Extra-market values and water management in New Zealand

Geoffrey N. Kerr
Lincoln University
kerr@lincoln.ac.nz

Presented to *Australian Agricultural and Resource Economics Society*
Fremantle, Australia
February 2003

Abstract
Efficient water management requires information on the magnitudes of all values associated with water volumes and quality, both in-situ and in extractive uses. This paper reviews and summarises New Zealand research into extra-market values placed on water. Studies have addressed issues as diverse as maintenance of ground water and instream flows, the value of recreational activities, and the quality of household water supplies. Results indicate that people place high values on avoiding further degradation of the natural environment, and in-situ values can have a significant role in water allocation efficiency despite high consumptive values of water.

Introduction

Water management is an extremely complex task because of the nature of the resource, the many demands placed upon it, and because of the conflicts inherent in water allocation and use.

A particular problem is inadequate incorporation of intangible values in decision making. It is relatively straightforward to measure the money benefits of water use in agriculture (for example), but it is not easy to measure how alternative water management scenarios affect aesthetic, recreation, wildlife and other non-market values.

There are several types of value that are particularly important, including use, option and existence benefits. Many use values have market values associated with them, but many water uses, such as recreation activities, are outside the market. Water provides value in ways other than through direct use. Many people value naturalness and are disturbed when natural environments are changed, either because natural environments provide important ecosystem services, or simply because the environment is perceived to be better in a more natural state (existence value). Intrinsic values are another important source of impacts. Where intrinsic values are

defined as values that exist independently of human valuation, economists, who study impacts on people, are not well positioned to offer advice.

The importance of water-related intangible values is readily apparent from conflicts that arise over water use. Recreationists and environmentalists are frequently at loggerheads with municipal, industrial and agricultural users of water. While it is generally acknowledged that intangible values are important, measurement difficulties can result in intangibles being overlooked, or given inappropriate weight in decision processes. Non-market valuation allows items outside the market to be included in cost-benefit analysis, or to be compared with market values on an equal footing.

While the New Zealand government has long recognised the importance of intangibles in decision-making, as evidenced by the role of time, health and mortality values in Transfund's project evaluation procedures (Transfund New Zealand, 1997), recognition does not extend across the full range of decisions. While transport decisions explicitly require incorporation of standardised non-market values for some attributes and valuation of other attributes is encouraged, this is not true for other types of decisions, including those about freshwater.

This paper briefly reviews the contributions that non-market valuation has made to managing New Zealand freshwater resources and draws some conclusions about future directions.

Potential roles of non-market valuation

Values derived from non-market valuation studies can serve three main purposes. Firstly, they can aid in resource **allocation** decisions through identification of the most efficient allocation of water. For example, it can identify whether society benefits more from using water for irrigation or by leaving it instream to maintain other benefits. Because it allows inclusion of all the costs of alternative resource uses, non-market valuation sounds potentially problematic for extractive or consumptive resource users, but it can work both ways. Non-market valuation studies may show recreational and environmental impacts to be relatively minor, despite the claims of affected recreationists and environmentalists (Kerr, 1996). While non-market valuation has the potential to reinforce environmental and recreational claims of importance, it also has the ability to reveal cases in which these values are small, but where proponents have exaggerated claims about importance of threatened resources.

Secondly, non-market valuation can be used to identify the adequacy of **mitigation**. It can be useful in identifying environmental, landscape, recreational and other facility changes that may offset damages. This may entail payment of compensatory damages, but need not do so, since non-market valuation can indicate willingness to trade a range of resource attributes and does not require a money numeraire. Consequently, non-market valuation may be extremely useful at the project design stage, allowing project proponents to design mitigation packages that meet community aspirations at lowest cost. This, in turn, enhances the prospects of the project obtaining approval.

Finally, non-market values can be used as a basis for **compensation**. This was the reason for one of the most well known applications of non-market valuation, the assessment of damages payable by Exxon Corporation for the Exxon Valdez oil spill in Alaska (Carson *et al*., 1994). While there was heated argument over the magnitudes of damage estimates derived in the Exxon case, it has clearly illustrated the potential importance of existence values, which have implications for allocation and mitigation decisions.

Some of the earliest non-market valuation studies were instigated to address freshwater management issues. The first non-market valuation study undertaken in New Zealand addressed values associated with angling (Gluck, 1974) and was followed by investigations into water pollution (Harris, 1981, 1983), existence and angling values (Leathers *et al*., 1985), and aesthetic and use effects of hydro-electricity developments (Kerr, 1985).

It is nearly three decades since non-market valuation was first applied to a New Zealand freshwater management issue. About 25 New Zealand studies address aspects of water management (from a total of about 85 different non-market valuation studies), including 9 studies of water-related recreation, 5 of water quality management, 5 of flow protection or enhancement, 3 of flood protection, 2 of domestic demand, and 1 of aesthetics.

The contribution of non-market valuation to freshwater management

During the late 1980s political reforms largely removed central government from active resource management roles, devolving powers and responsibilities to local and regional authorities and to individuals. Prior to those reforms central government frequently planned, paid for, constructed and operated many infrastructure services, including irrigation schemes and hydroelectric power developments. Cost-benefit analysis was undertaken for the tangible components of government projects. There were some attempts to incorporate non-marketed impacts, notably by Forbes (1984) at the Ministry of Agriculture and Fisheries, and by the National Water & Soil Conservation Authority in their funding of pioneering studies on the Rakaia and Waimakariri Rivers in the early 1980s (Leathers *et al*., 1985). Another early central government funded study was the Ministry of Works and Development funded study by Kerr (1985) into the aesthetic and use value changes from proposed hydroelectricity developments on the Kawarau River. This study was never used because of political interventions to halt hydroelectric development on the river.

This period of close central government involvement saw the only case in which non-market valuation results have been used as legal evidence in New Zealand, in an appeal before the former Planning Tribunal. In order to support their case for renewal of consents to transfer water from the Wanganui catchment into the Waikato catchment for electricity generation purposes, Electricorp (the government agency responsible for hydroelectric power development) introduced evidence from a travel cost study of recreational values (Cocklin *et al.*, no date, 1994; Fraser, 1989). The study sought to illustrate that the opportunity cost to recreation from water transfers was minor. However, Meister and Weber (1989) presented evidence that illustrated major deficiencies in, and effectively discredited, the Electricorp study. Consequently,

it is not possible to know what weight would have been given to a robust set of non-market value estimates.

Two regional catchment authorities also commissioned non-market valuation studies in this early period. The Waikato Valley Authority (Harris, 1983, 1984) investigated benefits of pollution abatement in the Waikato River. The North Canterbury Catchment Board used contingent valuation to value flood hazard protection (Kerr, 1989).

The political reforms of the 1980s saw the introduction of the Resource Management Act 1991 (RMA). Section 88 of the RMA requires resource consent applicants to make an assessment of socio-economic impacts. Section 32 of the RMA requires territorial and regional authorities to justify their institutional rules on efficiency grounds.

> s32. Duties to consider alternatives, assess benefits and costs, etc. --
>
> (1) In achieving the purpose of this Act, before adopting any objective, policy, rule, or other method in relation to any function described in subsection (2), any person described in that subsection shall --
> (a) Have regard to --
> (i) The extent (if any) to which any such objective, policy, rule, or other method is necessary in achieving the purpose of this Act; and
> (ii) Other means in addition to or in place of such objective, policy, rule, or other method which, under this Act or any other enactment, may be used in achieving the purpose of this Act, including the provision of information, services, or incentives, and the levying of charges (including rates); and
> (iii) The reasons for and against adopting the proposed objective, policy, rule, or other method and the principal alternative means available, or of taking no action where this Act does not require otherwise; and
>
> (b) Carry out an evaluation, which that person is satisfied is appropriate to the circumstances, of the likely benefits and costs of the principal alternative means including, in the case of any rule or other method, the extent to which it is likely to be effective in achieving the objective or policy and the likely implementation and compliance costs; and
>
> (c) Be satisfied that any such objective, policy, rule, or other method (or any combination thereof) --
> (i) Is necessary in achieving the purpose of this Act; and
> (ii) Is the most appropriate means of exercising the function, having regard to its efficiency and effectiveness relative to other means.

Costs and benefits are defined by Section 2 to “include costs and benefits of any kind whether monetary or non-monetary”. The Ministry for the Environment published a good practice guide to Section 32 (Young-Cooper *et al.*, 1993). The guide is not legally binding, and claims explicitly that it “is not the ‘authority’ on section 32” (page 5). It claims (page 46) that:

> As with costs, the objective is to measure benefits in dollar terms. This can be difficult in evaluation of public policy as often the benefits cannot be directly measured. This may be because "public goods" generate benefits which cannot be captured by any particular individual, organisation, or interest group, and which are not subject to a market transaction to establish a price.
>
> In response to the issue of identifying the public benefit, attention has been given to valuing the consumer benefits of public goods. This may be done in several ways: *Contingent valuation* ...

However, in discussing intangibles the guide states (page 48):

> Environmental and community impacts are, if not difficult to measure, virtually impossible to quantify in terms compatible with economic analysis, and to this extent are treated as intangibles. ... The sophistication and complexity of analyses intended to quantify intangibles by way of benefits and costs make them difficult to use in policy analysis. The literature on quantification of environmental values is inconclusive.

While the guide acknowledges the importance of non-market values and the need to include them in Section 32 analyses, it does not provide clear guidance on how this should happen. A more recent guide to Section 32 (Tonkin and Taylor *et al*., 2000) reiterates the desirability of inclusion of non-market impacts "To get a true measure of efficiency all benefits and costs (non-monetary and monetary, intangible and tangible, long-term and short-term) must be included" (page 10). However, the later guide is silent on methods of measurement. It claims (page 33): "The value of unquantified benefits and the need to try to put a monetary value on them will vary with the importance of the benefits to the community and their importance in terms of the purpose and principles of the [RMA]". This wording seems to imply that valuation will be required in some circumstances. The guide cites a court case in which monetary valuation was <u>not</u> considered necessary[1].

The RMA is under review and Section 32 is one component that has received close attention. The Resource Management Amendment Bill (8 May 2001) simplifies the wording of Section 32. It removes the requirement to examine the costs and benefits of objectives, but retains the requirement to take account of costs and benefits of policies, rules and other methods and for examination of effectiveness and efficiency of policies, rules or other methods.

Despite controversy over Section 32 requirements, the RMA could be expected to have facilitated adoption of non-market valuation. One of the earliest challenges under Section 32 was centered on water pollution in the lower Waimakariri River, near Christchurch (Sheppard *et al.*, 1992, 1993). A proposal by the Canterbury Regional Council to improve water quality standards was countered by dischargers, who stated they could clearly identify the costs of such a change, but claimed that the Council would breach Section 32 requirements because it could not identify the benefits. A subsequent study commissioned by the Council showed that the present value of aggregate benefits of water quality improvements ($96.4 million) vastly exceeded the costs ($17.2 million), reinforcing the Council's position.

[1] Wakatipu Environmental Society and others v Queenstown Lakes District Council C180/99

The RMA also governs conditions under which Water Conservation Orders are put in place. Recently, Fish & Game New Zealand applied for a water conservation order on the Rangitata River. Amongst the evidence presented in support of its claim of outstanding qualities Fish & Game utilised a travel cost study of angler benefits (Kerr, 2001). In making a recommendation for a water conservation order, the special tribunal noted that the travel cost values had illustrated the high value of the river for angling compared to other rivers, and had also identified the complementary roles of the Rakaia and Rangitata Rivers (Ward *et al.*, 2002). This case marks the first instance in New Zealand where non-market value estimates have been recognised in a formal decision making process.

The Local Government Act (1974) places responsibility on territorial and regional authorities to ensure that benefits of large capital investments of ratepayers' money can be justified. Waitakere City has recently used non-market valuation (Welsh, 2001) to help investigate the justification for expenditure on wastewater and storm water infrastructure and management.

All of the previously mentioned studies have occurred in support of resource allocation decisions. They have been attempts to identify the most efficient outcomes in order to determine whether some specific action is desirable. No studies have been undertaken to assess compensatory damages. Indeed, this type of action appears to be precluded by Section 17 (2) of the RMA. Negative environmental effects must be avoided, remedied or mitigated (RMA, Section 17). Mitigation is the third potential use of non-market valuation procedures.

The Auckland Regional Council (ARC) is funding a study designed to address the mitigation of environmental effects. Fieldwork for this study has just finished. The ARC's intention is to publish guidelines on appropriate valuation methods, including reference operating conditions, and possibly standardised values for common impacts. The motivation for the study is reduction of time delays and transaction costs of obtaining resource consents for developments that impact on Auckland waterways. The legal standing of the approaches being developed by ARC has not been identified. If ARC is successful in obtaining an Environment Court ruling that such approaches are acceptable there may be an increase of interest in non-market valuation for water management.

Value magnitudes

One advantage that arises once several studies of similar items have been undertaken is the ability to gain an understanding of "typical" values for that item. While differences between populations and resources typically preclude formal benefits transfer (Brouwer, ***), typical values can be useful for predicting the likely order of magnitude of impacts in new cases. While this practice is not expected to produce accurate results, it can avoid the need for further studies when it shows that expected values are far from any decision thresholds.

The only area for which sufficient studies have been undertaken in New Zealand to provide an indication of standard values is recreational fishing

There have been five non-market valuation studies of freshwater angling. However, Gluck's (1974) estimates were for a sub-sample of anglers and their annual basis is not directly comparable to the individual visit basis of the other estimates. The benefit estimates (Table 1) are remarkably uniform.

Table 1: Recreational fishing benefit estimates

River	Type of study	Value estimate $NZ\$_{June\ 2000}$	Author(s)
Rakaia River salmon fishery	Travel costs	$45/angler/visit	Leathers *et al.*, 1985
Rangitata River salmon & trout fishery	Travel costs	$70/angler/visit	Kerr (2001)
Tongariro River trout fishery	Travel costs	$60/angler/visit	McBeth (1997)
Tongariro River trout fishery	Contingent valuation	$60/angler/visit	McBeth (1997)
Greenstone & Caples Rivers trout fishery	Contingent valuation	$70/angler/visit	Kerr (1996)
Lake Tutira recreation	Travel costs	1980/81 = $8/visitor/day	Harris (1981)
Artificial Lake, Methven	Contingent valuation	1994 = $37-80/household/year	Meyer (1994)
Recreational Canoeing, Wanganui River	Contingent valuation	1985 = $42-58/person/visit	Sandrey (1986)

The Rangitata, Tongariro and Greenstone/Caples are all recognised as outstanding fisheries. The Rakaia and Greenstone/Caples are subject to water conservation orders and an order has been recommended for the Rangitata. Anglers note that while the Rakaia is a very important salmon fishery it is not of the same quality as the Rangitata. Valuation results reflect this situation. The Rangitata, Tongariro, and Caples/Greenstone provide similar use benefits, with the Rakaia yielding a somewhat lower level of benefits.

By way of contrast, it is interesting to note the use values attributable to lake recreation in the studies by Harris (1981) and Meyer (1994). The Lake Tutira values are considerably lower than the fishing values. While the Methven artificial lake values appear higher, it should be noted that they are annual values, so include multiple trips, and are household values, rather than the individual values of the fisheries. Recreational canoeing values on the Wanganui River, which is typically run as a multi day trip, exceed those from fishing.

With some of the high value rivers in Table 1 (and the highest use lakes) receiving annual angling use in excess of 30,000 angler days, the magnitude of angler benefits can exceed $2 million per year per river. This puts an upper bound on loss of recreation use benefits from fishery destruction. On lower use and/or lower quality rivers aggregate fishing use values will be somewhat less. By themselves, fishing benefits will frequently be insufficient to make a substantial change in water

allocation decisions when the large margins attributable to application of irrigation water in agriculture are considered (reference). Further, most water allocation decisions do not result in total destruction of fisheries. Knowledge of even this simple information may be adequate to place a conservative upper bound on fishery value changes for incorporation in cost-benefit analyses of new projects, avoiding the need for primary data collection.

While use benefits appear large, they pale in comparison to existence benefits. Two recent studies highlight this point. Groundwater abstraction on the Waimea Plains has resulted in reduced stream flows and some instances of salt water intrusion. Waimea Plains residents (about 8000 households) were willing to pay about $400 per household per year to reduce pumping from the aquifers by 20% in order to maintain stream flows and prevent salt water intrusion (Kerr *et al.*, 2001). Even for this small, intensively farmed community that is highly reliant on groundwater for irrigation, the internal rate of return for a 20% reduction in use of groundwater is 9%.

Christchurch households were studied to assess their willingness to pay additional rates to avoid flow depletion in the Avon and Heathcote Rivers, and also to avoid water use restrictions. The lower 95% confidence limit on household willingness to pay was about $400 per year, yielding aggregate annual benefit of more than $48 million (Kerr *et al.*, 2002).

Another area of water management in which non-market values play a role is domestic supply. Welsh (1991) valued the domestic reticulated supply to Christchurch households at **(1991)**$213/month. Households currently pay an average flat fee of about $75 per year for water supply, indicating very large surpluses. The quality of Christchurch City's groundwater supply is outstanding. The City has considered meeting expanded demand by reticulation of chemically treated river water. Christchurch households are willing to pay about $640 per year each to avoid the use of treated river water and retain their high quality domestic water source (Kerr *et al.*, 2001).

Recent studies (CPW) have shown the high benefits that are obtainable from irrigating farmland. Consequently, there is great pressure for access to groundwater and river flows for agricultural use. Consideration of opportunity costs of water use requires evaluation of recreation, conservation, existence and urban use values from water. The non-market valuation studies completed to date in New Zealand indicate that recreation values may be the least significant of all of these opportunity costs, but can still be large. Members of the public highly value instream flow protection, and are even willing to pay substantial amounts for aquifer protection.

Future prospects

While the existence of 25 water-related non-market valuation studies sounds like a substantial number, and gives the appearance that non-market valuation is well established in New Zealand water management processes, the benefits from these studies may not be that great. About half of the studies have been undertaken as student research by Masters or Honours degree students. While such studies are invariably focused on a case study, they are frequently (although not always) not a

critical element in resource use decisions. Other studies (e.g. Lambert *et al.*, 1992; Sandrey, 1986) have been undertaken by academics in order to explore conceptual issues about non-market valuation methods and have not been directed at policy issues.

In the twelve years since the passage of the RMA only 4 studies have been commissioned with the intention of direct use in water resource decision making. It is pertinent to ask why.

Failure to adopt non-market valuation can be attributed to a number of possible reasons:

(i) Lack of awareness of the existence of non-market valuation
(ii) Belief that non-market valuation is inaccurate
(iii) Cost
(iv) Time constraints
(v) Inadmissibility of non-market valuation results

In my experience, a significant proportion of decision-makers and policy analysts are aware of the existence of non-market valuation methods. Typically, however, they are not aware of the time requirements to successfully complete a non-market valuation study. This has resulted in disappointment on a number of occasions when a decision had been made by a policy agency to use non-market valuation only to find it could not be completed in the short space of time prior to a decision being made. Cost can be an exacerbating characteristic in this situation, which may be able to be averted by the use of more expensive, but faster, personal interviews for data collection.

Beliefs about the accuracy of non-market valuation methods are also problematic. There is widespread scepticism about the technical ability of available non-market valuation techniques to accurately measure values. This view is exemplified in the two guides to Section 32 of the RMA (Young-Cooper *et al.*, 1993; Tonkin and Taylor *et al*., 2000). This situation signals a role for non-market valuation analysts to make potential demanders of non-market valuation studies aware of the accuracy of methods now available. Another solution is to utilise non-market valuation procedures to identify relative values. While estimation of precise money values is extremely onerous, valuation methods are amenable to ranking outcomes. If properly designed they can be used to indicate preferences over policy portfolios, which may allay fears about ability to accurately value individual components.

Fears about inadmissibility are understandable. Where there are no precedents to show the acceptability of valuation there are risks to any agency adopting valuation in a legal context. First, there is the risk to the success of the case being taken. Second, there is an externality issue. Non-market valuation studies can be expensive, especially if done properly. Undertaking a study and presenting it as evidence in the hope of establishing a precedent incurs definite costs and uncertain benefits. However, if the precedent is established the benefits are shared by all others who may wish to use these methods. Given the experience of the Electricorp case, this may explain reluctance to use non-market valuation in a contestable setting. The recent acceptance of non-market valuation evidence in the Rangitata River water conservation order hearing is an important first step. The publication of

practice guidelines by the Auckland Regional Council will be an important follow-on with the potential to induce more water valuation studies.

References

Note: references marked † report New Zealand water-related non-market valuation studies.

Carson, R.T., Mitchell, R.C., Hanemann, W.M., Kopp, R.J., Presser, S. and P.A. Ruud (1994) Contingent valuation and lost passive use: Damages from the Exxon Valdez. *Resources for the Future Discussion Paper 94-18.* Washington, D.C.: Resources for the Future.

† Cocklin, C., Fraser, I. and M. Harte (no date) *The recreational value of the in-stream flows of the Upper Wanganui and Whakapapa Rivers*. Unpublished report to Electricorp.

† Cocklin, C., Fraser, I. and M. Harte (1994) The recreational value of in-stream flows: the Upper Wanganui and Whakapapa Rivers. *New Zealand Geographer* 50(1): 20-29.

Forbes, R. N. (1984) Cost benefit procedures in New Zealand agriculture: cost benefit handbook, 2nd ed. Wellington: Economics Division, Ministry of Agriculture and Fisheries.

† Fraser, I.H. (1989) *Statement of Evidence in the matter of the Water and Soil Conservation Act 1967 and appeals 781/88 and 840/88 under 25 of said Act.*

† Gluck, R.J. (1974) *An economic evaluation of the Rakaia fishery as a recreational resource*. Master of Agricultural Science thesis, University of Canterbury (Lincoln College).

† Greer, G. (2001) *The Value of the Rangitata River to its Angling Community*. Agribusiness and Economics Research Unit, Lincoln University.

† Harris, B.S. (1981) *Application of a travel cost demand model to recreation analysis in New Zealand: An evaluation of Lake Tutira*. Master of Agricultural Science thesis, Massey University.

† Harris, B.S. (1983) Valuation of non-market goods: An application of contingent valuation to water pollution control in the Waikato Basin. *Waikato Valley Authority Technical Publication* No. 27. Waikato Valley Authority, Hamilton.

† Harris, B.S. (1984) Contingent valuation of water pollution control. *Journal of Environmental Management* 19: 199-208.

† Harris, B.S. and A.D. Meister (1981) A report on the use of a travel cost demand model for recreation analysis in New Zealand: An evaluation of LakeTutira. *Discussion Paper in Natural Resource Economics* No. 4. Massey University.

† Kerr, G.N. (1985) “Aesthetic and use values associated with proposed Kawarau Gorge hydro-electric developments.” In: Sheppard, D. and J. Rout (eds) *Kawarau hydro investigations: River recreation economic study*. Wellington: Ministry of Works and Development.

† Kerr, G.N. (1989) “Willingness to pay for flood protection.” In: Blackford, C. *Public perceptions of risk from the Waimakariri River*. Report to the North Canterbury Catchment Board and Regional Water Board, Christchurch.

† Kerr, G.N. (1996) Recreation values and Kai Tahu management: The Greenstone and Caples Valleys. *New Zealand Economic Papers* 30(1): 19-38.

† Kerr, G.N. (2000) *Rangitata River anglers' contingent valuation results*. Report to Agribusiness and Economics Research Unit, Lincoln University.

† Kerr, G.N. (2001) *Statement of evidence before a Special Tribunal in the matter of an application by the New Zealand Fish and Game Council and the Central South Island Fish and Game Council for a Water Conservation Order under Section 201 of the Resource Management Act 1991.*

† Kerr, G.N., Sharp, B.M.H. and P. White (2001) *Non-marketed Impacts of Ground Water Extraction*. Paper presented to the Australian Agricultural and Resource Economics Society conference, Adelaide, January 2001.

† Kerr, G.N., Sharp, B.M.H. and P. White (2002) *Economics of Urban Water Management*. Manuscript, July 2002.

† Kirkland, W.T. (1988) *Preserving the Whangamarino Wetland: An application of the contingent valuation method*. Master of Agricultural Science thesis. Massey University.

† Lambert, R., Saunders, L., and T. Williams (1992) Cultural sensitivity of the contingent valuation method. *Centre for Resource Management Information Paper* No. 41, Lincoln University.

† Leathers, K.L., Kerr. G.N., and B.M.H. Sharp (1985) *Valuing instream uses of natural water systems in New Zealand*. Report to the National Water and Soil Conservation Authority, Ministry of Works and Development, Wellington, July 1985.

† Lynch, R.J. (1992) *The economic valuation of water from the Ashburton River: implications for allocation*. Master of Agricultural Science thesis, Massey University.

† Lynch, R.J. and J. A. Weber (1992) Valuing water of the Ashburton River: in-stream flows versus irrigation. *MAF Policy Technical paper* 92/13. Wellington: MAF Policy.

† McBeth, R. (1997) *The recreational value of angling on the Tongariro River. Non-market valuation using the travel cost method and contingent valuation method*. Master of Arts thesis, Department of Geography, University of Auckland.

† Meister, A.D. and J.Weber (1989) *Statement of evidence in the matter of the Water and Soil Conservation Act 1967 and appeals 781/88 and 840/88 under section 25 of said Act.*

† Meyer, F. (1994) *The dichotomous choice approach to the contingent valuation method*. Master of Commerce and Management thesis, Lincoln University.

† Montgomery Watson (1999) *Recreational Lake Demand and Economic Benefit Analysis*. Report to Palmerston North City Council, September 1999.

† Omwenga, R.M. (1995) *The Manawatu River water quality improvement project: An economic policy study*. Master of Agricultural Science thesis, Massey University.

† Sandrey, R.A. (1986) Non-market valuation in New Zealand: an empirical analysis of vehicle bias. *New Zealand Economic Papers* 20: 53-60.

† Sheppard, R., Kerr, G.N., Tipler, C., Cullen, R. and T. Ferguson (1992) *Recreational water quality standards for the Waimakariri River*. Report to the Canterbury Regional Council. Agribusiness and Economics Research Unit, Lincoln University.

† Sheppard, R., Kerr, G.N., Cullen, R. and T. Ferguson (1993) Contingent valuation of improved water quality in the Lower Waimakariri River. *Agribusiness and Economics Research Report* No. 221. Agribusiness and Economics Research Unit, Lincoln University.

Tonkin and Taylor, Boffa Miskell and Simpson Grierson (2000) *What are the options? A guide to using section 32 of the Resource Management Act*. Wellington: Ministry for the Environment.

Transfund New Zealand (1997) *Project Evaluation Manual.* First Revision, May 1997. Wellington: Transfund New Zealand.

Ward, J., Mulcock, C. and M. Parsons (2002) *Rangitata River water conservation order application: Report by the Special Tribunal.* October 2002.

† Weber, J.A., Lynch, R.J. and P.B. Halvorsen (1991) Allocating water in the Ashburton River: irrigation vs in-stream flows. In: Papers presented at the sixteenth annual conference of the New Zealand branch of the Australian Agricultural Economics Society. *AERU Discussion Paper* No. 131. Lincoln University.

† Welsh, C. (1991) *A contingent valuation study of consumers' willingness to pay for water: an approach to conserving Christchurch's groundwater resource*. Master of Science (Resource Management) dissertation, Lincoln University.

† Welsh, C. (2001) *Community benefits survey: Stormwater and wastewater improvements*. Report to Ecowater from Resource and Environmental Management Ltd.

† White, P.A., Sharp, B.M.H. and G.N. Kerr (2001) Economic Valuation of the Waimea Plains Groundwater System. *Journal of Hydrology (NZ)* 40(1): 59-76.

Young-Cooper, A; Cowper, I.; Macky, R. and P. McDermott (1993) *Section 32 – A guide to good practice*. Wellington: Ministry for the Environment.