

Marc Schallenberg's summary statement (29/07/2025)

1. Numerous studies have indicated that the lagoon ecosystem is under threat from high nutrient loads and from an opening regime that does not adequately account for ecological values and services. The aquatic plant/macrophyte communities, and especially the seagrasses (*Ruppia* sp.), play a key role in maintaining ecological health; however the aquatic plant communities seem to be in decline in recent years. Although intermittently open and closed coastal lakes/lagoons are vulnerable to rapid degradation, cumulative stressors have not yet resulted in persistent de-vegetation and a transition to a persistent degraded state in Waituna Lagoon.
2. I view issues of degradation of lakes and lagoons within a stressor – response theoretical framework. Stressor-response relationships for shallow lakes and lagoons tend to be non-linear, with tipping points being a common feature of their degradation trajectory. Tipping points occur when small changes in stressor levels can result in large changes in condition. Lake Ellesmere/Te Waihora is an example of a Waituna-type lagoon that tipped rapidly into a persistent degraded state in 1968. Other similar systems, such as Tomahawk Lagoon (Otago) and Lake Forsyth/Wairewa (Canterbury), undergo frequent shifts between turbid and clear water states. They are unstable and have occasional algal blooms that degrade ecological values and ecosystem services – algal blooms not unlike the one observed in Waituna Lagoon in January 2024, and alleviated by an emergency opening of the lagoon.
3. In addition to stressors and responses, there are also factors that can mediate the relationship between the ecological condition and the stressor level. In effect, mediators increase or decrease ecological resilience to stressors. Lagoon opening (frequency, duration) mediates the effect of stressor levels on ecological responses. Openings are like a release valve in that they can

somewhat reset the system when conditions are worsening and tipping points are imminent.

4. Waituna Lagoon and its associated wetlands are part of a complex socio-ecological system, providing multiple diverse values and opportunities to communities. High nutrient loads from the catchment limit the opportunities to prudently manage this system because under current loads, movement too far and too fast toward a natural opening regime (with prolonged lagoon closures) would present an increasing risk of cyanobacterial blooms, and breaching an ecological tipping point. The task at hand is to manage the multiple values of the lagoon within the current constraints imposed by the leaky catchment. This requires careful use of the tool of lagoon openings as an ecological mediator between multiple stressors and the responses of the condition of the lagoon.
5. A modification to the 2017 opening regime conditions is sought which would increase the water level trigger value towards a more natural opening regime while also providing mechanisms to alleviate potential ecological stressors that could eventuate, such as extended periods of opening during spring/summer and prolonged periods of closure under the current high nutrient loads.
6. The proposed opening regime is designed to shift the lagoon towards a more “natural” opening regime while safeguarding the lagoon’s diverse ecological values, while they are under threat from high catchment nutrient loads. The proposed opening regime is as part of an adaptive management process toward a more ecologically beneficial goal, supported by the monitoring of early warning indicators of degradation, by repeated reassessment of conditions and trends, and by the flexibility to open the lagoon for enhanced flushing and fish passage, if required.