

**BEFORE THE HEARING PANEL**

**AT HAMILTON**

**IN THE MATTER**

of the Resource  
Management Act 1991

**AND**

**IN THE MATTER**

of the Proposed Waikato  
Regional Plan Change 1  
Waikato and Waipā River  
Catchments

**AND**

**IN THE MATTER**

of Variation 1 to the  
Proposed Waikato  
Regional Plan Change 1  
Waikato and Waipā River  
Catchments

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**STATEMENT OF EVIDENCE IN CHIEF OF DR SIMON STEWART FOR THE  
DIRECTOR-GENERAL OF CONSERVATION**

BLOCK 3

5 July 2019

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## **INTRODUCTION**

1. My full name is Simon Donald Stewart.
2. I hold the position of freshwater research scientist at the Cawthron Institute. I have held this position for one year.
3. I am presenting this evidence for the Director-General of Conservation (the **Director-General**) in relation to protecting and restoring the values of lake ecosystems through addressing water quality pressures in the Waikato and Waipā catchments. The evidence covers all lakes within the proposed Plan Change 1 (PC1) boundary.

## **QUALIFICATIONS AND EXPERIENCE**

4. I hold a PhD in Limnology from the University of Waikato (2018), an MSc (Hons 1st class) in environmental science from the University of Canterbury (2011) and a BSc in biological science from the University of Canterbury (2008).
5. A detailed description of my qualifications and experience is provided in my Block II evidence dated 3<sup>rd</sup> May 2019.

## **CODE OF CONDUCT**

6. While this is not an Environment Court hearing, I have read the Environment Court “Code of conduct for expert witnesses”, and I agree to abide by it. I have prepared this Statement in accordance with that Code. I confirm that my evidence is within my area of expertise. I have not omitted to consider any material facts known to me that alter or detract from the opinions I express in this Statement. I have

acknowledged the material used or relied on in forming my opinions and in the preparation of this Statement.

## **SUMMARY**

7. This evidence covers freshwater lakes within the proposed Plan Change 1 (**PC1**) area, with specific focus on management of contaminant delivery to lakes.
8. My evidence focuses on requirements needed to reduce contaminant delivery from plantation forestry land during harvest as well as requirements of farm environment plans to reduce contaminant loss from farmland.
9. Forestry harvest can result in significant pulses of sediment being delivered to lakes where it will drive oxygen depletion and cause release of sediment-bound phosphorus and nitrogen into the water column where it drives eutrophication.
10. Because of this acute effect of sediment contamination of lakes, combined with the degraded state of many Waikato lakes, I believe that the 10 m riparian setbacks stipulated in the national environmental standards for plantation forestry (2017) provide insufficient protection, particularly during harvest. As such, I recommend that plan change 1 require 20 m setbacks for forestry activities from all water ways within lake FMUs, as well as within the upper river and mid-river FMUs, to reflect the sensitivity of the Waikato lake receiving environments (lakes and reservoirs) to fine sediment deposition.
11. Farm environment plans, within Schedule 1, are a critical component for achieving the objectives of Plan Change 1 and the Vision and Strategy

for the Rivers. As such, these require commensurate regulatory standards to ensure contaminant reduction.

12. I recommend adopting the amendments to Schedule 1 proposed by Ms Kissick. Specifically, as supported by my evidence in Block II, I recommend:

- Explicitly stating that the outcome of FEPs is to reduce contaminant loss and clearly identify and evaluate all contaminant source risks;
- Applying the 60<sup>th</sup> percentile Nitrogen Reference Point (NRP) as the benchmark within lake FMUs;
- Identifying ephemeral waterways as 'critical source areas' (or contaminant delivery hotspots) for targeted intervention;
- Requirements of 20 m stock exclusion setback from lakes and 10 m stock exclusion setbacks from catchment inflows within lake FMUs.

13. I also recommend requiring compliance with the agreed best practice standards for peat land farming for all FEPs within peat lake FMUs.

14. I disagree with the Section 42A officer's recommendation to delete implementation method 3.11.4.4 from Plan Change 1. Section 3.11.4.4 enables implementation of individual tailored lake management plans, which is a critical component of lake restoration beyond the bottom lines currently set for lake FMUs in Plan Change 1. Implementation method 3.11.4.4 should be retained to enable outstanding characteristics and specific issues to be addressed on a lake-by-lake basis as is best practice.

## **SCOPE OF EVIDENCE**

15. I have been asked to provide evidence specific to freshwater lakes in relation to the following matters:

- Management of plantation forestry practices within lake FMUs;
- Schedule 1 Farm environment plans.

## **MATERIAL CONSIDERED**

16. In preparing this evidence I have considered the following information:

- a. Block III Section 42A report including appendices;
- b. The National Environmental Standards for Plantation Forestry (Regulations) 2017.

17. Furthermore, when referencing evidence that I provided in Block II, in addition I considered the following publications:

- a. Block II Section 42A report including appendices;
- b. For Peat's Sake – Good management practices for Waikato peat farmers;
- c. Waikato region shallow lakes management plan: Volume 1 – Objectives and strategies for shallow lake management.

## **MANAGEMENT OF PLANTATION FORESTRY WITHIN LAKE FMUS**

18. In their report, the section 42A officers' recommend adopting the National Environmental Standards for Plantation Forestry 2017 (NESPF) stating that "*Provisions for forestry activities were not included in PC1 as it was determined that existing forestry rules were sufficient to control the adverse effects of contaminant loss to water*" (paragraph 588).

19. I disagree with the officers' report in this respect. In my opinion, the NESPF does not provide adequate protection for lakes, particularly during harvest periods. The NESFP is aimed at managing general

aquatic ecosystem impacts of fine sediment loss such as smothering benthic habitat but does not consider the lake-specific issue of bottom water deoxygenation which is not mentioned within NESFP 2017. Bottom water deoxygenation (also referred to as hypolimnetic anoxia) is an environmental impact specific to lakes and reservoirs where the water below the thermocline (i.e., not in contact with the atmosphere) becomes depleted of oxygen due to excessive organic carbon loading. Significant adverse effects of bottom water deoxygenation occur at lower rates of sediment input than the adverse effects of habitat smothering, for which the standards were designed.

20. Plantation forestry, particularly during harvest periods, can result in significantly elevated sediment loss to aquatic ecosystems. A case study from the Waitangi catchment in Northland demonstrated that plantation forestry occupied 8% of the catchment land area but contributed >26% of the sediment deposited in the receiving estuary. At some sites this contribution was >80% (Gibbs 2008).
21. Catchment sediment loads can have significant impacts on lakes by increasing oxygen consumption, ultimately leading to eutrophication. Elevated inputs of organic-rich terrestrial sediment to lakes will settle out onto the lakebed where it decomposes. Decomposing sediments can completely deoxygenate 16 times its volume of oxygen saturated water (Donohue and Molinos 2009). During periods of stratification, high rates of oxygen depletion associated with terrestrial sediment decomposition have been shown to result in bottom water anoxia (Kpodono et al. 2019). Under anoxic conditions sediments will release stores of phosphorus and nitrogen driving eutrophication. Terrestrial sediment loading has been shown to accelerate lake internal phosphorus cycling in New Zealand (Kpodono et al. 2019).
22. Lakes are particularly vulnerable to eutrophication by sedimentation-induced anoxia when the lakebed has large stores of legacy nutrients, as is the case in many Waikato lakes (Abell 2018). Controlling oxygen consumption is a critical aspect to restoring lakes with significant legacy nutrient loads, and additional inputs of catchment-derived organic sediment will limit the ability for nutrient reductions alone to prevent lake bottom-water deoxygenation. During harvest periods, when forestry land

is acutely susceptible to sediment loss, the NES-PF stipulates a 10 m setback from water ways. As demonstrated in evidence during Block II presented by Ms McArthur on behalf of the Director-General (paragraph 36), while a 10 m setback is likely to be adequate for removing 80 – 90% of fine sediment under typical conditions, substantially more (i.e., >90%) fine sediment interception would be required to mitigate the higher sediment yield.

23. I recommend 20 m riparian setbacks for forestry activities from all lakes and their catchment inflow streams within lake FMUs. A 20 m setback from lakes is consistent with recommendations that I have made in Block II evidence.

24. I also recommend that 20 m setbacks from waterways be applied to forestry activities in the upper- and mid-river FMUs as the receiving environments are reservoir lakes which are known to be particularly vulnerable to bottom water anoxia (Nürnberg 2002).

25. In summary, I recommend that a setback of 20 m be established from all waterways within lake, upper-river and mid-river FMUs from land where forestry activities are occurring.

## **SCHEDULE 1 – FARM ENVIRONMENT PLANS**

26. As PC1 is currently drafted, farm environment plans (FEPs) have been proposed as the primary mechanism to reduce sub-catchment nutrient losses.

27. In general, I support the use of FEPs as laid out in the officers' Section 42A report. However, I support the amendments sought by Ms Kissick on behalf of the Director-General and recommend that these are implemented.



28. Specific amendments that I support are:

- Explicitly stating that the outcome of FEPs is to reduce contaminant loss and clearly identify and evaluate all contaminant source risks;
- Applying the 60<sup>th</sup> percentile NRP as the benchmark within lake FMUs;
- Identifying ephemeral waterways as 'critical source areas' (or contaminant delivery hotspots) for targeted intervention; and
- Requirements of a minimum 10 m for stock exclusion setbacks from catchment inflows within lake FMUs, and 20 m stock exclusion setbacks around lakes themselves.

29. These amendments are supported by my Block II evidence in chief within the sections where I discussed FEPs within lake FMUs, the need to adjust the 75<sup>th</sup> percentile NRP to the 60<sup>th</sup> percentile NRP within lake FMUs and the need for larger setbacks from lakes.

30. Further to the amendments sought by Ms Kissick, I recommend requiring that FEP's apply the best management practices laid out in the "For Peat's Sake" guideline for farming on peat soils within peat lake FMUs to reflect their unique sensitivities as described in my Block II evidence.

31. Recent unprecedented high levels of cyanobacteria have occurred in some Waikato lakes (<https://www.stuff.co.nz/national/113750900/severe-spike-in-toxic-algae-blooms-for-two-waikato-lakes> - accessed 01/07/2019) highlighting the gravity of the level of nutrient enrichment within a number of the region's lakes. Moreover, the reported cyanobacteria blooms have occurred during winter as opposed to summer when they typically occur. These recent blooms reinforce the need for more stringent regulations for managing contaminant loss as

described through Ms Kissick's recommended amendments to Schedule 1.

32. In summary I support the amendments sought by Ms Kissick regarding FEP's in Schedule 1 and further recommend that recognised best practices be mandatory within tailored FEPs within peat lake FMUs.

#### **RETAINING EXISTING LAKE MANAGEMENT PLANS WITHIN 3.11.4.4 IN PLAN CHANGE 1**

33. The Section 42A Officers' report recommends deleting implementation method 3.11.4.4 *Lakes and Whangamarino Wetland/Ngā Roto me ngā Repo o Whangamarino* from Plan Change 1. In my opinion, 3.11.4.4 provides the best mechanism within Plan Change 1 to deal with the wide range of current status of lakes within lake FMUs and should be retained.
34. As described in Dr Phillips' Block I evidence on behalf of the Director General, there are several lakes where water quality currently exceeds (is already better than) the targets set by Plan Change 1. As described in my Block II evidence, many of these lakes contain vulnerable macrophyte communities which should be priorities for nutrient reductions.
35. Other than the recommendations that I have made in Block II evidence – to set water quality improvement as a minimum requirement for all lakes within the Plan Change 1 area – there is currently no additional proposed protection for these lakes with higher water quality which also hold the only extant macrophyte beds in the region. Lakes characteristically display significant inter-lake variation in terms of impacts of and responses to environmental stressors, owing to a myriad of factors such as lakebed morphometry, local climate, catchment topography as well as present flora and fauna. Because of these factors, it is recommended that restoration plans are tailored for individual lakes (Hamilton et al. 2016). By supporting lake catchment management plans, 3.11.4.4 provides an important mechanism to enable tailored

management above and beyond the minimum requirements set out in Plan Change 1 to support the specific issues faced by individual lakes.

36. Retaining reference to individual lake management plans is particularly important given that in their Block I Section 42A report, the officers' recommended rejecting the Director General's recommendation that lakes have their own individual FMU.
37. In summary, I disagree with and recommend rejecting the Section 42A Officer's recommendation to delete implementation method 3.11.4.4 from Plan Change 1 so that vulnerable lakes that currently have water quality above the national bottom line can be managed on a basis tailored to the lake's specific needs.

## **CONCLUSIONS**

38. The lakes within the Waikato region covered by PC1 are ecologically and culturally significant. They are also extremely vulnerable to impacts from land use. To safeguard against further degradation and restore ecological health in these lakes I recommend that:

- 20 m setbacks from all water bodies within all lake FMUs as well as the upper river and mid-river FMUs be mandatory for all land where forestry activities are occurring;
- The amendments sought to Schedule 1 farm environment plans by Ms Kissick are adopted;
- Current best practice guidelines for farming in peat lake catchments be adopted as a rule framework;
- All farm environment plans for land within lake FMUs should explicitly: rank all potential contaminant loss mitigation strategies; demonstrate contaminant load reductions; identify all

ephemeral water courses and provide effective mitigation strategies; and,

- Implementation method 3.11.4.4 is retained in Plan Change 1 to enable tailored management of vulnerable lakes which currently have water quality above the national bottom lines.

39. In my opinion these options are the best available to achieve the Vision and Strategy for freshwater lakes and for the Waikato and Wāipa Rivers through PC1.

A handwritten signature in black ink, appearing to read 'Simon Stewart', with a stylized flourish at the end.

**Dr Simon Donald Stewart**

5<sup>th</sup> July 2019

## REFERENCES

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