

1. I am the Technical Director – Water and Environmental Management at e3Scientific Limited where I have worked since 2015. I hold a Bachelor of Engineering (Environmental) (Hons) (1999) from the University of New South Wales (UNSW) and a Masters of Engineering Science (Groundwater Studies) from UNSW in 2008. The subjects completed for my masters also fulfilled criteria for Master of Engineering Science (Water Quality).
2. I have 20 years experience working in the water industry in Australia and New Zealand. My experience has encompassed a range of engineering studies including hydrogeochemistry and water quality assessments, groundwater supply assessments, groundwater-surface water interactions and investigations to characterise site hydrology, and assessments of environmental effect for take and discharge consents across Otago and Southland.
3. I confirm that I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2023. I have complied with the Code of Conduct in preparing this evidence and agree to comply with it while giving oral evidence before the Hearings Panel. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.
4. In addition to all of the technical reviews completed for this consent (taken as read), I visited the site on 10th May, 2024 and was given a tour by Mr. Simon Johnstone of Hawkeswood Resources.
5. The site hydrology is complex and difficult to assess due to the Clutha River boundary extending along the southern and western boundary of the site, the Tima Burn flowing along the eastern boundary, a closed landfill to the north of the site, and historic mining being completed along the southern boundary in the past. The Clutha River provides a complex recharge boundary due to rapid water level fluctuations (over 1 m per day) caused by hydropower generation.
6. The uncertainty and limitations regarding the pumping tests and calculated aquifer parameters are significant, however it is acknowledged that the actual pumping rates of the mine pit pumping test provide the best information regarding the required pumping rates.
7. The groundwater site maps indicate considerable variability across the site. It is noted that for an activity of this scale, establishing surveyed groundwater monitoring bores to measure baseline groundwater level and quality conditions prior to the activity occurring is considered to be best practice. During the site visit, Mr Johnstone stated that several groundwater monitoring bores have been monitored for over twelve months, including during the mine pit dewatering trial, and that site LiDAR is also available. It is unclear why none of this data has been documented within the assessments or used to improve the groundwater conceptual model for this site.
8. Drawdown at the site will be very complex due to the variable rate pumping, recharge boundaries and small aquifer extents, hence there is considerable uncertainty in the actual effects that will occur. As there may be effects on both the Tima Burn and other groundwater users, monitoring the effects and

using adaptive management strategies is considered appropriate mitigation for the potential effects. It was noted during the site visit that the Tima Burn stream bed was deeply incised at Teviot Road, and that the land did slope towards the Tima Burn, indicating that groundwater connectivity is at least seasonally likely.

9. The key issues with respect to groundwater quality are the discharge of sediments from washing, mobilisation of contaminants from landfill and the possible introduction of sediments during augmentation. Note that dewatering will not increase contaminant mobilisation from the landfill as there is an unsaturated zone beneath the landfill, rather dewatering will alter current flow paths. There will be no earthworks within 20 m of any watercourse, and no discharge of treated water to land within 50 m of any watercourse, including the Clutha and Tima Burn.
10. Wash water from the gold plant will either be recycled back into the mine pit or via a sediment retention pond to infiltration pits. The discharge is expected to only contain suspended sediment from the mine pit, which is intended to be settled out in the initial sediment retention pond before being discharged to groundwater via an infiltration pond and then migrating to the Clutha River. These infiltration ponds are intended to be located between the mine pond and the Clutha River, though no closer than 50 m to the Clutha River. Given that the infiltration ponds will cause some groundwater mounding, the gradient of flow is likely to be mostly towards the Clutha River from these locations. However, there may be some flow parallel to the Clutha River towards downgradient groundwater users due to the mounding and drawdown in the aquifer.
11. The key adaptive management strategies are:
 - Augmentation of the Tima Burn and providing alternative water supply to neighbouring groundwater users.
 - Providing alternative water supply to neighbouring groundwater users as per proposed Condition 7. The ability to obtain alternative supply should be confirmed.
12. To enable implementation of the management strategies, dedicated monitoring bores should be installed on the site boundaries, with water quality monitoring as per the proposed conditions. Water level monitoring should be continuous and real-time (this is not currently specified in the conditions) to assess the propagation of the drawdown cone and allow early warning to groundwater users enabling provision of alternate water supply in a timely fashion, and be used to support proposed condition 8 measuring water level decline adjacent to the Tima Burn.
13. Whilst out of the scope of this review, an erosion and sediment control plan should be provided as part of the environmental management plan for the site to ensure that topsoil stockpiles, overburden and runoff on the site is managed in a responsible manner, noting that the site extends across multiple catchments. Site rehabilitation plans should also be clarified. Monitoring of the Clutha River should occur upstream and downstream of the worksite, rather than just upstream and downstream of the infiltration pit due to the potential erosion and sediment impacts of the site as well as the infiltration impacts.