IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of applications for water permits to abstract water, land use consents to excavate and disturb the bed of the Homestead Stream, the construction and operation of a dam and discharge of water from a dam for the proposed Foveran and Winterberg activities

BY ROBERT HAY ROBERTSON
Applicant

TO ENVIRONMENT CANTERBURY
Local Authority

EVIDENCE IN REPLY OF THOMAS BRENDAN HELLER
IN SUPPORT OF THE APPLICATIONS BY ROBERT HAY ROBERTSON

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INTRODUCTION

1. This evidence is provided to the Commissioners for the assessment of specific impacts upon groundwater and surface water quality for the proposed irrigation of 163 hectares (ha) of land at the RPNZ property, with water sourced from the Winterberg Dam. I comment also on the use of water from the Winterberg Dam to irrigate 136 ha (currently irrigated) at the Winterberg property when connected surface water cannot be taken from the Hakataramea River under the existing consent CRC950602.2. These irrigation areas in conjunction with the proposed ~~401 ha~~ now 391 ha of additional irrigation at the Winterberg property, form the application (CRC032220) to take stored water from the Winterberg Dam (sourced from Homestead Stream) for irrigation of 690 ha in total (which is an additional 554 ha of new irrigation area). Should RPNZ not provide approval for the conveyance of water for irrigation from the Winterberg Dam, then that additional 163 ha of land area may be omitted from consent application CRC032220.

2. I also provide some clarification in respect of other evidence given on potential water quality impact of proposed irrigation in the Hakataramea Valley.

3. I comment on suggested conditions of resource consent(s), in particular, proposed monitoring of the environment and farm, nutrient and stock management plans.

SPECIFIC EFFECTS ON WATER QUALITY

4. The following assessment of water quality for the proposed activities focuses on the following areas of potential environmental impact:

   a) Effects of irrigation upon water quality for the existing irrigation area (136 ha) located at the Winterberg property

   b) Irrigation and nutrient water balance in comparison of previous land use to proposed land use activities for the RPNZ property (163 ha)

   c) Nutrient load in groundwater and the effects of an attenuated discharge to the Hakataramea River for the RPNZ property.

5. I note that assessments for the additional irrigation areas at the Foveran and Winterberg properties (65 ha and 401 ha respectively) for impacts upon water quality, have been given in my previous evidence (of Heller). The ~~401 ha~~ now 391 ha of additional irrigation area at the Winterberg property is the maximum available (non-irrigated) land area located within the applicant's land parcel.

Existing (irrigated) Winterberg property

6. The 136 ha area of land which is currently irrigated (CRC950602.2) at the Winterberg property is proposed for irrigation from the Winterberg Dam (when restrictions may be applied to the CRC950602.2 take).

7. As this area is currently irrigated and irrigation methods, land use and water application will not change under the requested consent, the potential impact upon water quality for the activity is assessed as being less than minor.

Nutrient and water balance – RPNZ property

8. A nitrate assessment worksheet has been used to assess the mass of nitrogen (N) loading over the RPNZ property given the change to landuse, allowing for the dimensions of the proposed irrigation area, and the existing groundwater receiving environment.

9. Currently the 163 ha area proposed for irrigation (as pasture for deer/sheep grazing and some possible viticulture), is solely dryland sheep farming. I have modelled the change in landuse as a fully irrigated deer farm with identical nutrient loadings per hectare to that of the Winterberg property (using data from Agresearch, 2008).

10. Surface water information, and groundwater quality and hydraulic data used in the analysis of proposed irrigation impacts upon water quality for the Winterberg property (given in previous evidence of Heller), has been utilised for assessment of the RPNZ property.

11. For the RPNZ property (for a total of 163 ha) - the total change in nitrate leaching per year from the nitrate assessment worksheet modelling was 480 kg, from 466 to 946 kg. With an existing N concentration of 1 mg/L in groundwater up-gradient of the activity, after total mixing, the adjusted N concentration in groundwater becomes a total of 1.5 mg/L prior to discharge to the Hakataramea River.

12. Thus, the potential increase in nitrate concentration down-gradient of the RPNZ property as resulting from the proposed activity is 0.5 mg/L.

13. It should be noted that the above groundwater nutrient concentration is conservative as no allowance has been made for lateral dispersion within the aquifer. Also, riparian mixing has not been allowed for in calculations, and the effect of that process would serve to reduce measurable N concentrations in groundwater that were potentially migrating to the river.

Nutrient load in groundwater and surface water – RPNZ property

14. Given the above change to the nitrate concentration as a consequence of land use irrigation development, the mass of N and the associated concentration of N in groundwater potentially discharging to the Hakataramea River for the RPNZ irrigation proposal has been assessed below.

15. For RPNZ, the pre and post irrigation groundwater discharge quality is taken as 1 and 1.5 mg/L N. The groundwater flow over the stream tube (land parcel) for the irrigation area is 14.6 and 19.5 L/s by calculation (pre/post irrigation). Table 1 shows the results for a mixed annual groundwater input to the Hakataramea River, at median flow (5,600 L/s) with a median total nitrogen (TN) concentration of 0.18 mg/L (from Rocky Point site data).

Table 1 Groundwater input predictions - RPNZ

Input	Flow (L/s)	TN (mg/L)
Hakataramea River	5,600	0.18
Groundwater influx (dryland/irrigation)	14.6 & 19.5	1.0 &1.5
Resulting river	5,614.6 & 5,619.5	0.182 & 0.185
Difference in river		**0.003**

16. It can be seen from the above calculation of N flux to the Hakataramea River from groundwater, that the change in land use for the RPNZ property produces a 0.003 mg/L TN change in the resulting water quality of the river. Note that it is most likely such a change will be in the form of nitrate-nitrite nitrogen (NNN).

CLARIFICATION IN RESPECT OF OTHER EVIDENCE

Ms Pringle – Fish and Game New Zealand

17. Ms Pringle (p. 71) indicated that effects assessments upon water quality had not been undertaken for the majority of applications in the Lower Waitaki. I can confirm that specific effects upon water quality for proposed irrigation of the Foveran and Winterberg properties were provided for in the application AEE submitted to Environment Canterbury (ECan). Additional assessment of catchment cumulative effects upon water quality has been presented in evidence (of Heller) to this hearing panel.

Mr Newey – Department of Conservation

18. Mr Newey (p. 53) advised that nutrient budgeting, farm irrigation and stock management plans should be provided for in conditions of resource consent(s). The Foveran and Winterberg applications do provide for consent conditions pertaining to nutrient budgeting, farm irrigation and stock management plans for the requested activities. The final detail of such conditions may be applied on a catchment-wide basis and/or at the individual farm level. It is suggested that the application and content of these conditions be verified by the hearing panel to provide for consistency of approach should consents be granted.

Mr Norton – Meridian Energy

19. I agree with and fully support the notion of on-farm best management practices and the requirement of irrigation, stock and nutrient management plans for irrigation development in the Hakataramea Valley (Norton, p. 26). As previously indicated, these concepts were provided for in evidence to the panel. However (as above), it is suggested that the application and content of these conditions be verified by the hearing panel to provide for consistency of approach relative to the potential environmental impact of the proposed activities, should consents be granted.

20. Mr Norton (p. 36) has stated that I had dismissed the earlier reports to ECan on water quality impacts in the Hakataramea catchment (I refer to these reports as ECan, 2007). My earlier evidence does not state this specifically, and indeed those earlier reports formed the technical basis on which the S42a reports have been written. In turn, I had provided my own independent assessment based on all existing data and updated on-farm assessments from Agresearch (Agresearch, 2008). However, ECan (2007) did provide a background to initiate further investigation and analysis of Hakataramea River water quality. This has resulted in some improved knowledge of the source, mass and variability of nutrients measured in the Hakataramea River.

21. Mr Norton's predictions of nutrient uptake and subsequent effects upon surface water ecology with further irrigation in the Hakataramea catchment (with predicted changes to Hakataramea River water quality - p. 39), are addressed in evidence of expert ecologist, Dr Donovan. While Mr Norton has modelled the potential cumulative effects of all of the consent applications for the Hakataramea catchment on the periphyton growth in the Hakataramea River, he admits (Norton, p. 23) that he "can't predict whether any individual applicant will cause a breach of the biomass outcomes of PNRRP Objective WQL1". With respect to this application suite, this assessment was presented by Dr Donovan, who concluded (Donovan p. 58) that "Given that the quality of water entering the Hakataramea River from either the areas to be irrigated, and from the Winterberg Reservoir, will not significantly alter the water quality of the river then the proposed irrigation will not have a significant adverse effect on the ecology of the river."

22. I can confirm that the nutrient sources outlined in my previous evidence are based on measured water quality data for the Hakataramea River and in respect of on-farm and catchment cumulative mass-balance modelling (Norton, p. 47).

23. To clarify (Norton, p. 49), my evidence in relation to NNN and organic nitrogen (ON), shows that the increase of 0.03 mg/L NNN predicted for cumulative impact (of additional irrigation) in the Hakataramea River (at low flows), is relatively small compared to ON, which appears to make up the bulk of TN in measured river concentrations.

24. The main thrust of my evidence is that based on real measurements and some predictive modelling, the major component of nitrogen in the Hakataramea River (ON), is, and will remain, of little consequence of irrigation drainage.

25. A point I wish to make quite clear, is that the complexity associated with sinks, sources and speciation of N in the Hakataramea River-catchment (confirmed in Norton, p. 47), and given the significant ON content measured which may undergo transformations over time and space, that these factors are not likely to make ecological predictive modelling an easy task.

26. Furthermore, at flows of approximately 1000 L/s or less, the Hakataramea River at below Wright's Crossing becomes "groundwater dominant". At this flow range the natural effects of surface flow losses with increased thickness and permeability of the alluvial strata, coupled with the residence groundwater outflow time and inferred contact with Tertiary strata, causes major changes to river water attributes and quality. Such changes include: dissolved oxygen - redox and acidity (eH/pH), temperature, total dissolved solids (TDS), total organic carbon (TOC), and significant changes to N species (with most likely a conversion of ON to NNN dependant on redox state). This may explain why periphyton growth has been mainly observed in the lower reaches of the river at below the lower gorge.

27. This natural phenomenon of the Hakataramea River has not been studied in any detail. However, examples of similar situations are found for the Selwyn, Pareora, Kauru, Shag, Cardrona and Lindis Rivers. This highlights perhaps three important aspects for the Hakataramea. Firstly, that there are still some parts of the physical river system which are relatively unknown. Secondly, there may be some doubt over the validity of ecological modelling and prediction for the Hakataramea catchment, as is the case for the aforementioned rivers. And thirdly, the targeting of irrigation practices as the primary driver for ecological impact in the Hakataramea River is most likely, ill-founded.

28. This "condition" (as above) for the Hakataramea River experienced during low flows, is also likely to result in phosphorus (P)-limiting conditions downstream. Where P is likely to be sorbed onto sediments and subsequently released during times of high flows.

29. However, in light of land use development, I believe that the focus of nutrient improvement for the Hakataramea catchment should be based around stock and riparian management to effectively reduce ON flux to the river. I am confident that with farm or catchment-based best management practices and plans, that efficiencies may be gained in terms of both current and proposed irrigation-based drainage (for NNN) and in respect of riparian practices (to minimise or reduce ON and P flux).

30. I note that no further evidence has been presented to the panel on the proposed mitigation of potential water quality impacts of (proposed) irrigation for the Foveran and Winterberg properties. Given the proposed changes to existing irrigation practices at the Foveran property, the ability to augment water from the proposed Winterberg Dam to the Hakataramea River, and in respect of individual property nutrient flux calculations provided in evidence (of Heller), the potential effects upon water quality for these properties will be effectively mitigated. This ability to mitigate potential effects upon water quality is clearly available and quite unique to the Foveran and Winterberg applications.

FARM IRRIGATION MANAGEMENT AND MONITORING CONDITIONS

31. As discussed in previous evidence (of Heller) I provided confirmation that the applicant is committed to best practices and sound environmental performance for farm irrigation, nutrient budgets and stock and riparian management. Further to this, I provide below, detail of suggested conditions for a Farm Irrigation Management Plan (FIMP) to address ongoing monitoring and reporting/compliance for soil moisture levels and nutrient application, stock and riparian management. The FIMP will be submitted (and revised) annually to the consent authority inclusive of additional specific monitoring as set out below.

32. Specific environmental monitoring proposed to be undertaken for Foveran and Winterberg will include:

- Quarterly groundwater sampling for N and P at suitably located monitoring wells, and
- Monthly (for 12 months, then quarterly) sampling for N and P and physio-chemical attributes from the Winterberg reservoir.

The above samples will be collected and assessed to determine baseline conditions, and any changes to Winterberg reservoir or groundwater quality as a result of the proposed activities.

33. Further “catchment-wide” monitoring in association with the “Haka-Group” of applicants is proposed. I am fully supportive of the approach given in additional evidence of Torgerson (p. 25) in relation to catchment environmental monitoring and reporting, in addition to farm specific monitoring as indicated above.

34. Suggested additional conditions for Foveran CRC031592 and Winterberg CRC032220 applications for water permits are detailed below.

CRC031592 (Foveran)

A.	Within six months of the granting of this consent, but before the consent is first exercised, the consent holder shall prepare and forward to the Canterbury Regional Council a Farm Irrigation Management Plan ("FIMP") for the operation of the farm irrigation area. The management plan shall include, but not be limited to: (a) Monitoring and reporting of soil moisture and management of irrigation water application rates; (b) Detailed monitoring and reporting of nutrient budget for the operation of the irrigation area; (c) A detailed stock grazing and riparian management plan; and (d) Details of farm environmental monitoring sites and reporting.
B.	The FIMP shall be reviewed by the consent holder at least once annually for the purpose of addressing any issues relating to compliance with the conditions of this consent. The current plan shall be forwarded to the Canterbury Regional Council prior to 1 September in any year.
C.	A representative monitoring bore shall be established down-gradient in terms of groundwater flow, of the farm irrigation area. The exact location and depth of the monitoring bore shall be determined in consultation with the Canterbury Regional Council. The monitoring bore shall be established prior to the exercise of this consent.
D.	The monitoring bore described in condition C shall be constructed of suitable materials with a minimum internal diameter of 50 millimetres, with a screen spanning the likely range of water table elevations so as to allow full hydraulic connection to the aquifer.
E.	Water samples shall be taken from the monitoring bore established in accordance with condition C no later than one month after the bore has been established. Thereafter water samples shall be taken from the bore at least once during the months of October, January, April and July for the duration of this consent. Water samples taken from the monitoring bore shall be collected by a suitably experienced person and analysed for the following determinands: total nitrogen [milligrams per litre] nitrate-nitrite nitrogen [milligrams per litre] dissolved reactive phosphorus [milligrams per litre].
F.	(a) The consent holder shall, no later than 1 September of each year provide an Annual Environmental Report in association with the FIMP, to the Canterbury Regional Council setting out a summary of results (with analyses) and comments as appropriate on all surface water and groundwater monitoring undertaken in relation to this consent over the previous season (from 1 July to 30 June inclusive). (b) The report shall include an analysis of the results to date (with input from an appropriately qualified and experienced scientist), recommendations on the monitoring programme for the next year and proposals for mitigating any adverse effects found to be occurring.

G.	(a) All sampling required under this consent shall be undertaken by a competent person using the most appropriate scientifically recognised and current methods. (b) All samples taken shall be analysed using the most appropriate scientifically recognised and current method by a laboratory that is accredited for that method of analysis by a nationally recognised accreditation authority such as International Accreditation New Zealand; or, where there is no laboratory in New Zealand with accreditation for such a method, by a laboratory that has accreditation for similar analyses. (c) For the purposes of clause (b) of this condition, accreditation must be by International Accreditation New Zealand (IANZ), or an equivalent accreditation organisation that has a Mutual Recognition Arrangement with IANZ.

CRC032220 (Winterberg)

A.	Within six months of the granting of this consent, but before the consent is first exercised, the consent holder shall prepare and forward to the Canterbury Regional Council a Farm Irrigation Management Plan ("FIMP") for the operation of the farm irrigation area associated with this consent. The management plan shall include, but not be limited to: (a) Monitoring and reporting of soil moisture and management of irrigation water application rates; (b) Detailed monitoring and reporting of nutrient budget for the operation of the irrigation area; (c) A detailed stock grazing and riparian management plan; and (d) Details of farm environmental monitoring sites and reporting.
B.	The FIMP shall be reviewed by the consent holder at least once annually for the purpose of addressing any issues relating to compliance with the conditions of this consent. The current plan shall be forwarded to the Canterbury Regional Council prior to 1 September in any year.
C.	A representative monitoring bore shall be established down-gradient in terms of groundwater flow, of the farm irrigation area associated with this consent. The exact location and depth of the monitoring bore shall be determined in consultation with the Canterbury Regional Council. The monitoring bore shall be established prior to the exercise of this consent.
D.	The monitoring bore described in condition C shall be constructed of suitable materials with a minimum internal diameter of 50 millimetres, with a screen spanning the likely range of water table elevations so as to allow full hydraulic connection to the aquifer.
E.	Water samples shall be taken from the monitoring bore established in accordance with condition C no later than one month after the bore has been established. Thereafter, water samples shall be taken from the bore at least once during the months of October, January, April and July for the duration of this consent. Water samples taken from the monitoring bore shall be collected by a suitably experienced person and analysed for the following determinands: total nitrogen [milligrams per litre] nitrate-nitrite nitrogen [milligrams per litre] dissolved reactive phosphorus [milligrams per litre].

F.	Representative water samples shall be taken from the Winterberg reservoir no later than one month after the reservoir has been established. Thereafter, water samples shall be taken from the reservoir on a monthly basis for at least twelve months, and then during the months of October, January, April and July for the duration of this consent. Water samples taken from the Winterberg reservoir shall be collected by a suitably experienced person and analysed for the following determinands: total nitrogen [milligrams per litre] nitrate-nitrite nitrogen [milligrams per litre] ammoniacal nitrogen [milligrams per litre] total phosphorus [milligrams per litre] dissolved reactive phosphorus [milligrams per litre] turbidity [ntu] total suspended solids [milligrams per litre] total organic carbon [milligrams per litre] temperature [degrees celsius] dissolved oxygen [milligrams per litre] pH [pH units].
G.	(a) The consent holder shall, no later than 1 September of each year provide an Annual Environmental Report in association with the FIMP, to the Canterbury Regional Council setting out a summary of results (with analyses) and comments as appropriate on all surface water and groundwater monitoring undertaken in relation to this consent over the previous season (from 1 July to 30 June inclusive). (b) The report shall include an analysis of the results to date (with input from an appropriately qualified and experienced scientist), recommendations on the monitoring programme for the next year and proposals for mitigating any adverse effects found to be occurring.
H.	(a) All sampling required under this consent shall be undertaken by a competent person using the most appropriate scientifically recognised and current methods. (b) All samples taken shall be analysed using the most appropriate scientifically recognised and current method by a laboratory that is accredited for that method of analysis by a nationally recognised accreditation authority such as International Accreditation New Zealand; or, where there is no laboratory in New Zealand with accreditation for such a method, by a laboratory that has accreditation for similar analyses. (c) For the purposes of clause (b) of this condition, accreditation must be by International Accreditation New Zealand (IANZ), or an equivalent accreditation organisation that has a Mutual Recognition Arrangement with IANZ.

35. The conditions suite presented by the “Haka-Group” (in supplemental evidence of Torgerson) in relation to catchment-wide environmental monitoring of the Hakataramea River is considered acceptable to be appended to conditions of consent for Foveran CRC031592 and Winterberg CRC032220.

36. These catchment based conditions identify baseline and on-going monitoring and reporting of environmental performance for the whole catchment in addition to that provided for by specific farm monitoring as detailed in the conditions as above.

37. Alternatively, Foveran and Winterberg wish to be a part of and contribute to any “catchment-wide” environmental monitoring and reporting programme deemed necessary by the hearing panel, should consents be granted.

CONCLUSIONS

38. The proposed irrigation of the (currently irrigated) Winterberg property (136 ha) from the Winterberg Dam, will result in a less than minor impact upon water quality in groundwater and the Hakataramea River.

39. The proposed change in land use at the RPNZ property (163 ha) is likely to produce an acceptable change in groundwater quality (for N), with a negligible change in the resulting water quality of the Hakataramea River.

40. I support the use of best management practices and farm management plans to accompany irrigation development in the Hakataramea Valley. Conditions of resource consent(s) are proposed to address the provision of a Farm Irrigation Management Plan (FIMP) and provide for ongoing monitoring and reporting of farm-based and catchment-wide environmental performance.

41. It is contended that the potential nutrient impact of proposed additional irrigation for the Foveran and Winterberg properties will be completely mitigated by changes to existing irrigation practices at Foveran, and through low-flow augmentation of the Hakataramea River from the Winterberg Dam.

Tom Heller

30 September 2008