

BEFORE THE HEARING PANEL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of applications by Tararua District Council to Horizons Regional Council for application APP-2005011178.01 for resource consents associated with the operation of the Eketahuna Wastewater Treatment Plant, including a discharge into the Makakahi River, a discharge to air (principally odour), and a discharge to land via pond seepage, Bridge Street, Eketahuna.

REPORT TO THE COMMISSIONERS

DR BRENT COWIE (CHAIR), MR REGINALD PROFFIT AND MR PETER CALLANDER

STATEMENT OF EVIDENCE OF KATHRYN JANE MCARTHUR – FRESHWATER QUALITY

FOR KAHUNGUNU KI TAMAKI NUI-A-RUA TRUST

21 March 2017

A INTRODUCTION

Qualifications and experience

1. My name is Kathryn Jane McArthur.
2. I hold a Bachelor of Science degree with Honours in Ecology and a Master of Applied Science with Honours in Natural Resource Management, both from Massey University. My areas of post-graduate research included the influence of land use on freshwater macroinvertebrate communities and the interaction between policy and science for improved freshwater resource management, with a particular focus on water quality objectives and limits. I have 15-years post-graduate experience working in the field of freshwater resource management and I joined The Catalyst Group (an environmental consultancy based in Palmerston North) as the Practice Leader - Water Quality in 2012.
3. Before joining The Catalyst Group, I held the role of Senior Scientist – Water Quality with Horizons Regional Council (Horizons). Over 6 years with Horizons I coordinated the State of the Environment (SOE), periphyton and discharge monitoring programmes for water quality and aquatic biodiversity, produced expert evidence for a number of resource consent hearings and enforcement actions (relating mainly to takes of, and discharges to, water). During my work on the Horizons One Plan I led the identification of Sites of Significance – Aquatic work, completed the framework of water management zones for the region, reviewed and refined the river, lake and coastal water quality targets and project managed the water quality evidence for the One Plan hearings and Environment Court proceedings.
4. I have authored and co-authored a range of reports and publications, including technical reports to support the One Plan. I have also authored and co-authored papers in peer-reviewed journals on topics such as: the relationship between flow and nutrients in rivers; nutrient limitation; methods for monitoring native fish; the calculation of in-river nutrient loads and limits, and the setting of water quality objectives and limits in resource management policy. I have provided evidence in these areas before the Environment Court, in Board of Inquiry and Independent Hearings Panel processes over the last five years.
5. Most recently, I have provided ecological, water quality and water policy advice to Nelson City Council, Northland Regional Council, Ngāti Kahungunu Iwi Incorporated, Hawkes Bay Regional Council, the national Iwi Leaders Group, the Department of Conservation and the Ministry for the Environment.

6. On behalf of the New Zealand Planning Institute I co-led workshops throughout the country on freshwater science and policy development. Participants have included: local government and industry planners, planning consultants, iwi/NGO resource managers, and the Ministry for the Environment Water Directorate staff. I am a member of the National Objectives Framework reference group for the National Policy Statement for Freshwater Management amendments.
7. I have been a member of the New Zealand Freshwater Sciences Society since 2001 and I am currently elected onto the Society's executive committee. I have been a member of the Resource Management Law Association of New Zealand (RMLA) for six years, and was the RMLA scholarship recipient in 2010 for my work on water quality limits for the Manawatū River. I am a guest lecturer in environmental planning and science at Massey University and an accredited and experienced RMA hearings commissioner.
8. I am familiar with the Eketahuna Waste Water Treatment Plant ("EWWTP") site and the receiving environment of the discharge.

Expert code of conduct

9. I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I have complied with it in preparing this evidence and I agree to comply with it in presenting evidence at this hearing. The evidence that I give is within my area of expertise except where I state that my evidence is given in reliance on another person's evidence. I have considered all material facts that are known to me that might alter or detract from the opinions that I express in this evidence.

Purpose and scope of evidence

10. This statement of evidence was prepared on behalf of Kahungunu ki Tamaki nui-a-rua Trust in support of their submission on the application for continued discharge from the EWWTP to the Makakahi River and to groundwater beneath the ponds. This statement should be read in conjunction with the planning evidence provided by Mr Greg Carlyon.
11. My evidence addresses the following matters where it is within my expertise:
 - Water quality of the Makakahi Water Management Sub-Zone
 - Current water quality impacts of the EWWTP discharge
 - Potential future water quality impacts of the EWWTP
 - Summary

- Consent conditions
12. In preparing my evidence I have read and reviewed the following documents:
- Eketahuna Wastewater Treatment Plant Resource Consent and Assessment of Environmental Effects (“AEE”) and appended material, including subsequent updates and responses to requests for further information, and the Aquanet report “Eketahuna WWTP discharge to the Makakhi River: summary of current effects on freshwater quality and ecology”
 - S42A report of Tim Michael Baker - groundwater
 - S42A report of Logan Arthur Brown - freshwater quality
 - Statement of evidence of Dr Olivier Michel Nicolas Ausseil - freshwater quality
 - Statement of evidence of John Milton Crawford – wastewater engineering
13. I have focussed my evidence on highlighting those areas where my expert opinion agrees/disagrees with the available material. For the sake of brevity, I do not replicate material in my evidence that I substantively agree with and which is presented or addressed in the evidence of others.

B WATER QUALITY OF THE MAKAKAHI WATER MANAGEMENT SUB-ZONE

14. At sections D and E Mr Brown describes the Makakahi Water Management Sub-Zone catchment and values. I concur with his assessment. I note Mr Brown’s assessment of the aquatic ecology (section G) includes the identification of the upper Makakahi catchment as a significant area for shortjaw kōkopu, a ‘threatened’ and ‘nationally vulnerable’ native fish species¹. Shortjaw kōkopu migrate through the discharge area into adult spawning habitat in the remaining forested areas of the catchment. They are benthic feeding fish, requiring clean substrate and high quality benthic macroinvertebrates, i.e. EPT² taxa.
15. At section F Mr Brown partially describes the water quality of the Makakahi Water Management Sub-Zone, where he indicates the lower Makakahi catchment (as monitored at Hamua) does not meet the One Plan MCI and periphyton targets. There is no commentary on other water quality parameters monitored at this site. However, given the MCI and periphyton targets are not being met, it is highly likely that one or more of the other monitored water quality parameters (nitrogen, phosphorous, sediment etc) similarly exceeds the One Plan targets. Unfortunately,

¹ Goodman JM, Dunn NR, Ravenscroft PJ, Allibone RM, Boubee JAT, David BO, Griffiths M, Ling N, Hitchmough RA, Rolfe JR 2014. Conservation status of New Zealand freshwater fish, 2013. New Zealand Threat Classification Series 7, Department of Conservation, Wellington, 12p.

² Mayflies, stoneflies and caddis flies.

there are no recently published water quality summary reports available to confirm the current water quality state of the Makakahi River.

16. An assessment of the LAWA river water quality for the Makakahi at Hamua site suggests that although showing improving trends, the site is still within the worse 50% of lowland rural sites in New Zealand for E. coli, total nitrogen, total oxidised nitrogen and is frequently subject to blooms of potentially toxic cyanobacteria. Macroinvertebrate communities are in “fair” health, but below the One Plan targets.
17. According to LAWA, water quality at the Makakahi upstream of the EWWTP is also within the worst 50% of lowland rural sites for E. coli, but is in the best 50% of like sites with respect to all forms of nitrogen and dissolved reactive phosphorus. Cyanobacteria is also problematic at this site.
18. The water quality situation in the Makakahi Water Management Sub-Zone is relevant because it suggests the catchment in its middle and lower reaches is over-allocated with respect to one or more of the One Plan water quality targets and is therefore likely to be impacting on freshwater values. The area of greatest pressure for nitrogenous contaminants appears to occur between the upstream EWWTP monitoring site and Makakahi at Hamua.
19. I agree with Dr Ausseil (at paragraph 5.2) that the effects on the EWWTP downstream monitoring site (and to some degree also the Hamua site) reflect the cumulative impacts of diffuse contaminants (via the Ngatahaka Stream) and the EWWTP discharge on the Makakahi River. The flow partitioned analysis in the Aquanet reports provides a summary of effects identifying the Ngatahaka Stream as the key source of nitrogen to the downstream site under most flow conditions. Although, the contribution of the EWWTP discharge increases to approximately 37% of the soluble inorganic nitrogen and 70% of the dissolved reactive phosphorus, below half median flows.
20. Management of the effects of nutrient contaminants on aquatic ecology (both diffuse and point sourced) are a regulatory responsibility of the regional council. These responsibilities are reflected in the Act (RMA 1991), the National Policy Statement for Freshwater Management (2014) and the One Plan.

C CURRENT EWWTP DISCHARGE

21. The EWWTP is described in the resource consent application materials. What is not well described, due to limited information on inflows, treatment effectiveness and outflows from the EWWTP, is the effluent concentration and flow characteristics. Throughout the documents

supporting the application, the treatment inflows, outflows, and contaminant loadings have been based on assumptions and experience from other systems of similar construction and scale. Some effluent outflow volume and loading data has only recently become available (January 2016-January 2017).

22. The water quality impacts of the EWWTP on the Makakahi River are described at length in the water quality report submitted with the resource consent application by Dr Ausseil, the section 42A report of Mr Brown, and the statement of evidence and updated water quality report provided by Dr Ausseil.
23. There is disagreement between these experts regarding the exact nature and scale of the water quality impacts of the EWWTP discharge on the Makakahi River, and the discharge's compliance with One Plan targets. I agree with Dr Ausseil's statement about the manner in which the samples taken above the 20th FEP should be removed to assess One Plan compliance for SIN and DRP and that the 0.01g/m³ DRP target is the appropriate one for this sub-zone.
24. Periphyton, based on the limited samples available, does exceed the One Plan target at the downstream site. I disagree with Dr Ausseil and Mr Brown's interpretation of exceedance of the periphyton targets of the One Plan. Despite the debate over periphyton exceedance criteria in the Feilding case mentioned by Dr Ausseil, I maintain that the periphyton targets in the One Plan were set (reviewed and provided as evidence to the Hearing Panel and Environment Court by me) as absolute maximum values, consistent with the New Zealand periphyton guidelines, which apply an annual maximum approach. The exceedance criteria recommended by Dr Ausseil in his technical report were not included in the One Plan provisions on my advice, based on the above rationale. No party (including those represented by Dr Ausseil) refuted the interpretation of the One Plan targets during the lengthy plan hearing and environment court proceedings. I maintain my view that the annual maximum periphyton biomass of 120mg/m² is the appropriate target to apply to the EWWTP (and other discharges to the rivers of the Manawatū-Whanganui Region).
25. What is not in dispute is that the EWWTP discharge is negatively impacting water quality in the Makakahi River. For some parameters (i.e. E. coli, MCI, QMCI and periphyton biomass) the discharge exceeds One Plan targets. For others parameters, the discharge materially contributes to increases in concentration (i.e. SIN, DRP), contributing to an overall degradation of the water quality and ecological health of the Makakahi River, particularly at low flows, even though One Plan targets are not exceeded.
26. I agree with Mr Brown and Dr Ausseil that the decline in QMCI between the upstream and downstream sites constitutes a significant adverse effect on aquatic life. Regardless of the cumulative nature (diffuse and point-sourced combined) of the contaminant contributions, this

is an issue that needs to be addressed in relation to this application and in regulating the surrounding land use in the Makakahi sub-zone.

27. In addition to the direct impacts of the EWWTP on surface water quality, are the impacts of the Eketahuna wastewater system on groundwater, and therefore indirectly on surface water. The applicant acknowledges there has been significant, but unquantified, leakage from the wastewater system pipe network (that substantially increased in response to damage caused by the 2014 earthquake), and treatment ponds. I do not comment on this contaminant pathway further because there is no information upon which to base a discussion, and in any event it is outside of my area of expertise.

D PROPOSED EWWTP DISCHARGE

Proposed discharge location

28. Tararua District Council have proposed two potential locations for discharge points further downstream of the current discharge in order to remove the confounding effect of inflows from the Ngatahaka Stream. I share the concerns of Mr Brown raised in paragraphs 82 and 83 of his s42A report. In my opinion, the current upstream and downstream monitoring sites are far more comparable in terms of instream habitat and exposure to sunlight than the proposed downstream site³, particularly with a proposed 330m mixing zone. Figure 1 shows the gorge area likely to be the proposed monitoring site. I note the high degree of shading in this area.
29. In my opinion the potential downstream monitoring site and the proposed mixing zone are not appropriate for the Eketahuna discharge or the Makakahi River environment. The mixing zone is not consistent with the One Plan definition of reasonable mixing⁴, which has been applied to most other discharge consents throughout the Manawatū-Whanganui Region.

³ Which cannot be accurately ascertained at this point from the information provided.

⁴ One Plan definition of reasonable mixing – “in relation to the discharge of contaminants into a river or an artificial watercourse, means either:

(a) a distance downstream that is the least of:

(i) The distance that equals seven times the width of the river at the point of discharge when the flow is at half the median flow, or

(ii) 200 metres from the point of discharge or, for discharges to artificial watercourses, 200 metres from the point of discharge or the property boundary, whichever is the greater, or

(iii) the point at which mixing of the particular contaminant concerned has occurred across the full width of the body of water in the river, artificial watercourse, or

(b) a distance for reasonable mixing determined as appropriate for a consent application where special circumstances apply.”

30. In my view, with an approximate river width of 15m in the Makakahi River, a mixing-zone consistent with the One Plan definition would be a maximum of approximately 105m downstream of the discharge point, assuming comparable habitats can be found for biological monitoring and sample collection. Depending on where the proposed discharge point is ultimately located (if changed), care should be taken to ensure periphyton and macroinvertebrate sampling is not undertaken within the shaded gorge reach, yet is still able to be tested against in-river consent conditions, including those for “effects on aquatic life beyond the zone of reasonable mixing.” To be clear, conditions should not allow for macroinvertebrate or periphyton monitoring within the zone of reasonable mixing as this makes a determination of compliance with conditions around effect on aquatic life difficult and equivocal.
31. Ideally, an additional site can be added to the monitoring programme to account for differences between 1) the upstream, 2) the upstream influenced by the Ngatahaka Stream, 3) the Ngatahaka Stream contribution, and 4) the downstream Makakahi River (within comparable habitat and shade conditions).



Figure 1. Current monitoring sites for the Eketahuna Wastewater Treatment Plant (WWTP).

Proposed changes to the EWWTP

32. I understand Taranaki District Council are in the process of making, or have proposed to make, a number of changes to the EWWTP. These include:
- Replacement of the pipe network to repair earthquake damage and pre-existing damage
 - Pond lining – to have been completed by March 2017, but delayed until no later than 1 July 2018 (although see the evidence of Mr Crawford)

- Introduction of a clarifier and a UV disinfection reactor
 - Introduction of a wetland between the treatment ponds and the discharge point
 - Introduction of a rock structure at the discharge point
33. These changes are additional to recent suggested changes to the system including introduction of fine screening (not yet commissioned), inflow meter (not installed correctly), a lift pump (not yet commissioned), and pond desludging.
34. Dr Ausseil and Mr Crawford both comment on how the actual and proposed improvements to the EWWTP will impact on treatment of the effluent and ultimately impact on water quality in the Makakahi River downstream of the discharge point. From my reading it appears their assessments of likely effluent and water quality improvements are largely based upon assumptions and experience from similarly designed and operated wastewater schemes elsewhere in New Zealand.
35. My concern with these assessments is that there are many unknowns about the EWWTP, providing little certainty around outcomes or improvements. For example, how will inflows change once the pipe network repairs are completed, how much pond leakage is there, what will be the effect of each proposed improvement?
36. Other uncertainties arise over suggested changes to the operation of the plant and potential water quality improvements associated with them. I can find no information about the wetland proposal, or what difference it may make (if any) to treatment of the effluent⁵. Based on the further information provided, effluent treatment improvements at other Tararua District Council wastewater treatment plants have either not eventuated, or have been less than predicted.
37. I raise these points to highlight there is considerable uncertainty surrounding: (1) what changes will be made to the EWWTP; (2) what system changes will actually be made operative; (3) the timeframes over which these changes will occur; (4) what difference it will make to treatment of the effluent, and ultimately, (5) what difference it will make to water quality in the Makakahi River.
38. Regardless of these uncertainties, the information provided by the Applicant clearly states that no changes will be made to the plant to reduce the EWWTP contribution to SIN (largely comprised of ammoniacal nitrogen in the discharge) and other contaminants that are contributing to a cumulative water quality issue (MCI and periphyton) in the downstream receiving environment of the Makakahi River.

⁵ Despite a reference in Mr Crawford's statement to evidence being prepared by Mr MacGibbon (paragraph 11.2).

E SUMMARY

39. In my opinion, the key points about the EWWTP resource consent application from a water quality perspective are:

- The EWWTP is currently discharging into an over-allocated Makakahi Water Management Sub-Zone with respect to E. coli, MCI and periphyton
- The current EWWTP exceeds One Plan targets for some water quality parameters (E. Coli, MCI and periphyton), and is a significant contributor of nitrogen and phosphorus under low flow conditions
- Much is unknown about the current operation of the EWWTP and its effectiveness
- Considerable uncertainty surrounds the current and proposed EWWTP upgrades and whether they will actually be made operative
- Because of this uncertainty, improvements to the discharge and to the Makakahi River are equally uncertain
- The EWWTP discharge to the Makakahi River needs to be improved to meet One Plan targets, and
- Moving the downstream monitoring site into the shaded gorge area (and having a 330m mixing zone) are likely to mask any issues associated with periphyton growth (and potentially MCI) and transfer them to downstream environments.

F CONSENT CONDITIONS – DISCHARGE TO WATER PERMIT

40. I have reviewed the draft consent conditions provided by Ms Morton and Ms Manderson and the recommendations of Mr Brown and Dr Ausseil. I make the following comments with regard to proposed conditions:

- a. The treated wastewater standards recommended by Ms Morton in condition 1 better reflect the current effluent contaminant concentration and are supported. There is no justification for the higher concentrations recommended by Ms Manderson.
- b. Condition 2 in Ms Morton's version is confusing as written. The wording applies to the Makakahi River (instream standards) but the concentrations of E. coli and DRP appear to be effluent concentrations, these are not supported to apply in-river, but are reasonable to apply to the effluent.
- c. Ms Morton's concentrations in condition 3 are supported.

- d. Condition 4 suffers from the same issues of wording as condition 2. If changed to reflect the effluent quality rather than in-river then these concentration standards are supported.
- e. Condition 8 of Ms Morton's version applies receiving water quality standards. I do not support the 330m reasonable mixing zone. There is no justification provided in evidence for this distance. I do not support the application of the NPS-FM chlorophyll a standard (clause l). Additionally, the One Plan periphyton standard for chlorophyll a should apply as an annual maximum. A definition of "more than minor effects on aquatic life" would provide a useful guide for assessing compliance with clause f.
- f. Condition 17 requires the addition of continuous dissolved oxygen monitoring over at least a week in every summer period during low flow conditions to assess daily minima in terms of percent saturation (One Plan target) and in terms of the NPS-FM requirements downstream of discharges (mg/L). Spot, in-river DO measurements provide no information on the effects of the discharge.
- g. Condition 20 requires biological monitoring to occur within the mixing zone. This should be required beyond the mixing zone to allow for an assessment of adverse effects on aquatic life commensurate with condition 8, clause f. Other than that, I support the macroinvertebrate monitoring conditions as proposed.
- h. Condition 22 – the same issue occurs (in g above) with respect to the location of periphyton monitoring. The standards within condition 8 relate to beyond the reasonable mixing zone, so monitoring needs to be consistent with determining compliance with condition 8. Condition 22(a) relates to monitoring for periphyton within riffle habitat. My understanding of the technical method referenced in the condition is that it is supposed to be applicable to 'run' habitat, rather than riffles.
- i. Condition 28 (c) excludes the participation of an independent scientist who has presented evidence at the hearing. Given all experts have provided advice to the hearing commissioners under the auspices of the Environment Court code of conduct the manner in which this condition is drafted appears to call into question the independence of any expert representing submitters. I object to the inference made in the wording of this condition.
- j. Condition 29 (a) requires the independent panel to assess the effects of the discharge on Schedule B values identified in the One Plan. I question how the proposed panel will be qualified to assess effects on mauri, given there are no proposals for the monitoring of mauri or any other aspect of cultural health or tangata whenua values.

Kathryn McArthur

21 March 2017