BEFORE HEARING COMMISSIONERS at CHRISTCHURCH

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of the proposed Variation 5 to the Proposed Canterbury Land and Water Regional Plan – Nutrient Management and Waitaki
BETWEEN	DairyNZ Limited
AND	Canterbury Regional Council

STATEMENT OF PRIMARY EVIDENCE OF JUSTIN ALLAN KITTO

FOR DAIRYNZ LIMITED

22 July 2016

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1. EXECUTIVE SUMMARY

1.1 LWRMS have proposed changes to some of the outcomes for Table 15B(a). I am concerned that the periphyton outcome proposed by Lower Waitaki River Management Society for the Hakataramea River is unlikely to be met even under natural conditions due to the low flow nature of the river.

1.2 Table 15B(c) proposes nitrate-nitrogen limits. Both Fish & Game and Lower Waitaki River Management Society have proposed alternative nitrate-nitrogen limits. I argue that these proposed limits are not fit for purpose and there is no definitive scientific justification for their inclusion. It is my view that focusing on the implementation of farm environment plans to manage specific environmental risks around land management and the reintroduction of riparian shade is likely to be sufficient to improve ecosystem health in spring-fed waterways.

2. INTRODUCTION

2.1 My full name is Justin Allan Kitto.

2.2 I am employed by DairyNZ as a Water Quality Specialist. I hold the degrees of Bachelor of Science (Geography) (Hons) and Master of Environmental Science (Freshwater Ecology) (Hons).

2.3 In my current role I provide technical expertise on water quality issues relating to dairy farming. Prior to this role I was employed by the Otago Regional Council as an Environmental Scientist (Water Quality). During this period I was responsible for a number of water quality and stream ecology investigations and authored a number of technical reports.

3. SCOPE OF EVIDENCE

3.1 In my evidence I provide a response to the submissions from two submitters (Central South Island Fish & Game (*F&G*) and the Lower Waitaki River Management Society (*LWRMS*)) who seek various relief in respect of the Tables included in the proposed Plan Change 5B (Waitaki) (PC5B) to the Canterbury Land & Water Regional Plan (LWRP).

3.2 My evidence specifically relates to spring-fed plain rivers (Waikakahi Stream and Whitney's Creek) and the mainstem (not tributary sites) of the Hakataramea River (hill-fed lower). My evidence includes:

a) Amendments to Table 15B(a)

A response to the proposal to amend Table 15B(a) so alternative outcomes are expected to be achieved for Periphyton.

b) Amendments to Table 15B(c)

A response to the proposal to amend Table 15B(c) so alternative nitrogen limits (with targeted load adjustments accordingly) are implemented.

3.3 In preparing this evidence I note that although this is a Council hearing I have read the Expert Witness Code of Conduct set out in the Environment Court Practise Note 2014. I have complied with the code in preparing this evidence and I agree to comply with it while giving oral evidence. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

3.4 In preparing my evidence I have read proposed PC5 to the proposed LWRP, the DairyNZ submission, and the submissions of other relevant parties. In preparing this evidence I have read the following reports:

a) Greer, M. Clarke, G. & Gray, D. (2015) Predicting consequences of future scenarios in the Lower Waitaki: Surface water quality and ecology.

b) Clarke, G. & Greer, M. (2015) Lower Waitaki catchment water quality and ecology: State and trend.

c) Etheridge, Z. (2015) Predicting consequences for future scenarios in the Waitaki catchment: Lower Waitaki groundwater quality.

4. AMENDMENTS TO TABLE 15B(a)

4.1 Table 15B(a) ("Freshwater Outcomes for the Waitaki to be achieved by 2030") of PC5B sets out freshwater outcomes for rivers in the Waitaki catchment.

4.2 The outcomes set out in Table 15B (a) appear consistent with the indicators and numeric thresholds for the water quality objectives that have been described in Table 1(a) of the LWRP. In this regard, there appears to be one difference between the two tables which is the inclusion of numerical bacteria outcomes.

4.3 In their original submission LWRMS sought changes to the periphyton outcome for lowland and plains streams from the proposed 200 to 120 mg chl *a*/m^2.

4.4 For spring-fed plains (specifically Waikakahi Stream and Whitney's Creek), the plant growth of most concern is most likely to be macrophyte cover for which an outcome has been proposed that is better than current state. If the Zone Committees solutions package for riparian planting program is implemented, I am confident that the macrophyte outcome can be reached. This is because it has been indicated that amount of riparian shading is a strong predictor of macrophyte growth (Wilcock et al. 2002; Kohler et al. 2010).

4.5 There is no quantitative algal biomass data (Chlorophyll *a* mg/m^2) for the waterways I am commenting on so this makes it difficult to assess future compliance with the chlorophyll a outcomes. Nevertheless, there is filamentous algae data from ECan's state of environment monitoring (observed % cover) and an outcome for this in Table 15B (a), so I will assess periphyton growth compliance with this surrogate measure.

4.6 For the three monitoring sites in Waikakahi River and one in Whitney's Creek, the filamentous algae outcome is already being complied with and only exceeds the outcome on one single occasion at the Waikakahi Stream Old Ferry Road site. This indicates that current habitat conditions (e.g. nutrients, shade, and macrophyte dominance) are not leading to nuisance growths of periphyton. Therefore, setting the periphyton outcome at 120 mg chl *a*/ m^2 would be appropriate due to the dominance of macrophytes or fine sediment limiting excessive periphyton growths. In the longer term, the riparian planting program should be providing shading requirements limiting both macrophyte and periphyton growths.

4.7 In the Hakataramea River, a periphyton outcome of less than 120 mg chl *a*/ m^2 as requested by LWRMS's in their submission is unlikely to be achievable given the summer low flow conditions and resulting periphyton accrual periods in this catchment. An investigation published by Biggs (2000) found that the number of days since the last flood explained more variation in the mean amount of periphyton when compared to nutrients.

4.8 As mentioned in Paragraph 4.5, in the absence of chlorophyll a data, the available periphyton percent cover data is useful. Figure 1 (from Clarke and Greer, 2015) suggests that filamentous algae does exceed the 30% periphyton cover outcome in Table 15B (a) periodically during the bathing season in an environment that has low DIN and DRP concentrations. Between 2009 and 2013, QMCI scores (which is an overarching indicator of ecosystem health in the Canterbury Land and Water Plan) was compliant with the outcomes sort in Table 15B(a) for all years expect 2009.

4.9 Prolonged summer low flows in the Hakataramea River are a controlling driver of periphyton biomass. In my opinion even if irrigation and pastoral land-use were removed from the catchment, conspicuous algal growths would still occur in this river. As a result the periphyton outcome requested by LWRMS will be difficult to achieve in this catchment.

5. AMENDMENTS TO TABLE 15B (c)

5.1 LWRMS requests that to prevent excessive periphyton growth, nitrogen limits should be set at the ANZEEC guideline levels of 0.44 mg/l for nitrate nitrogen and 0.61 mg/l for total nitrogen.

5.2 The ANZEEC guideline levels were designed as trigger values so that if water chemistry exceeded these values, catchment specific investigations should be undertaken to determine if ecosystem health was compromised and local water quality data could be collected to then determine appropriate water quality limits to provide for local ecosystem health. These trigger values were never designed to act as water quality limits to prevent unwanted periphyton growth and do not take into account other influences such as substrate, flow regime or shade.

5.3 Additionally, LWRMS have requested that a limit of 0.8 mg/l for DIN is not exceeded for either a median or 95th percentile. It is not explicitly clear if these requested changes are for outcomes or limits or both. Clarification of this would be beneficial.

5.4 The 0.8 mg/l DIN limit was decided upon during the Ruataniwha Board of Inquiry. Subsequently to this, Young and Clapcott (2015) have reviewed the appropriateness of this DIN limit. The review found that DIN itself was not a strong driver of macroinvertebrate health (being the indicator for ecosystem health) and that at best DIN only had an indirect effect on macroinvertebrate health by potentially stimulating plant growth.

5.5 To determine locally specific DIN limits (as recommended in the ANZECC guidelines [ANZEEC 2000]), Environment Canterbury (ECan) has conducted a modelling exercise to determine DIN concentrations (bearing in mind the potential errors in the modelling) in rivers under the future land-use scenario. Assessments have then been made about the effect of increased DIN on ecosystem health (Clarke and Greer, 2015). While I will provide some more detailed comments about the effects on ecosystem health later, it is my view that the limits proposed by ECan are more appropriate as they have been specifically calculated for the lower Waitaki catchment.

5.6 I also understand from the evidence of Dr Treweek that ECan have assumed that all farmers are currently operating at GMP. The work from Dr Treweek suggests that this is not the case and that by getting dairy farmers from their current position to GMP will likely lead a notable reduction in nitrogen loss beneath the root zone. This work estimate indicates that DIN limits notified in Table 15B(c) for the Northern Fan waterways are likely to represent 'upper limits' and potential worst case scenario (in the context of the limitations and assumptions of the entire modelling process).

5.7 It is my view that provided the solutions package prescribed by the Zone Committee is implemented as intended (specifically the requirements of riparian planting to provide shade) and farmers continue to operate in the bounds of their farm environment plans (FEPs), the ecosystem health in both the Waikakahi Stream and Whitney's Creek will be enhanced from its current state and will probably achieve the outcomes by 2030, despite the relatively high DIN concentrations that have been modelled.

5.8 This is possible because the Waikakahi Stream has been a case study waterway for the benefits of improved water way management, specifically with respect to fencing. Recently published data from the Waiakakahi River has demonstrated that riparian fencing can reduce fine sediment inputs at or below the fine sediment outcome prescribed in Table 15B(a) (Holmes et al. 2016).

5.9 Additionally, research on spring fed rivers in Canterbury has been demonstrating that those high levels of fine sediment on the stream bed are also a significant stressor on macroinvertebrate communities (Greenwood *et al.* 2011; Burdon *et al.* 2013). Another recent Canterbury University study has demonstrated that nitrate concentrations had no significant effect on macroinvertebrate communities in spring fed streams (Moore, 2014).

5.10 Furthermore, research into multiple stressors has indicated that between sediment and nutrients, sediment has the strongest negative effect on insect metrics. But, when they act together, the effect can be even stronger (Piggot et al. 2012; Wagenhoff et al 2012). With this insight, by reducing the amount of fine sediment on the stream bed in the spring-fed streams and provided conditions are not conducive to excessive plant growth, insect metrics should improve. Simply, sediment is a master stressor in streams.

5.11 For plant growth, while nutrient enrichment can contribute to macrophyte growth, a modelling study of ECan's state of environment data indicated that the extent of stream bed fine sediment was highly correlated with excessive macrophyte growth. It was further suggested that the control of fine sediment entering waterways as opposed to solely relying on the management of nutrients could be just as effective for controlling excessive macrophyte (Booker and Snelder, 2012).

5.12 The net conclusion from this work is that by minimising sediment inputs, the amount of fine sediment build up on the stream bed can be reduced (hopefully to the 20% outcome as prescribed, otherwise more intervention {sediment removal} will be required). This action in combination with riparian planting should help macroinvertebrate communities to recover and meet the outcomes (i.e. QMCI>5). Also, by introducing shade and removing the preferred substrate for macrophytes (fine sediment), macrophyte cover will also be reduced, thus allowing other ecosystem health measures to be achieved.

5.13 With respect to the main-stem of the Hakataramea River, the river is too wide to benefit from riparian shading. Current state median DIN concentrations are low at 0.023 mg/l (Hakataramea River at Main Road). This number is not high, yet there are still exceedances for percent observed filamentous periphyton. I suspect these exceedances are likely caused by the cumulative effects of low summer flows, infrequent flushing events and high temperatures to the point where even if irrigation and land-use ceased, there are likely to be periodic periphyton blooms in this river. Doubling the DIN concentration to 0.05 mg/l (as proposed), if all other influencing factors remain the same, is likely to add increased risk of periphyton growth in this river assuming phosphorus is not limiting.

6. CONCLUSION

6.1 The periphyton outcome as proposed by ECan for the Hakataramea is appropriate for the context of the warm temperature, low flow and infrequent flushing setting of this river. Retaining the periphyton outcome of 200 mg chl *a*/ m^2 will acknowledge this river’s propensity for higher periphyton growths.

6.2 In the Northern Fan the environmental outcomes are likely to be met over time provided sufficient weight (and implementation) is given to minimising sediment loss and the requirement for riparian shading. This will negate the need for DIN limits that are unlikely to be the dominant cause of ecological stress.

6.3 The Hakataramea River is naturally predisposed to periodic nuisance periphyton growths. Despite this, macroinvertebrate community outcomes are still being achieved. If all else remains the same, the doubling of DIN (albeit still at low concentrations) will present at increased risk of periphyton growth.

7. FIGURES

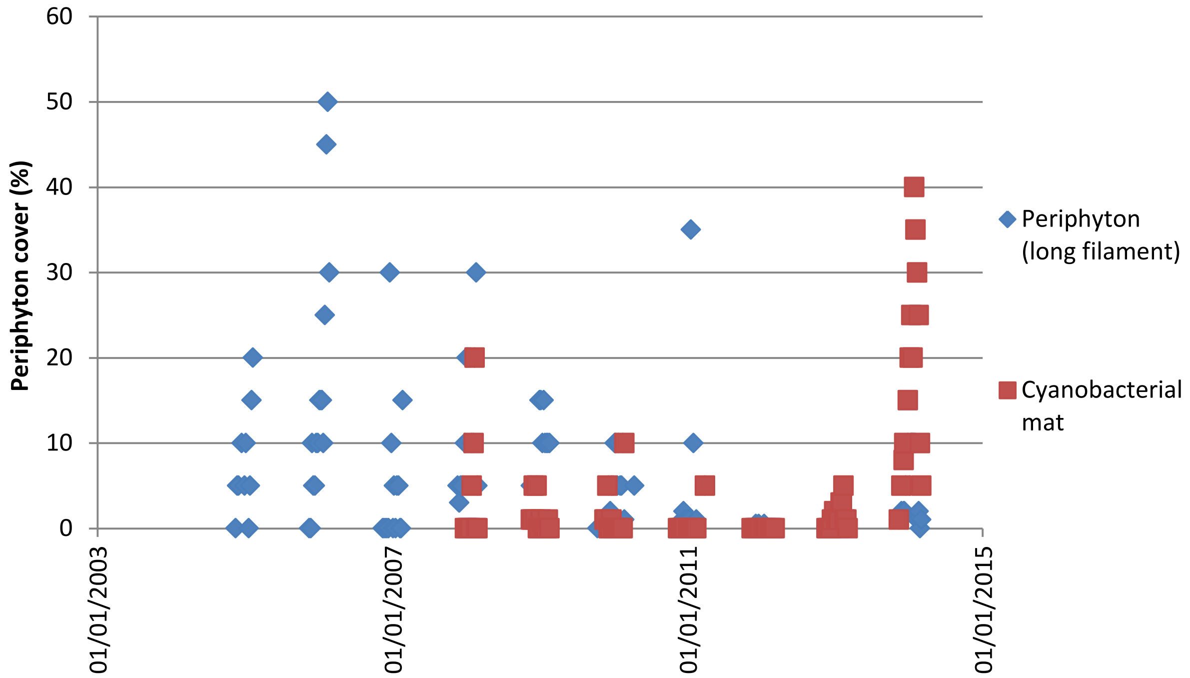

Figure 1: Percent estimates of long filamentous algae and cyanobacteria in the Hakataramea River at SH82 2004-2014 from ECan's contact recreation monitoring (From Figure 3.1, page 12 of Clarke and Gree, 2015).

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22 July 2016

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