Evidence of Matthew John Dale for Kāi Tahu: 30 March, 2016

1. **Correction:** Paragraph 11 – "*It is the largest tributary of the main stem of the upper Clutha River/Mata Au*" should be amended to "*It is the second largest tributary of the main stem of the upper Clutha River/Mata Au*"

2. **Clarification**: Paragraph 42 of my evidence in chief that that "*The current NNN concentration of 0.212 l/s* (should read mg/l) *is three times the Schedule 15 limit.*" This is taken from *the Water Quality in the Lindis Catchment* report (Olsen, 2016) but differs from the 0.1812 mg/l stated in *Water Quality and Ecosystem Health in Otago* (ORC, 2015).

Executive Summary

3. The Lindis River has a naturalised 7-day Mean Annual Low Flow (MALF) of 1,864 l/s, however due to a combination of losses to groundwater and abstraction there are several kilometres of river that become dewatered during most irrigation seasons. Despite losses to groundwater, it is clear that the Lindis River would naturally flow into the Clutha River/Mata Au even in the driest of conditions.

4. The two main areas of dewatering are upstream of the Ardgour Rd Bridge ("upper losing reach) and downstream of the Ardgour Rd flow recorder to the Clutha River/Mata Au confluence (lower losing reach).

5. During most irrigation seasons the upper losing reach consists of a series of dewatered and rewetted subreaches. These flow patterns are largely driven by a combination of groundwater/surface water interactions (up to 500 l/s lost to groundwater), water abstraction and by-wash from irrigation races (Dale & Olsen, 2016).

6. The lower losing reach generally remains dry for most of its length, without the any recharge from groundwater as is experienced further upstream. The rate of loss in this reach can vary depending on antecedent groundwater and flow levels, with estimates of flow losses varying between 322 l/s and 523 l/s depending on the year of measurement and the method used.

7. Due to the level of uncertainty and variation surrounding the rates of flow loss downstream of the proposed minimum flow site, in my opinion a precautionary

approach is required when setting a flow to maintain continuity through to the Clutha River/Mata Au.

8. Tuna (longfin eel) are considered a taonga (treasured) species by Kāi Tahu. Recruitment of tuna into the Lindis River is currently restricted by migration barriers at the Roxburgh and Clyde Dams. However consent conditions for the Roxburgh and Clyde Dams specify that tuna and kanakana (lamprey) passage must be provided by March 2017.

9. Although most of the suitable habitat for adult tuna is located above the Ardgour Rd minimum flow site, it is important that connection is maintained throughout the lower reaches of the Lindis River to ensure that any juvenile tuna located within the lower reach are able to move into refuge habitats if conditions become unsuitable due to low flows or high temperature.

10. A recent study by Olsen (2016) found that nitrate-nitrite nitrogen (NNN) was elevated in the reach between the Ardgour Rd bridge and SH8 to levels approximately three times the Schedule 15 limit (0.075 mg/l) in the Regional Plan: Water. High NNN concentrations such as these increase the risk of periphyton blooms, including the potentially toxic cyanobacteria *Phormidium.*

11. Extensive blooms of filamentous algae have been observed in the Lindis River in the reaches downstream of The Point, which is likely due to a combination of low flows and high NNN concentrations.

Conclusions

12. It is clear that there is spatial and temporal variation in the amount of surface water lost to the alluvial aquifer in the lower Lindis River, therefore a precautionary approach should be used when considering a minimum flow that will provide for Kāi Tahu values.

13. Kāi Tahu is seeking a primary minimum flow of 1,000 l/s. This will ensure good quality habitat for tuna, reduce the risk of significant algal blooms, and will ensure meaningful connection with the Clutha River/ Mata Au.