

BEFORE THE INDEPENDENT HEARING COMMISSIONERS

IN THE MATTER of the Resource Management Act 1991 ('the Act')

AND

IN THE MATTER of proposed Canterbury Land and Water Regional Plan ('LWRP')

BETWEEN **RAYONIER NEW ZEALAND LTD**

Submitter

A N D **CANTERBURY REGIONAL COUNCIL**

Local Authority

**SUPPLEMENTARY EVIDENCE OF DR JOHN MARTIN QUINN ON BEHALF OF RAYONIER NEW
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INTRODUCTION

- 1 My full name is Dr John Martin Quinn. My role, qualifications and experience are as described in my statement of evidence filed with the independent Hearing Commissioners ('the Commissioners') on 4 February 2013.
- 2 During the course of the hearing on 12 March 2013, a number of questions were raised regarding specific points in my evidence in chief ('my evidence'). Additionally, the Commissioners requested that I answered some questions that other experts in this field have also been asked to provide their opinion on.
- 3 I have prepared this supplementary evidence to assist the Commissioners in making their decision on the LWRP.

RECOMMENDATION ON WATER CLASSES IN SCHEDULE 5

- 4 At the hearing the Commissioners referred to paragraph 23 of my evidence and Schedule 5 at page 16-9 of the LWRP. I was asked to provide my considered view on whether my recommendation applies to all, or only some, of water classes within Schedule 5.
- 5 In my opinion the recommendation in my paragraph 23 should apply to all streams classes in Schedule 5 within planted forests.

APPLICATION ON PROPOSED WORDING

- 6 The Commissioner asked me to clarify whether the proposed wording in paragraph 29 of my evidence relating to Rule 5.72(b) should apply to other rules that contain reference to suspended sediment levels in the LWRP.
- 7 It is my recommendation that the proposed wording apply to all rules that include references to suspended sediment concentration in the LWRP.
- 8 I was also asked about my opinion of the merits of the approach to monitoring compliance with suspended solids/clarity standards outlined in paragraph 29 vs the approach recommended in Mr Boyes evidence that involves use of a code of environmental practice for forestry with water clarity compliance assessed at flows less than the median against the LWRP Schedule 5 standards.
- 9 I responded that both approaches were improvements on the LWRP that provide ways to deal with the issue created by naturally high background suspended solids at high flows, but that I thought the approach I proposed was simpler because it did not require knowledge of whether flow was below the median when measurements were made. This view was somewhat in conflict with my evidence in chief statement in paragraph 27 option iii that "forestry be managed by a separate

rule that requires adherence of a code of practice and meets water clarity change standards in Schedule 5 when flows are below the median (similar to the approach adopted in Horizon's One Plan)." I confirm that, subject to my comments below, I continue to support option iii as it has the advantage of moving away from stormwater suspended solids standards as the prime tool to manage the diffuse effects of forestry on instream clarity, to use of and Erosion and Sediment Control Plan backed up by instream compliance monitoring.

- 10 The commissioner's question has prompted further refinement of my thinking on this issue. On reflection, I now consider that reference to the phrase "when flows are below the median" is not appropriate when compliance with visual clarity standards is assessed in relative terms (i.e. % change in visual clarity) as proposed by the LWRP. The One Plan Schedule D standards (attached as **Appendix A**) include absolute clarity standards, that apply "when flows are below the median" and vary between water body types, whereas its standards for % change in clarity have no flow specifications. In contrast, the LWRP does not seek to measure compliance using absolute values (rather than % change), possibly because ECan does not have the data set required to support this approach. Thus, in the LWRP context, I consider that % change in clarity standards should not refer to conditions when flows are less than the median.
- 11 Again prompted by the Commissioner's question, another aspect of the LWRP that concerns me is that the clarity change standards in Schedule 5 do not reference any guidance on the spatial and temporal scales at which compliance should be assessed (as discussed in my Evidence in Chief paragraphs 23-27). This is a general issue for all land uses but is particularly important for forestry because of the relatively short, cyclical, period of potentially reduced clarity associated with the harvest phase against a background of relatively high clarity for the remainder of the forest rotation and in parts of the forest that are not in the harvest/replanting phase.
- 12 I think that it is likely that forestry would comply with the LWRP Schedule 5 instream clarity standards if compliance is monitored at an appropriate spatial scale (e.g., at the forest estate level or where the upstream catchment is more than 300 ha) over an appropriate time scale (e.g., using a 4-5 year rolling median), as suggested in paragraph 27 of my primary evidence in respect of Option ii. My evidence in chief did not make it entirely clear that I considered any monitoring should be at such appropriate spatial and temporal scales, although that was the intention of my statement in my paragraph 30. I trust that this supplementary evidence clarifies that compliance monitoring at an appropriate spatial and time scale should occur in respect of both options (ii) and (iii) at para 27 of my evidence in chief.

- 13 In conclusion, I support the package in Mr Boyes recommendation regarding Rule 5.72 (now 5.72A) of his Appendix 2 expect that I think the change in clarity standards should apply at all flows (not at flows less than the median) and suggest that the following sentence be added as a guidance note to either the rule or the Schedule 5 clarity standard. For forestry, compliance should be measured at appropriate spatial and temporal scales for forestry's cyclical diffuse inputs, namely as a 4 year rolling median at the forest estate level or downstream of the point where the forest catchment area is 300 ha (or words to that effect).

MEASUREMENT OF VALUES IN SCHEDULE 5

- 14 The Commissioners also asked me to provide my view about how to measure the values mentioned in Schedule 5 at page 16-9 LWRP (e.g. daily, weekly, monthly, annual, median/average etc). I set the details of my view out below.

DOC (dissolved organic carbon)

- 15 DOC limits in schedule 5 are only set for Banks Peninsula rivers and large high country lakes. DOC can influence the optics of water (affecting light penetration and colour), dissolved oxygen (by stimulating respiration), and the growth "sewage fungus" (bacterial/fungal slimes) promoted by high levels of readily available dissolved organic matter, such as low molecular weight carbohydrates and amino acids found in poorly treated organic wastes.
- 16 I suspect that the application of the DOC standard to large high country lakes primarily reflects concerns about protecting their light climate. DOC levels in large lakes are likely to be quite stable at daily or weekly time scales, so that grab samples should represent levels over such time periods and be suitable for measuring compliance.
- 17 In the Banks Peninsula rivers I presume the DOC limit has been included to avoid sewage fungus development, although soluble 5-day Biochemical Oxygen Demand (sBOD₅) is a more targeted measure for this (MFE 1992). It is not obvious why only Bank Peninsula rivers have this measure applied. Sewage fungus growth develops under steady flow conditions and in response to sustained DOC inputs over a period of several days to weeks. Therefore, if the aim is to manage sewage fungus, I suggest that the most relevant time scale and timing for assessment is therefore the daily or weekly mean DOC concentration under flows below the median (as a simple guide to baseflow conditions).

Temperature

- 18 My understanding is that this is to protect against ecosystem disturbance and thermal stress on biota. Small streams can show large diurnal fluctuations in temperature (e.g., Quinn and Wright-Stow 2008). Studies of temperature tolerance

of macroinvertebrates indicate that when large diurnal fluctuations occur these are more stressful than the same change in daily average temperature as a constant temperature (Cox 1999). Nevertheless the 2 deg C change is relatively conservative, so I suggest that this be interpreted as the change in daily mean temperature during summer months (December – March inclusive). It is relatively easy and cheap to measure temperature continuously with loggers, so that it should be practicable to measure daily average temperature to evaluate compliance.

pH Values

- 19 pH values can also vary diurnally in response to primary production altering the amount of bicarbonate in the water. Ideally the waters should be within these ranges all the time, unless natural factors are driving the pH values (e.g., beech forest naturally acid streams). I suggest instantaneous measurements.

Colour

- 20 Colour change is most relevant at or below baseflow as a daily or weekly average. At higher flows colour is likely to be naturally high and variable. I note that the text reads % change which is inconsistent with the MFE 1994 guidelines that deal in absolute changes in Munsell Units –The use of % change for Munsell units appears to be an error and I recommend that the % text be dropped so that the change is in absolute terms consistent with the MFE 1994 colour and clarity guidelines.

DIN (dissolved inorganic nitrogen) and DRP (dissolved reactive phosphorus)

- 21 My understanding is that the dissolved nutrient limits are included to protect against nuisance periphyton growth, except for DIN in spring-fed plains streams where higher limits (< 1.5 mg/l) are set which I presume are to protect biota from toxicity effects of nitrate (the dominant form of DIN in most rivers). The limits targeting control of periphyton growth are most relevant during receding or stable conditions when periphyton growth is favoured. Hence I suggest these be assessed as daily or weekly means at flows below the median.
- 22 The < 1.5 mg/l DIN standard corresponds to the nitrate-N level recommended by Hickey (2013) for providing a very high level of protection against toxic effects. It is slightly lower (more protective) than the earlier (1.7 mg/l NO₃-N) limit proposed by Hickey and Martin (2009) for protection of slightly-moderately disturbed ecosystems. Hickey (2013) recommends assessing compliance using the 95%ile based on the annual average (e.g., from monthly samples) and I recommend this approach for applying the DIN standard in spring-fed streams.

E. coli (Escherichia coli)

- 23 *E. coli* limits aim to protect waters for contact recreation. The numbers come from guidelines the MFE/MOH 2003 guidelines that relate health risk to 95th percentile values during the bathing season. The table correctly states that these are 95th percentile values. As contact recreation occurs generally under non-flood conditions in the bathing season (probably December to April in Canterbury), so it could be argued that compliance sampling should be carried out under non-flood conditions (e.g. excluding flow that are exceeded <20% of the time) at this time of the year.
- 24 I hope the above comments are of some assistance.

Dr John Martin Quinn

19 April 2013

REFERENCES

Cox, T.J. (2000). Thermal tolerances of two stream invertebrates exposed to diurnally varying temperature. *New Zealand Journal of Marine and Freshwater Research* 34(2): 203-208.

Hickey, C.W.; Martin, M.L. (2009). A review of nitrate toxicity to freshwater aquatic species. No. Technical Report No. R09/57. Environment Canterbury, Christchurch. pp. 56.
<http://www.crc.govt.nz/publications/Reports/report-review-nitrate-toxicity-freshwater-aquatic-species-000609-web.pdf>

Hickey, C.W. (2013). Updating nitrate toxicity effects on freshwater aquatic species. No. ELF13207; HAM2013-009. NIWA report prepared for the Ministry of Building, Innovation and Employment, Wellington (<http://www.envirolink.govt.nz/Envirolink-reports/>). pp. 39.

Quinn, J.M.; Wright-Stow, A.E. (2008). Stream size influences stream temperature impacts and recovery rates after clearfell logging. *Forest Ecology and Management* 256: 2101-2109
<<http://dx.doi.org/doi: 10.1016/j.foreco.2008.07.041>>

MFE (1992). Water quality guidelines No. 1: Guidelines for the control of undesirable biological growths in water. Ministry for the Environment, Wellington, 57 p.

MFE (1994). Water quality guidelines No. 2: Guidelines for the management of water colour and clarity. *Ministry for the Environment, Wellington*. 77 p.

MFE/MOH. (2003). Microbial water quality guidelines for marine and freshwater recreation areas. Ministry of Environment and Ministry of Health, Wellington. 159 p.

The One Plan Schedule D Standards