MEMO	
ATTENTION	Sven Exeter
FROM:	Shane Kelly
CC	Paul Barrett
DATE:	9 January 2023
REGARDING	Pōrangahau and Te Paerahi WWTP's

COAST & CATCHMENT
ENVIRONMENTAL CONSULTANTS

BACKGROUND AND SCOPE

Central Hawke's Bay District Council (CHBDC) have applied for a consent to implement a staged process for shifting discharges from the Pōrangahau and Te Paerahi wastewater treatment plants (WWTPs) to Pōrangahau River and the Te Paerahi coastal foredunes, respectively, to irrigated land disposal on an existing farm. My previous memos dated 30 September 2021, March 3, 2022, have reviewed the Applicant's assessments of effects on the water quality and ecology of Pōrangahau River. My key conclusions on water quality in Pōrangahau River in the March 3 memo are reproduced below:

"With that in mind, the assumptions and estimates from the revised model appear reasonable and I am satisfied they address the matters I previously raised. In summary, together with the additional contextual information provided in the revised report, Everitt (2022) suggests that:

- *Water quality at the monitoring site 200 m downstream of the existing Pōrangahau discharge will improve between stages 1 and 3, but total phosphorus and total nitrogen concentrations could still exceed guideline values[1], as those nutrients are already elevated above the relevant criteria upstream of the discharge.*
- *The proposed shift to land based disposal will lead to a slight decrease in total nutrient loads from the combined WWTPs and land disposal site. I note that loads to Pōrangahau River will increase slightly due to the Te Paerahi discharge being diverted to the land disposal site and population growth.*
- *That the combined nutrient loads of the Pōrangahau and Te Paerahi WWTPs and the land disposal site only comprise a small proportion of overall catchment loads (around 2 to 2.5%), and that the proposed wastewater redevelopment will further reduce that contribution (albeit negligibly). However, I note that diverting the Te Paerahi discharge to the land disposal site will increase the wastewater contribution to the river catchment loads (albeit negligibly).*

Although subsurface soil and groundwater attenuation of nutrients in the land disposal site were not allowed for in the assessment, Everitt (2022) suggests that those processes are likely to lessen adverse effects. The report also highlights that UV disinfection and best practice irrigation management will help minimise local surface water effects. I also note that the diffuse seepage of wastewater from the land disposal site to the river is likely to enhance dilution."

[1] ANZECC physical and chemical stressor triggers and MfE Microbiological Assessment Category for Freshwater Grade D.

I also highlighted that the sites used to evaluate water quality were situated along a freshwater to marine gradient, yet measured parameter values are only assessed against freshwater chemical and physical stressors, ecological toxicity, and human health trigger/guideline values. I noted that "*I agree that there is a paucity of marine guidelines, but the application of freshwater guidelines to saline waters is fraught and can potentially (in my opinion probably) lead to misleading interpretations of water quality data.*"

Concerns have subsequently been raised about the Applicant proposing nutrient loading rates for the discharge property that are significantly greater than those assessed. This matter is addressed in the PDP memo dated 22 December 2022. The implications of the proposed nutrient loading rates for river water quality have not been quantified by the Applicant's experts, but my understanding is that they consider:

- nitrogen to be the key nutrient of concern; and,
- the risk posed by the proposed wastewater nitrogen discharge loads, on river water quality, is low.

Land and groundwater experts acting for the Applicant and HBRC appear to agree that nitrogen is the key nutrient of concern in terms of leaching to surface water. I also note that nitrogen is generally considered to be the limiting nutrient in coastal systems, and consequently, it is generally regarded as the key nutrient of concern for coastal systems. However, the paucity of marine guidelines makes it difficult to contextualise risk in estuary and harbour systems, which are susceptible to eutrophication. Indicators of coastal eutrophication include high total nitrogen concentrations, blooms of nuisance marcoalgae, and abnormally strong blooms of microalgae (typically indicated by high chlorophyll *a* concentrations). Chlorophyll a concentrations of <0.01 mg/l are likely to be barely noticeable, whereas concentrations >0.03 mg/l are indicative of strong blooms.

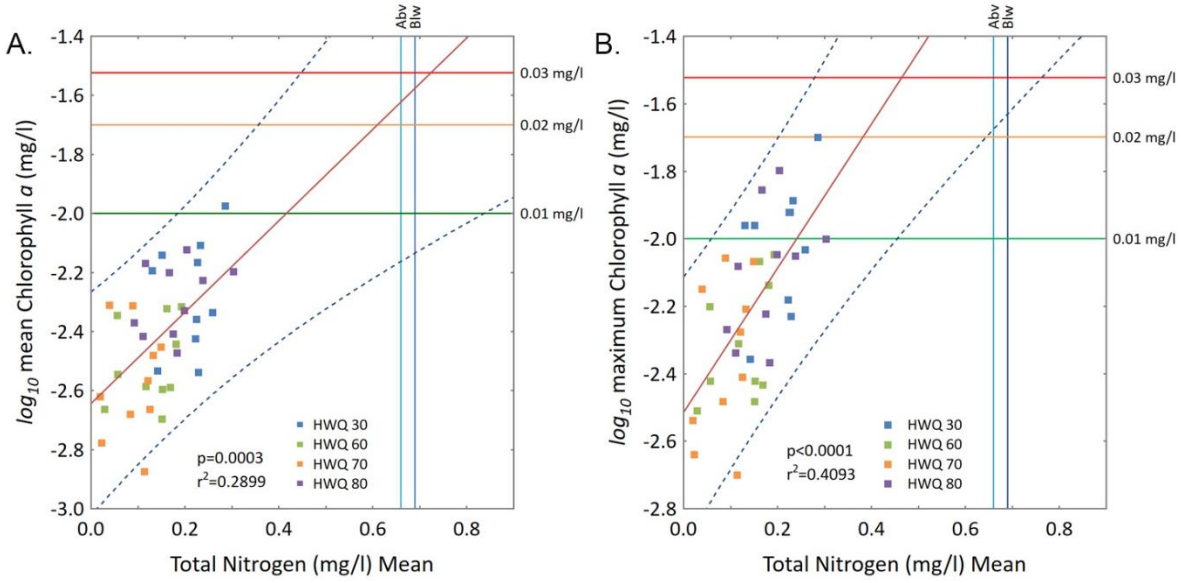
Chlorophyll *a* concentrations are influenced multiple factors, including: light, temperature, nutrient availability, consumption of primary producers, and analytical methods. In turn, multiple factors influence each of these factors. Responses to nutrients (and relationships between nutrients and chlorophyll *a*) tend to be stronger during summer when temperatures are high and days are long. However, I am not aware of any Pōrangahau specific data on the relationship between summer nitrogen concentrations and primary productivity (chlorophyll *a* does not appear to have been monitored).

In order, to contextualise the current Pōrangahau situation and the potential risk of adding more nitrogen to the river, I have used Watercare Services monitoring data from Manukau Harbour that demonstrates the relationship between mean summer total nitrogen concentrations (pooled data from 4 sites monitored between July 2011 and June 2022) and mean and maximum chlorophyll *a* concentrations (maximums show the strongest phytoplankton blooms recorded each summer, Figure 1). Reference lines were fitted showing median total nitrogen concentrations 200 m above and 200 m below the existing Pōrangahau discharge (Table 22 of the revised WQ report).

Note that the Manukau relationship may not be directly transferable to Pōrangahau, so care needs to be taken with this analysis and interpretation. With that caveat in mind, I still consider the comparison useful, as it provides an insight into the potential for adverse productivity effects in Pōrangahau. In my opinion, Figure 1 indicates:

- Median total nitrogen concentrations above the current discharge already have the potential to cause elevated mean summer chlorophyll *a* concentrations and strong phytoplankton blooms.
- Median total nitrogen concentrations above the current discharge also have the potential to generate very strong summer phytoplankton blooms (based on maximum chlorophyll *a* concentrations).
- The logarithmic nature of the relationship between total nitrogen and chlorophyll *a* means increases in nitrogen concentrations have a disproportionate (multiplicative) influence on chlorophyll *a* concentrations.
- The effects of the existing discharge appear to be relatively small compared to background concentrations measured above the existing outfall, but background concentrations in the river are very high, and ideally should be reduced.
- I therefore support the total nitrogen load and concentration limits proposed by PDP, rather than the Applicant.

Figure 1: Least squares regression plots (± 95% prediction bands) of relationships between mean summer total nitrogen concentrations and: A. log_{10} mean summer chlorophyll *a* concentrations; and B. log_{10} maximum summer chlorophyll *a* concentrations in four long-term monitoring sites in Manukau Harbour (data used with the permission of Watercare Service Ltd). Vertical reference lines show the median total nitrogen concentrations 200 m above and 200 m below the existing Pōrangahau discharge. Horizontal reference lines show untransformed concentrations in 0.01 mg/l bands.



REFERENCES

Everitt, L. (2022) Pōrangahau and Te Paerahi wastewater - Water quality assessment. Report prepared for Central Hawkes Bay District Council, 2022 P:D.25b, Beca Ltd. 68 pp., plus Appendices.