

**IN THE ENVIRONMENT COURT
WELLINGTON REGISTRY**

**I TE KŌTI TAIAO O AOTEAROA
TE WHANGANUI-A-TARA ROHE**

UNDER the Resource Management Act 1991

IN THE MATTER of appeals under sch 1, cl 14(1) against the decision of
Manawatū-Whanganui Regional Council on Plan Change 2
to the One Plan

BETWEEN **TE RUNANGA O RAUKAWA**
ENV-2021-WLG-20

NGĀTI TURANGA
ENV-2021-WLG-21

ANDREW DAY
ENV-2021-WLG-22

WELLINGTON FISH AND GAME COUNCIL
ENV-2021-WLG-23

Appellants

AND **MANAWATŪ-WHANGANUI REGIONAL COUNCIL**

Respondent

**STATEMENT OF REPLY EVIDENCE OF DR ANTONIUS HUGH SNELDER ON BEHALF OF
MANAWATŪ-WHANGANUI REGIONAL COUNCIL**

STATE OF ENVIRONMENT AND WATER QUALITY MODELLING

Dated: 13 November 2023


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REPLY EVIDENCE OF ANTONIUS SNELDER**A. INTRODUCTION**

- [1] My full name is Antonius Hugh Snelder.
- [2] I prepared a statement of evidence dated 6 October 2023 on state of environment and water quality modelling (**Evidence**) on behalf of the Manawatū-Whanganui Regional Council (**Horizons**) for Proposed Plan Change 2 to the One Plan (**PC2**).
- [3] My experience and qualifications are set out in my Evidence.
- [4] In this reply evidence I use the same defined terms as in my Evidence.
- [5] I repeat the confirmation given in my Evidence that I have read and will comply with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2023, and that my evidence has been prepared in compliance with that Code.

B. SCOPE

- [6] My reply evidence responds to points made in evidence by:
- (a) Dr Elizabeth Parlato on behalf of Ngāti Turanga and Wellington Fish and Game Council regarding the Risk Assessment Tool for Pastoral Farm Systems
 - (b) Michael Scott on behalf of Andrew Day regarding modelled differences in SIN loads between different regulatory settings.
 - (c) Greg Carlyon on behalf of Ngāti Turanga and the Wellington Fish and Game Council.

C. RESPONSE TO DR ELIZABETH PARLATO

- [7] In her evidence at paragraphs 5.6 and 6.21, Dr Parlato notes that the estimates of reductions in nitrogen losses by Professor Horne were made with respect to a historical baseline of 2012. Dr Parlato also notes at paragraphs 5.6, 6.24, and 6.28 that estimates which I made of changes in

water quality, in response to the estimated reductions in nitrogen losses, are similarly made with respect to a historic baseline of 2012. At paragraph 6.31, Dr Parlato notes that the consequence of the use of the 2012 baseline on my analysis of water quality are that land use changes, practice changes or intensification since the historic baseline are unaccounted for.

- [8] I agree with Dr Parlato that the analyses were undertaken with respect to the 2012 baseline. However, the estimates of the changes in nitrogen losses by Professor Horne,¹ and the assessment of consequent changes in water quality by myself, were for the comparison of the two sets of potential regulations: DV-PC2 and the proposed amendments to DV-PC2 (i.e., the risk assessment tool). Because the analysis compares the nitrogen loss and water quality outcomes under these two sets of potential regulations, the results and conclusions are not impacted by the choice of baseline. Professor Horne's and my assessments show that the differences in the nitrogen loss and water quality outcomes between the two sets of potential regulations are small. The same results and conclusions would be reached had a different baseline been used. It is true that the actual magnitude of change from the baseline for each set of potential regulations would differ under different baselines, but this is immaterial. It is the difference between the two potential regulations that is important and was the point of our analyses.
- [9] At paragraphs 5.7 and 6.32, Dr Parlato emphasises that the changes in water quality that I estimated for the two sets of potential regulations are uncertain. Dr Parlato considers that my assessment is unreliable because the uncertainty of my assessment is not quantified.
- [10] I agree with Dr Parlato that the absolute estimates of water quality outcomes under each set of regulations are uncertain. However, because my analysis is a comparison of the outcomes under the two sets of potential regulations, DV-PC2 and the amendments to DV-PC2, the conclusions are not impacted by this uncertainty. This is because the uncertainties of the outcomes under each set of regulations are nearly identical. The analysis of

¹ Statement of Evidence of David Horne (6 October 2023) at section L and Table 1.

both sets of potential regulations relied on the same land use information, nitrogen loss model (Overseer), and water quality data. In other words, the primary sources of uncertainty were exactly the same for the two analyses. Consequently, our best estimate of the difference in the water quality outcomes between the two sets of potential regulations are unaffected by the uncertainty.

- [11] Catchment water quality modelling is generally highly uncertain because there are always significant limitations in data and knowledge of the processes being modelled. These limitations are so significant that formal quantification of uncertainties, such as with confidence intervals as Dr Parlato suggests, is generally not able to be robustly undertaken. It is also a given that when undertaken, uncertainty assessments are themselves uncertain. One reason for this is that water quality modelling inevitably involves the need to make assumptions, the uncertainty of which is unknown. For this reason, water quality modelling results are best presented as comparisons between two modelled scenarios, or a modelled scenario compared to a modelled baseline. It is these comparisons that are the most reliable source of information, rather than the absolute results for an individual scenario. This is because the uncertainties (and bias) of both outcomes are similar. Therefore, our best estimate of the difference between the two scenarios is largely unaffected by the uncertainty.

D. RESPONSE TO MICHAEL SCOTT

- [12] In his evidence at paragraphs 8.35 and 8.36, Mr Scott considers that the assessment of the water quality improvement and the achievement of Objective 14-1 should be based on that delivered by the implementation of recalibrated Table 14.2 alone. This appears to be making the point that the alternative pathways (in DV-PC2 or as amended) do not achieve the same improvements as would be delivered by the recalibrated Table 14.2 alone.
- [13] During the hearing for the decisions version of PC2 I presented supplementary evidence that tabulated water quality outcomes modelled by Dr Cox and myself for a range of scenarios representing different sets of potential regulations. The table was included at Appendix B of my primary

evidence (and described at paragraph [50] onwards in that evidence). The third row in the table represents the outcome delivered by the implementation of PC2 with no alternative pathway, which is what Mr Scott refers to as recalibrated Table 14.2 alone. The rows in the table labelled Proposed Pathway A to F represent the water quality outcomes assuming different alternative pathways. The modelled outcomes for the alternative pathways available in the DV-PC2 provisions are shown in Pathway B.

- [14] The important observation from these modelled scenarios is that the differences between them in terms of water quality outcomes are small. As noted by Mr Scott at paragraph 8.35, the joint witness statement by water quality experts referred to the modelled estimates of improvements in water quality under PC2 as “*modest*”.
- [15] The difference between the water quality outcomes under the alternative pathways are between 1.8% (Proposed Pathway D) and 5.8% (Proposed Pathway E) of the mean relative difference of the outcome for the scenario that Mr Scott considers is the most relevant (recalibrated Table 14.2 alone). In my opinion, these differences to the “*modest*” improvement represented by the ‘best case’ scenario (recalibrated Table 14.2 alone) are not of practical importance to the environmental characteristics that are affected by river nitrogen levels.
- [16] It is important to note that the conclusions drawn from the water quality modelling carried out by Dr Cox and myself for the DV-PC2 process (which are summarised in Appendix B of my primary evidence) are relevant to the proposed amendments to DV-PC2 (risk assessment tool). This is because the analyses of changes in nitrogen losses by Professor Horne, and the assessment of consequent changes in water quality by myself, show that the two sets of potential regulations are not distinguishable from one another in terms of their water quality impact.
- [17] The differences in water quality impacts between variants of the regulations proposed under the amendments to DV-PC2 (e.g., alternative pathways) can be expected to be similarly as small as those modelled under DV-PC2.

E. RESPONSE TO GREG CARLYON

- [18] At paragraph 14.6 of his evidence, Mr Carlyon appears to suggest that the change in the SIN concentration in the Hoki_1a WMSZ resulting from the application of the risk tool to CVG (estimated by Dr Jolly) is minor (i.e., 2%). This is based on my estimated change in the mean relative difference between the baseline (92%) and the implementation of the risk assessment tool (90%). This is not a correct inference and the change in the SIN concentration is appreciably larger than 2%.
- [19] The mean relative difference is an indicator of the extent to which the SIN concentration exceeds the target. It is not a measure of the estimated change in the concentration per se.
- [20] In the case of Hoki_1a, which is the WMSZ that hosts almost all the CVG in the Manawatū-Whanganui region, the baseline SIN concentration (2.15 g m^{-3}) is much higher than the One Plan target (0.167 g m^{-3}). This means the mean relative difference is high (92%).
- [21] The 70% reduction in nitrogen loss that Dr Jolly estimates for CVG under the proposed amendments to DV-PC2 results in a 21% reduction in SIN load and concentration from the Hoki_1a WMSZ (once all other sources of nitrogen in the WMSZ are included). This is shown in Table 5 of my Evidence. This is an appreciable reduction and is much greater than the 2% (i.e., 92% to 90%) change in the mean relative difference indicator.²
- [22] In case Mr Carlyon is suggesting that there would be a notable change in the magnitude of the SIN reduction if Dr Jolly's 70% figure overestimates the reduction in nitrogen loss to be expected from implementing the CVG risk assessment tool, I have considered the effect of varying the size of that reduction in nitrogen loss. Even if the nitrogen loss reduction of 70% calculated by Dr Jolly were reduced to (for example) 50%, a change in the SIN load and concentration in the WMSZ of 15% would still be seen. This is still appreciably higher than the 2% change in mean relative difference might

² Despite the 20% change in SIN concentration, the mean relative difference is 90% because the estimated concentration after implementation will be $2.15 + (2.15 \times -20\%) = 1.72 \text{ g/m}^{-3}$ and therefore the mean relative difference $= (1.72 - 0.167)/1.72 = 90\%$.

suggest at first glance. Nonetheless, as with the 70% reduction figure, the resulting concentrations of SIN in the WMSZ would remain appreciably greater than the One Plan target.

F. CONCLUSION

- [23] The point of the analyses of the estimates of the changes in nitrogen losses by Professor Horne, and the assessment of consequent changes in water quality by myself, was to compare the outcomes under the two sets of potential regulations: DV-PC2 and the proposed amendments to DV-PC2 (risk tool). Because it is the comparison between the two outcomes that is important, my conclusion is that the differences between the alternative regulatory settings are insignificant, regardless of baseline chosen, and is robust to the inherent uncertainties.
- [24] The water quality improvement that Mr Scott considers best achieves Objective 14-1 is that pertaining to the implementation of recalibrated Table 14.2 alone. My analyses indicate that the water quality outcomes under the alternative pathways are not practically distinguishable from that achieved by implementation of recalibrated Table 14.2 alone.
- [25] The reduction in nitrogen loss from the Hoki_1a WMSZ resulting from the implementation of the risk tool to CVG is not as marginal as Mr Carlyon appears to be asserting. Implementation of the risk tool to CVG does produce an appreciable (21%) reduction in the SIN concentrations in the Hoki_1a WMSZ. However, despite this reduction, the resulting concentrations in WMSZ remain appreciably greater than the One Plan target.

13 November 2023

Antonius Hugh Snelder