IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of the Proposed Canterbury Land and Water Regional Plan

REBUTTAL EVIDENCE OF SHIRLEY ANN HAYWARD FOR THE GROUP 2 HEARING

1. INTRODUCTION

1.1 My name is Shirley Ann Hayward and I have the qualifications and experience described in my Evidence in Chief dated 4 February 2013. I repeat the confirmation given in that statement that I have read and agree to comply with the Code of Conduct for Expert Witnesses.

2. SCOPE OF EVIDENCE

2.1 In this statement of evidence, I address issues raised by Dr Cooke and Associate Professor Death with regard to the nutrient allocation zone map and implications of the proposed Canterbury Land and Water Regional Plan (proposed plan) on risks to water quality and ecological health (life supporting capacity) of Canterbury's waterbodies.

2.2 I also discuss Ms Guest's assertion that the definition of red and orange nutrient allocation status implies that significant adverse effects are, or are close to, occurring.

3. EVIDENCE OF DR COOKE

3.1 Dr Cooke and colleagues undertook a simple modelling exercise to explore potential changes in nitrogen loads and concentrations in three example catchments. The modelling, while simple, appears sound except for a number of assumptions that went into the model inputs, particularly N loss estimates for different land uses and seasonality of nitrate concentrations in streams.

3.2 The attenuation co-efficients that Dr Cooke calculated appear low (i.e., indicate a very high level of attenuation in the range of 74 to 85% attenuation of nitrogen). These values indicate a much higher rate of attenuation than that commonly reported for catchments (more typically around 50%) (e.g., Rutherford, 2013). The reason for this apparent high attenuation is likely related to the high estimates of N losses, which over-estimate the total load of N lost from the land, compared to measured N loads in the streams. Effects of time lags between current N losses and measured N losses may also contribute, but are unlikely to be the sole reason for unrealistically high attenuations. For example, in the upper Rakaia catchment, lag periods are likely to be short and N losses unlikely to have changed to any significant amount in the past couple of decades, but Dr Cooke's modelling indicates an attenuation of 85% which suggests that estimates of N inputs are too high.

3.3 Dr Cooke's model provides an estimate of both annual average nitrogen concentrations and summertime concentrations. However, the predictions of summertime concentrations for at least the Selwyn River at Coes Ford are unrealistically high, and do not match measured summertime concentrations. For example, based on data provided to me by Environment Canterbury for the period 2008 to 2012, I calculate the average total nitrogen concentration in the Selwyn River at Coes Ford for the months November to March to be 5.1 mg/L, which is much lower than the value given in Table 3 of Dr Cooke's evidence of 18 mg/L of total nitrogen. Nitrate concentrations typically have strong seasonal patterns, particularly in streams with significant groundwater inflows, such that summertime nitrogen concentrations are typically lower than wintertime concentrations.

3.4 Dr Cooke's modelling analysis including modelling the effect of nitrogen caps on all farms, in the range of 10 – 40 kgN/ha/yr (paragraph 63). Notwithstanding comments above about the concerns with input assumptions, Figure 4 illustrates that at the upper range of the N cap modelled, N loads would be reduced for current land uses, and that N caps in the range of 30 to 40 kg N/ha/year plus the irrigation scenario (Aeru scenario) would hold nitrogen loads near current levels. It is therefore, not clear why the model results presented in Table 6 provide details for a nitrogen cap of only 20 kgN/ha/year, and this appears to provide the basis for Fish and Game's recommendation for a nitrogen cap of 20 kg N/ha/year.

4. EVIDENCE OFASSOCIATE PROFESSOR DEATH

4.1 Associate Professor Death addressed the question of whether the proposed plan would safeguard the life-supporting capacity of waterways. I sympathise with the frustration he expressed in attempting to link the water quality outcomes tables (which I consider as objectives rather than limits) with the nutrient allocation zone map in the proposed plan. In my evidence for the Group 2 hearings, I undertook an analysis in an attempt to understand the linkage. My analysis focused on those indicators that I consider are relevant to the question of the nutrient allocation status of the zones, which is different to the broader question Associate Professor Death attempted to answer.

4.2 In attempting to answer the question of whether the proposed plan will safeguard the life supporting capacity of waterbodies, Associate Professor Death considers a broader set of water quality issues than just nutrients (bacterial contaminants, nutrients, sediment, flows etc) and indicators (eg QMCI) but only relates this to the nutrient policies, and does not consider all the other aspects of the Plan that will also contribute to addressing these broader water quality outcomes (e.g. stock exclusion rules, point source discharge rules, flow allocation regimes).

4.3 Associate Professor Death discusses the poor water quality and ecological health of some of Canterbury's waterways. He attributes this to nutrient enrichment, faecal contamination, excess siltation, reduced flows and potentially to nitrate toxicity. While I concur with Associate Professor Death that QMCI values are low for many lowland streams across Canterbury that indicate poor ecological health, this does not mean that nutrient enrichment is the primary causative factor nor will reduction in nutrient inputs necessarily be the solution. In fact, fine sediment deposition in lowland streams, loss of habitat heterogeneity and loss of flow are more likely to be the primary drivers for poor QMCI values in Canterbury's lowland streams. In this case, policies and rules in the plan for stock exclusion and works in river beds are likely to make a contribution to improving the condition of these waterways.

4.4 Furthermore, the dairy industry's initiatives described by Mr Cullen and Mr Ryan including the farm environmental planning approach and Supply Fonterra, will help farmers to identify environmental risks such as poor instream and riparian habitat and to implement actions to mitigate those risks which will also contribute to improved stream condition.

4.5 I agree with the broad framework that Associate Professor Death outlined in paragraph 26 of his evidence listing out the steps needed to establish nutrient limits for waterways. This is the process that is outlined for development of nutrient limits in the sub-regional chapters. However, I do not support the approach proposed by Associate Professor Death to bring the water quality standards in Schedule 5 into the water quality outcomes tables. This is because these standards were developed for the NRRP to address a specific issue of setting thresholds for classifying the activity status for point source discharges as permitted or discretionary (Hayward *et al*. 2009). That is, the water quality standards were developed at a regional level to set thresholds where there was a high level of confidence that if the water quality beyond the mixing zone could meet the water quality standard this would not have adverse effects (Hayward *et al.* 2009). There was an implicit assumption that because these standards were intended to relate to point source discharges, attenuation of the discharge would occur beyond the mixing zone and therefore, it was tolerable that water quality standards could be set coarsely for the management units in the Plan, knowing that discharges that could comply with all the permitted activity conditions were unlikely to result in any significant adverse effect on water quality. Larger discharges would more likely need to apply for a resource consent which would more appropriately consider the full impacts of the discharge on the specific receiving environment.

5. EVIDENCE OF MS GUEST

5.1 Ms Guest implies that by definition, nutrient allocation status of red or orange zones have, or are close to having, significant adverse effects on aquatic life. However, this has not been demonstrated to be the case in any technical analysis provided by Environment Canterbury for the basis for the nutrient allocation zones. Appendix 6 in the Section 32 report provided a definition for the red, orange and green nutrient allocation status categories as follows:

> Red = 1."*Water quality outcomes not met"* where effects on instream values are observed, and a reduction in nutrient loads will be required ;
>
> Orange = 2. "*Water quality outcomes are "at risk*" - Effects on instream values are starting to become apparent or the water bodies are at, or

close to, water quality limits/outcomes. Control of nutrient inputs into the catchment will be required;

Green = 3. "*Meets water quality outcomes*" _ effects on instream values are not apparent and/or are unlikely to be exhibited in the near future.

5.2 These definitions do not indicate thresholds of significant adverse effect on aquatic life, rather they are thresholds of observable effects on a range of values.

5.3 Furthermore, where numerical water quality criteria were used, these were not at the threshold of significant adverse effects on aquatic life. For example, nitrate toxicity guidelines were stated to be used as part of the assessment of the status of rivers and streams (Appendix 6 of Section 32 report). The nitrate toxicity guidelines used were Hickey and Martin (2009), which have subsequently been updated with high concentration criteria by Hickey (2013). The nitrate toxicity guidelines (Hickey and Martin 2009, Hickey 2013) are developed conservatively, addressing non-lethal risks (e.g. growth rates) on sensitive species and as such represent thresholds where there may be in an increased risk of minor effects on growth rates, development and reproduction of some aquatic organisms.

5.4 Interestingly, in Associate Professor Death's evidence for the Group 1 hearing, he includes a graph (Figure 4, page 21) that shows that high QMCI scores (over 6 – being the outcome in the proposed plan's Table 1a for upland areas[1]) are recorded across almost the full range[2] of nitrate concentrations shown on the graph. This graph illustrates a lack of correlation between nitrate concentrations and indicators of aquatic health (QMCI).

Shirley Hayward

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1. The Table 1a outcome for lowland rivers are in the 4-5 range.
2. That range is from approximate 0.01 to 10 NOx (mg/l).

References

Hayward, S., Meredith, A., Stevenson, M., 2009: Review of proposed NRRP water quality objectives and standards. Environment Canterbury report R09/16

Hickey, C.W.; Martin, M.L. (2009). A review of nitrate toxicity to freshwater aquatic species. Environment Canterbury Report No.

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