BEFORE THE INDEPENDENT COMMISSIONERS

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of the Proposed Waikato Regional Plan Change 1 - Waikato and Waipa River Catchments, and Variation 1 to proposed Plan Change 1

AND

IN THE MATTER of submissions under clause 6 First Schedule

ON BEHALF OF **BEEF + LAMB NEW ZEALAND**
Submitter

EXECUTIVE SUMMARY OF DR HANNAH MUELLER
26 MARCH 2019

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INTRODUCTION

1. My full name is Hannah Mueller. As of 18th March 2019, I am a Senior Ecology Consultant with 4Sight Consulting Ltd, environmental and planning consultants of Hamilton. My qualifications, background and experience have been included in my Brief of Evidence, dated 15 February 2019.

2. I practice as Senior Ecologist and have seven years' experience in environmental consulting. With a background and experience in both terrestrial and freshwater ecology, I specialise in environmental impact assessments, ecological management, catchment and land use management, and mitigation and restoration plans.

3. I have been engaged by Beef + Lamb New Zealand to provide evidence on freshwater ecological health and water quality outcomes outlined in the Proposed Waikato Regional Council Plan Change 1 – Waikato and Waipā River catchments and Variation 1 (PC1)

4. I provided a Statement of Evidence in Chief on behalf of Beef + Lamb New Zealand dated 15 February 2019.

5. I confirm the qualifications and experience set out in my Statement of Evidence in Chief.

6. As set out in my Evidence in Chief, I have read the Code of Conduct for Expert Witnesses in the Environment Court's 2014 Practice Note and I have complied and continue to comply with it. I confirm that the opinions I have expressed represent my true and complete professional opinions. The matters addressed by my evidence are within my field of professional expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

EXECUTIVE SUMMARY

7. Water quality in the Waikato River changes from the headwaters to river mouth, with total nitrogen and total phosphorus levels increasing alongside turbidity and E. coli levels. The same spatial

trend can be observed for the Waipā River. These increases are partially linked to anthropogenic factors, including diffuse pollution from land use (in particular impacting nitrogen and sediment levels), and point source discharges from factories and municipalities. However, in both catchments, water quality is also variable across sub catchments, with some sites representing good water quality such as the upper Waikato and some tributaries, with current water quality within the National Policy Statement for Freshwater Management (NPS-FM) National Objectives Framework (NOF) band A or B.

8. The National Policy Statement for Freshwater Management (NPS-FM) states that the life supporting capacity of freshwater systems must be safeguarded. A main objective of the NPS-FM is to protect ecosystem health, which is a compulsory national value described as: "*The freshwater management unit supports a healthy ecosystem appropriate to that freshwater body type (river, lake, wetland, or aquifer)*". In a healthy freshwater ecosystem, ecological processes are maintained, there is a range and diversity of indigenous flora and fauna, and there is resilience to change. In this way ecological health can be provided for even in systems which are modified ie not pristine or in reference condition. Other NPS-FM objectives are to protect natural character, mahinga kai, fishing, water supply, industrial and commercial, and other use values. The provision of Te Mana O Te Wai also requires that the integrated and holistic well-being of freshwater systems is provided for.

9. Water quality decline is a multidimensional issue, and deterioration of various parameters measuring water quality from the headwaters to the river mouth of the Waikato are closely linked to land use, and in particular intensification of land use. However, degradation of waterways in the Waikato and Waipā catchments is a multidimensional issue driven by pressures beyond the impacts of water quality including nutrients alone. These impacts include changes to the physical form and structure of the Waikato River, and its hydrology, such as through the creation of hydro Lakes for energy generation, and stop banks for flood control purposes, along with

losses of riparian vegetation and wetland habitats, and the introduction of exotic freshwater species. As such restoration and protection should be focussed on more than just water quality parameters and should be managed in an integrated and holistic fashion.

10. The water quality parameters currently proposed to be applied as part of PC1 (as represented in Table 3.11.-1) are chlorophyll *a*, Total Nitrogen (TN), Total Phosphorus (TP), nitrate (often linked to land use), ammonia (which at high concentrations is toxic to aquatic life), *E.coli* and clarity. The *E.coli* outcomes are addressed by Dr Dada. These parameters are useful indicators of water quality, as well as swimmability related to human health. While the water quality outcomes in Table 3.11-1 are useful indicators of water quality, they do not thoroughly account for ecological health, the life supporting capacity of freshwater systems, or incorporate mātauranga Māori concepts to measure ecosystem health.

11. Water quality objectives set out in Table 3.11-1 can be complemented by including additional freshwater attributes such as oxygen levels, temperature, and biota that indicate that an ecosystem can sustain diverse life.

12. Biota attributes should include biodiversity indicators such as the Macroinvertebrate Community Index (MCI) and/or other measurements of biota (e.g. fish, birds), as well as consider mātauranga Māori indicators such as the cultural health index (CHI) to give effect to NPS FM and the Vision & Strategy of the Waikato River. I have outlined additional numerical parameters that should be included in Table 3.11-1 in Table 1 in my Evidence in Chief, but also seek that Table 3.11-1 is reviewed through expert conferencing to incorporate the full suite of attributes and appropriate numerical states to protect and where degraded restore ecological health and processes.

13. Excess levels of nutrients (both nitrogen (N) and phosphorus (P)) in waterways can lead to nuisance biological growth and compromise the way a freshwater ecosystem functions, ecosystem health and

the quality of habitat it provides for its biota (including invertebrates and fish). When managing nutrients for water quality outcomes and ecological health, there is lack of scientific evidence that focusing on a single nutrient can achieve water quality improvements. In particular, limitation of P only may not prevent nuisance biological growth in river.

14. River system conditions are changeable and complex, and community compositions of algae and macrophytes may change depending on availability and ratios of nutrients. On a spatial scale, nutrient levels vary at different locations within the same catchment, so both N and P should be managed. Spatial and seasonal variations will need to be accounted for.

15. In order to reduce nuisance biological growth, including periphyton, nutrient loads to freshwater need to be managed; however, in relation to the PC1 Table 3.11-1 instream N and P concentrations, there is uncertainty around the level of nutrient concentrations related to achieving the periphyton and chlorophyll *a* outcomes.

16. In some catchments such as the upper basin instream nitrogen concentrations may be overly constraining, while in other subcatchments such as some of the tributaries they may be overly lenient. Expert conferencing would also be useful to revise the total nitrogen and nitrate freshwater outcomes. As a starting point, numerical outcomes for instream concentrations could be aligned with recommendations made on nitrate concentrations[1], and ANZECC values for TN[2].

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[1] Suggested concentrations of <0.11 mg/L (A band<), >0.58 mg/L (B band) and <1.66 mg/l (C band) for nitrate as discussed in Death, R. G., Canning, A., Magierowski, R. and Tonkin, J., 2018. Why aren't we managing water quality to protect ecological health?. In: Farm environmental planning – Science, policy and practice. (Eds L. D. Currie and C. L. Christensen). http://flrc.massey.ac.nz/publications.html. Occasional Report No. 31. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand. 13 pages.

[2] TN trigger values for chemical stressors: 0.295 mg/L for upland rivers, 0.614 mg/L for lowland rivers. Presented in: ANZECC (Australian and New Zealand Environment and Conservation Council) 1992. Australian water quality guidelines for fresh and marine waters. ANZECC, Canberra, Australia.

17. PC1 includes two primary mechanisms for achievement of the desired water quality outcomes that are set out in Table 3.11-1: a Nitrogen Reference Point (NRP) aimed at holding nitrogen emissions at historic levels while seeking reductions from the highest emitters, and the requirement of a Farm Environment Plan (FEP) for each property to manage contaminant losses from various land uses.

18. The NRP approach may not be sufficient to achieve water quality outcomes for a range of factors, because this approach may not account for the spatial and temporal movement of nitrogen through the system in particular due to more recent intensification of land uses, and it does not distinguish between land use types or capability of land resources, nor does not account for attenuation, topography, or soil types.

19. To achieve the desired water quality outcomes and ecological health, land use practices and differences in land use capability (including soil, topography and climatic conditions) need to be considered alongside losses of nutrients and other contaminants. This can be achieved by using a spatial framework based on sub-catchments; integrated contaminant management focusing on nutrients, sediment and microbial contaminants; a focus on critical source areas at a property scale; the consideration of a wide range of edge-of-field management options; along with recognising and rewarding the provision of ecosystem services provided at the farm or/and sub catchment scale to incentivise land management practices for effective improvements in water quality outcomes.

DATED this 26th day of March 2019

Dr Hannah Mueller