Before the Hearing Commissioners
appointed by the Grey District Council and
West Coast Regional Council

Under	the Resource Management Act 1991
In the matter of	Resource consent applications by TiGa Minerals and Metals Ltd to establish and operate a mineral sands mine, and associated activities on State Highway 6, Barrytown (RC-2023-0046; LUN3154/23)

Joint Witness Statement – Groundwater Management Through Injection

6 March 2024

Introduction

1 This joint witness statement has been prepared to record the outcome of witness conferencing on hydrology and water-related matters arising from the proposed mineral sands mine and associated activities at State Highway 6, Barrytown (**Application and Application Site**).

2 Witness conferencing took place on 21st February 2024 between:

(a) Jens Rekker, Kōmanawa Solutions Ltd, for TiGa Minerals and Metals Limited (**TiGa**);

(b) Brett Sinclair, Wallbridge Gilbert Aztec New Zealand Pty Ltd, for West Coast Regional Council and Grey District Council (the **Councils**);

3 Previous correspondence between the parties consisted of:

(a) Brief correspondence between Mr Rekker and Mr Sinclair in mid-January regarding Brett's role and involvement on behalf of the WCRC.

(b) A previous conferencing meeting between Mr Rekker, Mr Sinclair and Professor Brian McGlynn regarding the hydrogeology of the proposed TiGa mine site and the viability of water management at the site, which resulted in a Joint Witness Statement – Hydrology and Water, dated 2 February 2024.

4 In preparing this statement, the expert witnesses have read and understood the Code of Conduct for Expert Witnesses as included in the Environment Court of New Zealand Practice Note 2023.

Matters considered

5 Matters discussed relate to the viability of the aquifer recharge systems proposed by the applicant and their capacity to address potential off-site effects on the groundwater system and connected surface water bodies. These matters specifically include:

(a) The objectives of the water recharge systems within the framework of the site mine water management programme.

(b) The use of infiltration trenches to achieve groundwater recharge objectives.

(c) The outcomes of the water injection trial documented in the report by Kōmanawa (2023).

(d) The differences between this trial and the likely design of a full site groundwater management system.

Matters agreed

6 Objectives of the water recharge systems.

(a) The groundwater recharge systems planned to be installed around the edges of the proposed mineral sands mine are not primarily intended to enable the management of mine water accumulating within the operational pit. This mine water is to be managed by discharge via the proposed water treatment plant, as described in the mine Water Management, Monitoring and Mitigation Plan (WMMMP). Water from the water treatment plant is to be primarily discharged to Collins Creek Lagoon, with discharge via an infiltration trench to be installed close to Collins Creek being the backup option.

(b) The use of treated water for enhanced groundwater recharge around the edges of the proposed mineral sands mine represents the appropriate use of an available water resource to manage or mitigate potential off-site effects.

(c) If groundwater levels around the edge of the proposed mine are at or close to surface, operational flows to the proposed groundwater recharge systems may be reduced or stopped completely without significantly impacting other components of the mine water management system at the site. It is expected that the proposed groundwater recharge systems will only receive a fraction of the water passing through the water treatment plant.

(d) A planned infiltration trench located on the north side of Canoe Creek, to the west of the proposed mine site, is intended to be used as a backup discharge point for treated mine water. Water discharged to this trench is expected to enter the shallow underlying groundwater system and flow through this system to Collins Creek. It is expected that the mine operators would only need to use this recharge trench for water management purposes in response to periods of heavy rainfall, if it is deemed that additional discharges to Collins Creek Lagoon could result in undesirable environmental effects due to excessively high water levels in the lagoon. Under such circumstances, water flows in Canoe Creek are also likely to be high and any additional contribution to the flow in Canoe Creek is unlikely to have a detectable effect on water quality.

7 The use of infiltration trenches

(a) The proposed infiltration trenches to be installed along the edges of the mine footprint are intended to be used to maintain shallow groundwater levels in the immediate vicinity of the trenches above water levels in nearby surface water bodies. These trenches are not intended to function as a primary treated mine water discharge system and are unlikely to have the infiltration capacity to perform that function.

(b) If the groundwater level in the vicinity of a trench is above the water level in the nearby surface water body due to natural recharge, operational flows to the trench may be reduced or stopped completely without significantly impacting other components of the site mine water management system.

8 Outcomes from the water injection trial.

(a) The water injection trial documented in the report by Kōmanawa (2023) represents a reasonable proof of concept with respect to the use of treated mined water to manage potential groundwater drawdown around the edges of the proposed mine. The pump-out test resulted in a drawdown in the test bore of approximately 7.7 m under a flow rate of approximately 3.4 L/s. Analysis of the test data indicated the mineral sand aquifer is partially confined with a lower permeability silt and clay rich layer above the mineral sand and underlying Collins Creek at this point. However, Collins Creek should not necessarily be considered a perched water body. Groundwater drawdown between the operational pit and Collins Creek can be expected to result in a small depletion of stream flows in the absence of appropriate management measures being put in place.

(b) The pump in (injection) test resulted in a head increase in the bore of approximately 4.3 m (to approximately 3 m above ground level) at an injection rate of approximately 5.8 L/s. This injection pressure resulted in some return of injected water directly back to surface around the bore casing. Furthermore, a distinct spring developed 13 m from the injection bore and seeps appeared along the banks of Collins Creek. These ‘leakage’ effects represent unwanted outcomes in an operational groundwater recharge system. Therefore, the injection pressure and flow rate applied in this test were higher than what would be applied under operational mining conditions. Optimisation of the recharge system design and operation should prevent such leakage.

(c) The water injection trial demonstrated that groundwater pressures within the mineral sand ore deposit could be increased by more than 1 m at distances at least 16 m from the injection bore. This indicates that a line of injection bores can be designed to generate overlapping groundwater mounding effects with separation distances of at least 32 m between bores.

(d) The key objectives of the proposed injection bores are to prevent depletion of flows or reductions in water availability in nearby surface water bodies, springs, or wetlands. For operational purposes, this objective should be locally achieved if the groundwater level half-way between adjacent injection bores is maintained above a consented level, which is above the water level in the adjacent surface water body. The trial outcome indicated that injection rates and pressures at individual bores may need to be reduced to avoid unwanted 'leakage' effects. Reducing the injection pressures would require the separation distance between bores being correspondingly reduced to achieve the groundwater management objectives.

(e) An increase in the number of injection bores would not impact on the effectiveness of the proposed groundwater management program. The proposed sequence of mine panels progresses from south to north, with the area most susceptible to surface water depletion and off-site groundwater drawdown being along the northern boundary of the mine. Therefore, the number of injection bores required and their spacing may be optimised through system testing during the early stages of the mining operation.

9 Differences between the injection trial and a full groundwater management system for the site.

(a) The minimum buffer area around the mine footprint, within which no mining excavations are proposed, is 20 m in width. The applicant proposes to install injection bores within this buffer area, where appropriate to manage off-site drawdown of groundwater and surface water depletion effects. The injection trial indicated groundwater mounding from water injection could extend at least 16 m from an injection bore. Therefore, in areas where the buffer zone is approximately 20 m wide, the operational bores would be installed close to the adjacent surface water body to minimize movement of injected water back toward the open pit. This concept is slightly different to the original conceptualization, which envisaged installation of the injection bores in the middle of the buffer zone. The installation of a line of such injection bores should enable a mine water management operator to maintaining groundwater pressures beneath the adjacent to surface water body and thereby achieve the objective of preventing measurable water-body depletion effects.

(b) The number of injection bores eventually required to achieve the groundwater management objectives may be greater than the number indicated in the current WMMMP, due to the likely need to reduce bore spacing as described in Paragraph 8(d) above.

(c) Installation costs for the trial bore were relatively high, as is often the case for trial systems. However, drilling and installation methodologies are available that should substantially reduce installation costs on a per-bore basis. This is not necessarily a matter for consideration during the consenting process, but it is a matter for the applicant to be aware of when costing the final injection system designs.

(d) Reinjection bores are likely to be installed close to the surface water body requiring protection. This positioning would leave no room to install groundwater compliance monitoring wells between the injection bores and the surface water body, as is proposed in the current WMMMP. Groundwater compliance monitoring wells would be more appropriately positioned half-way between adjoining injection bores, where the combined operational groundwater mounding effects are expected to be smallest.

10 In summary, it is reasonably expected that a groundwater recharge system can be installed and managed in a manner consistent with preventing surface water and off-site groundwater resource depletion, either in terms of flows or water levels.

Dated 6 March 2024

Jens Rekker, Principal Hydrogeologist, Kōmanawa Solutions

Brett Sinclair, Principal Hydrogeologist, WGANZ