to its own negative consequences in preventing the flow of water, even if minus its clay particles, into the seepage areas and eventually into the aquifers.	Groundwater	General potential impacts
849	Anthony Power		3	The large amount of water needed from the river 3 million litres. If this amount was allocated to the vegie growers it would create more jobs than the mine.	Water supply	Water supply
875	Astrid Rose		8	…vegetable growers will be in competition with the mine for water and will have less or no opportunity to expand their businesses.	Water supply	Water supply
875	Astrid Rose		8	Due to its location near the Mitchell River, approximately 350 -500 metres at the nearest point, shortage of water and competition for water issues, and proximity of a viable food industry, there is a very high risk that Kalbar's mine will close well before its anticipated 15-20 years duration.	Water supply	N/A
875	Astrid Rose		18	Vegetable growing is highly sensitive to reduced water availability and should not be put at risk by an open cut mine which could impact on the income it contributes to the State's economy which is 150-200 million dollars annually. In dry spells and times of drought it should not have to compete for water with an industry that claims it requires the allocation of a fixed volume of water- 3 GI - regardless of likely climate changes in the 15 -20 years of operation and rehabilitation.	Water supply	Water supply
887	Anita Hallett		2	This mine will initially be using 3 Gigalitres (3 billion litres) per year for up to 15 years to process the sands and control dust. There have been reports that this will increase to between 6 -9 Gigalitres annually . This is an enormous amount of water to come from where?? *More questions need to be asked about increasing demands for water as the mine increases production.*	Water supply	Water supply
887	Anita Hallett		2	If the mine is allowed to access groundwater, this has enormous ramifications for most of the farming properties around. A lot of properties in the area, including ours, rely on stock and domestic bores to provide an essential water supply for our domestic use, plus water for our livestock. *If our existing bores run dry, put in at our own cost, WHO PAYS?*	Water supply	Monitoring and mitigation measures
887	Anita Hallett		2	The local aquifers are already oversubscribed. Farmers are currently unable to get new or increased water licences, let alone irrigation licences. This sand mine requires massive amounts of water. *How can Mining Companies suddenly get access to vast quantities of water, when farmers cannot?*	Water supply	Access licensing/entitlements
887	Anita Hallett		3	This is one of the most serious issues, because **any contamination of groundwater in this area means the end of farming here**. Farming in our area is TOTALLY reliant on access to good quality groundwater.	Groundwater	Water quality

887	Anita Hallett		3	The Perry River is a major recharge for the Boisdale Aquifer which supplies a lot of farms with their drinking water, as well as water for livestock. It is also the sole source of drinking water for the City of Sale, plus several other towns around the area. *Any contamination of groundwater will put the health of these people at serious risk, both short & long term.*	Water supply	Water quality
887	Anita Hallett		3	The source of the Perry River is just near the proposed sand mine site, so contamination by dust containing radioactive substances and silica coming from the mine will definitely be getting into this vital groundwater aquifer.	Groundwater	Water quality
887	Anita Hallett		5	The Victorian State Government has planning guidelines in place to preserve prime agricultural land. Gippsland has some of the best agricultural land in Australia, and the vegetable industry in the Lindenow valley is a major producer of vegetables for both Victoria and interstate. The Government should not put at risk the water aquifers, the rivers and Gippsland Lakes system, the agricultural production and the liveability that are the hallmarks of country Victoria by allowing a short-term mineral sand mine that would have devastating long term effects on the health and welfare of local residents, and the extensive "clean green" produce that comes from this area. Why would this be put at risk? This is a serious conflict of interest.	Groundwater	Risk assessment
887	Anita Hallett		6	1. Contamination of aquifers, groundwater, dams, rivers and the Gippsland Lake System is inevitable, both through dust and contamination from the tailings dam. How can the Panel allow a project to go ahead that will have such serious and long-term consequences on public health, welfare of livestock, safety of our food, and welfare of wildlife and aquatic animals?	Groundwater	Water quality
889	Timothy Hamilton		3	The proposed groundwater bore field is of concern mainly because the regulator Southern Rural Water really has no hard and fast data on the connectivity of the various regional aquifers. There are VCAT transcripts whereby SRW opposed an irrigation bore licence application in Lindenow on the grounds of connectivity to the Latrobe Valley aquifer and others. Then subsequently changed tac and allowed a Local Government body organisations application to proceed in the Woodglen area on the grounds there wasn't connectivity.	Groundwater	Conceptualisation
889	Timothy Hamilton		3	Over the past four years the Woodglen aquifer from discussion with bore licence holders there has clearly been unprecedented reliance on groundwater and it has been stressed. Water levels have dropped and some higher saline levels than normal are being detected.	Groundwater	Water level decline
889	Timothy Hamilton		3	When making this known to SRW they were dismissive of this observation on the grounds it couldn't be true because it contradicts the models and we didn't have professional technicians record what we were hear say observing.	Groundwater	SRW modelling
889	Timothy Hamilton		3	The models SRW operate from need to be revisited. There are enough concerned licence holders to be willing to participate in an actual practical test pumping experiment to place actual physical extraction against the theoretical figures models to see how they concure in the current status quo before Kalbar be given a conditional licence.	Groundwater	SRW modelling
893	Sharon Clerke	Attachment 1	5	9. Only 11 tanks have been tested by Kalbar while many more residents have had their tanks, bores, dams and the Mitchell River, independently tested to ensure a true and correct baseline. Will this flag a class action further down the track against both the government and Kalbar for contaminated water due to the Kalbar mine? Oh yes of course, Kalbar state there is nothing in the dust? 10. Who will be held responsible when contamination occurs? And it will.	Groundwater	Monitoring and mitigation measures
893	Sharon Clerke	Attachment 1	9	33. 'Abstraction of water from the Latrobe Group Aquifer could reduce groundwater levels within the aquifer.' Have all farmers that use this aquifer been notified by Kalbar of their intentions or do you rely on all these farmers reading a 10,500 page document?	Water supply	Community consultation
893	Sharon Clerke	Attachment 1	9	34. Comments regarding groundwater such as: 'Other users could be affected' 'Could reduce groundwater levels within the aquifer' Seepage of water from the tailings stored in the mine void' 'Is not expected to impact' 'Have a measurable impact' 'Marginally above relevant criteria' 'Tailings seepage is predicted' 'Not significantly impacted' Does this not concern you? It certainly does me.	Groundwater	General potential impacts
896	John Hine		6	Many of the farms in the Lindenow Valley rely heavily on the Latrobe Group of aquifers as well as the Mitchell River. Drawing of water from this aquifer for the mine will drop the water depth from its static level of 47 metres. During drought events due to lack of recharge this level has been known to drop below 34 metres which is close to the maximum that makes this water accessible for irrigation. Any further drop caused by the proposed mine drawing on this water will have a serious impact on the availability for vegetable production.	Water supply	Water supply


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