Job No.10292

MEMORANDUM

To: Jamie Cox, Wairoa District Council

From: Hamish Lowe, Lowe Environmental Impact

Date: 23 May 2017

Subject: Task A3I1a – Wairoa River Estuary Impact Summary

Background

The Wairoa wastewater treatment system requires a replacement consent by May 2019. Consenting will require the assessment of discharge to water options. This will need to include an assessment of the capacity to safely receive nutrient and pathogen loading into the Wairoa River, its estuary, and ocean beyond.

Purpose

To document the current condition of the waters of the Wairoa River estuary based on currently available information. This should include a commentary about the impact of the wastewater discharge based on existing benthic monitoring reports completed by Environmental Assessment & Monitoring NZ Limited (EAM) and additional Wairoa River monitoring. This memo provides information on previous surveying and is not intended to provide a recommendation for future treatment or discharge from the current wastewater outfall location.

Scope

This Memorandum reports the results of Task A3I1a of the Wairoa Wastewater Consenting Task Scopes. The matters to be addressed for this task are as follows:

- A summary of water quality and biological trends in the Wairoa River based on available information;
- Recommendation for further river monitoring if needed; and
- This memo is to have a primarily ecological focus, and is to be considered in conjunction with the separate memo on the physical and social history of the river mouth environment.

It is not intended that this Memorandum cover the following matters, which are addressed elsewhere:

- Social and cultural impacts;
- The physical history of the river mouth environment; or
- Planning considerations.

Sources of Information

The sources of information from which this memorandum has been prepared are as follows:

EAM 2007: Report EAM042, *"Assessment of Ecological Effects on the Wairoa River Estuary from the Wairoa Wastewater Treatment Plant Outfall"* Unpublished report by EAM NZ Limited to Wairoa District Council, July 2007. 33 pp plus appendices.

EAM 2012: Report EAM042, *"Monitoring of Benthic Effects of the Wairoa District Council Wastewater Treatment Plant Outfall Discharge at Sites in the Lower Wairoa River Estuary – 2011 Survey"* Unpublished report by EAM NZ Limited to Wairoa District Council, May 2012. 29 pp plus appendices.

This Memorandum summaries the findings of the two EAM reports; more specific detail may be found in the EAM reports held by WDC.

Background to EAM Studies

The Wairoa municipal wastewater treatment plant on Rangihoua / Pilot Hill, and its discharge into the river's estuary, were commissioned in 1981. The discharge has operated for 35 years, which may be considered long enough for any adverse physical or environmental effects from the discharge to become apparent.

In 2006 a review of the Wairoa Wastewater Treatment Plant (WWTP) was completed for WDC by Opus International Consultants, which recommended that the WWTP monitoring program required by the authorising resource consent be broadened. It was proposed that the monitoring program include the following:

- Characterisation of influent and effluent and associated pollutant loading;
- Assessment of unit process performance; and
- Assessment of effects from the discharge on the receiving environment.

It was agreed that, amongst other things, monitoring would be undertaken every four years to consider and report on the effects of the treated effluent discharge on the macrobenthos and sediments in the receiving environment surrounding the wastewater discharge. This monitoring included:

- Assessment of sediment texture, organic content, trace metal and nutrient levels at outfall monitoring sites and at a suitable reference site; and
- Assessment of benthic macroinfaunal communities at outfall monitoring sites and at a suitable reference site.

Monitoring Sites

Three sites were selected by EAM for monitoring the bed of the Wairoa River estuary, as follows:

- 100m south-west (downstream) from the wastewater outfall;
- 100m north-east (upstream) from the wastewater outfall; and

- 500m north-east (upstream) from the wastewater outfall.

The 500m upstream site was selected as a control, being sufficiently far upstream from the discharge to be unlikely to be affected by it. The two sites either side of the outfall were considered representative of the area likely to be affected by the discharge.

Results

The sediment survey had the following key findings:

- Estuary bed sediments are characterised by fine grained sand, mud and silt, with grain size distribution not evidently affected by the wastewater outfall;
- Average sediment depths to the Redox Potential Discontinuity Layer (RPDL)[1] at the 3 monitoring sites were between 33 and 43 mm;
- Below the RDPL, the blackened anoxic zone at all 3 sites had a distinctive smell of hydrogen sulphide. Few infauna[2] reside in the anoxic zone;
- The shallow depth of the surface "oxic zone" and the black and smelly anoxic zone material **are not related** to the wastewater discharge, and are shown to occur equally upstream and downstream from the discharge point;
- There has been variation in sediment grain size distribution between successive monitoring surveys, but this variation is evidently the result of normal river sediment transport processes, rather than in any way attributable to the presence or operation of the wastewater outfall;
- There was no statistically significant difference in Total Volatile Solids (organic matter) content in sediments between sites or between successive surveys; organic matter content was low by comparison with other estuaries nationally;
- Sediment nutrients (nitrogen and phosphorus) lie in the mid-range of values for reference estuaries throughout New Zealand; while there are variations between sites and between successive surveys, there is no consistent pattern of variation that would suggest an effect caused by the wastewater discharge;
- Trace metals were present in the sediments at levels not exceeding ANZECC sediment quality guidelines; at these levels, the contaminant load at each site would rarely be expected to induce adverse biological effects. These results generally indicate that accumulation of trace metals is **not occurring** in the sediments surrounding the WWTP outfall; and
- There is no evidence suggesting the wastewater discharge is have an adverse effect on sediment texture or chemistry surrounding the discharge site.

The biological survey had the following key findings, where "infauna" refers to organisms living within the estuary bed sediments:

[1] As oxygen concentration diminishes, anaerobic processes come to dominate. The transition layer between oxygen-rich and oxygen-poor layers is called the redox discontinuity layer and appears as a grey layer above the black anaerobic layers.
[2] The animals living in the sediments of the ocean floor or river or lake beds

- Infaunal abundances were relatively high and not significantly different across all 3 monitoring sites, with the corophid amphipod *Paracorphium excavatum* the most abundant taxon at all sites;
- Scores for infaunal diversity, richness and evenness indices for the 2 sites nearest the wastewater outfall were not significantly different to the upstream reference site, and all were low indicating a low diversity community;
- Infaunal community structure at the 2 sites nearest the wastewater outfall were not significantly different to the upstream reference site; and
- Key infaunal species influencing community structure among sites were *Paracorphium excavatum* and *Nicon aestuariensis.*

EAM Conclusion

Conclusions from EAM (2011) state that:

"Examination of the sediment texture and chemistry results, combined with the benthic infaunal characteristics indicates that there is currently no evidence to suggest that the outfall is having any adverse effect on the receiving environment.

Sediment texture and chemistry reveals no indication of a discharge related effect, and results are similar to those observed at the upstream reference site"

Additionally; "*Assessment and analysis of the biota living in the sediments surrounding the outfall did not detect any significant differences in the community assemblages between sites suggesting that the outfall discharge has a limited influence on community structure."*

EAM (2007) Additional Findings

Dilution of Effluent Plume in Estuary. On 24 April 2007, EAM mapped the dilution contours of the discharged effluent plume in the estuary, in circumstances representative of "worst case" discharge conditions, during a period of minimal tidal and river flows, and with restricted river bar conditions. While wastewater dilution by fresh river water within 20 m of the wastewater outfall was only 10:1 (10 freshwater to 1 effluent), within 50 m laterally and 150 m downstream, the dilution rate had improved to be greater than 200:1.

Trace Metals in Flounder. Demersal (bottom feeding) fish such as yellow-bellied flounder can be useful bio-indicators, potentially taking up contaminants in estuary bed sediments and accumulating them not only in their livers, but also in their muscle tissue which in turn may be passed on to people catching and eating them. Sample flounder were netted from the Wairoa estuary "*directly in front of the outfall"*, and separately also from the Mangawhio estuary on Mahia peninsula, 42 km east of Wairoa. The fish were weighed, measured and filleted, with the fillets sent to Hill Laboratories in Hamilton for analysis.

The length/weight relationships between fish from the two sites, and their respective condition factors, were similar; with the fish from the two sites being directly comparable. Key findings from their analyses were as follows:

- Compared to concentrations of trace metals in flounder from Mangawhio, Wairoa flounder were higher in only Zinc by 2.1 mg/kg (44%) more;

- Concentrations of the trace metals Arsenic, Copper, Lead and Zinc were lower in Wairoa flounder than in other flounder caught around wastewater outfalls in Hawke's Bay; the only exception was Mercury, which was higher by 0.017 mg/kg (22% more) in Wairoa flounder.
- *"The concentration of trace metals in Wairoa flounder is low, and would not pose a health hazard unless large quantities were consumed daily over the course of a lifetime".*

Further Work

The information summarised in this report highlights the condition of the Wairoa River close to the existing wastewater discharge and upstream from the discharge site.

Results from the 2011 survey show that the diversity of species within the Wairoa River is low at both the discharge site and upstream of this site. The trend over time has indicated species richness has declined from previous surveys conducted in 1996 and 2007. What is not clear is whether the background environment is contributing to the current observations. Land use and other discharges, such as stormwater may be influencing water quality. Consequently, additional upstream water quality sampling and consideration of information already available for discharges could be reported on to identify the characteristics of the river in general, and not just around the WDC wastewater discharge.

The historical monitoring by EAM has provided two rounds of in-river monitoring over a five-year period. Triplefin consulting are now in the process of undertaking a further round of monitoring. The results to be gained from this monitoring round would be appropriate to use to build on the trends seen from 2007 to 2011. Results gained from 2017 monitoring may then have a bearing on the most appropriate discharge option as part of the wastewater consenting programme.