IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	applications for resource consent (**APP-2005011178.01** and **APP-2018201909.00**) to Horizons Regional Council associated with the construction of a wetland as part of the proposed upgrades to and ongoing operation of the Eketahuna Wastewater Treatment Plant
BY	**TARARUA DISTRICT COUNCIL** **Applicant**

STATEMENT OF EVIDENCE OF OLIVIER MICHEL NICOLAS AUSSEIL
(FRESHWATER QUALITY)
ON BEHALF OF TARARUA DISTRICT COUNCIL

12 November 2018

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INTRODUCTION

Background and role

1. My name is **Olivier Michel Nicolas Ausseil** (pronounced “O-Say”).

2. I am Principal Scientist – Water Quality at Aquanet Consulting Ltd, a water quality and ecology consultancy based in Palmerston North and Wellington.

3. My first brief of evidence dated 14 March 2017 was given in relation to the application for resource consents (APP-2005011178.01) for the discharges from the Eketahuna Wastewater Treatment Plant ("**EWWTP**") lodged by Tararua District Council ("**TDC**") on 31 March 2015 ("the **First Application**").

4. This brief of evidence is given on behalf of TDC in relation to its application ("the **Wetland Application**") under section 88 of the Resource Management Act 1991 ("**RMA**") for resource consents relating to the construction of a wetland as part of the wider proposed upgrades to and ongoing operation of the EWWTP ("the **Project**").

5. My evidence relates to actual and potential effects of the EWWTP Project, including the proposed wetland, on water quality and freshwater ecology and includes responses to queries raised by the Panel in its minute dated 29 October 2018 ("the **Ninth Memorandum**") and comments on the Council Officers' Section 42A Reports, as relevant to my area of expertise.

6. In light of the limited scope of the Wetland Application and the hearing that will take place on 27 November 2018, I address matters relating to the Wetland Application in Part A. My responses to matters raised that fall outside the scope of the Wetland Application, and 27 November hearing, are addressed as "other matters" under Part B.

Qualifications and experience

7. My qualifications and experience are set out in my first brief of evidence dated 14 March 2017.

Code of conduct

8. I confirm that I have read the 'Code of Conduct' for expert witnesses contained in the Environment Court Practice Note 2014.

9. My evidence has been prepared in compliance with that Code. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Scope of evidence

10. My evidence relates to the following matters:

    (a) Part A: Wetland Application:

        (i) Updates to my previous evidence in light of the Wetland Application;

        (ii) Matters raised in the Panel's Ninth Memorandum and Logan Brown's Section 42A Report relating to the Wetland Application; and

    (b) Part B: Other matters raised in Logan Brown's Section 42A Report

EXECUTIVE SUMMARY

11. The proposed wetland location has been confirmed; appropriate water quality and biological monitoring sites will be able to be determined.

12. Data gathered at these monitoring sites will enable a robust assessment of the effects of the EWWTP discharge in isolation from other influences (as opposed to the effects of the EWWTP discharge <u>plus</u> inputs from the Ngatahaka Creek as is currently the case).

13. The EWWTP is currently a very minor contributor to in-stream nitrate-nitrogen concentrations and loads. The level of nitrate-nitrogen removal performance in the wetland makes a very small, and not measurable, difference to in-stream nitrate-nitrogen concentrations.

14. Whilst there is an increase in periphyton growth downstream of the Ngatahaka confluence/EWWTP discharge, it does not generally exceed the One Plan targets;

15. There is no clear evidence that ammoniacal-nitrogen from the EWWTP discharge plays a significant role in the moderate increase in periphyton currently measured downstream of the Ngatahaka confluence/EWWTP discharge. Other factors such as nitrogen inputs from the Ngatahaka Creek and phosphorus inputs from the EWWTP discharge are much more likely to dominate and drive the periphyton response.

16. Uncertainties relating to the EWWTP discharge’s effects on water quality and freshwater ecology remain and must be acknowledged; however, there is little that can be done to address these uncertainties in the current situation where the effects of the discharge cannot be separated from those of the Ngatahaka Creek. The only way to address these uncertainties is via robust

monitoring following relocation of the discharge point to the proposed new location.

PART A: WETLAND APPLICATION

Updates to previous evidence in light of the Wetland Application

Wetland location and in-stream monitoring sites

17. In response to the Hearing Panel's Second Memorandum dated 31 March 2017 ("the **Second Memorandum**"), my 2017 Supplementary Evidence dated 5 April 2017 (paragraphs 5.1 to 5.7) referred to two potential locations for the proposed wetland location and explored the implications in terms of water quality and ecological monitoring.

18. The proposed wetland location has now been confirmed as "Option 2" and I can confirm the statements made in paragraph 5.7 of my 2017 Supplementary Evidence.

19. In particular, I am of the opinion that appropriate monitoring locations can be identified upstream and downstream of the discharge from the proposed wetland (both the direct discharge to surface water and the discharge via groundwater). There does not appear to be any significant inputs between the two sites, thus direct comparisons of monitoring results obtained at the upstream and downstream sites will enable a direct assessment of the water quality and ecological effects of the discharge from the EWWTP.

20. Whilst the location of water quality sampling sites can be determined now, particular care needs to be given to the comparability of biological (periphyton and macroinvertebrate) monitoring sites. Physical characteristics of the two sites, such as depth, velocity, shading, and substrate should be as similar as possible. Importantly, river bed conditions do change over time and I concur with Mr Brown's view (at paragraph 36 of his Section 42A Report) that any consent condition must provide a degree of flexibility with regards to the exact location of the monitoring sites.

21. To confirm the comparability of the monitoring sites, particularly with regards to macroinvertebrates and periphyton, I recommend that one or two ecological surveys be conducted at the future/proposed upstream and downstream monitoring sites before the discharge is shifted to the new proposed location.

Wetland location and "background" water quality

22. An important aspect of the broader EWWTP Project is that, following commissioning of the proposed wetland, the discharge from the EWWTP to the Makakahi River will be located some distance downstream of the confluence with the Ngatahaka Creek, as opposed to the current discharge point which is immediately upstream of the confluence.

23. This will have the distinct advantage of allowing a direct assessment of the effects of the EWWTP discharge, as opposed to the effects of the EWWTP discharge <u>plus</u> inputs from the Ngatahaka Creek as is currently the case. It also means that the water quality upstream of the EWWTP discharge will be significantly different to what it currently is (as it will incorporate the inputs from the Ngatahaka Creek).

24. Specifically, it means that background (upstream) concentrations of SIN and nitrate-nitrogen will be considerably greater than at the current "upstream" site. Periphyton growth will be less (and less often) nitrogen limited, as the Ngatahaka Creek causes significant increases in SIN (under the form of nitrate-nitrogen) concentrations in the Makakahi River under all flow conditions. Existing and predicted future SIN and DRP concentrations are summarised in Table 1 below.

Table 1: Existing and predicted future SIN and DRP concentrations upstream of the EWWTP discharge

	River flow	Existing average upstream concentration	Future (predicted) upstream concentration	One Plan Target
DRP (g/m^3)	< 20^{th} FEP	0.005	0.006	0.010
	< Half median	0.004	0.006	-
SIN (g/m^3)	< 20^{th} FEP	0.226	0.470	0.444
	< Half median	0.053	0.280	-

Matters raised in the Panel's Ninth Memorandum and Mr Brown's Section 42A Report relating to the Wetland Application

Wetland performance and risk of effects

25. An error occurred in the load calculations provided in response to the request for further information. Tables 2 and 3 below provide corrected load estimates. The conclusions reached are not affected, i.e. the EWWTP contributes a significant proportion of the DRP load in the Makakahi River, but only a small proportion of the SIN load. The proposed treatment upgrades are expected to significantly reduce the DRP load entering the

Makakahi River from the Eketahuna WWTP, but will have little impact on SIN load.

Table 2: Pre-upgrade (current) estimated nutrient loads in the Makakahi River downstream of the Eketahuna WWTP, and relative contribution of key sources.

		Load by source (t/yr)						
		Upstream of WWTP					Downstream of WWTP	
Flow bin	Parameter	Makakahi River	Ngatahaka Creek	Other	Total (U/S of WWTP)	Effluent	Makakahi River	WWTP contribution to d/s load
All flows	SIN	32.28	54.01	1.08	87.37	1.13	88.51	1.3%
	DRP	0.48	0.43	0.00	0.91	0.13	1.03	12.2%
Below 20th FEP	SIN	12.55	20.93	0.00	33.47	0.49	33.96	1.4%
	DRP	0.17	0.16	0.00	0.33	0.06	0.40	15.6%

Table 3: Post WWTP estimated upgrade nutrient loads in the Makakahi River downstream of the Eketahuna WWTP, and the relative contribution of key sources.

		Load by source (t/yr)						
		Upstream of WWTP					Downstream of WWTP	
Flow bin	Parameter	Makakahi River	Ngatahaka Creek	Other	Total (U/S of WWTP)	Effluent	Makakahi River	WWTP contribution to d/s load
All flows	SIN	32.28	54.01	1.08	87.37	1.06	88.44	1.2%
	DRP	0.48	0.43	0.00	0.91	0.07	0.97	7.1%
Below 20th FEP	SIN	12.55	20.93	0.00	33.47	0.46	33.93	1.4%
	DRP	0.17	0.16	0.00	0.33	0.03	0.37	9.2%

26. Question 2.8 of the Ninth Memorandum requests that information be provided as to the nitrate removal efficiency rate used, whether this varies between seasons and if such an efficiency rate whether this would be appropriate as a potential condition of consent.

27. The efficiency rate used (i.e. the % of nitrate nitrogen assumed to be removed from the effluent during the passage through the wetland) was 50%. Mr Roger MacGibbon states in his evidence that this rate can vary from between 50% - 90% in the summer, and between 30% - 50% in the winter.

28. The analysis presented below is based on a range of efficiency rates, and shows that nitrate-nitrogen removal through the wetland will make very little difference to the in-stream SIN concentrations. This is logical given the EWWTP discharge is a very minor contributor to the Nitrate-nitrogen measured in the Makakahi River downstream of the discharge.

29. At paragraph 16 of his Section 42A Report, Mr Brown states that it will be "vital" to monitor the reduction in nitrate that occurs as a result of the installation of the wetland. At paragraph 17, Mr Brown recommends a consent condition to ensure that wetland reduces the nitrate concentration by 50 percent. The justification Mr Brown offers for this recommendation is that this performance was the assumption made in the load calculation provided in the S92 response.

30. My understanding is that consent conditions should be imposed to manage specific environmental effects (or risk thereof). On that basis, it is relevant to explore whether the nitrate removal through the wetland performance is likely to be a significant factor in mitigating potential effects.

31. I ran a sensitivity analysis to test the influence of the wetland's nitrate nitrogen removal performance on in-stream nitrate and SIN nitrogen concentrations. The analysis was run on various assumed nitrate-nitrogen removal efficiency rates ranging from 0% (equivalent to the situation without the wetland) to 100% (Figure 1 below).

32. This analysis shows that the difference various levels of assumed nitrate-nitrogen removal makes to in-stream concentrations is very small (e.g. in the order of 2% of the total concentration). This is well within typical laboratory analytical error (typically 15-20%) and is highly unlikely to be able to be measured in-stream. Given the background concentrations (in the order of 0.400 g/m^3) the ecological relevance of such concentration changes (in the order of 0.010 g/m^3) is immaterial.

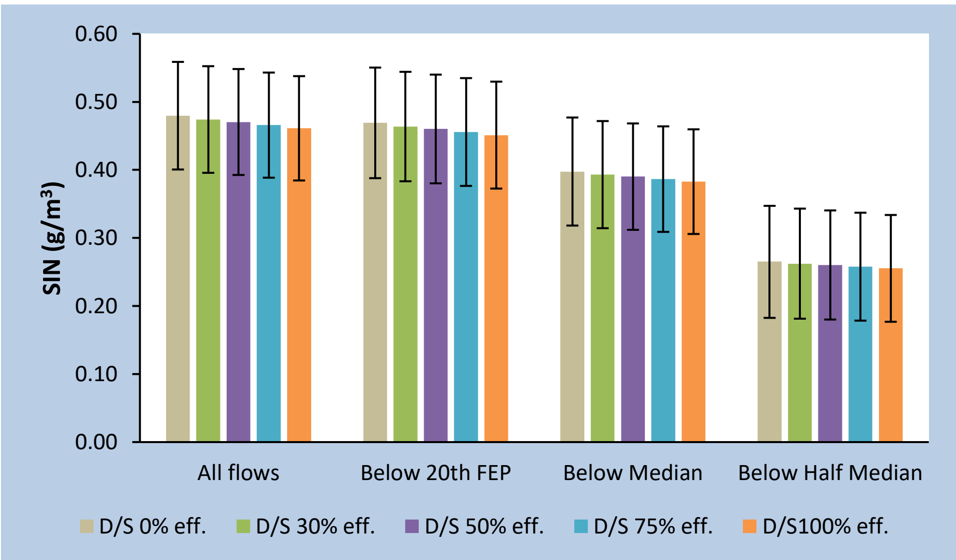

Figure 1: Predicted average SIN concentrations downstream of the EWWTP, assuming 0%, 30%, 50%, 75% and 100% removal of nitrate-nitrogen from the effluent.

33. On the basis of my analysis above, I am of the opinion that there is little effects-based justification for placing a strong compliance emphasis on the nitrate-nitrogen reduction from the wetland, as it does not make a material difference to the risk of effects caused by the EWWTP discharge.

34. Further nitrification (conversion of ammoniacal-N into nitrate-N) at the wastewater plant could theoretically further reduce the nitrogen outputs from the EWWTP; however, I understand from Mr Crawford's evidence that this would require a fundamental change of treatment process. As explained in my evidence below, I am of the opinion that there is no clear evidence that the ammoniacal-nitrogen component of the discharge is a significant contributor to the moderate periphyton increase currently measured downstream of the Ngatahaka confluence/EWWTP discharge.

PART B: OTHER MATTERS RAISED IN MR BROWN'S SECTION 42A REPORT

Contribution of the EWWTP to in-river nitrogen loads

35. At paragraph 38 of his Section 42A Report, Mr Brown states that the implementation of resource consents issued under the One Plan in the Mangatainoka catchment will result in a "*10.5% reduction in N loss from farm*". Mr Brown goes on to say that because the predicted reductions of SIN load from the EWWTP are 6.1%, the "*EWWTP discharge will make up a larger proportion of the SIN load in the Makakahi and Mangatainoka River*".

36. Mr Brown seems to assume that all SIN in the Makakahi and Mangatainoka catchments originates from consented dairy farms. This is an incorrect assumption, as dairy farming only makes up a proportion of the land cover/land use in the Makakahi (37%[1]) and Mangatainoka (39%[2]) catchments, and other land covers/land uses will also export nitrogen loads to the river catchments.

37. Based on information I used to prepare evidence to the One Plan Environment Court hearings in 2012, dairy farming generated approximately 50% of the in-river nitrogen load in the Mangatainoka catchment. Assuming nitrogen losses from other land uses remain constant, a 10% reduction of the

[1] Refer to Map 3 in Mr Brown's S42A report in relation to the Eketahuna WWTP, dated 7 March 2016
[2] Refer to Map 3 in Mr Patterson's S42A report in relation to the Pahiatua WWTP, dated 21 April 2017

nitrogen load from dairy farming would only result in a 5% reduction of the overall in-river load (and not a 10% reduction as assumed by Mr Brown).

38. In my opinion, the conclusion reached by Mr Brown in his paragraph 38 is incorrect and overestimates the in-stream reductions that may result from nitrogen loss reductions from dairy farms in the Mangatainoka catchment.

Ammoniacal nitrogen and periphyton

39. In paragraphs 25 to 27, Mr Brown discusses the results of an experimental study conducted by NIWA in 2017. I am familiar with the study and its findings. Mr Brown concludes that these results *"help explain why at times we see increased periphyton growth downstream of discharge that are not necessarily aligned with an increase in SIN overall"*. It is unclear whether Mr Brown refers to discharges in general or the EWWTP discharge specifically.

40. The NIWA study was an "out of stream" study under controlled conditions. This is of course entirely appropriate for an experimental setup aimed at exploring a working hypothesis, but care must be taken when interpreting in-river situations. In my opinion, Mr Brown's interpretation does not take into account several critical elements that are particularly relevant in the EWWTP case, in particular:

    (a) The ammoniacal-nitrogen to nitrate ratios that elicited a positive response in the NIWA experiment (30 - 77%) were significantly greater than those present in the Makakahi River downstream of the Ngatahaka Creek confluence/EWWTP discharge (3% in general, and up to a maximum of 12% under low river flow conditions).

    (b) Whilst other (than SIN and ammoniacal-nitrogen) water quality parameters were kept constant in the NIWA experiment, in the EWWTP situation there is a significant increase in DRP concentration in the Makakahi River between upstream and downstream of the Ngatahaka confluence / EWWTP discharge. The DRP concentrations upstream is very low (0.004 g/m^3) and is likely to exert strong limitation over periphyton growth. The increase currently measured downstream of the Ngatahaka confluence / EWWTP discharge (to 0.010 g/m^3 under half median flow) is ecologically highly relevant and is not a factor that should be ignored. The contribution from the EWWTP to this increase[3] will be significantly reduced following the WWTP upgrades.

(c) The nitrate-nitrogen concentrations in the Ngatahaka Creek are always elevated compared with the Makakahi River upstream of the confluence. Even under low flow conditions, inputs from the Ngatahaka Creek lead to a 5 - 6-fold increase in SIN concentrations, primarily under the form of nitrate-nitrogen. This concentration increase is particularly ecologically relevant given the very low concentrations upstream (0.050 g/m^3 at flow below half median flow [4]) and relatively elevated (0.280 g/m^3 at flow below half median flow [5]) concentrations downstream of the Ngatahaka confluence. This means that the Makakahi River moves from a strongly N-limited situation to a situation where nitrogen exerts very little control over periphyton growth. In my opinion, this concentration increase is highly likely to be a significant contributor to the observed periphyton increases, and must not be ignored in any analysis or interpretation.

(d) In my opinion, the evidence is far from clear that the addition of ammoniacal-nitrogen from the discharge plays a significant role in the moderate periphyton increase currently measured downstream of the Ngatahaka confluence/EWWTP discharge. The overall increases in nitrate-nitrogen and DRP concentrations are, in my opinion highly likely to be more significant drivers.

41. With regards to the risk of effects of the EWWTP on periphyton growth in the Makakahi River, the following considerations are relevant.

(a) As explained in my 2017 evidence,[6] nutrients targets in the One Plan were set as a way to control periphyton growth, as opposed to an "end" in themselves. The actual "end" that is aimed at is the avoidance of excessive periphyton growth. The One Plan targets relative to periphyton were defined as being suitable to maintain/safeguard a range of ecological and recreational values. In other words, as long as the periphyton targets are met, the effects are compatible with the

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[3] Currently, I estimated that the EWWTP discharge contributes approximately 0.004 g/m^3, whilst the Ngatahaka Creek contributes approximately 0.002 g/m^3 to DRP concentrations in the Makakahi River.
[4] Measured in-stream
[5] Estimated downstream of the Ngatahaka confluence, but without the discharge, i.e. representative of the future "upstream of the discharge" situation.
[6] At paragraph 4.3

expectations set in the One Plan. This interpretation seems to be similar to that provided by Horizons' experts.[7]

(b) Whilst increases in periphyton growth were detected at the site downstream of the Ngatahaka confluence/EWWTP discharge (compared with upstream), these increases were generally within the One Plan targets, as follows:

(i) As explained in paragraph 5.12 of my March 2017 evidence, the One Plan target relative to periphyton biomass (120 mg Chlorophyll *a* /m^2) should be applied with an allowable degree of exceedance (equivalent to one acceptable exceedance per year, based on monthly monitoring). Figure 19 of my March 2017 evidence shows that the target was exceeded three times out of four years of monitoring at the monitoring site locate downstream of the Ngatahaka confluence/EWWTP discharge. Although data is insufficient to enable a full assessment against the One Plan target (monthly data would have been required), there is no clear evidence that the One Plan target relative to periphyton biomass is exceeded.

(ii) The One Plan target relative to long filamentous algae cover was always met.

(iii) The One Plan target relative to thick periphyton mat cover (including cyanobacteria) was always met.

(iv) The above measurements were made downstream of the Ngatahaka confluence/EWWTP discharge, i.e. they reflect the combined effects from the two contaminant sources.

42. In conclusion, I am of the opinion that:

(a) Whilst there is a degree of uncertainty about the role played by the ammoniacal nitrogen component of the discharge in the moderate increase in periphyton growth currently observed downstream of the Ngatahaka confluence/EWWTP discharge, other confounding factors (in particular the nitrate-nitrogen from the Ngatahaka Creek and the

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[7] For example, paragraph 18 of Mr Brown's S42A report for the EWWTP discharge to water (7 March 2017): "*As such, if the targets set out in the One Plan are complied with, the effects of an activity on the receiving water body are likely to be no more than minor*".
Also refer to M Patterson's S42A report in relation to the Pahiatua WWTP S42A report, dated 21 April 2017, para 19

DRP inputs from the discharge) are much more likely to dominate and drive the periphyton response.

(b) The One Plan periphyton targets are generally met downstream of the Ngatahaka Creek/EWWTP discharge. Periphyton therefore does not appear to be at levels that would significantly affect ecological and/or recreational river values, although a degree of uncertainty remains regarding compliance with the periphyton biomass target.

(c) In my opinion, there is little that can be done to address these uncertainties until the discharge is relocated away from the Ngatahaka Creek confluence, and these uncertainties should be addressed via robust monitoring following relocation of the discharge point to the proposed new location.

(d) There is presently no strong evidence that the nitrogen component of the discharge currently causes significant adverse effects on periphyton growth, either at the site scale or cumulatively; this conclusion will however need to be confirmed or otherwise once robust monitoring information becomes available.

Olivier Michel Nicholas Ausseil

12 November 2018