BEFORE THE INDEPENDENT COMMISSIONERS
AT CHRISTCHURCH

UNDER the Resource Management Act 1991

IN THE MATTER of Plan Change 3 to the Canterbury Land and Water Regional Plan

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REBUTTAL EVIDENCE OF ANGELA FAY CHRISTENSEN ON BEHALF OF CENTRAL SOUTH ISLAND FISH AND GAME COUNCIL

21 October 2015

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1. My name is Angela Fay Christensen.

QUALIFICATIONS AND EXPERIENCE

2. My qualifications and experience were set out in my Evidence in Chief, dated 25 September 2015.

3. I have relied on the advice of other experts in their fields in preparing this rebuttal evidence.

4. In preparing this rebuttal evidence, I have reviewed:

   (a) The reports and statements of evidence of other experts giving evidence relevant to Fish & Game's submission, including:

      (i) Gerard Willis for Fonterra and Dairy NZ

      (ii) Justin Kitto for Fonterra and Dairy NZ

      (iii) Greg Ryder for Otaio Water Users Group

5. The particular points that I wish to rebut are set out below.

EVIDENCE OF JUSTIN KITTO

6. I have read the Evidence in Chief of Justin Kitto who has provided evidence on water quality for Fonterra and Dairy NZ. Mr Kitto cites that DIN and DRP should not be included as outcomes but rather as limits. Fish & Game consider that DIN and DRP need to be in both Tables 15 (a) as outcomes and 15 (c) as limits. Fish & Game consider that Table 15(a) should represent the attributes and numerical states which are essential in providing for fresh water ecological health and processes; therefore, we consider the attributes listed within the Fish & Game proposed Table 15(a) are appropriate. This is discussed in detail below. Fish & Game also proposed amendments to Table 15(c) limits to set a maximum cap of 0.8 mg/L for nitrogen in order to achieve the outcomes set in Table 15 (a). Fish & Game consider that amendments sought to Table 15(c) are appropriate as the limits proposed represent the maximum amount of resource use available, which allows a freshwater objective to be met.

7. As discussed in the Evidence in Chief of Gerard Willis on behalf of Fonterra, Plan Change 3 has to “give effect” to the NPSFM 2014 (s55(1)), as promptly as reasonable, and by no later than 31 December 2025. In that respect, it is useful to turn to the NPSFM in relation to

setting freshwater objectives, attributes, attribute states, and limits. The NPSFM requires that the life supporting capacity and ecosystem processes of freshwater are safeguarded (Objective A1), and that the overall quality of freshwater within a region is maintained or improved (Objective A2) by every regional council establishing freshwater objectives in accordance with Policies CA1 – CA4, and setting freshwater quality limits for all freshwater management units in their regions (Policy A1). Policy CA2 sets out the process by which regional councils must follow in developing freshwater objectives, and includes identifying the compulsory values including ecological health and contact recreation, and setting freshwater attributes and states necessary to provide for the value. In relation to Plan Change 3, Tables 15(a) and 15(b) sets out the freshwater objectives, which are attributes and attribute states required for compulsory value of ecological health and in order to maintain and, where degraded, improve water quality.

8. While it is a non statutory document, the Ministry for the Environment guidance on the National Policy Statement on Freshwater Management is useful in relation to further defining what is required under the NPSFM. In "A Guide to the National Policy Statement for Freshwater Management 2014" it states

> "*Regional councils will need to develop freshwater objectives in each freshwater management unit (FMU) for all attributes that are applicable to the value and the freshwater body type. This is likely to include attributes not found in Appendix 2 (eg, sediment, temperature, clarity, and additional nutrients).*[1] *Freshwater objectives can reflect the current water quality state or be aspirational (better than the current water quality).*"[2]

9. As set out in the evidence of Adam Canning for Variation 2

> "*Instream habitat quality, water quantity, nutrients (nitrogen and phosphorus), suspended and deposited sediment and riparian margins all need to be managed appropriately to achieve*

[1] Ministry for the Environment, A Guide to the National Policy Statement for Freshwater Management 2014. Wellington, 2015. p 29.
[2] ibid, p 34.

> *ecosystem health. All of these factors interact together to determine ecosystem health thus all need to be managed.*"[3]

10. The numerical DIN and DRP attributes proposed by Fish & Game for inclusion to Table 15(a) are "characteristics of the water that need to be managed to provide for the value"[4] of ecosystem health and are derived from the recommended water quality standards for specific management units as outlined in the 2009 Environment Canterbury Technical Report.[5]

11. Mr Kitto discusses the importance of having a fine sediment outcome, which Fish & Game agrees with and therefore, was included within the proposed table. In Mr Kitto's evidence, he cites, "Clarity is one of a number of measures available to measure the amount of sediment in a water column and the effects of too much sediment in the water and on the stream bed are well documented…it is my view that having a fine sediment outcome is a much better indicator of ecosystem health than clarity."[6] However, while fine sediment is referred to as having negative effects on the stream bed, it also impacts the clarity of the water which reduces the ability of trout to "sight feed" as Dr Death points out in his evidence for the LWRP. Dr Death states

> "*Generally maintaining clarity levels of 3.5m-5m, as measured by black disk, are required to maintain reaction distances of drift feeding trout at appropriate levels. Thus I recommend the inclusion of visual clarity limits in Table 1a as proposed by Hayward et al. (2009) which take into account the freshwater objectives and waterbody type (management unit) to represent pragmatic environmental bottom lines.*"[7]

Fish & Game therefore consider it appropriate to include clarity in Table 15(a) as an attribute for ecosystem health, and disagree with Mr Kitto's more limited consideration of its relevance.

12. Turning now to the matter of temperature in which Mr Kitto recommends a winter temperature of 16℃, as he was unable to find evidence that

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[3] Adam Canning, EiC Variation 2 LWRP, 7 May 2015, p 3.
[4] Ministry for the Environment, A Guide to the National Policy Statement for Freshwater Management 2014. Wellington, 2015. Figure 3, p 33
[5] Shirley Hayward, et al, Review of proposed NRRP water quality objectives for rivers and lakes in the Canterbury Region. Environment Canterbury. 2009.
[6] Kitto, EiC, para 19.
[7] Russell Death, EiC LWRP, 4 February 2013, p 27.

any rivers within the South Canterbury Coastal Area are regionally significant trout fisheries. Fish & Game consider that any rivers where trout spawn are regionally significant as without this spawning, the fishery would be non-existent. The Evidence in Chief of Fish & Game Field Officer Mark Webb details the rivers within the area in which trout spawn, warranting a winter maximum temperature of 11℃ as proposed by Fish & Game. Mr Canning also agrees that to maximise trout hatching success temperatures should not exceed 11 degrees.[8]

13. Mr Kitto considers that it is unnecessary to set a more stringent numerical state at 120 mg/m^3 for Chlorophyll *a* as set out in Fish & Game's submission, as it would be challenging to meet in relation to hill fed streams and is not required for spring fed streams.[9] Fish & Game disagree. Dr Death discusses the relationship between macroinvertebrate community health and periphyton in his EiC for the Canterbury Land and Water Plan.[10] Chlorophyll *a* levels of 200mg/m^3 normally only occur in very eutrophic waterbodies (degraded ecological health), and would therefore not be consistent with protecting the ecological health and processes of freshwater, nor achievement of the filamentous algal cover of less than 30% or the QMCI freshwater objectives set in Table 15(a). The Chlorophyll *a* freshwater outcome of 120 mg/m^3 is therefore provided as the maximum Chlorophyll *a* biomass to maintain ecological health, which is consistent with achieving the 30% filamentous algal outcome and QMCI outcomes in Table 15(a).

14. I will now turn to the DIN limits within Table 15(c). Mr Kitto argues that the 0.8 mg/l DIN limit recommended by Fish & Game is based solely on the Tukituki Plan Change where correlations between DIN concentrations and macroinvertebrate community index scores were specific to the Manawatu catchment and therefore not relevant to spring fed streams in Canterbury.[11] Mr Canning modelled data collected by Environment Canterbury from 350 macroinvertebrate sampling occasions across Canterbury during the summers 2008-2014 in his evidence for Fish & Game at the Variation 2 hearing. His modelled results from the Canterbury region for DIN limits mirror the proposed limits set forth by Fish & Game to achieve the QMCI for each

[8] Canning, EiC, p8.
[9] Kitto, EiC, p7-8.
[10] Russell Death, EiC LWRP, 4 February 2013, para 43 and 44.
[11] Kitto, EiC, para 32.

management unit.[12] Therefore, it is incorrect that the limits have no relevance for spring fed streams in Canterbury.

15. Mr Kitto states that discharge, shade and fine sediment strongly influence macroinvertebrate communities. He goes on to argue that for sites exceeding 0.8 mg/l, the key ecosystem health stressors are likely to be high levels of fine sediment and a lack of shade. Mr Kitto states, "*I consider managing for these two stressors alone is the appropriate approach in ensuring the ecological outcomes in Table 15(a) are met over time.*"[13] Fish & Game do not support this approach. Establishment of, and management to, appropriate nutrient concentration limits (nitrogen and phosphorus) are critical elements in relation to managing to achieve the outcomes in Tables 15(a) and 15(b), and in maintaining and, where degraded, improving water quality (s30RMA).

16. The importance of setting and managing to instream nutrient concentrations for both nitrogen and phosphorus are set out in my EiC.[14] The macroinvertebrate index (MCI and QMCI) was developed by Stark[15] for use in stony riffles as biotic indicators of organic enrichment (elevated levels of nitrogen and phosphorus). The indices rely on allocation of scores to taxa of freshwater macroinvertebrates based upon their pollution tolerances. Taxa that are characteristic of low organic enrichment (pristine conditions) score more highly than taxa that are found in predominantly polluted conditions (high organic enrichment). To therefore conclude that nutrient levels do not play a role in managing to QMCI outcomes in Table 15(a) is contrary to the indices themselves.

17. Multivariant analyses investigating relationships between nutrient concentrations and macroinvertebrate community health (both direct and non direct) from various data sets including Canterbury specific and national data sets[16] show that above threshold nitrogen concentrations of 0.7 – 0.8 mg/L, macroinvertebrate community health declines to below induce levels of MCI 100 or QMCI 5. Furthermore, research by Clapcott

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[12] Canning, EiC, p17.
[13] Kitto, EiC, para 8.
[14] Christensen, EiC, p 17, p 22 to p25, Appendix 2, and Appendix 3.
[15] Stark, J.A macroinvertebrate community index of water quality for stony streams. Water & Soil miscellaneous publication. 87: 53. 1985.
[16] Death (2013) EiC, Board of Inquiry Tukituki Catchment Proposal; Canning (2015) EiC, Variation 2 to the CLWRP; Jowett (2013) Physical impacts of water quality changes. Report prepared for Ministry of the Environment; Wagenhoff et al (2015) Ecological thresholds study.

& Goodwin (2014) looking at multivariant drivers of macroinvertebrate health concluded that nutrients were a stronger driver of MCI than sediment.[17]

18. The relationship between nutrients and periphyton are also well documented in the national and international literature,[18] and it is recognised that management of both nitrogen and phosphorus instream concentrations are essential elements in reducing the frequency and duration of periphyton blooms and in managing to periphyton limits. In relation to management of natural resources including freshwater, 'Liebig's Law of the minimum' applies. The law states that "growth is controlled not by the total amount of resources available, but by the scarcest resource (limiting factor)." Mr Kitto's position that shade and low sediment levels alone will be sufficient to achieve QMCI and periphyton outcomes in Table 15(a), is incorrect and fails to recognise the significant ecological role nutrients play in these processes. Even hypothetically, if shade and sediment levels were managed, this would not be sufficient to achieve the periphyton and macroinvertebrate outcomes set in Table 15(a), if nutrient levels exceeded thresholds.

19. Fish & Game agree that fine sediment and lack of shade are stressors to ecosystem health. However, any mitigation measures that reside within Farm Environment Plans or Good Management Practices[19] to address sediment and riparian margins, must sit alongside provisions that manage nutrients. As set out above, the management of shade and sediment alone will not provide for the outcomes set in Tables 15(a) and 15(b), safeguard life supporting capacity and ecosystem processes of freshwater, nor maintain and where degraded improve water quality. Furthermore, the provisions of the notified plan are inadequate in relation to managing sediment discharges and establishing vegetated riparian margins. Fish & Game has sought amendments to the stock exclusion provision which go some way in addressing these issues.[20]

Dated this 21st day of October 2015
Angela Christensen

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[17] Clapcott & Goodwin (2014) Relationship between macroinvertebrate community index and environmental drivers. Report prepared for Ministry of the Environment, Report No. 2507.
[18] Biggs (1990), Biggs (2000), Clapcott et al (2014).
[19] Schedule 24b Farm Practices (c) and (d), and rule 15.5.19
[20] Christensen, EiC, p21.