

**BEFORE THE CANTERBURY REGIONAL COUNCIL
AND THE ASHBURTON DISTRICT COUNCIL**

IN THE MATTER OF of the Resource Management Act 1991

AND

IN THE MATTER OF resource consent applications by Rangitata Diversion Race Management Limited to the Canterbury Regional Council and Ashburton District Council for resource consents for the construction, operation and maintenance of the Klondyke Water Storage Facility, its associated water takes from and discharges to the Rangitata River, and all associated activities.

STATEMENT OF EVIDENCE OF GLEN GREER

Introduction

1. My name is Glen Greer. I am a Research Economist at Plant and Food Research. 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 Agribusiness and Economics Research Unit (AERU) at Lincoln University 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 was employed as a Research Officer from 1985 to 1999 and a Senior Research Officer until December 2017.
2. I am a member of the New Zealand Agricultural and Resource Economics Society and the Australian Agricultural and Resource Economics Society.
3. During the past thirty four years I have undertaken a broad range of research projects in the area of agricultural economics, including cost benefit analyses of diverse agricultural sector issues, such as irrigation and other land use developments.

4. 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

5. The purpose of this evidence is to present the results of a regional economic analysis that I have undertaken on the potential impacts of the proposed water storage facility and associated facilities, including a new fish screen and a whitewater course at Klondyke (Klondyke storage proposal). The analysis is based on land use data described in the evidence of Mr Veendrick that was used to inform the development of a water-supply-demand model (PDP; 2016), and data on the reliability of water supply from the Rangitata Diversion Race (RDR) over 38 years provided by Mr Curry. The report prepared for Rangitata Diversion Race Management Ltd (RDRML) is included as Annexure 3 to the Environmental Impact Assessment.
6. After a summary and a description of the impact definitions employed, my evidence addresses:
 - 6.1 The economic impacts of increased reliability of irrigation supply to existing RDR irrigators.
 - 6.2 The economic impacts at the farm-level of increasing the area developed for irrigation within the boundaries of irrigation schemes supplied by the RDR to the total area presented consented for irrigation.
 - 6.3 The regional economic impacts of the proposed storage facility.
 - 6.4 The environmental, amenity and recreational impacts of the proposed facility and associated developments.
 - 6.5 The potential impacts of the proposed development on the considerations identified in s 7(b) or the Resource Management Act 1991 ("RMA" or "the Act").

7. I am familiar with the technical assessments prepared for RDRML to support this application and have used these to inform the analysis on which my evidence is based. I have also reviewed the evidence of Mr Curry, Mr Brown, Dr Sanders, Mr Hegley; Ms Harwood, Dr Ryder, Mr Veendrick, Mr Callander, Mr Morgan, Mr Woods, Mr Mikaere, Mr Fletcher, Mr Peters, Mr Metherell, Mr Greaves, and Mr Greenaway .
8. In preparing this evidence I have also read and used data from a number of studies investigating the economic impacts of changes in the reliability of irrigation supply, and of irrigation development in Canterbury. These sources are listed in Annexure A.
9. I have reviewed the draft consent conditions prepared by Mr Greaves (and attached to his evidence) and do not consider that these will affect the conclusions of the economic analysis reported in my evidence.
10. I have also reviewed the submissions that have been received by Environment Canterbury on the resource consent applications, and, having considered the evidence of the experts presenting evidence for the RDRML, do not consider that these affect the conclusions of the economic analysis.
11. I have read the Section 42A Officers Reports prepared by Environment Canterbury and Ashburton District Council and do not consider that this affects the conclusions of the economic analysis.

Executive summary

12. The Klondyke storage proposal has the potential to increase the efficiency of allocation and/or of resources used in agricultural production, particularly the use of land and the allocation of water, in the region. As such it is, in my opinion, consistent with s 7(b) of the RMA, which requires persons exercising functions and powers under the Act to have regard to *“the efficient use and development of natural and physical resources”*.
13. The value of the Klondyke storage proposal estimated in a regional economic analysis of the proposal commissioned by RDRML includes:

- 13.1 The value of increasing the reliability of irrigation water supply to existing RDR irrigators from 84 per cent on average to at least 99 per cent throughout the season (when distribution losses are accounted for);
- 13.2 The value of expanding the area irrigated by 19,155 hectares to include the entire area currently consented for irrigation by the three community irrigation schemes that are shareholders in the RDR, provided the additional irrigable area within the Valetta and Mayfield Hinds scheme boundaries is developed before 2019 (as required under Plan Change 2 to the Canterbury Land and Water Regional Plan for renewal of the consent) and RDRML is successful in gaining consent renewal for the currently consented irrigation area within the boundaries of the Ashburton Lyndhurst scheme when the current consent expires in 2019.
14. The analysis demonstrated that the direct increase in value-added to the farm-gate of the development is expected to contribute an average of \$34 million (range \$22 million to \$45 million) per year to the GDP of Ashburton District, as a result of increased reliability of supply, and an average of \$43 million if the irrigable area within the scheme boundaries is irrigated. The total of \$77 million is equivalent to 3.9 per cent of the GDP generated in 2015. An associated 445 jobs would be created on-farm, which represents an increase of 2.4 per cent of the 2015 level of employment.
15. The total (direct, indirect and induced) effect of increased reliability of irrigation supply and expansion of the area irrigated on the Canterbury regional economy was estimated to be \$116 million in the average season, comprising 51 million (range = \$32 million to \$70 million) from increased reliability of supply, and \$65 million as a result of expansion of the irrigated area.
16. A review of the potential adverse social and environmental effects of the proposal that are addressed by evidence presented on behalf of RDRML, in particular in the evidence that is to be presented by Mr Brown, Dr Sanders, Mr Hegley, Ms Harwood, Dr Ryder, Mr Veendrick; Mr Callander, Mr Morgan, Mr Woods, Mr Fletcher; Mr Peters; Mr Metherell and Mr Greenaway indicated that these would be mitigated to levels those experts deem to be acceptable by the proposed conditions of consent and management plans that have been developed. Consequently, I expect the economic

costs of the potential environmental impacts to be very low. Mitigation strategies have been built into construction specifications, consent conditions and management plans that will be protected by consent conditions. Environmental benefits will be generated by the installation of a more efficient fish screen than the existing screen, while social benefits will be derived from construction of a white water course.

17. I consider that the potential economic benefits of the development for the local and regional economies exceed the potential economic, social and environmental costs.

Economic impact definitions

18. Estimating the regional economic impacts of changes in the reliability of irrigation supply and of additional irrigation development 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.

18.1 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 increased farm production on the output of, and employment in, the secondary processing sector have not been included in this analysis.

18.2 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.

18.3 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, increases in farm incomes in the Ashburton District may lead to an increase in purchases from local shops.

19. 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.

Methodology employed to derive the regional economic impacts

20. The value of increasing the reliability of irrigation supply to existing RDR irrigators from present levels to more than 99 per cent was estimated by calculating the differences in the value-added generated at the farm level between the average season under existing supply conditions and the average season if restrictions were not imposed.

21. The baseline reliability of irrigation supply to existing RDR irrigators has been calculated on the basis of data on the monthly availability of water to the RDR from 1979-80 to 2014-15, supplied by Mr Curry. When these were adjusted to account for distribution system losses associated with open-races it was estimated that the reliability of supply is 84 per cent on average, but only 78 per cent during autumn. Modelling undertaken for RDRML by PDP (PDP, 2014)¹ shows that if the proposed storage facility and the supplementary water take are consented, existing RDR irrigators will be assured of irrigation reliability of at least 99 per cent throughout the season.

22. The increases in pasture production expected if irrigation restrictions were not required were calculated using data on average pasture production at different periods during the irrigation season on the Lincoln University dairy farm. Losses experienced as a result of restrictions were estimated as the total number of irrigation days lost during each period multiplied by the average pasture production during that period. The approach to estimating the value of increased reliability of irrigation was based on an approach developed by Harris Consulting and used in several studies cited in Annexure B. In the absence of daily data on restrictions in supply, the loss of irrigation days was calculated as the number of days in the period multiplied by the percentage restriction during the period. It was estimated that in the average season, pasture production losses in the Mayfield Hinds scheme as a result of irrigation restrictions have been 15 per cent, while in the Valetta and Ashburton-Lyndhurst schemes the average loss has been six per cent. The magnitudes of the differences in production experienced with and without irrigation restriction are summarised in Table 1.

¹ The reliability modelling was undertaken by Mr Veendrick, Environmental Scientist, Pattle Delamore Partners Ltd.

Table 1: Pasture production losses – RDR irrigated farms

	Mayfield Hinds		Valletta/Ashburton-Lyndhurst	
	Kg Dm/ha	% of total production	Kg Dm/ha	% of total production
Average	2,479	15%	975	6%
1 in 5 seasons	3,195	19%	1,691	10%
1 in 10 seasons	3,839	23%	2,335	14%
Worst season	5,338	32%	3,835	23%

23. Pasture production losses were translated to financial losses using standard conversion ratios and medium term price projections forecast by the Ministry for Primary Industry (MPI, 2015), or current Canterbury prices where projections were not available. On dairy farms three potential management strategies for dealing with pasture production reductions were evaluated including:

23.1 The use of purchased feed to compensate for reductions in the pasture grown with no reduction in milk production.

23.2 The reduction in pasture production is reflected in a reduction in milk production.

23.3 Reductions in irrigation reliability resulted in an increase in feed purchases and reduced milk production (50:50).

24. Data on current land use (PDP, 2016)² was used to aggregate the per hectare financial losses that occur as a result of irrigation restrictions to the area currently irrigated by the three irrigation schemes supplied by the RDR. This data is summarised in Table 2. No change in land use with improved reliability of irrigation supply has been assumed in the analysis, although it is probable that intensification of land use would occur.

² The land use data were set out in Table 5 of the Klondyke Storage Proposal – Hydrology assessment and were supplied to PDP by RDRML.

Table 2: Land use in areas irrigated by the RDR

	Hectares	Proportion
Dairy	42,263	56.3%
Dairy support	14,459	19.4%
Sheep/beef	7,832	10.4%
Arable	9,149	12.2%
Other	1,217	1.6%
Total	75000	100%

25. Estimation of the value of increasing irrigation development within the boundaries of the three community irrigation schemes supplied by the RDR to the total area presently consented for irrigation was based on estimates of the additional values of production under irrigation derived from a study of the potential value of irrigation in Canterbury by Saunders and Saunders (2012). These were adjusted to reflect the patterns of land use within the irrigation schemes supplied by the RDR, and updated using prices forecast by the Primary Industry (MPI, 2015), or current Canterbury prices where projections were not available.
26. The assumptions on which the estimates were based were that:
 - 26.1 An additional 19,155 hectares would be developed for spray irrigation at current irrigation rates after development of the storage facility.
 - 26.2 Land-use in newly irrigated areas would reflect the pattern of existing land-use in the RDR scheme areas.
27. Regional multipliers derived from the AERU/Canterbury Development Corporation economic impact model (Saunders, et al., 2010) were used to estimate the impacts on total regional value-added (GDP) and employment of the development of the Klondyke storage facility.
28. The potential impacts on the environmental, recreational and amenity values in the area surrounding the proposed development that have been identified in the technical reports listed in Annexure A were reviewed in order to assess the expected level of costs and benefits associated with the development to be incurred by the community, and the costs of mitigating adverse impacts to a level acceptable to the community.

29. The potential impacts of the proposed development have been reviewed in the light of relevant requirements of section 7b of the RMA, which requires persons exercising functions and powers under the RMA to have regard to: “the efficient use and development of natural resources”.

Estimated regional economic impacts of the Klondyke storage proposal

30. Impacts of increased reliability of irrigation supply:
- 30.1 The proposed development has the potential to contribute to the efficient use of water in Canterbury (a consideration under section 7(b) of the RMA). The Canterbury Water Management Strategy (Canterbury Water, 2009) identifies reliability of irrigation supply as a key factor influencing the efficiency of water use, since reliable supply enables farmers to match water use to agronomic demand rather than having to take water when it is available. Reliable supply of irrigation water also increases the efficiency of allocation of other resources to the farming operation by removing uncertainty about the level of pasture production and, therefore, animal production, that will be possible in any season. Reliable irrigation supply leads to intensification of land use and, as a result, higher economic returns from land in agricultural production
- 30.2 In conjunction with the storage proposal RDRML has applied for consent for an additional 10m³/s flood flow take from the Rangitata River. This will increase the economic efficiency of the development by reducing the volume of storage required to achieve 99 per cent reliability of supply to existing irrigators and, therefore, the costs of facility construction. Mr Veendrick’s evidence shows that the storage volume required at current irrigation application rates would be 36 per cent lower with the additional water take, while at the average application rate for Canterbury, the requirement for storage would be 20 per cent lower.
- 30.3 It was estimated that increasing the reliability of irrigation supply to 99 per cent would result in a direct increase in value-added at the farm-gate of between \$22 and \$45 million in the average irrigation season. The range of values reflects different management responses to restrictions in irrigation supply. The benefits would be significantly greater in seasons during which the current

regime imposes more severe restrictions. In a season in which restrictions were as severe as the worst experienced during the past 36 years, I estimate that the benefit from the improvement from increased reliability would be as high as \$59-\$119 million.

30.4 In the average season the total (direct, indirect and induced) additional contribution to Canterbury Gross Domestic Product (GDP) of increasing the reliability of irrigation supply to existing irrigators to 99 percent is estimated to be between \$32 million and \$70 million per annum. Between 291 and 635 jobs would be created in the region in total, of which between 125 and 272 would be created on-farm.

31. Impacts of additional irrigation development:

31.1 Increasing the area of irrigation development is expected to lead to increased value of economic output. A number of studies on the value of irrigation development in Canterbury have demonstrated that irrigation development has led to a significant increase in value-added at the farm-gate as a result of irrigation development. Consequently, the additional irrigation made possible by the proposed facility is consistent with an improvement in land use efficiency, in addition to increases in the incomes and employment in the region. However, the potential environmental and social impacts of expansion of the irrigation area will require assessment before water can be supplied from the storage facility, and management consistent with the requirements of the policy framework and the RMA.

31.2 If the entire area consented for irrigation from the RDR is developed, the additional value-added at the farm-gate is estimated to be \$43 million per annum in the average season.

31.3 The total increase in contribution to regional GDP (including the direct, indirect and induced effects) as a result of the potential new irrigation development is estimated to be \$65 million per annum. Almost 600 jobs would be created in the region in total, of which 251 would be created on-farm.

32. In total the development of the Klondyke storage facility, in conjunction with the supplementary water take of 10 cubic metres per second, is expected to result in a direct increase in the value-added on farms irrigated from the RDR of approximately \$77 million per annum once all development is complete, if the outcome of the development includes both increased reliability of supply and expansion of the area irrigated. This represents 3.9 per cent of the GDP of Ashburton District (\$1,803 million in 2015; Infometrics 2016; Ashburton District Profile. [http://ecoprofile.infometrics.co.nz/Ashburton District](http://ecoprofile.infometrics.co.nz/Ashburton%20District)).
33. The direct contribution to employment in the Ashburton District of approximately 445 farm jobs represents a 2.4 per cent increase in the number of jobs in the district (Infometrics 2016).
34. The potential total (direct, indirect and induced) additional contribution to the GDP of the Canterbury region of \$116 million is equivalent to 0.4 per cent of regional GDP (MBIE, 2016).
35. The analysis reported here does not include the potential benefits over and above increasing the reliability of supply to existing irrigators from the RDR, and expansion of the irrigable area within the boundaries of the three irrigation schemes that are shareholders in the RDR to 94,486 hectares. This will require only 14 cubic million metres of storage if current irrigation application rates are maintained, and 36 cubic metres if the application rate is increased to 0.52 L/s per hectare. This means that between 17 and 39 cubic million metres will be available for new/other irrigators, and for other uses including managed aquifer recharge (MAR) which has been identified as a potential avenue to enhancing economic, environmental, and cultural values (Environment Canterbury, 2013), and/or for targeted stream augmentation (TSA).
36. Neither the future uses of the unallocated portion of the water available as a result of the proposed development, nor the potential infrastructural costs of delivering water for these uses have been identified. Although RDRML has applied for consent for a 53Mm³ storage pond, there is an option to build this in stages. The first stage would meet the demand for more reliable irrigation to existing irrigators, and the subsequent stages would be implemented when opportunities to expand the irrigation area beyond current scheme boundaries have been identified and

consented, or if new uses (such as managed aquifer recharge) identify themselves. Obtaining consent for the entire development at the outset means that the lag between demand identification and the provision of water can be significantly shorter and the economic benefits of irrigation captured earlier. Although the capital costs for a staged development have not been estimated, Mr Woods' evidence provides an estimate that construction costs would be ten to 15 per cent, or between \$24 and \$36 million, higher than the costs of development in a single stage. Offset against this would be removal of the risk of unnecessary resource expenditure should additional demand not be identified, or expansion of the irrigation area not be consented. In addition, two-stage development would result in a reduction in debt servicing (\$1.2 to \$1.8 million per annum) for the period during which the additional capacity was not required. Ultimately, however, it is not possible to determine the potential impacts of staged development on economic efficiency until information is available on the timing and scale of the demand for additional water.

37. The extent of the investment in on-farm infrastructure required for more intensive land uses such as dairy production, has not been investigated. For the reasons outlined in paragraphs 34 and 35, a cost benefit analysis of the proposed development was not possible. However, the expected levels of costs of developing and operating the facility and of the on-farm costs of potential irrigation development on the remaining consented area were estimated for comparison with the expected annual benefits to RDR irrigators of \$77 million. These are summarised in Table 3, which shows the approximate annual costs of debt servicing and operation to be \$30 million per annum including the costs of additional farm infrastructure.

Table 3: Costs of the development and on-farm irrigation infrastructure

	\$ million	Total \$ million	Annualised \$ million
Facility development		237.67	19.26 ¹
Storage facility	207.00		
White water course	0.32		
Canal modification	0.35		
Fish screen	Unknown		
Other	30		
On-farm irrigation development		82.35	10.65 ²
Other on-farm development	Unknown		
Opportunity cost of lost production			0.09
Total		320.02	30.00

¹ Annual costs of facility comprising interest and operating costs

² Annual costs of borrowing over ten years at 5 per cent

The economic value of environmental and social impacts of the development

38. The evidence being called by RDRML examines potential adverse impacts of the construction and operation of the proposed storage facility and associated supplementary water take on the environmental, social and amenity values of the area. Mitigation or remediation strategies for these impacts have been identified and are to be included in the construction specifications or the consent conditions, or achieved by the establishment of management and monitoring plans. The potential impacts and management strategies have been presented in the evidence given by Mr Brown, Mr Mikaere, Dr Sanders, Mr Hegley, Ms Harwood, Dr Ryder, Mr Veendrick, Mr Callander, Mr Morgan, Mr Woods, Mr Fletcher, Mr Peters, Mr Metherell and Mr Greenaway. The potential environmental and social impacts of the development, their scale, the management strategy proposed, and the costs of mitigation are summarised in Annexure B of my evidence.
39. The potential environmental and social impacts of the proposed development are expected to be, or can be managed to be, acceptable to the wider community. Consequently the economic costs associated with those impacts are also expected to be very low. Many of the mitigations required to ensure that these impacts are minimised are to be incorporated into the design of the facility, while others will be built into resource consent conditions, or met by other legislative requirements. Most

of the costs of compliance with proposed mitigation strategies have not yet been separately identified, and are not included in the sum of mitigation costs, which has been estimated to be between \$440,000 and \$550,000 during construction, plus annual costs throughout the construction period of \$35,000. This figure is a significant under-estimate of the resources that will be committed by RDRML to ensure that the environmental and social costs of the proposed development are avoided, mitigated or minimised, and to provide greater protection of the Rangitata fishery and enhanced recreational opportunities for local residents and visitors. The potential social and environmental impacts of further expansion of the irrigation area beyond the current scheme boundaries will require assessment against the requirements of the RMA and relevant policy frameworks before water can be supplied from the Klondyke water storage facility.

40. Potential environmental benefits of the development have not been quantified but include:

40.1 The potential for farmers to increase irrigation application rates from the current rate of 0.41 litres per second, which is low for Canterbury, may lead to reduced nutrient leaching as a result of greater uptake by plants in the absence of moisture stress (Carlton et al., 2017).

40.2 The installation of a Mechanical Rotary Fish Screen downstream of the existing BAFF to reduce the numbers of salmon, trout and native fish species entering the RDR, and to return sediment that is too large to fit through the screen to the river. Mr Ryder's evidence reports that the proposed fish screen "largely meets" the recommendations for best practice for fish screening outlined in the Canterbury good practice fish screening guidelines, and that he expects it to represent a very significant improvement on the existing screen. He notes, however, that it will not be possible to quantify the extent of that improvement until the recommended monitoring programme has been implemented.

40.3 The potential for the implementation of MAR or TSA. The potential benefits of MAR include the maintenance of groundwater levels, the enhancement of lowland stream flows and the dilution groundwater contamination from land use intensification (Jenkins, 2015). However, Mr Callander states in his

evidence that the potential benefits from the implementation of MAR using water from the proposed Klondyke facility were difficult to predict in advance.

- 40.4 The net economic value of changes in amenity and recreational value are expected to be low, Mr Greenaway's evidence identifies a number of enhancements to and adverse impacts on these values that will occur if the development proceeds but concludes that the proposal is a balanced approach and will not result in unacceptable outcomes for recreation.

Conclusion

41. The proposed development has the potential to contribute directly to the economy of the Ashburton District and to the achievement of the targets of the Canterbury Water Management Strategy. These include improvement in the reliability of irrigation water supply for existing irrigators, and increasing the area developed for irrigation in the region, without increasing pressure on the region's freshwater resources.
42. Increasing the reliability of supply to existing RDR irrigators has the potential to increase the efficiency of use of water abstracted from the RDR for irrigation because farmers will be better able to match water use to agronomic demand if they can be assured of supply at the right time. By reducing uncertainty about the level of pasture production, reliable irrigation will encourage greater efficiency in the allocation of other resources to production. The potential value of increasing the reliability of supply to existing RDR irrigators has been estimated to be between \$22 and \$45 million at the farm-gate in the average season.
43. Expansion of the area irrigated from the RDR, providing RDRML secures resource consent in 2019 for the area currently consented for irrigation, as a result of the development has the potential to lead to increased efficiency of land use in the region. The potential value of expanding the area irrigated to the area currently consented for irrigation from the RDR has been estimated to be \$43 million in the average season.
44. The total additional annual value-added on farms irrigated from the RDR of approximately \$77 million represents 3.9 per cent of the GDP of Ashburton District.

The direct contribution to employment in the Ashburton District of approximately 445 farm jobs represents a 2.4 per cent increase in the number of jobs in the district.

45. The potential total (direct, indirect and induced) additional contribution to the GDP of the Canterbury region of \$116 million is equivalent to 0.4 per cent of regional GDP (MBIE, 2016).
46. The Section 42A Officer's Report prepared by Canterbury Regional Council and Ashburton District Council does not affect the conclusions of the economic analysis.
47. There will be a significant volume of water (17 to 39 million cubic metres) available for allocation to uses that have yet to be identified, including MAR/TSA and irrigation development outside the boundaries of the irrigation schemes currently supplied by the RDR.
48. The evidence given by experts called by RDRML supports the conclusion that the potential adverse impacts of the construction and operation of the facility, its associated water takes from and discharges to the Rangitata River, and all associated activities, on the surrounding district are considered to be, or will be mitigated to be acceptable. Strategies for mitigating or remediating potential adverse impacts have been built into construction specifications, consent conditions and management plans, and the costs of implementing them will be met by RDRML. Consequently the potential economic benefits of the development for the local and regional economies are expected to be considerably higher than the social and environmental costs, and to lead to an increase in the economic wellbeing of the community. The impacts of expansion of irrigation development beyond the gazetted area of RDRML have not been assessed. Assessment of these against the requirements of the LWRP and the RMA will be required before water could be supplied from the storage facility.

Name: Glen Greer

Date: 28 March 2018

Annexure A: References used to inform the economic analysis

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Annexure B: Summary of environmental and social impacts

Impact	Scale of impact	Management strategy required	Cost
Visual landscape Natural character	<ul style="list-style-type: none"> Canal modifications and fish screen construction– minimal impacts Views and amenity values impacts from low to moderate Natural character of River – low or very low 	<ul style="list-style-type: none"> Shelter belts replaced Native plantings established Design of emergency outfall to minimise visual impact 	\$150,000 Included in design and construction costs
Terrestrial and avian ecology	<ul style="list-style-type: none"> Native birds – no impact Improvements in native vegetation, and lizard habitat 	<ul style="list-style-type: none"> Lizard sanctuary developed Revegetation corridor established 	\$30,000
Transportation	Acceptable	<ul style="list-style-type: none"> Traffic management plan Road maintenance monitoring 	Unknown – included in construction costs
Noise levels	<ul style="list-style-type: none"> District Plan requirements will not be exceeded by noise levels during construction Increase in traffic noise within acceptable limits 	<ul style="list-style-type: none"> Noise levels are to be managed by consent conditions. 	Costs of modifications included in construction costs
Air quality	Less than minor (smoke “no more than minor”) provided extensive monitoring and mitigation are conducted	Smoke Management Plan Dust Management Plan Ambient dust and weather monitoring	Monitoring \$35,100 per annum during construction
Aquatic ecology and surface water quality	<ul style="list-style-type: none"> No significant fauna or habitat at the pond site WCO conditions met with respect to water quality 	Monitoring during operation	Included in operating costs
Groundwater	No more than minor	Construction specifications to minimise risks Consents manage the effects of activities	Included in construction costs
Hydrology	Less than minor	-	-
Dam break	Risk to people and property minimised to a very low level	PIC high. Design to incorporate requirements of Dam Safety Guidelines (2015).	Not known, incorporated in construction costs

Fish screen	Positive benefits for fish species as a result of increased diversion from the RDR		Not known
White water course	Increased recreational opportunities available.		\$260,000-\$370,000
Recreation and Tourism	Impacts “not unacceptable”	Balanced approach to development	–