**IN THE MATTER** of the Resource Management Act 1991

**A N D**

**IN THE MATTER** of submissions and further submissions by Rangitata Diversion Race Management Limited (**RDRML**) on proposed Variation 2 to the proposed Canterbury Land & Water Regional Plan

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**STATEMENT OF EVIDENCE OF GLEN GREER**

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## Introduction

1. My name is Glen Greer.

2. I am a Senior Research Officer in the Agribusiness and Economics Research Unit at Lincoln University (AERU). I graduated from Lincoln University (then Lincoln College) in 1982 with Bachelor of Agricultural Science with first class honours in economics. I was employed by the AERU as an Assistant Research Officer in 1982, then by the Department of Scientific and Industrial Research as a Scientist in 1983 and 1984. I returned to the AERU in 1985, where I have been employed as a Research Officer from 1985 to 1999 and a Senior Research Officer since that time.

3. I am a member of the New Zealand Agricultural and Resource Economics Society and the Australian Agricultural and Resource Economics Society.

4. During the past thirty three years I have undertaken a wide variety of research projects in the area of agricultural economics, including cost benefit analyses of a diverse range of agricultural sector issues, such as irrigation and other land-use developments.

5. I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2014, and complied with the Code of Conduct during the preparation of this evidence. The written evidence is within my area of expertise, except where I state that I am relying on the evidence of another

person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

**Scope of evidence**

6. The purpose of this evidence is to present the results of a comparative regional economic analysis of the impacts of the imposition of nitrate limits under the proposed Variation 2 ('**Variation 2**' or '**V2**'), and the impacts under the limits proposed by RDRML, on existing farms that are irrigated from the RDR. The impacts of the limitations on the entire Hinds Catchment area were outside the scope of this evidence, but are likely to be significantly higher than those estimated for the RDR area. The regional analysis is based on data on the farm-level impacts of the Variation 2 and an RDRML proposal (arising out of the Company's submission and further submissions to V2) that were estimated by Mr Stuart Ford. The current land-use data used to aggregate from the farm-level to the regional level were provided by DairyNZ and Aqualinc to Mr Ford. The evidence includes:

6.1 A description of the impact definitions employed.

6.2 A description of the scenarios under which the regional economic outcomes were analysed.

6.3 Aggregation of the farm-level impacts of the Variation 2 and RDRML proposal on the production of individual farms, which were modelled by Mr Ford, to the total area irrigated from the RDR.

6.4 A comparative analysis of the impacts of changes in farm output from the area of the RDR as a result of imposition of the nitrogen limits imposed by Variation 2, and those proposed by RDRML on GDP and employment in the Canterbury region and the Ashburton District.

6.5 Discussion of the differences in results of this analysis and the economic impact analysis reported by Paragahawewa, U. H. (2014).

7. I am familiar with the proposed Variation 2, the RDRML's submission and further submissions to it, and the report (section 42A report) that has been prepared by the Council Officers.

8. In preparing this evidence I have also read:

   8.1 The Agribusiness Group (2015). *Derivation of the actual reductions possible to achieve water quality limits in Variation 2 of the Hinds* Plan. Prepared for HOBEC Lawyers on behalf of RDRML. May 2015. 55 pp.

   8.2 Paragahawewa, U. H. (2014). *Economic impact assessments of the Hinds water quantity and quality limit setting process.* Report prepared for Environment Canterbury. June 2014. AgResearch Report No R14/82. 56pp.

   8.3 Oblubode-Awasola, F., Paragahawewa, U. (2013). *Economic impact* assessment of *the Solution Package for the Hinds water quantity and quality setting process.* Report prepared for Environment Canterbury. June 2013. AgResearch RE500/2013/052/82. 22pp

   8.4 Oblubode-Awasola, F., Paragahawewa, U. (2013). *Economic impact assessments of the development scenario for the Hinds water quantity and quality setting process.* Report prepared for Environment Canterbury. April 2013. AgResearch RE500/2013/051. 21pp

   8.5 Oblubode-Awasola, F., Paragahawewa, U. (2013). *Economic impact assessments of the baseline scenario for the Hinds water quantity and quality setting process.* Report prepared for Environment Canterbury. March 2013. AgResearch RE500/2013/056. 15pp

**Executive summary**

9. A regional economic analysis of the impacts of two nitrogen loss policies on farms irrigated by the RDR has been undertaken. The analysis was based on representative farm models reflecting each of the policies, which were then

aggregated to the area irrigated by the RDR using current land-use data. The policies include:

9.1 Variation 2 - Nitrogen losses from dairy farms to be reduced by 45 percent and on dairy support farms by 25 percent by 2035.

9.2 RDRML Managed Proposal - Nitrogen losses from dairy farms to be reduced by 30 percent by 2035 (dairy support to be reduced by 20 percent by 2035).

10. The analysis demonstrated that the direct impacts of Variation 2 on the local economy would be moderately severe (2.2 percent reduction in Ashburton GDP), and that the policy would have a small total impact on regional economy (0.1 percent reduction in Canterbury GDP).

11. If the reduction in nitrogen losses from farms required by 2035 were reduced in accordance with the RDRML Managed Proposal, the reduction in local and regional GDP would be only 30 percent of the reductions under Variation 2.

**Economic impact definitions**

12. Estimating the impacts of the imposition of differing levels of nitrogen loss limits on RDR farms involved the calculation of the contribution of the direct, indirect and induced impacts on the local economy of the farm-level changes in the value of output. These changes are the result of the management changes required to achieve lower nitrogen losses.

12.1 The **direct effects** are the changes in the RDR farms' own output and/or employment levels. For the purposes of this study, the output is measured in dollar terms at the farm gate. The impacts of reduced farm production on the output of, and employment in, the secondary processing sector have not been included in this analysis.

12.2 The **indirect effects** are the effects of changes in farm output on the output of, and employment in, firms servicing the farms in the local area, such as input suppliers and service providers.

12.3 The **induced effects** are the effects of the change in household expenditure, that occur as a result of the direct and indirect effects of changes in the value of farm output, on the output and employment of other businesses in the local area. For example, reductions in the household incomes of Hinds sharemilkers may lead to a reduction in their expenditure in Ashburton cafes.

13. The analysis does not include any changes in **land value** that may occur with changes in the returns from the land. These values are only realised when a property is sold but do have an impact on economic growth since they influence the extent to which farmers are able to borrow for investments that lead to future economic growth.

**Scenarios evaluated**

14. Three scenarios were modelled by Mr Ford for the regional economic analysis. Each scenario described the impacts of differing nitrate limits on the financial performance of seven representative farms in the Hinds catchment. The derivation of the farm models is described in Mr Ford's evidence. The changes defined for each scenario affected only the dairy farm and dairy farm support models.

15. The Baseline Scenario

15.1 Under the Baseline Scenario a weighted average of the System 3 and System 4 dairy farm models was estimated to comprise 200 effective hectares; carry 3.5 cows per effective hectare; and produce 426.5 kilograms of milksolids per cow.

15.2 The dairy support farm model of 127 effective hectares made 530 tonnes of silage and grazed 170 young stock, 680 cows during June and July and 300 cows in August.

16. The Variation 2 Scenario

16.1 The baseline-weighted average dairy farm model was modified to reflect the Variation 2 proposal by reducing cow numbers to 427 per effective hectare, with milk production remaining at 426.5 kilograms of milksolids per cow. This reduced the level of supplementary feeding and fertiliser nitrogen required to support production.

16.2 The number of cows grazed during winter on the dairy support farm modelled was reduced by 34 percent, with a consequent reduction in the costs of inputs.

17. The RDRML Managed Scenario (30 percent reduction in N loss by 2035 for dairy and 20 percent reduction in N loss by 2035 for dairy support)

17.1 Under the RDRML Managed Scenario the stocking rate was reduced to 3.05 cows per hectare but an increase in per head productivity maintained total production at the baseline level. Supplementary feed levels were reduced. Capital expenditure was required as all farms currently using borderdyke irrigation methods would convert to spray irrigation within ten years. At present 10.4 percent of the RDR area is irrigated by borderdyke systems.

17.2 On the representative dairy support farm a 40 percent reduction in the number of cows wintered has been modelled in conjunction with a 33 percent reduction in the quantity of silage conserved. A reduction in the area of crops grown has resulted in a reduction in fertiliser, cropping and re-grassing costs.

**Methodology employed to derive the regional economic impacts**

18. Mr Ford provided farm models describing the financial performance of representative dairy, sheep and beef, arable, and dairy support farms in the area irrigated by the RDR. As only the dairy and dairy support model outcomes differed amongst the scenarios, the economic analysis was based only on the weighted average dairy farm model and the dairy support farm model. These showed the value of farm output without restriction on nitrogen losses; under the restrictions proposed by Variation 2 and under the RDRML proposal. The values of farm output by scenario are shown in Table 1.

Table 1: Value of farm output on RDR farms under the baseline, Variation 2 and RDRML proposal scenarios

| | $ per farm | | $ per hectare | |
|---|---|---|---|---|
| | Dairy | Dairy support | Dairy | Dairy support |
| Baseline scenario | 2,048,823 | 371,871 | 9,756 | 2,656 |
| Variation 2 scenario | 1,626,666 | 349,109 | 7,746 | 2,494 |
| RDRML Managed Proposal Scenario | 1,920,138 | 350,509 | 9,144 | 2,504 |

19. The values of output per hectare were then converted to the total value of output on the area irrigated by the RDR using the land-use data shown in Table 2.

Table 2: Area by land-use in the area irrigated by the RDR

| | Dairy | | Arable | | Sheep and Beef | | |
|---|---|---|---|---|---|---|---|
| | Dairy | Dairy support | Small seeds | Process | Breeding | Finishing | Total |
| Valetta | 6,792 | 2,341 | 31 | 0 | 98 | 96 | 9,358 |
| Mayfield Hinds | 22,280 | 7,622 | 1,970 | 285 | 992 | 495 | 33,644 |
| Total | 29,072 | 9,963 | 2,001 | 285 | 1,090 | 591 | 43,002 |

Source: DairyNZ and Aqualinc

20. Regional multipliers were used to estimate the impacts on total regional output, employment and value-added (GDP) under each scenario. These multipliers, which by G. V. Butcher to the AERU, are shown in Table 3. The dairy support sector is diverse and includes sheep and beef properties that include dairy support enterprises of varying sizes as well as dedicated dairy support farms. Since no multipliers are available for the sector, sheep and beef multipliers were used to estimate the dairy support impacts in this analysis. It is not likely that this had a significant impact on the estimated values, particularly as the dairy support changes comprise only a small proportion of the total change in economic performance.

Table 3: Dairy and dairy support farming multipliers for the Canterbury region

| | | Dairy farming | Sheep & beef/dairy support farming |
|---|---|---|---|
| Output | Indirect | 0.53 | 0.62 |
| | Induced | 0.13 | 0.13 |
| Employment (FTEs per $ million of output) | Direct | 2.74 | 2.71 |
| | Indirect | 2.59 | 3.06 |
| | Induced | 0.70 | 0.67 |
| Value added ($ per $ of output) | Direct | 0.63 | 0.32 |
| | Indirect | 0.22 | 0.26 |
| | Induced | 0.06 | 0.06 |

Source: G.V. Butcher 2007

21. The dairy support industry produces "intermediate goods" rather than final outputs. It has been assumed that the feed (including grazing) produced by dairy support farms in the RDR area is purchased by dairy farmers in the Canterbury region. Consequently the revenue earned from feed production by the dairy support sector is not included in the estimated value of output from the RDR dairy industry. However, the costs of feed production by dairy support farmers are an additional cost to the dairy industry as a whole and as such have been included in the estimation of value-added by the sector. The employment generated on dairy support farms has also been included when calculating the total employment impacts of the nitrogen limitation scenarios.

22. The changes in regional GDP and employment were evaluated in the context of the contribution of the RDR area to the Canterbury regional economy. These impacts were also examined in the context of the GDP and employment of the Ashburton District.

**Estimated regional economic impacts of imposing N loss limits in the RDR area**

23. Impacts on the value of output

23.1 The impacts of nitrogen loss limits on farm revenue under each of the scenarios are shown in Table 4. The reduction in farm revenue from the Baseline level if Variation 2 were to be implemented is estimated to be almost $60 million per annum. If the N loss reduction proposed

under the RDRML Managed Scenario is adopted, the estimated reduction in total farm revenue will be limited to 6.3 percent ($18 million per annum), as irrigation and animal production efficiency gains partially offset the reductions in stocking rate required.

Table 4: The impacts of N loss limits on total farm revenue in the RDR area

| | $ million | Change from baseline | % change |
|---|---|---|---|
| Baseline Scenario | $283.64 | | |
| Variation 2 | $225.19 | -$58.44 | -20.6% |
| RDRML Managed Scenario | $265.82 | -$17.81 | -6.3% |

23.2 The total impacts on regional output, which are shown in Table 5 are 66 percent higher than the direct impacts on total farm revenue

Table 5: The impacts of N loss limits on total farm revenue in the RDR area

| | $ million | Change from baseline | % change |
|---|---|---|---|
| Baseline Scenario | $470.30 | | |
| Variation 2 | $373.40 | -$96.91 | -20.6% |
| RDRML Managed scenario | $440.76 | -$29.54 | -6.3% |

**Impacts on employment**

24. The changes in revenue on RDR dairy and dairy support farms as the result of the imposition of nitrogen loss limits will give rise to changes in farm employment. Under the Baseline Scenario a total of 848 full time equivalent staff (FTE) are supported on dairy and dairy support farms in the RDR area. This represents five percent of total number of employees in the Ashburton District in 2014 (16,040 - Statistics New Zealand, Business Demography Statistics), and undoubtedly a significantly higher proportion of the FTE workforce.

25. If Variation 2 were to be implemented the reduction in farm production would result in the loss of 164 jobs on dairy and dairy support farms (19.4 percent) in the RDR area. Under the RDRML Managed Scenario 53 jobs (6.2 percent) would be lost.

26. When the flow-on effects of on-farm employment to the wider Canterbury economy are added to the number of jobs on-farm on dairy and dairy support farms in the RDR area, the total employment generated in the region at present is estimated to be 1881 FTEs. Implementation of Variation 2 would result in the loss of an estimated 363 jobs in Canterbury, while under RDRML Managed Scenario, 117 jobs would be lost in the region.

**Impacts on Regional Gross Domestic Product (GDP)**

27. The output generated by dairy and dairy support farms in the RDR area under the Baseline Scenario results in a direct value-added contribution of $170 million per year. This is the equivalent of approximately 10 percent of the GDP of Ashburton District ($1,643 million in 2013; Infometrics (2013), "Annual Economic Profile – Ashburton 2013". Provided by Rob Brawley, CEO, Grow Mid Canterbury).

28. The reduction in output that is expected under Variation 2 would result in an estimated reduction in direct value-added of $36 million per annum (21 percent = 2.2 percent of Ashburton GDP). Under the N loss limit proposed by RDRML, the reduction in value-added is estimated to be $10.8 million (six percent).

29. When the flow-on effects to the wider economy are included, the total annual contribution by RDR dairy and dairy support farms to the regional GDP is estimated to be $247 million. This represents 0.6 percent of regional GDP (Canterbury GDP in 2014 = $28 million; MBIE Regional Economic Activity, 2014). If the Variation 2 nitrogen loss limits were enforced, the total GDP contribution would be reduced by an estimated $53 million per annum (0.2 percent of regional GDP) to $195 million. The estimated contribution to GDP of RDR dairy and dairy support farms in the RDRML Managed Scenario is $232 million per annum, $15 million less than under the Baseline Scenario.

30. The regional economic impacts of the imposition of nitrogen loss limits on farms in the RDR area are summarised in Figures 1 and 2

Figure 1: Impacts of nitrogen loss limits in the area irrigated by the RDR on GDP in Canterbury

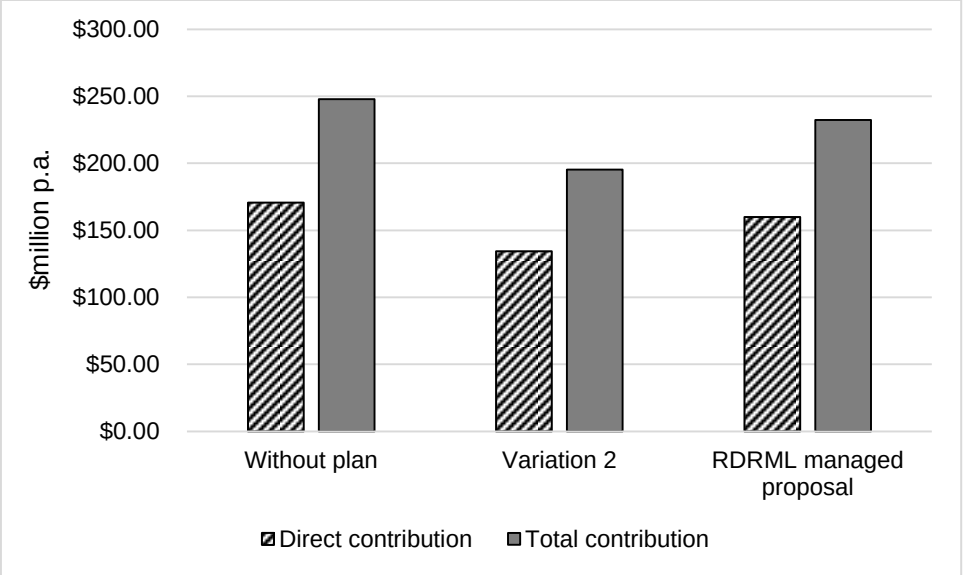
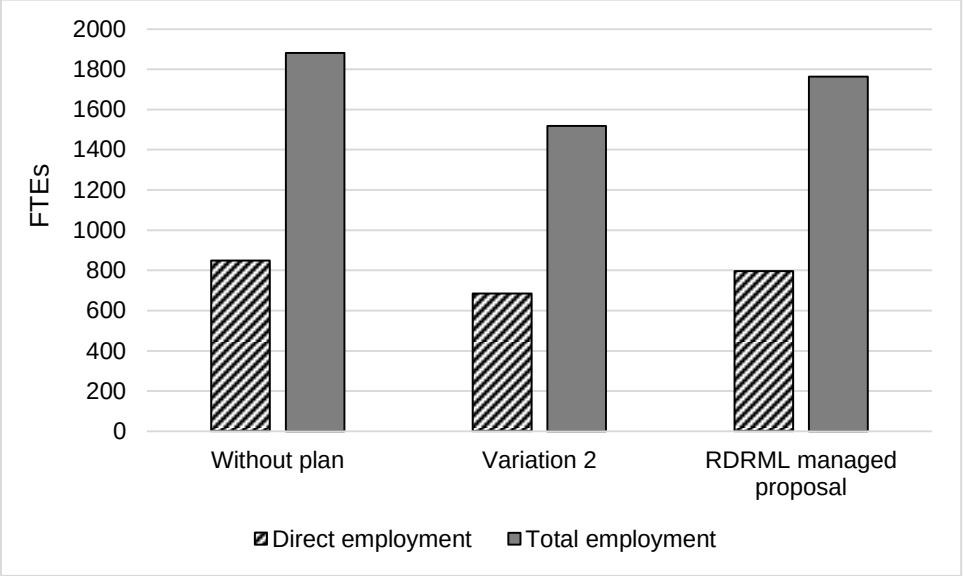



Figure 2: Impacts of nitrogen loss limits in the area irrigated by the RDR on employment in Canterbury




31. The analysis reported here deals only with changes in the value of output produced, and consequent changes in employment and GDP contribution. There will also be capital impacts if farmers are required to develop farm infrastructure, for example irrigation infrastructure, in order to meet the nitrogen loss limits imposed. Only one of the scenarios analysed has been assumed to involve infrastructural changes. Under the RDRML Managed Scenario, it has been assumed that irrigation efficiency gains will be achieved

by converting all borderdyke irrigation to spray irrigation within ten years. Mr Ford has estimated that there are 4,454 hectares of borderdyke irrigation in the RDR area. At an estimated capital costs of $6,230 per hectare, the total capital costs under the RDRML Managed Scenario are estimated to be $32.56 million.

**Comparison with the Economic Impacts Report prepared for Environment Canterbury by AgResearch**

32. The assessment of the economic impacts of Variation 2 prepared by AgResearch for Environment Canterbury (Paragahawewa, U. H., 2014) found that that total Cash Farm Surplus of all farms in the Hinds Catchment would increase by nine percent under the proposed solutions package. The differences between that conclusion and the results of this analysis are attributable to a number of factors.

32.1 The benefits estimated in the AgResearch analysis are heavily reliant on the impacts of managed aquifer recharge (MAR). The author has attributed a high level of benefits to this technology. He assumed that MAR will reduce the costs of mitigation required by removing the necessity to apply the most costly mitigation, in addition to improving dry matter production in areas where water reliability is low. However, Mr Callander has reported in his evidence that while "MAR definitely has the potential to help address water quality and quantity issues, the exact extent and magnitude of those benefits is uncertain until field trials are conducted".

32.2 The multipliers employed by AgResearch (Oblubode-Awasola, F., Paragahawewa, U., 2013) are considerably higher than those used in the analysis reported in this evidence. The multipliers I have employed are those used by the Canterbury Economic Development Model, which was constructed to address several considerations for decision- making concerning the economic development of Christchurch[i]. They have been used in an assessment of the potential valuation of irrigation to Canterbury[ii] and other studies, and are also consistent with values of agricultural industry multipliers employed in other regions of New Zealand.

32.3 Different land-uses were assumed in the two analyses. Mr Ford outlined the reasons for the adoption of the more accurate DairyNZ – Aqualinc land-use data in his evidence.

32.4 The AgResearch analysis dealt with the entire Hinds Catchment area, rather than just the area irrigated by the schemes associated with the RDRML.

32.5 There is insufficient detail provided in the AgResearch report to determine how the farm-level modelling differs from the modelling that formed the basis of this evidence.

**Conclusion**

33. The regional economic analysis reported shows that the direct and total economic impacts of nitrogen loss limits under Variation 2 will have a moderate negative impact on the economic contribution of the Ashburton District (two percent per annum), and a small negative impact on the GDP of the Canterbury Region.

34. The RDRML Managed Scenario was developed to reflect the management changes required in order to reduce nitrogen losses by 30/20 percent (dairy/dairy support) by 2035. Improvements in the efficiency of irrigation and animal production have been included in this scenario to achieve this outcome. However, the magnitude of the reductions in regional output, employment and GDP are reduced to approximately 30 percent of the reductions estimated under Variation 2.

Name: Glen Greer

Date: 15 May 2015

[i] Saunders, C., Rutherford, P., Guenther, M, Black, O. (2010). *The Canterbury Economic Development Model – Methodology and Data.* Report Prepared for the Canterbury Development Corporation. AERU, Lincoln University.

[ii] Saunders, C., Saunders, J. (2012). *The potential value of irrigation to Canterbury*. Lincoln University. September 2012