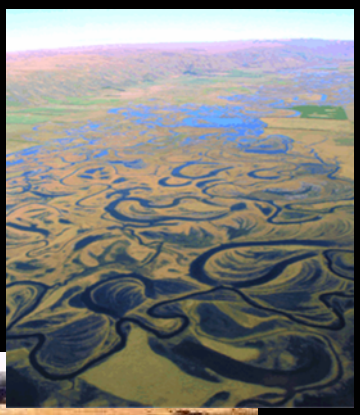

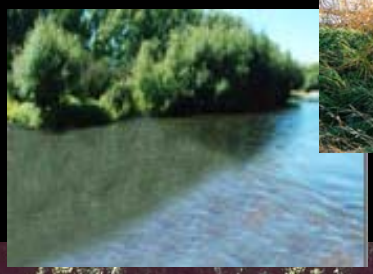

The Taieri Catchment and Community Health Survey

Margot Parkes

2003

Geography and Health Research Report Series

Report Number: 2

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Background:
This report presents and discusses the findings from the Taieri Catchment & Community Health Survey conducted in June 2000. The catchment survey was part of a larger research project known as 'The Taieri Catchment and Community Health Project' (TC&CH Project), a collaborative research project initiated by Dr. Margot Parkes and colleagues at the University of Otago. The survey was developed in consultation with community reference groups who participated in the TC&CH Project.

A more detailed account of the design, findings and implications of this survey, and the TC&CH Project are presented in the author's doctoral thesis:

Parkes M. (2003). *Linking Ecosystems and Social Systems for Health and Sustainability: Public Health Lessons from the Taieri River Catchment.* A thesis submitted for the Degree of Doctor of Philosophy at the University of Otago, Dunedin, New Zealand.

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Further information is also available at the website of the TAIERI Trust*: www.taieri.net.nz
* TAIERI = Taieri Alliance for Information Exchange and River Improvement.

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PREFACE

This is the second publication in the Geography and Health Research Report Series. This Series has been established to mark the formal collaboration between Public Health South and the Department of Geography, University of Otago, in the area of public health research.

In particular, the Series represents a commitment by Public Health South and the Department of Geography not only to undertake academic research into public health issues of mutual interest, but also to support partnerships in health research and to disseminate the results to the wider community. It is hoped that this will result in advancing community and agency understanding of key public and community health issues.

It is with pleasure, therefore, that Public Health South and the Department of Geography launch this next publication of the Health Research Report Series.

Associate Professor Richard Morgan
Head of Department
Department of Geography
University of Otago

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Manager, Health Promotion
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THE TAIERI CATCHMENT AND COMMUNITY HEALTH SURVEY

Margot Parkes

MB. ChB; M. Hum Ecology; PhD

Research completed during the course of doctoral research

under the supervision of the

Department of Public Health and the Department of Geography,

University of Otago, Dunedin, New Zealand.

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Sincere thanks go to my PhD supervisors Dr. Phil Weinstein (Department of Public Health) and Dr. Ruth Panelli (Department of Geography) for their guidance, constructive critique and support in all phases of my research. I am indebted to Clare Salmond for her advice in the design, conduct and analysis of the survey. Special thanks to Robbie Razack for her companionship and practical assistance throughout the design, conduct, data entry, and analysis of the Survey. The support of Rebekah Eyles is especially appreciated– the experience of doctoral research was enhanced by our collaboration throughout the Taieri Catchment and Community Health Project. Thanks also go to George Benwell, Colin Townsend, Simon Hales, Marc Schallenberg and Chris Arbuckle for their encouragement, technical support and sharing of knowledge regarding the Taieri River catchment.

Particular thanks go to Louise Croot who supported this research throughout, and helped facilitate the production of this Survey Report along with her colleagues at Public Health South. I also gratefully acknowledge the New Zealand Health Research Council who supported my work through a 'Training Fellowship' between 1999 and 2001.

Finally, I would like to acknowledge the energy and commitment of all involved in the TAIERI Trust since its inception in 2001. It has been most encouraging seeing the 'Taieri Alliance for Information and Exchange' take on a life of its own (see for example www.taieri.net.nz). The activities of the TAIERI Trust continue to create opportunities for community knowledge and catchment research to be turned into action that fosters the long term health and sustainability of the Taieri River catchment.

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Executive Summary

In June 2000, a random sample of people from throughout the Taieri River catchment area were invited to participate in the 'Taieri Catchment and Community Health Survey'. The survey was conducted by Dr. Margot Parkes from the University of Otago as part of the 'Taieri Catchment and Community Health Project'.

Approximately 500 people from throughout the Taieri catchment participated in the survey. There were similar proportions of male (53%) and female (48%) participants and a wide range of ages (between 18 and 80). Occupations were diverse and included 15% farmers and 20% retired. Of the 33% of participants who owned or leased agricultural land, sheep farming was the most common land-use, followed by cattle farming. Most (85%) had lived in their area for more than 10 years.

Overall, there was a high level of awareness and interest in catchment management and ways in which land and water resources influence health and well being. The survey has provided valuable information regarding the way catchment and community health issues vary according to where people live. Social factors that may influence future community involvement in catchment initiatives were also identified.

There was a fairly high degree of satisfaction with living the Taieri catchment area, and concern regarding both social and environmental issues. Respondents described satisfaction with many aspects of living in the Taieri River catchment, with an emphasis on the natural environment, climate, services, lifestyle, farming and recreation. This suggests that most people would not support changes that would threaten these aspects of their physical or social environment. Although unemployment and need for jobs was the most frequently identified key issue, other themes of concern were spread between social and environmental concerns.

Findings highlighted the importance of health and safety concerns and their relationship with water resources and drinking water supply. The health and safety impact of water resources is experienced differently in different areas of the catchment. About 17% of respondents indicated that exposure or changes to the environment or water resources in the catchment area had affected their physical or mental health. Drinking water supply varied between areas. The overall proportion of 75% on community drinking water supply in the Taieri catchment is slightly lower than the national proportion of 80%. Although there is increased confidence in the upper catchment regarding the safety of water supply, health consequences of drought and water shortage are of greater concern in this area of the catchment. In the lower catchment people's health and well being is more affected by water quality and drought concerns.

The importance and impact of catchment issues varied according to where people lived and was higher for other people than for respondents personally. Several issues received higher ratings from upper catchment respondents (water shortage, loss of population, loss of farm productivity) and some were more important in lower catchment (flooding). Other issues affected rural respondents to a higher degree (weed and pest control and changing climate). The benefit, importance and impact of all issues were rated as higher for other people in the Taieri than for respondents personally. This suggests a high awareness of catchment issues, even when particular issues do not affect individuals themselves, and an appreciation of the need for land and water management at the catchment scale, as well as local initiatives.

There was high recognition of the benefits of freshwater resources, and the importance of land and water management issues. Land and water issues were perceived to be important, both personally and catchment-wide. However, land and

water management issues were not always uppermost in people's minds. This highlights the need to recognise that while people may support land and water management of various kinds, socio-economic issues are also very important to them.

Involvement and interest in local issues was high, but people's sense of responsibility for, and interest in, becoming involved in catchment issues varied. There was strong support for proposals for community involvement in catchment management, and moderate levels of personal and community preparedness to be involved in catchment issues. Despite the high level of interest in Taieri catchment and community issues it appears there are conflicting factors that could hinder community participation in catchment related activities. There is already a high level of community involvement in a variety of group and voluntary activities. There is also variation between areas, with existing community involvement and willingness to be involved both greater among upper catchment respondents.

Participants showed awareness of resource management problems and also described preferences for how these issues could be managed. A spectrum of resource management problems were described including developmental driving forces, pressures on the environment, concerns regarding pollution and overuse, and the importance of natural values. Respondents also described priorities and preferences for how these issues could be addressed, ranging from the principles of sustainability, equity and participation, to highlighting the importance of monitoring, evaluation and specific management activities.

There were areas for improvement regarding the role of agencies & government programmes, and suggestions for future catchment management were made. There was limited awareness of current government programmes and reports regarding the Taieri catchment and its management. This highlights the communication challenge of meeting the apparent level of interest in catchment and community health issue with appropriate and accessible information. Looking ahead, all government agencies were rated higher in terms of their responsibility for the future of the Taieri catchment, compared to their current influence. The Otago Regional Council, District Councils and Department of Conservation had the highest ratings for future influence, in addition to calls for increased cooperation between groups.

There was support for a spectrum of catchment management initiatives as well as indications of opportunities for and obstacles to achieving catchment goals. Responses showed support for a variety of catchment management initiatives, an awareness of opportunities to address catchment issues and identified barriers and impediments to change. Specific questions and open-ended responses highlighted that addressing catchment management challenges will requires a range of stakeholders to be involved (individual landholders, local residents, government, and 'everybody that has the knowledge'). This was linked to the need for human and financial resources and incentives, as well as attention to the management priorities identified by survey respondents, such as equity, co-operation, communication and local community participation.

The survey has provided valuable information that was not previously available for the Taieri River catchment. New insights have been gained regarding community awareness and understanding of catchment management issues. The findings identify priorities and principles for future management as well as pointing to the potential role that local communities and individuals can contribute to catchment initiatives. The survey findings will contribute to ongoing communication between communities, researchers and agencies working throughout the region. The survey is also an important part of the Taieri Catchment and Community Health Project. Dr. Parkes would like to reiterate her sincere thanks to all who took the time to participate in her PhD research.

1 INTRODUCTION

This report presents and discusses the findings from the Taieri Catchment & Community Health Survey (TS&CH Survey). The survey gathered information regarding personal experiences, priorities and concerns regarding catchment and community health issues from people living in Taieri River catchment area, Otago, New Zealand. The Taieri Catchment includes all of the 5650km^2 area that drains the Taieri River and its tributaries and is host to a population of approximately 18,000 people.

Public health issues of concern in the Taieri River catchment reflect those experienced throughout the country in relation to freshwater resources. Key issues include water-related disease and the interactions between rural development, ecological sustainability and the socio-economic determinants of health. The Taieri Catchment and Community Health Survey examined these interactions within the Taieri River catchment, through the perspectives and insights of people who live their lives within the catchment.

The catchment survey was part of a larger research project known as 'The Taieri Catchment and Community Health Project'(TC&CH Project), a collaborative research project involving two doctoral studies and research colleagues from the University of Otago (Parkes and Panelli, 2001; Parkes et al. 2003; Eyles et al. 2003; Parkes et al, in press). The survey was developed in consultation with community reference groups who participated in the TC&CH Project. The survey provided one means to respond to reference group interest in the views and opinions about catchment and community health issues held by catchment residents throughout the catchment, concerns regarding lack of understanding of community concerns in the catchment as whole, and the need to consider and value community insights, along with research and agency knowledge.

Based on this input, the specific objectives of the TC&CH Survey were as follows:

i. To examine the knowledge, experience and concerns of Taieri catchment residents in relation to land and water (catchment) management and related public health issues;
ii. To assess whether and how lived experiences and concerns regarding catchment and community health issues vary according to where people live;
iii. To identify social features and processes that may influence the implementation of community-based catchment management as part of the response to water-related community health issues in the Taieri river catchment;
iv. To provide a point of reference by which future decision-making regarding catchment management in the Taieri River catchment can be assessed in the future (including providing a potential benchmark for comparison with future catchment surveys).

This report provides an accessible overview of the survey context, design and findings regarding the health, safety and sustainability concerns in the Taieri River catchment. The report complements the more detailed account of the survey design and findings presented in the author's doctoral thesis (Parkes 2003 – see especially Chapter 6)[1]. An overview of the context and design of the survey is provided in Section 2, including a brief overview of catchment and community health issues, an introduction to the local context of the survey and the methods used to conduct it. In Section 3 the survey findings are presented and discussed, outlining the demographic characteristics of the survey participants, and the survey results highlighting key environmental, social, health and sustainability themes emerging from the study. Section 4 presents Conclusions and Recommendations.

[1] The author's doctoral thesis can be accessed at University of Otago Library. Specific information and papers relating to the thesis are also available on the website of the TAIERI Trust: www.taieri.co.nz.

2 CONTEXT AND DESIGN: SURVEYING CATCHMENT AND COMMUNITY HEALTH

This section sets the scene for the results of the survey provided in Section 3. First, 'catchment and community health issues' are described in relation to the Prism Framework for Health and Sustainability. The Taieri Catchment and Community Health Project (TC&CH Project) is then introduced, providing background to the methods for conducting and analysing the survey.

2.1 What are catchment and community health issues?

River catchments (or watersheds) provide an appropriate scale to study the relationships between freshwater resources, health and sustainability. River catchments come reasonably close to what might be considered an idealized ecosystem – they are functionally distinct hydrologic units in which the water cycle (and associated quality and quantity) is a key driver of ecosystem processes, structure and function (Baron et al. 2002). Furthermore river catchments often correspond to human settlement patterns and political boundaries that both scientists and lay people can easily relate to. There is also increasing evidence that the complex, multi-stakeholder challenges of freshwater management are most successfully addressed at the scale of river catchments (McGinnis et al. 1999; Mullen and Allison 1999; CWAP 2000; Ewing et al. 2000; Wagner et al. 2002; Moore and Koontz 2003). Studying the relationship between fresh water resources and human health in a river catchment is therefore important for both understanding – and responding to –catchment and community health issues.

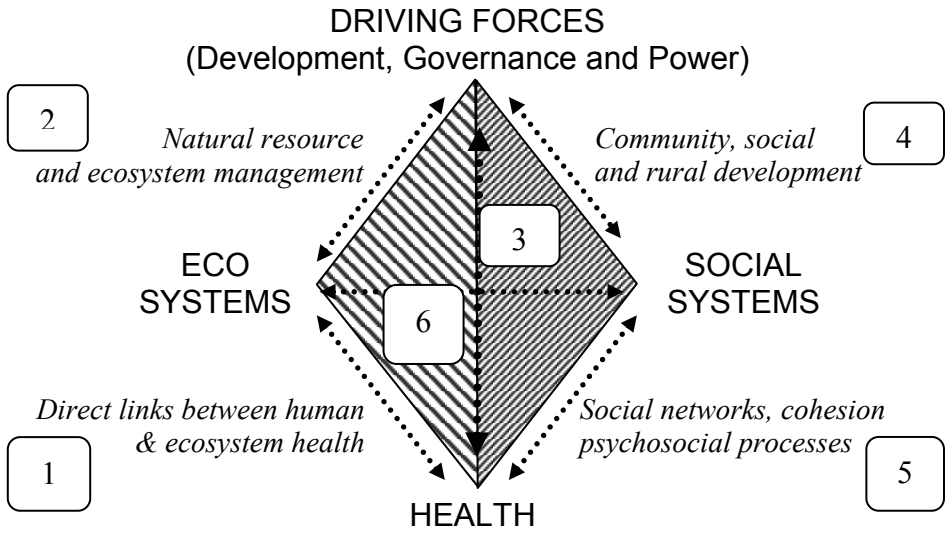
The Prism Framework (Figure 1) was developed in parallel to research in the TC&CH Project to depict the interactions between freshwater resources, health and sustainability concerns within a river catchment in an integrated way (see Parkes 2003; Parkes et al. 2003). The Prism Framework in Figure 1 depicts development, governance and power as drivers of both ecosystem and social change, with converging implications for both the environmental and socio-economic determinants of health. Informed by these interrelationships between driving forces, ecosystems, social systems and health, catchment and community health issues can be described in several ways. For example, the health impact of freshwater ecosystem change can be both:

- **direct:** generally associated with risks and hazards from the direct exposure to the physical environment – requires understanding of ecosystem services required to water and sanitation and the ecological determinants of water-related disease.
- **indirect:** generally associated with the 'side-effects' of ecosystem disruption influencing the socio-economic determinants of individual and population health.

Furthermore, the Prism Framework illustrates that changes to ecosystems and social systems at the catchment scale influence both the environmental and socio-economic determinants of health. These influences are the result of disruption to:

- **living systems (**or life-support systems, resulting in microbiological or chemical contamination/pollution of ecosystems and disruption to ecosystem services).
- **livelihoods** (disruption of capacity to 'earn a living' from ecosystem-dependent industries, especially agriculture, food production, tourism. Closely linked with concepts of sustainable communities and livelihoods).
- **lifestyles** (includes, quality of life, identity, sense of place and recreational benefits).

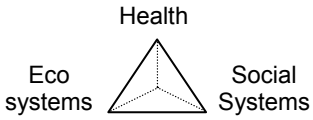
The Prism Framework illustrates health and sustainability interactions as ***six interacting axes***



1. Direct links between human & ecosystem health (traditional environmental health)
2. Natural resource and ecosystem management (including land and water use)
3. Health services and Infrastructure (includes water and sanitation services)
4. Community & social development (includes socioeconomic determinants of health)
5. Social networks, cohesion, health promotion, education (includes social capital)
6. Linked socio-ecological systems (social processes that generate health benefits through empowerment, justice and social cohesion as well as enhancing ecosystems create synergies between the environmental and socio-economic determinants of health).

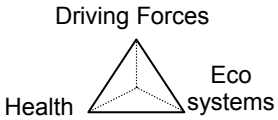
The three-dimensional framework also depicts ***four 'views'*** *or perspectives* from which to understand catchment and community health issues.

I *Linked socio-ecological systems as the foundation for health*



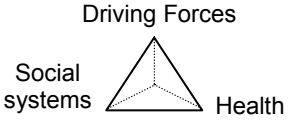
Healthy lifestyles, livelihoods, living systems

II. *'Environment and Health'*



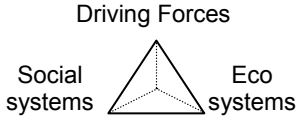
Physical environment and catchment ecosystem services

III. *'Society and Health'*



Social environment and community involvement within the catchment

IV. *Human dimensions of health and sustainability*



Addressing the driving forces of catchment and community health issues

Figure 1 The Prism Framework for Health and Sustainability[2]

[2] Development of the Prism Framework and its application to addressing health and sustainability issues is described and discussed in detail in the author's doctoral thesis (Parkes 2003) as well as in published papers and book chapters (Parkes and Panelli, 2001; Parkes et al, 2003; Parkes and Weinstein, in press).

2.2 The Taieri Catchment and Community Health Project

The 'Taieri Catchment & Community Health Project' (TC&CH Project) studied the interactions illustrated in Figure 1 in the context of the Taieri River catchment. Figures 2 and 3 provide a visual introduction to the Taieri River catchment and background to catchment and community health issues studies in the TC&CH Project.[3]

Figure 2 depicts the natural topography of the catchment, showing the origins of the Taieri River in the dry range and basin landscapes of Central Otago and its route through three intermontane plains including the important agricultural floodplains of the Maniototo, Strath Taieri and Taieri plains. The river drains a catchment area of 5650km^2. While the dry landscapes in the upper catchment mean the Taieri is a low-volume river prone to drought, the fertile floodplains also indicate its capacity for flooding in low lying areas (Otago Regional Council 1991; Otago Regional Council 1999). Having been an important source of food for Māori in pre-European times (Tipa 1999), the catchment has undergone considerable change in water and land-use over the past 150 years.

Key settlements and governance boundaries are depicted in Figure 3, showing the catchment's proximity to the City of Dunedin (population ~ 110, 000). In the 2001 census (conducted the year following the survey), the Taieri catchment was host to a population of 17,718 people (Statistics New Zealand 2001a). Around a third of the population lived in the urban are of Mosgiel (6345), another third in the rural areas and settlements of Taieri Plain (5736) and another third within the upper catchment, including the Strath Taieri and Maniototo Plain. Figure 3 also shows that the catchment is divided between the jurisdiction of four Territorial Local Authorities and the Otago Regional Council.

Currently, farming, including sheep, dairy, cattle, deer farming, cropping, market gardening and forestry dominate land use in the Taieri catchment and reflect national trends toward intensification of agriculture and forestry (Ministry for the Environment 1997; Otago Regional Council 1999; Tong and Cox 2000). Other (native) forest, residential, wetland, and conservation land uses occur in smaller areas of the catchment (Otago Regional Council 1991; Otago Regional Council 1999). High ecological and conservation values relate to native tussock grassland habitats, extensive upland scroll-plains, coastal wetlands and rare native fish and insect species. The catchment provides freshwater ecosystem services for irrigation, municipal water supplies, hydroelectricity, mining and many recreational uses (Otago Regional Council, 1999).

The Taieri catchment was chosen as a case study to examine catchment and community health issues for three key reasons. Firstly, the extensive history of biophysical research undertaken in the Taieri River and catchment, make it one of the most intensively researched river catchments in New Zealand (TSRP 1994 -1999; Hamel 1998; Tipa 2003; Townsend and Riley 1999), reflecting in part its proximity to the University of Otago in Dunedin. Second, the catchment's history of rapid environmental and social change is characteristic of most New Zealand Rivers (Ministry for the Environment 1999; Tong and Cox 2000) and exemplifies the challenges of integrated water resource management in New Zealand River catchments (Bowden 1999).Third, public health concerns relating to land-use change; water resource management and rural water supplies in New Zealand (Duncanson et al. 2000; Mills 2002; Poore 2003) are all topical issues in the Taieri.

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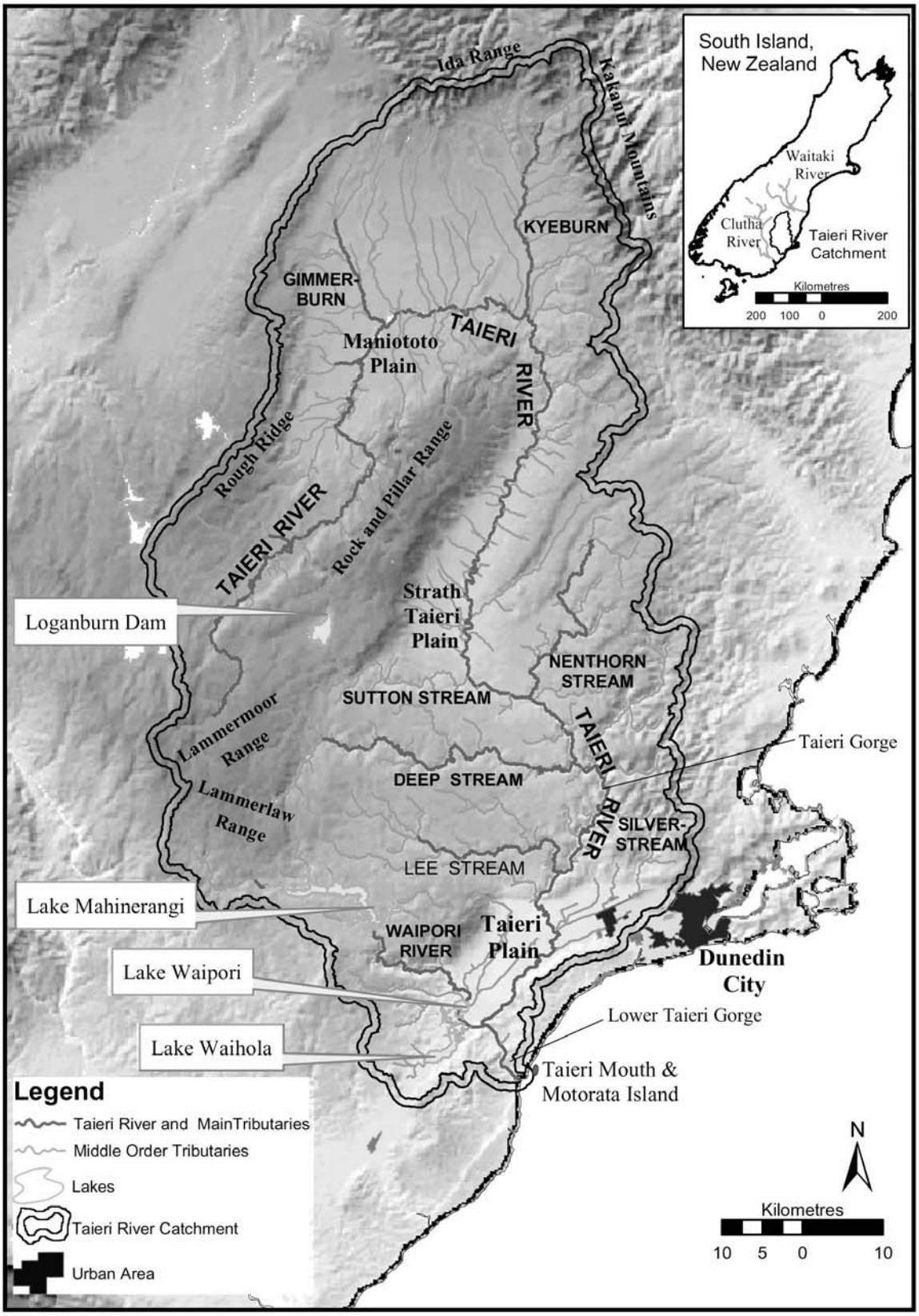
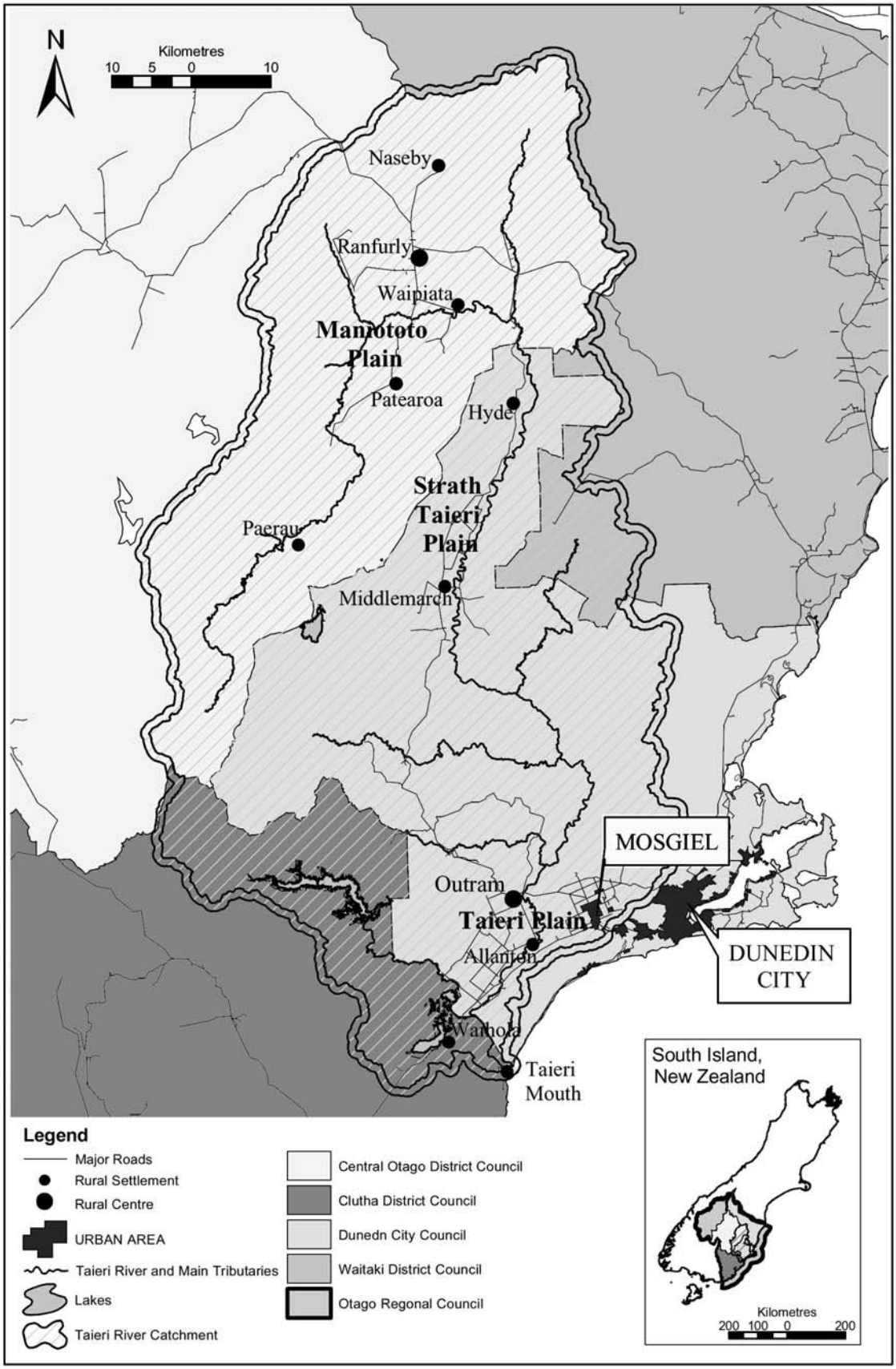
[3] Additional colour maps produced for the TC&CH Project are available in authors doctoral thesis (Parkes 2003) and in the paper by Parkes et al. (in press) – freely available for viewing online at: www.wepi.org/jrreh/

Figure 2 The Taieri River Catchment:
natural topography



Note: Catchment Area = 5650 square kilometres

Figure 3 The Taieri River Catchment:
settlements, governance boundaries and main roads.



Note: Based on 2001 Census, the Taieri River catchment population was estimated at 17,718 (Statistics New Zealand, 2001)

To study the interacting catchment and community health issues outlined in Figure 1, the TC&CH Project undertook a range of collaborative research initiatives, including biophysical and participatory studies. The biophysical component of the project focussed on a multi-disciplinary study investigating the ecology of the human pathogen *Campylobacter* in an aquatic ecosystem (Eyles et al. in press). The Participatory component of the TC&CH Project involved community reference groups and co-researchers in selected collaborative research initiatives, ranging from a series of community catchment meetings, to the catchment survey, the establishment of a community–university partnership, and the evolution of an externally funded multi-stakeholder community catchment forum (Parkes and Panelli 2001; Parkes 2003; TAIERI 2003; Parkes and Weinstein in press).

Through participatory research with community reference groups in the TC&CH project (March 2000 to June 2001), it was found that local community knowledge of catchment and community health issues is less accessible and recognised when compared with knowledge of researchers and agencies. The prompt for the survey was therefore the relative lack of information regarding community understanding of catchment and community health issues when compared to the abundance of specialised, scientific and strategic knowledge in the Taieri Catchment. The community collaboration and contributions to the development of the survey is outlined in detail in Parkes (2003), as are the participatory processes that enabled interim survey findings to be fed back to reference groups as they became available. Parkes (2003) also provides a detailed timeline of the development, design and analysis of the survey.

2.3 Survey Methods

By collecting data from individual catchment residents, the survey complemented findings gained from participatory research conducted 'community reference groups' around the Taieri river catchment between. Design of the survey was based on comparable catchment-based community surveys with an explicit emphasis on freshwater ecosystems and land and water management (McCreddin and Syme 1999). The survey's interest in the interactions between health, ecosystems and social systems also reflect themes in other surveys that examine health and sustainability in rural communities, in relation to the physical environment (Robson and Schneider 2001); quality of life (Garrison 1998) and contribution of both the social quality of community life and physical environments (Molinari et al. 1998).

The questionnaire was designed to collect descriptive date about catchment and community health concerns throughout the catchment and differences in these findings according to where people lived, rather than causal relationships between these factors. In order to be able to make comparisons between different areas of the catchment it was necessary to make the sample size as large as possible. A mailed self-administered questionnaire was chosen as a means of administration to achieve the required sample size and to provided good protection of anonymity (Dillman 1978; Alreck and Settle 1995; Davidson and Tolich 1999).

Sampling frame, sample size and catchment comparisons

The sample size for the TC&CH Survey was estimated to ensure adequate power to detect specified differences between catchment areas, while staying within the given resource constraints (human, financial and time) of the research. Catchment variations

of interest were informed by the social, ecological and geographical variations throughout the catchment. Since catchment variations are most striking between the upper and lower catchment (Otago Regional Council 1999; Townsend and Riley 1999) this was the catchment variation of primary concern when calculating sample size.

The New Zealand electoral roll was chosen as the overall sampling frame for the TC&CH Survey. The sampling frame was creating by pooling data from all age groups between 18 and 85 on the electoral roll in the four Territorial Local Authorities that overlap the Taieri Catchment area. A random sample was selected from the target population of individuals on the electoral roll living within the Taieri Catchment boundary. Spatial sampling in rural areas was enabled by dividing upper and lower sub-catchment populations into urban/rural sub-categories to ensure proportional sampling. Appendix B summarises the characteristics of the TC&CH Survey sampling frame and the survey sample.

Sample size was determined to satisfy three criteria. First, to provide adequate precision for estimates of proportions. Second to provide adequate power to compare variables between catchment areas. Third, to provide a sample size as large as possible while still being financially affordable within given resource constraints. The chosen sample size of 1324 fits these criteria. The sample allows proportions of 50% to be estimated within 95% confidence intervals of ±7%. The study had 80% power to detect changes in proportions of 50% or more on base proportions of 20-67% i.e. covering a substantial potential range in observed proportions (Documenta Geigy 1962).

Spatial distribution of the sample was achieved by proportionally sampling in 'rural areas' as distinct from 'rural centres' or 'urban' areas in both upper and lower catchment. For analysis of catchment differences, the catchment was divided into three catchment areas (upper catchment, lower rural and lower urban), based on the distribution of population distribution throughout the catchment. No rural/urban distinction was made for the upper catchment since there are no meshblocks in the upper catchment that are classified as urban areas under international definitions (Statistics New Zealand 2001b). The rationale for statistical analysis of responses comparing three catchment areas is detailed in Parkes (2003).

Design of questionnaire

Most of the themes and questions in the TC&CH Survey were drawn from relevant catchment or public health surveys relating to similar themes (see copy of TC&CH Survey Questionnaire, Appendix A). Figure 4 presents the overall analytical framework for the survey, and groups the survey questions and themes accordingly. The analytical framework for the TC&CH Survey reflects the variation of attitudes and perceptions according to where people live in the catchment.

Many of the questions relating to land and water issues were adapted to the Taieri Catchment and New Zealand context from the comprehensive community catchment survey developed in the Herbert River Catchment (Queensland, Australia) and conducted by CSIRO Tropical Agriculture (Bellamy 1999; Butterworth et al. 1999; McCreddin and Syme 1999). Notable examples of these adaptations include Q5–10, Q14, Q16–18 and Q19. While the Herbert River Study has a similar population to the Taieri (~18, 000 people), the distribution of population between location (upper and lower) and land use (rural and urban areas) of the Taieri catchment is different. The high proportion of the Taieri population living in the lower catchment required adaptation of the sample size accordingly.

Demographic and health related questions reflect the style used in relevant Public Health Questionnaires and the New Zealand Census (Ware and Sherbourne 1992; Statistics New Zealand 1996; Ministry of Health 1999). Other New Zealand-based questionnaires with themes and emphasis pertinent to development of the TC&CH Survey include the New Zealand Values Survey (Massey University 1996), and the 'Social Capital' and 'Housing & Health Project' by the Department of Public Health, University of Otago (Howden-Chapman and Martin, *personal communication*).

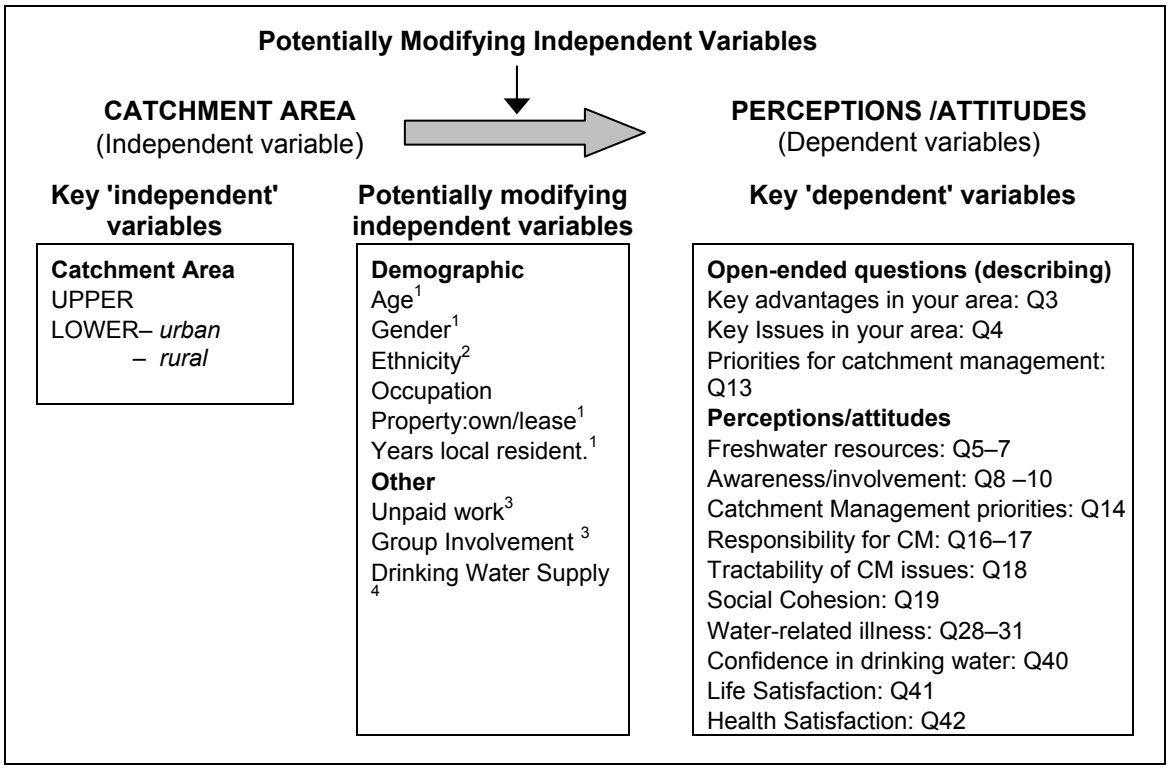


Figure 4 Analytical framework of the TC&CH Survey

Notes: [1] Potentially modifying variables for stratified analysis in all Likert scale questions
[2] Ethnicity – Not used for stratified analysis since numbers were too small
[3] Unpaid work and Group Involvement – potentially modifying variable for stratified analysis in questions regarding community-based involvement in catchment management only
[4] Drinking Water Supply- potentially modifying variable for stratified analysis in questions regarding water quality and drinking water supply

Statistical and qualitative analysis

Non-parametric statistical tests were used to examine differences in dependent variables (perceptions and attitudes) according to the three catchment areas (upper catchment, lower rural and lower urban). The rationale for the choice of catchment divisions and the non parametric statistical analysis used (Kruskal–Wallis test and Wilcoxon or 'Mann–Whitney *U'* tests) is presented in the author's doctoral thesis (Parkes 2003), along with statistical tests for all results (including those presented in Figures 6-10). Statistical analysis was undertaken using Epi Info 6 and SAS Release 8.00©. All percentages are reported to 1decimal place.

Qualitative data analysis and interpretation of open-ended questions (Q3, 4, and 13) was conducted using manual and electronic coding and grouping. Electronic analysis was conducted using Filemaker Pro 5.0v3 (© 1984-2000 Filemaker, Inc). When presented, respondent comments are associated with three respondent characteristics: the catchment area in which they live, their gender and years lived in the area. These were considered appropriate, non-identifying details to associate with participants' quotes.

3 RESULTS: CATCHMENT AND COMMUNITY HEALTH ISSUES IN THE TAIERI

The survey generated a range of findings regarding community perceptions, concerns and priorities for catchment and community health issues. Figure 5 provides a guide to the survey findings in relation to the Prism Framework, and illustrates that the results are grouped according to themes rather than in the order that the questions were given to the respondents in the questionnaire.

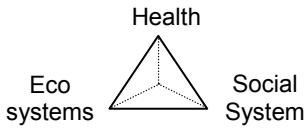
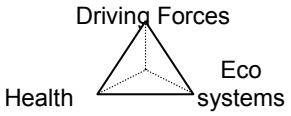
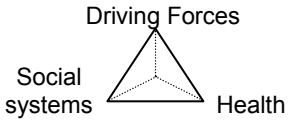
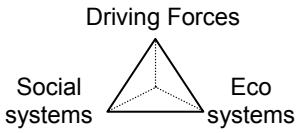
Results Section	Key lessons about catchment and community health	Prism 'View' on Health and Sustainability (Figure 1)
3.1 The people of the survey -Who participated in the survey?	This section provides an overview of the 'people' behind the health and sustainability themes in the Taieri Catchment and Community Health Survey.	
3.2 Life in the Taieri Catchment - Issues and advantages -Healthy lifestyles, living systems, livelihoods - Health and safety issues	The lives, health and security of those who live in the Taieri reflect interactions between physical and social environment. *Healthy lifestyles, livelihoods, living systems*	
3.3 The physical environment: Freshwater resources and catchment ecosystem services - Impact and importance - Differences in the perceived relevance of catchment issues - Benefits from freshwater resources and urgency of catchment issues	The physical catchment environment (and its ecosystems) has a far reaching importance, impact and benefits for those who live in the catchment *'A healthy environment' **	
3.4 The social environment: involvement in local and catchment issues - Sense of community and voluntary activity - Involvement and interest in catchment issues	People's willingness to get involved in local community issues reflects their sense of community, and is influenced by where they live in the catchment *'A caring community… **	
3.5 Addressing the driving forces of catchment and community health challenges - Priorities for water resources infrastructure and governance - Addressing catchment management challenges - Support for catchment initiatives	Catchment residents have a sophisticated understanding of priorities and principles for future catchment management, and the role communities and individuals can contribute to catchment initiatives. *'… and excellent services' **	

Figure 5 A guide to survey results and catchment and community health issues

Note: *These 'catch phrases' are taken from a survey participants answer to Q3 *"What are the major advantages of living on your area of the Taieri River Catchment?"*. The response to this question was "A healthy environment, a caring community, excellent services" (upper catchment, male, local resident 43 years).

3.1 Who participated in the survey?

A total of 496 surveys were returned from the 1324 surveys mailed, yielding an overall response rate of 37.5% (Table 1). Of the 496 participants in the survey 47.6% were female; 26.0% were over 65 years old and 19.8% were retired. Most respondents (71.4%) had lived in their area of the catchment for more than 10 years. Approximately one third (33%) of participants owned agricultural property and 16.8% identified their occupation as farmers.

The first part of Table 1(a) provides a summary of respondent characteristics by catchment area. When compared against findings in the 2001 Census, the survey respondents were found to be generally representative of the demographics of the Otago area with the exception of Māori. The proportion of respondents who identified as New Zealand Māori in Q23 (3.0%) is less than the estimation of the proportion of Māori in the Taieri catchment (5.3%) and for New Zealand as a whole (14.7%) for the 2001 census. Due to the small numbers involved, this variable was not included as an independent modifying variable for analysis.

Table 1 TC&CH Survey response rate and participants

1(a) Characteristics of respondent by catchment area

Potentially modifying variables	**Age (Q21; n=496)**		**Gender (Q22; n=487)**		**Occupation= farmer (Q25; n=482)**		**Years in area (Q32; n=486)**		**Property ownership (Q34; n=481)**		**Total (n=496)**
	<65 years	>65 years	Female	Male	Yes	No	<10 years	>10 years	Yes	No	**%**
Upper*	78.2	21.8	53.5	46.5	41.2	58.8	22.6	77.4	62.7	37.4	**17.5**
lower rural*	85.2	14.8	45.6	54.4	30.4	69.6	29.0	71.0	58.4	41.6	**25.8**
lower urban*	67.6	32.4	46.7	53.3	2.9	97.1	30.2	69.8	11.4	88.6	**56.7**
Total*	74.0	26.1[1]	47.6	52.4	16.8[2]	83.2	28.6	71.4	32.4	67.6	**100.0**

1 (b) Response rate for TC&CH Survey by catchment area

	Total Population (sample frame)	**Total Surveys sent** (sample size)		**Total Responses** (by catchment area)		**Response Rate**
Catchment area		N	%	n	%	%
upper	1677	184	13.9	87	17.5	47.3
lower rural	1962	215	16.3	128	28.8	59.2
lower urban	8404	924	69.8	281	56.6	30.4
TOTAL	**12043**	**1324**	**100**	**496**[3]	**100.0**	**37.5**[4]

Notes: 1. Population over 65 years: Taieri Catchment: 13.3%; New Zealand 12.1% (Census 2001)

2. Occupation agricultural/fishery worker: Taieri Catchment: 15.6%; New Zealand 8.0% (Census 2001)

3. An omission error resulted in only 148 responses to Question 42. Accordingly, the power of statistical tests to assess catchment differences for Question 42 (N=148) are reduced.

4. The overall response rate of 37.5% is lower that anticipated, resulting in non-response bias that reduces the power of statistical tests used (Baum, 1998), and the extent to which the findings can be generalised. Issues relating to the TC&CH Survey response rate are outlined in Appendix C.

The second part of Table 1(b) shows that the level of participation in the survey varied according to where people lived in the catchment with response rates of 47.3% from the upper catchment, 59.2% from lower rural and 30.4% from the lower urban area. The increased response rate in rural catchment areas highlights a potential bias toward rural responses. Other issues relating to the overall response rate are detailed in Appendix C.

3.2 Life in the Taieri River catchment

Questions early in survey allowed respondents to share open-ended and general impressions of life in the Taieri catchment (Q3 and Q4). These responses offer evocative detail regarding priorities and concerns for those living in the Taieri catchment.

Issues and advantages of life in the Taieri

There was a fairly high degree of satisfaction with living in the Taieri catchment area in response to Q3 ('*What do you think are the major advantages of living in your area the Taieri River catchment'*), along with concerns regarding both social and environmental issues outlined in Q4 ('*What do you think are the key issues facing people in your area').* Table 2 provides a summary of the themes raised in Q3 and 4 and enables comparisons of advantages and issues.

Table 2 Key advantages and issues of living in the Taieri (Q3 and Q4)

Advantages of the Taieri Catchment. Responses to Q3, describe:	**% of total responses** (n= 431)
-Landscape and physical environment (open spaces, beauty, hills, nature)	32.9
-Good climate (desirable sun, wind, rain patterns for lifestyle or farming)	27.8
-Safety, quality and health of environment (clean, safe, healthy living)	27.6
-Water resources (drinking water, lakes, river, irrigation, streams)	26.2
-Proximity (access to amenities in nearby towns and centres e.g. Dunedin)	24.8
-'Rural' Lifestyle (quality of life, peace, quiet, unhurried, tranquil)	22.5
-Recreational opportunities (swimming, boating, fish and game hunting)	20.6
-Services and Facilities (medical services, schools, banks, retail, library)	15.3
-Community and family life (friendly atmosphere, safe, organisations, events)	14.4
-Rural atmosphere (rural or country life)	13.9
-Good environment for farming (good soil, stock water)	8.8
-Good infrastructure (water supply, road access)	8.1
-Far enough away (from city, urban stress, big populations)	6.3
-Socio-economic factors (jobs, good cheap housing)	4.9
-Conservation values (abundant wildlife, unspoiled, native flora and fauna)	4.2
Key Issues in the Taieri Catchment Responses to Q4 describe	**% of total responses** (n= 425)
-Need for employment and jobs	35.5
-Traffic, transport and roading issues	13.4
-Pollution (including water quality issues)	12.9
-Loss of population, 'rural downturn'	10.4
-Need for new industry (including appropriate, unpolluting development)	10.1
-Services (health, education, community facilities)	9.6
-Shops and retail services (ongoing provision, closing down)	8.0
-Flooding and flood control	7.1
-Lack of opportunities for young people	6.8
-Air pollution and smog	5.9
-Decision making processes and specific agencies, local organisation.	3.5
-Natural resource infrastructure (sewerage, drainage, flood banks)	3.3
-Water supply (including drinking water)	2.8

Note: Total is more than 100% since some responses covered several categories

The findings from Q3 and 4 also supported each other. For example, the fact that 35.5% of respondents identified the theme of employment as a key 'issue' in Q4, is consistent with the small proportion of respondents (4.9%) who indicated that employment opportunities and socio-economic factors were a major 'advantage' in Q3. The following comment exemplifies this.

> *Gradual whittling away of essential services particularly health services. Loss of population, employment opportunities, businesses unable to keep going* (Q4; upper catchment, female, local resident for 10 years).

Combined descriptions of advantages and key issues were common, such as the following comments regarding issues and advantages of maintaining the quality of the environment.

> *Effective drainage and flood prevention. Unpolluted water in our rivers (i.e.-no rubbish, industrial waste placed in them) - so that humans and wildlife can use rivers safely* (Q13; lower urban, female local resident 8 years).

The themes of 'a good clean healthy environment' (Q3, upper catchment, female local resident 78 years) is reflected in the 27.6% of respondents who raised concerns regarding quality and safety issues in their responses to Q4 (Table 2). These concerns are indicated by comments such as 'Not one person I know in Allanton will swim or take children into the river'. The benefits of and threats to a clean healthy environment are especially important for those depend on the water resource for domestic, industrial and recreational use

> *Drinking water supply. Water for farming and industrial needs and control of flooding. Water for recreation-hunting, fishing, boating, swimming, beauty* (Q13; lower urban, female, lived in catchment 32 years).

Overall, respondents described satisfaction with many aspects of living in the Taieri River catchment, with an emphasis on the natural environment, climate, services, lifestyle, farming and recreation. This suggests that most people would not support changes that would threaten these aspects of their physical or social environment. Although unemployment and need for jobs was the key issue identified, other themes of concern were spread between social and environmental concerns.

Healthy lifestyles, living systems, livelihoods

Beyond the categories in Table 2, individual comments emphasised interactions between the social and physical environment. The following comment illustrates the appealing social and physical characteristics of the of the Taieri catchment in terms of lifestyle, livelihoods and living systems.

> *Peace and quiet, able to farm. Good place to bring up children. Relatively crime free. Beautiful scenery. Unpolluted. Friendly community. Able to get to Dunedin and Alexandra fairly easily* (Q3; upper catchment, female, local resident 10 years).

Descriptions of lifestyle benefits were often specifically linked to living systems in terms of natural habitats for wildlife, feeding grounds, the quality of water necessary to maintain flora and fauna, as well as ensure the safety of recreational contact, as indicated by this comment

> *Hunting and fishing, long walks in the forestry soaking up history and stories from the surrounding environs. Peaceful environment to write, study in, etc,* (Q13; lower rural catchment, male, local resident 7 years).

Similar, integrated ideas of lifestyle, living systems and livelihoods are repeated here

Climate - as it is warmer than the areas closer to the coast. Close to the river - as the Glen has some good recreational swimming. The farmlands- as we are able to go camping near the river and fishing (Q3; lower rural, male, local resident 18 years).

These interactions are also expressed in terms of health and safety concerns relating to fish catch and seafood – especially important for those with cultural attachment to the river.

Mauri (life-force) of the Taieri River. Moturata [Taieri Island]. Taieri beach, spending time recreationally, culturally, (kai moana), for our emotional and spiritual well-being. People live in Taieri mouth for the river and the beach, so issues for us are a clean river we can swim and harvest food from. A clean river also means a clean beach and shellfish beds (Q4; lower rural, female, local resident 16years).

The open-ended comments also describe the links between catchment ecosystems and natural resources as the foundation for rural and farming 'livelihoods'. Descriptions of 'a healthy farming area' and 'living on fertile land with a source of good quality water' highlight advantages of living in the Taieri catchment area in relation to ecosystem services – providing a fertile and productive basis for rural livelihoods. Lists of catchment priorities for catchment management (Q13) highlight awareness of the driving forces and processes of ecosystem change threatening the quality and quantity of catchment 'living systems' – and consequently livelihood and lifestyle benefits that people enjoy.

1. keeping our water clean
2. erosion from hills and off land filling up water ways and lake
3. weed problems in lake and willows clogging up water ways
4. maintaining habitat for wildlife while catering for increase in population and recreational use of river and lake
5. nitrogen run-off from farms (Q13 lower rural, female, local resident for 24 years).

Lifestyle and the livelihood attractions were also important motivations for the 139 respondents who indicated they had moved to the Taieri catchment within the last 10 years (Q32). Of those who provided reasons for their move, the dominant motivations were lifestyle (44.8%), family or spouse related (26.0%); employment related (21.2%) and farming related (13.6%).

Health and safety issues

Survey findings highlighted the importance of health and safety concerns and their relationship with both the quality and quantity of water resources and drinking water supply. In addition to the comments in Table 2, specific questions focused on how and when the physical environment influences the health of catchment residents (Q28, Q30 and Q31). Detailed analysis of these three questions, including estimates of direct and indirect health effects of freshwater ecosystem change can be found in Parkes (2003).

An overall estimate of indirect and direct health effects of freshwater resources for catchment residents was estimated by pooling responses from Q28, Q30 and Q31. Of the 487 responding to these three questions, 17.2 % of respondents indicated direct or indirect health effects relating to freshwater resources. This pooled estimate includes personal/family experience of water-related illness (Q28, Q30) and physical or mental health effects from contact with water resources / changes to the environment (Q31). An explanation of reported direct and indirect health effects was sought in Q31.

Of those who identified health impacts of the changing environment, around a third described that their health had been affected by the impact of drought (29.0%) or floods (31.2%). These impacts are exemplified by the following comment:

> *'Drought affected our stock. We don't like seeing stock suffering. Mental health affected by flooding on farm property'* (lower rural, female, local resident 10 years).

Upper catchment respondents reported significantly higher proportions of indirect health effects. This is consistent with the high profile of water quantity (especially drought) concerns in the upper catchment – with combined physical and mental health effects of drought highlighted by the following comment:

> *'Drought causes ongoing farming problems and to some extent affects physical and mental health -extra work and worry'* (upper catchment, female, local resident 40years).

Drinking water supply is an important source of direct impacts on health and was noted to be a high profile issues in the findings summarised in Table 2. Overall, 73.6% of the population indicated they were on a community drinking water supply, and 26.4% received their drinking water from an individual supply (rain, stream or bore water source) or a private scheme. This compares with ~ 80% on registered community supplies in NZ overall. Water supply varied according to where people lived in the catchment, with 95.6% on community supply in the lower urban catchment compared to 54.5% in the lower rural area and 41.4% in the upper catchment. As well as having a lower percentage receiving community drinking water supplies in the upper catchment, respondents from the upper catchment indicated greater confidence in their water supply and less negative impact from poor water quality. The results of statistical analysis regarding perceptions of drinking water and water supply are available in Parkes (2003).

While responses to Q40 showed that drinking water was generally considered safe (Q40), confidence in the safety of drinking water supply was significantly higher for upper catchment than for other areas. Respondents also highlighted tensions between the convenience of community drinking water supply and concerns regarding the quality of these supplies.

> *Town water supply- quality may not be as "natural" as tank/bore but constant supply is a bonus* (Q13; lower urban, female, local resident 6years).

Catchment differences were also noted in the assessment of self-rated health status provided a specific sense of respondent health and well-being. Of the 148 responses to this question, 90.5% rated their health as good, very good or excellent, whereas 58.8% rated their health as very good or excellent. This latter proportion was 83.3% of the 18 upper catchment responses; 62.5% of the 48 responses from the lower rural catchment; and 51.2% of the 82 respondents from the lower urban catchment. Catchment variations in self rated health were not statistically significant since, as noted Table 1 an omission error resulted in lower responses rate for Q42 (n = 148), and reduced power of statistical tests to assess catchment differences.

3.3 The physical environment: Freshwater resources and catchment ecosystem services

This section draws together findings regarding the profile of different catchment and community health issues in the Taieri, and emphasises variations in findings across the catchment. The importance and impact of freshwater resources and catchment issues were assessed in Q6 and Q7. Figures 6 and 7 provide a visual summary of the findings from these questions and a point of reference to discuss the way in which perceptions of catchment and community health issues varied according to where people lived. Detailed statistical findings relating to Figures 6 and 7, including significant catchment differences, and different ratings for self vs. others are available in Parkes (2003).

Importance and impact of catchment issues

In Figure 6, findings regarding the importance of ten catchment issues in Q6 are presented. Based on importance ratings, agreement between self and others and significant catchment differences, issues are categorised as *'high profile'*, *'catchment wide'* and *'location specific'*.

Water quality problems and drought/water shortages were found to be *'high profile'* with high personal importance, relatively high agreement between ratings for self and importance to others, and significant differences in importance according to where people lived in the catchment. Water quality problems were most important for lower urban respondents and water shortages more important in the upper catchment. The high level of concerns expressed by survey participants regarding the importance and impact of water quality and quantity issues are consistent with issues raised in national and international literature. In a national survey by the Ministry for the Environment (2001), water-related concerns were rated as the most important environmental issues in New Zealand as a whole.

Nature conservation, sense of place and loss of bio-diversity were found to be *'catchment-wide'* issues. These issues received moderate importance ratings, relatively high level of agreement between self and others and no significant differences between catchment areas.

Responses to several issues were found to be *'location specific"* where importance varies according to where you live in the catchment. For these issues there were significant differences between catchment areas, a lower level of personal importance, but higher importance ratings for others. Flooding was most important for lower catchment respondents, weed and pest control more important for rural respondents (upper and lower rural) and both riverbank stability and land/soil degradation were more important for lower rural respondents.

Overall in Q5 several catchment issues received higher importance ratings from upper catchment respondents (water shortage, loss of population, loss of farm productivity) and some were more important in lower catchment (flooding). Others issues effected rural respondents to a higher degree (weed and pest control and changing climate). The importance of all issues was rated as higher for other people in the Taieri than for respondents personally. This reiterates a high awareness of the importance of catchment issues, even when particular issues do not affect individuals themselves.

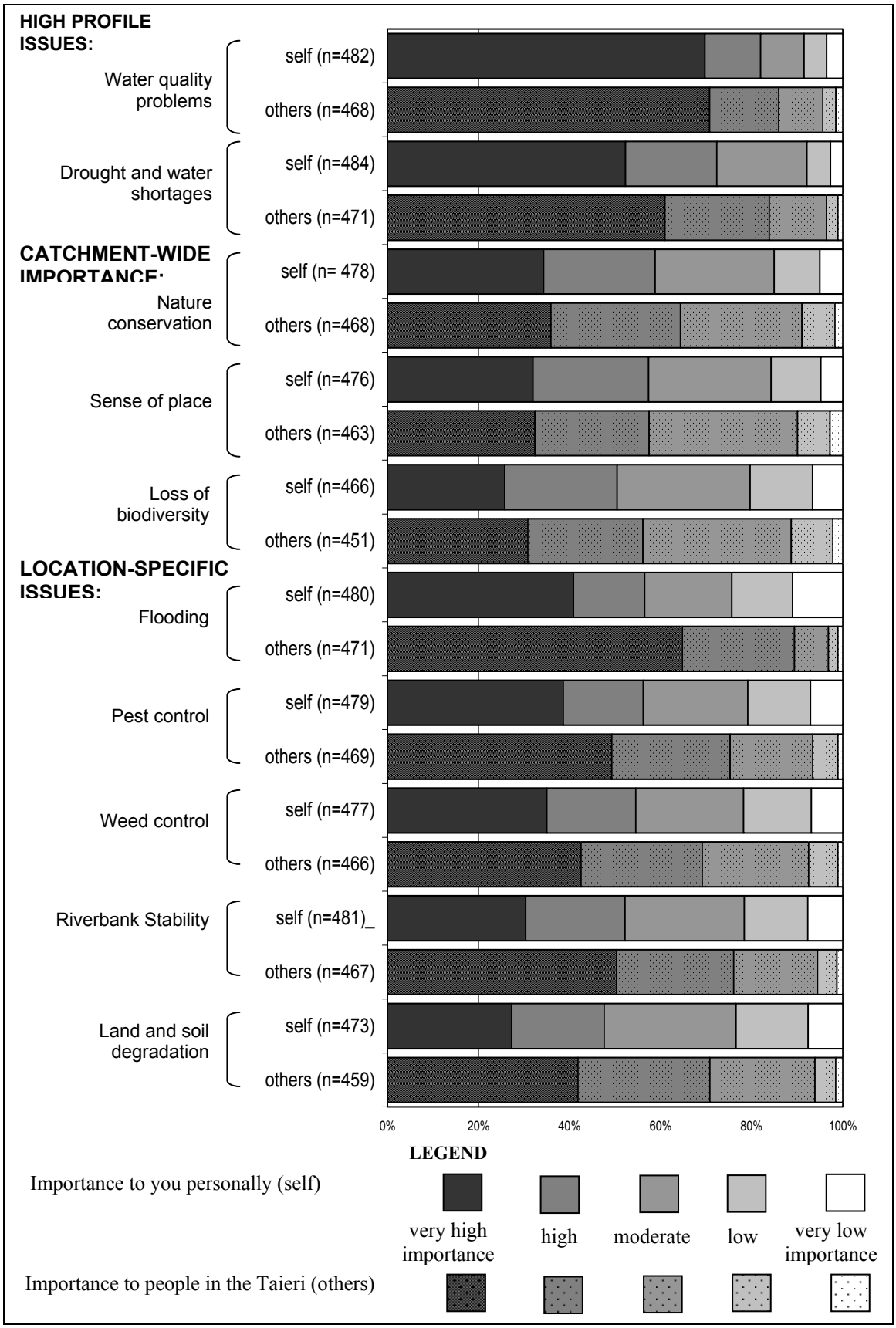


Figure 6 Catchment issue importance
– to self and to people in the Taieri generally

Source: Question 6, TC&CH Survey Questionnaire (see Appendix A)

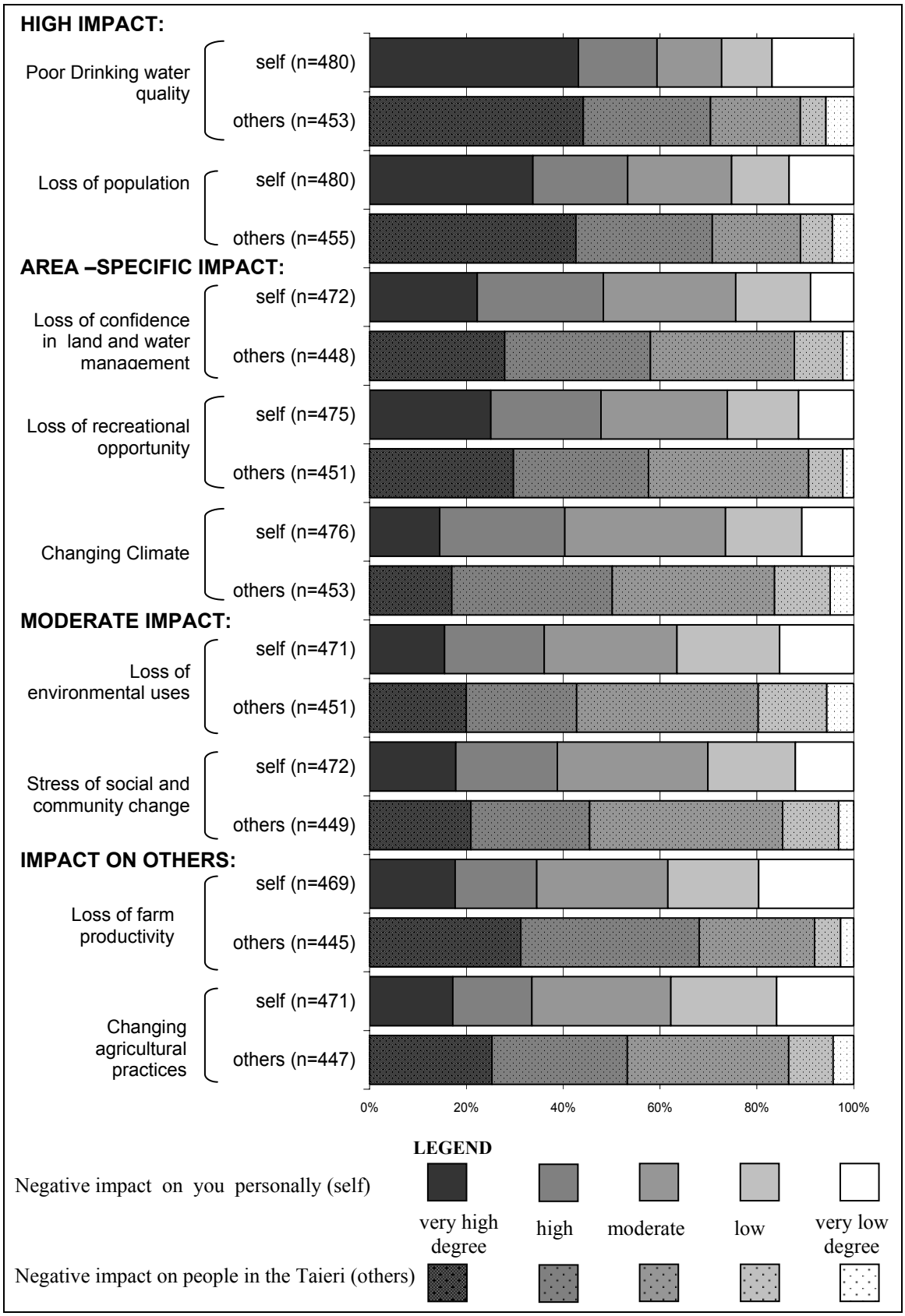


Figure 7 Negative impact on life in the Taieri – for self and people in the Taieri generally.

Source: Question 7, TC&CH Survey Questionnaire (see Appendix A).

Nine catchment issues were rated based on their perceived negative impacts on life in the Taieri. These issues were categorised as *'high impact'*, *'area-specific- impact', 'moderate impact'* and *'impact on others'* (Figure 7), according to their ratings, the level of agreement between self and others, and significant differences between catchment areas. The two *high impact* issues were found to poor drinking water quality and loss of population which showed a relatively high agreement between self and others. Drinking water was also found to be significantly less important and loss of population significantly more important for upper catchment respondents. Not only was population loss rated to have significantly more personal impact for upper catchment respondents, but it was also the only issue where the Kruskal–Wallis test detected a significant catchment difference in ratings for 'others'.

Loss of confidence in land and water management, loss of recreational opportunities and changing climate were identified as issues with '*area-specific impact'* (Figure 7). Ratings for these themes showed moderate personal impact, moderate low agreement between self and others and significant catchment differences. Respondents in the lower rural catchment gave significantly higher impact ratings for both 'loss of confidence in management' and 'loss of recreational opportunities' when compared with other areas.

Opinions were divided for the '*moderate impact'* issues of loss of environmental uses and benefits and the stress of social changes (Figure 7) with slightly higher impact on others and no difference between catchment areas. The impact of issues specifically relating to farming (loss of productivity and changing agricultural practices) were found to affect others more the respondents themselves (see '*impact on others*' Figure 7). Over half of respondents reported these issues to have a 'high' or 'very high' degree of impact on people in the Taieri generally, whereas personal impact was only 'moderate'.

Differences in the perceived relevance of catchment issues

Several issues received higher ratings from upper catchment respondents (water shortage, loss of population, loss of farm productivity) and some were more important in lower catchment (flooding). Others issues affected rural respondents to a higher degree (weed and pest control and changing climate). Many catchment differences are intuitively obvious (such as pest control and weed control being more important for rural respondents than for urban), other differences reveal considerations for future catchment management that may otherwise not have been considered. Notable findings and their implications are outlined here:

- More urban residents agree that 'it is too hard to think about land and water management in an area as big as the Taieri River catchment'. This significant difference that highlights the challenge of gaining support for whole-catchment proposals in urban settings.

- The greater concern regarding water quantity issues than water quality problems in the upper catchment is consistent with increased confidence in water supply and decreased concern regarding water quality and poor drinking water quality.

- Significant differences between rural and urban respondents in the lower catchment suggest a higher level of acceptance of and perceived need for catchment management interventions in the lower rural catchment. When compared to lower urban responses, lower rural respondents showed higher level of concerns around land and soil degradation; riverbank stability; need for solutions and understanding; and personal willingness to get involved and benefit from catchment projects.

- The impression of a higher level of concern in the lower rural catchment is strengthened by the finding that lower rural respondents gave significantly higher ratings for loss in confidence in land and water management and loss of recreational opportunities indicated in the lower rural catchment.

A further important indication of the variations in perceived relevance of catchment issues was the consistent finding that the importance, impact and benefits of catchment issues were rated as higher for 'others' in the Taieri than for respondents personally. This finding was detected through comparison of findings in Q5, 6 and 7 where respondents were asked to provide ratings of issues for "*you personally"* as well as for "*people in the Taieri generally"* providing ratings for 'other' (see Appendix A).

This finding suggests a high awareness of catchment issues, even when particular issues do not affect individuals themselves, and an appreciation of the need for land and water management at the catchment scale, as well as local initiatives. Alternatively, this finding could potentially represent a lack of support for issues that are not perceived to be directly personally relevant ('not my problem'). Either way, this finding highlights interesting dynamics and potential tensions between personal and public good when it comes to catchment issues. The findings are also consistent with the significant variations in responses according to where people lived – which in term reflect variations in ecosystem and social context throughout the catchment.

Benefits from freshwater resources and urgency of catchment issues

Responses to Q5 provide an overview of the benefits of freshwater resources and their relevance to peoples lives throughout the catchment. In Table 3, freshwater resources are ranked according to the proportion of respondents who indicated each freshwater resource was of benefit to them personally.

Table 3 Personal benefit from freshwater resources (Q5)

Which of the following freshwater resources are of ***benefit***	to you Personally – self (% yes)	to People in the Taieri – others (% yes)	Agreement between self and others (%)‡
Natural Beauty	93.6 (n=487)	94.2 (n=462)	94.8
Drinking water supply	83.9 (n=490)	88.7 (n=461)	85.0
Dilution and removal of pollution	65.6 (n=474)	77.0 (n=456)	76.9
Swimming	64.5 (n=477)	88.7 (n=461)	69.6
Catching/hunting fish and game	58.3 (n=477)	86.5 (n=462)	60.5
Conservation areas	55.0 (n=476)	82.3 (n=460)	64.2
Hydroelectricity	53.0 (n=479)	75.9 (n=461)	70.4
Boating	47.1 (n=478)	86.6 (n=463)	52.3
Cultural and traditional values	41.5 (n=482)	61.3 (n=462)	62.8
Stock water	35.3 (n=479)	84.2 (n=461)	42.7
Water for Irrigation	32.8 (n=473)	78.0 (n=460)	42.2
Water for Industry	26.9 (n=472)	77.3 (n=458)	39.0

Note: ‡ Proportion indicating 'Yes' for *both* self (personal benefit) and others (people in the Taieri)

Natural beauty and drinking water supply were found to be of personal benefit to over 80% of respondents, in keeping with the advantages of living in the Taieri summarized in Table 2. Recreational uses (swimming, fish and game), and general service provision (dilution and removal of pollution, hydroelectricity) were found to be of benefit to around half or more respondents, and specific uses (stock water, water for irrigation and water for industry) were of personal benefit for around a third of respondents.

These findings can be compared with those in other parts of the survey that assessed the urgency and priority of action for catchment issues. More than half of respondents indicated that there were environmental problems that needed urgent action. Opinion was divided on whether or not the environment had worsened since respondents first lived in the Taieri.

Responses to Q5 (Table 3) reinforce the consistent finding across Q5, 6 and 7 that catchment issues were consistently perceived as higher importance, impact and benefit to *others* in the catchment than to respondents personally. The middle column of Table 3 shows that for almost all freshwater resources, at least 75% of respondents indicated benefit to 'others'. The right-hand column in Table 3 summarises the extent of agreement between perceived benefit for self and others. Comparing these columns identifies informative examples of the variation between findings for self and others. For example, although small proportions of respondents indicated boating, stock water, and irrigation benefited them personally, high proportions of respondents indicated these issues were of benefit to others, suggesting an appreciation beyond self interest.

Open-ended responses provide more detailed descriptions of the benefits, importance and issues relating to freshwater resources in the Taieri. Responses to Q4 and Q13 provide personal descriptions of the relevance and priority of catchment and community health issues and complement the disaggregated results (from Q5, 6 and 7).

The open-ended responses in Table 4 highlight the links between management of the water catchments and the quality of drinking water, as well as the conflicting demands on ecosystem services ranging from sewerage disposal to the land use tensions between urban development and agricultural lands. The findings demonstrate that the importance of a healthy physical living environment – and the spectrum of negative impacts when this is threatened – should not be seen in isolation from socio-economic processes and factors.

Table 4 Freshwater ecosystems: health and sustainability priorities (Q4 and Q13)

Freshwater ecosystems and importance of/for	Example (Selected comments from Q4 and Q13)	Source
Driving forces - land use	*Water quality. State of 'river', what goes into it from the hinterland. Aim to keep the beach areas in their natural state. Hope to keep the native bush on the hills and gullies and not pine trees which as wildings will ruin the area. Logging has a detrimental effect on our roads, surfaces and traffic and on the land and waterways.*	Q4; lower rural, female, local resident for 69 years
Driving forces - land use	*No more encroachment of farming etc into tussock country. Replanting tussock back into the catchment for a more natural pristine environment to drink from.*	Q13; lower rural, male, local resident 7 years
Driving forces - pollution - waste	*Water is the most important resource we have and should be preserved at all costs. Acts of pollution should be heavily fined and reparation be called for. Protect river environs. Let people use it where possible but acts of vandalism, pollution, removal of plants, trees, rocks, poaching needs to be dealt with quickly and with a degree of discouragement. This area can not become a poor man's garden centre or rubbish dump.*	Q13; lower urban, local resident 6 years
Driving forces -Sewerage - Land use *Health and Safety*	*Stopping Mosgiel effluent entering the Taieri River from Mosgiel and farming activities. Keeping Lake Waihola as clean and natural as possible. Stopping the urban sprawl of Mosgiel spreading past Riccarton Rd. Keeping rural land for rural use. No industrial areas outside of where they are now.*	Q13; lower urban catchment, male, local resident 55years
Health and safety - drinking water - social and community use	*Drinking water should be a high priority (although it seems okay right now!). Water that is social and community used i.e. swimming, irrigation, fish and game etc. should also be the highest as water is life and if quality is low, population becomes low.*	Q13; lower rural catchment, female, local resident 3 years
Health and safety - domestic use - agricultural use	*Maintaining clean fresh pure water for drinking (household) and stock water.*	Q13; lower rural, female, local resident 11 years

3.4 The social environment: involvement in local and catchment issues

This section expands on themes raised in previous sections but shifts emphasis to consider society and health themes – presenting results that relate to the interaction between social processes, catchment ecosystems and the socio-economic determinants of health. Findings in this section identify a high level of involvement and interest in local issues within the catchment and strong support for community involvement in catchment issues, but also highlight the potential for voluntary overload within the catchment.

Sense of community and voluntary activity

Insights regarding community life in the Taieri were gained from responses to Q19 – where respondents were asked to indicate their level of agreement with a series of statements in relation to their local community. Responses to Q19 are summarised in Figure 8.

Over 75% of respondents indicated at least moderate satisfaction with the area where they lived, the community in which they lived, life in general, standard of living and existing community services and facilities. Of 489 responses, 94.9% agreed or strongly agreed that their community is a good place to live. There was no significant catchment variation for this finding or in the level of agreement with the statement that 'it's very important for me to live in this community'.

Indicators of the sense of community and community involvement did vary according to where people lived, with upper catchment respondents demonstrating significantly higher levels of agreement regarding the positive features of community life. Upper catchment respondents were more likely to feel that people in their community are willing to help and have shared values and to be interested in local community issues, and to become involved in local community issues. The upper–lower catchment differences persisted for the question – 'I don't have any time to become involved in local community issues' (Q19f). Whereas only 20.9% of the 86 upper catchment responses strongly agreed or agreed with this statement, this percentage was 42.4% of 276 lower urban catchment responses and 35.0% of the 123 lower rural responses.

A sense of community life and local social networks was an important finding in open-ended questions. The importance of community and family life, were notable positive factors of living in the Taieri area.

> *A natural environment for children to grow up in. Local people still appreciate the 'backwater' and know their neighbours and care what happens to them. A good community spirit.* (Q4; lower rural catchment, female, local resident for 69 years).

This notion of 'community spirit' is a theme that was frequently raised. The following comment juxtaposes the idea of community spirit with tensions faced in Taieri catchment communities

> *Great area to bring up a family. There is a wonderful community spirit here.... (However)...Ranfurly is dying slowly. People are not as loyal to local shops as they should be* (Q4; upper catchment, male, local resident for 5 years).

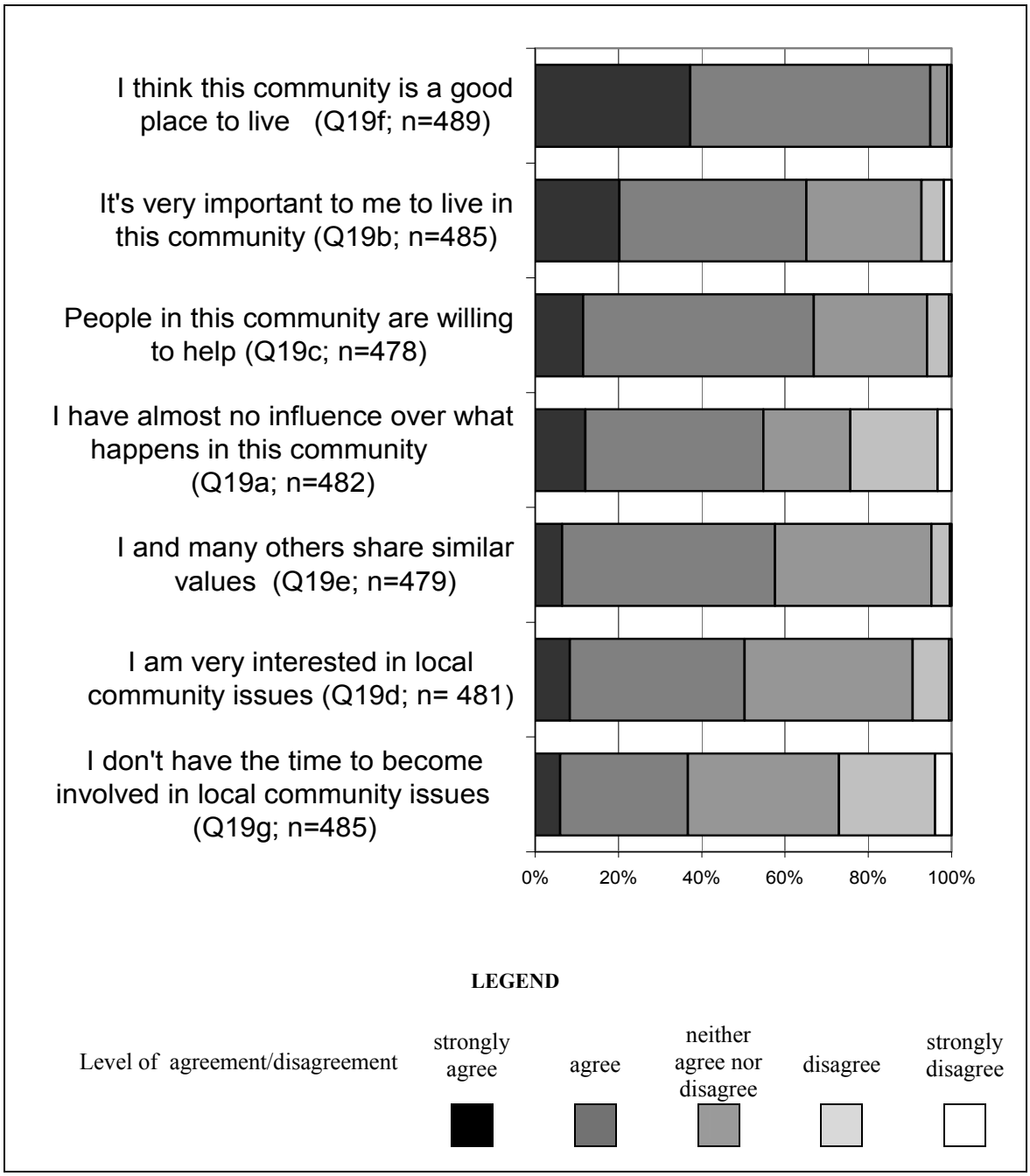


Figure 8 Sense of Community

Source: Question 19, TC&CH Survey Questionnaire (see Appendix A)

The survey found a high level of voluntary activity throughout the Taieri Catchment (Q26 and Q27), with most respondents involved in community groups and associations in the last year (52.0%) and undertaken unpaid work in the last month (61.9%). Respondents from the upper catchment showed significantly higher proportions of involvement in unpaid work and group involvement, in addition to higher levels of agreement regarding positive community features (Q19).

Since Q26 was the same as that used for the 1996 New Zealand Census, comparisons with national data came be made. The 61.9% who indicated involvement in unpaid work in the TC&CH Survey is greater that the 47.5% reported nationally from the 1996 Census (P. Howden-Chapman and J. Martin, pers. comm. Social Capital Study, Department of Public Health, Wellington School of Medicine). However such comparison should take into account a possible and plausible response bias in the TC&CH Survey when compared to the Census i.e. those involved with community activities are more likely to respond to the TC&CH survey (see Appendix C).

Even without national comparisons, the fact that almost two thirds of those responding to the survey are already involved with voluntary activity highlights the high load on existing volunteers within the Taieri River catchment. This issue is made very clear by the following comment regarding issues faced in the Taieri catchment:

> *Gradual whittling away of essential services particularly health services. Loss of population, employment opportunities, businesses unable to keep going. Lack of professional people coming into area. Having to fund-raise more and more for our services. Overuse of volunteers to keep things going… in a small community there is more than enough voluntary labour.* (Q4; upper catchment, female, local resident for 10 years).

Gender differences in unpaid work and group involvement were also observed – with 68.5% of women indicating they did unpaid work (compared with 56.1% for men) and 52.6% of women involved in groups and associations (compared to 47.4% for men). These findings regarding community involvement provide important insights into scope and variety of the community networks and processes already established in the Taieri, and the demands already placed on voluntary efforts within the catchment. These findings provide an important background when considering findings regarding the potential for community involvement and interest in catchment issues.

Involvement and interest in catchment issues

There was strong support for proposals for community involvement in catchment management, and moderate levels of personal and community preparedness to be involved in catchment issues. Sense of responsibility for, and interest in, becoming involved in catchment issues varied.

The notion of community participation in catchment management received high profile and ratings throughout the survey, as outlined by the following points:

- Of 480 respondents, 67.9% rated ‘encourage discussion between community interest groups’(Q14a) as being of high or very high importance.
- 58.0% the 478 responses rated ‘encourage community action at a catchment level’ (Q14e) as being of high or very high importance.
- An even higher proportion (69.0%) was found to strongly agree or agree that ‘government agencies need to give more resources to encourage voluntary groups to become involved in environmental issues’ (Q18c).

There were no significant differences for any of these findings based on where people lived, suggesting the relevance of community participation across the catchment. Table 5 presents a series of open-ended responses that support proposals for enhancing and valuing community involvement in catchment management processes.

Table 5 Survey suggestions for valuing community participation and local input (Q13)

Valuing community participation and local input	Example (Selected comments from 332 responses to Q13)	Source
- Connect to 'ground zero'	*Take notice of people at ground zero level*	lower rural catchment, male, local resident for 15years.
-Autonomy -smaller areas have input	*With amalgamation to DCC the smaller areas have lost the impact they had earlier. Services here are not as good and user pays has diluted them even more. General concern for small business, roading, public transport, health and education.*	lower urban catchment, male, local resident for 12 years
- Transparency	*Involving the community in decision-making. More public involvement about the role of the Otago Regional Council*	lower urban, male, local resident 34 years.
- Local vs. vocal representation	*Involvement of local people in the decisions instead of greeny do-gooders.*	lower rural, male, local resident for 30 years.
- Local vs. expert representation	*Cohesion in management. More local input. Not so many consultants*	lower urban, male, local resident for 5 years.
- Public awareness and contributions	*Increase public awareness of issues involving water and land resources. Get public input*	lower urban, male, local resident for 10 years.
- Area based participation	*Consult with local people more. Meetings in each area.*	upper catchment, female, local resident for 8 years.
- Public awareness - opportunities for participation	*Communities need to be made aware of management and given the opportunity to be involved in decision making*	upper catchment, female, local resident 6 years.

Further detail regarding community participation in catchment initiatives is provided by the following responses regarding personal and community interest and willingness to get involved in local and catchment issues.

- Half (50.2%) of respondents indicated they were very interested in local issues (Q19d, Figure 8).
- Over three quarters (76.1%)% respondents agree that there are things that they can do personally to help the Taieri environment (Q18a) and 65.2% indicated they were prepared to become involved in water, land and catchment issues to a moderate degree (Q10)
- 86.3% of respondents agreed that there are things community groups can do to help improve the Taieri environment (Q18e) and 74.2% indicated they thought local people are prepared to become involved in water, land and catchment issues to a moderate degree (Q10).
- Less than 20% of respondents indicated that 'it was too hard to think about land and water management for an area as big as the Taieri River Catchment (Q18b).

There was an increased willingness of lower rural catchment residents to be involved in catchment initiatives, and to think about management concerns at the catchment scale, Of 125 the lower rural responses to Q10, 36.0% indicated they would be willing to be involved to a high or very high degree, compared with only 59.5% of the 279 lower urban catchment respondents. Lower rural respondents were more likely to disagree

that ‘it’s too hard to think about land and water management for an area as big as the Taieri River catchment’ (Q18b). The lower rural responses to this question were significantly different to those for lower urban respondents – which seems consistent with the different experiences and priorities of urban residents.

The findings regarding community involvement in catchment issues should be seen in relation to the high degree of existing voluntary activity through the catchment communities. Respondent concerns regarding placing further demands on voluntary workers were seen as a key priority for catchment management:

> *“…although planning needs to be done in consultation with farmers don't off load a lot of voluntary work on to them. In a small community there is more than enough voluntary labour”* (Q4; upper catchment, female, local resident for 10 years).

Concerns regarding voluntary overload were emphasised throughout the survey and were consistent with the findings during the participatory research with reference groups. Thus, while there is a high level of interest in Taieri catchment and community, it is important to consider the implications of the high existing level of voluntary activity in terms of community capacity to participate in future catchment related activities. These are important concerns that offer new insights regarding the interaction between community participation, social capital and networks, and community engagement in natural resource management (Flora 1995; Mullen and Allison 1999; Pretty and Ward 2001). Results regarding local community interest and involvement in catchment management provide valuable background and context to the findings focused on the driving forces of catchment and community health issues.

3.5 Addressing the driving forces of catchment and community health issues

This section focuses on the survey responses that relate to the priorities, tractability and management of catchment and community health issues (Q13, Q14, and Q18). Themes relating to the physical environment and catchment ecosystems (Section 3.3) are drawn together with findings regarding the social environment (Section 3.4) to focus on the driving forces influencing catchment management. These driving forces of governance, development and power forces are depicted in the Prism Framework for Health and Sustainability (Figure 1). They are also dominant themes in survey responses regarding catchment management and including innovative proposals to link *“a health environment, a caring community and excellent services”* in the Taieri catchment.

Priorities for water resources infrastructure and governance

Specific questions (Q11, 12, 16, 17) were designed to gauge interest and awareness of the role of various agencies and government programmes within the catchment. The responses to these questions identified challenges and areas for improvement in existing water resource management and indicated preferences for the future role of different agencies.

Approximately one-quarter of respondents (24.6%) indicated they were aware of environmental programmes in the Taieri River catchment funded by local, regional, or national government (Q11). Of the initiatives described, flood control was most frequently referred to, followed by those relating to the proposed sewerage scheme, weed and pest control, drainage schemes and support for wetlands. Around 5% of respondents had seen the Otago Regional Council 1999 Taieri Catchment Monitoring Report (Q12). Several people indicated they would like to see it or didn’t know where to get it. Comments varied from ‘most informative and good detail’ to accessibility

concerns –'No-where is it shown?'; and intentions to seek it out – 'Must get it and read it and see if it is like the detail of the 1970's or better.'

The comments in Table 6 highlight the numerous challenges for the governance and provision of freshwater resources in the Taieri. Concerns expressed relate not only to the quality of water supply but also a sense of frustration regarding being on the fringe of local government jurisdictions and the confusing overlap of roles and responsibilities between different agencies in the catchment.

Table 6 Challenges of governance and service provision in a dispersed rural catchment (Q4, 11and 13)

Infrastructure and service provision	Example (Selected comments from Q4, Q11 and Q13)	Question; Source
Water infrastructure - quality vs. convenience	*Town water supply- quality may not be as 'natural' as tank/bore but constant supply is a bonus*	Q13; lower urban, female, local resident 6years,
Waste and Water infrastructure - quality vs. convenience	*[There is an] Urgent need to move away from septic tanks to a proper sewerage scheme. This is the year 2000 so lets not be content with what people found acceptable in 1900. Since coming to live in Outram 9 years ago I have noticed a big difference in the taste and smell of our water supply. A primary reason for shifting from the Dunedin suburb of Waverly was the foul domestic water supply.*	Q13; lower rural catchment, female, local resident 9 years.
Water supply - quantity/ source concerns	*Clean up the river of pollutants and keep the flow high over summer [i.e. DCC takes less water for Dunedin City, by repairing leaking pipelines and not spilling excess (by increasing storage facilities)]. Regional council enforcing a minimum flow!*	Q13; lower rural catchment, female, local resident 16years
Priorities - Representation of outlying areas	*Employment, poor representation from the DCC. I do not believe that the DCC still regards the Taieri Plains as part of its responsibility*	Q4; lower urban catchment, male, local resident for 12 years.
Priorities - Representation of outlying areas	*Being on the outer edge of district council area we tend to be forgotten (except when payments are due!) And treated as unimportant…Having a council that takes comments/complaints about water (etc.) Seriously would be a huge start. Maybe having a quality control committee or group that is not under the pay of CDC [Clutha District Council]*	Q13; lower rural catchment, female, local resident for 5 years.
Responsibilities - controls land-use - pollution prevention	*Maintain flood control and good ground cover everywhere to reduce erosion. Maintain public access to rivers and waterways. Ensure adequate treatment and control runoff (e.g. dairy farms)to keep rivers clean*	Q13; lower urban catchment, female, local resident 6 years
Responsibilities -shared/overlapping roles	*ORC does the flood bank. DOC or someone checks what goes into the waterways- salmon release in the Taieri etc. DOC for pest control up Whare Creek and river- possum. DOC organises clean up of tracks and maintains them. Someone does drainage over the Taieri*	Q11; lower rural catchment, female, local resident for 19 years.

When prompted about the responsibility of different groups for catchment management the Otago Regional had the highest ratings for both current responsibility (Q16) and future influence (Q17), followed by District Councils and the Department of Conservation. When rankings for current influence and future responsibility were compared, Fish and Game was found to have a lower ranking for future influence compared to other groups. The Ministry for Agriculture and Forestry, and the Ministry for the Environment were both ranked as having higher future influence.

Individual farmers, Industry and Ngai Tahu had the same rank for current responsibility and future influence, with industry and Ngai Tahu receiving the lowest ratings in both categories. The low ratings for the role of Ngai Tahu should be interpreted in relation to the fact that only 3.0% of survey respondents indicated their ethnicity as Māori (Table 1). This compares to the estimated 5.3% of Taieri catchment population who are Māori and 14.5% in New Zealand as a whole (New Zealand Census, 2001). Even so, the finding raises important issues regarding awareness and acceptance of role of Ngai Tahu in water resource management, since the mandated role of Iwi under the Treaty of Waitangi (1840) and New Zealand's Resource Management Act (1991) is as relevant in the Taieri as in other New Zealand river catchments.

Addressing catchment management challenges: principles and priorities

Participants showed awareness of resource management problems and also described principles and priorities for how these issues could be managed. Open questions about catchment management priorities (Q13) highlighted awareness of both problems and a variety of opportunities for addressing these issues. Table 7 provides an overview of respondent proposals for future catchment management priorities and highlights the interaction between socio-economic and environmental dimensions of catchment and community health issues.

Table 7 Key priorities for future management of water and land resources (Q13)

Q13. What do you think should be the priorities for the future management of water and land resources in the Taieri River catchment?		**% of Total responses** (n=322)
Principles and priorities for the human dimensions of catchment priorities		57.8
Sustainability and equity (includes concepts of fairness and 'balance')	*17.2*	
Participation (co-operation, local input, working together, education)	*12.0*	
Specific activities and actions (monitoring and control, legislation)	*10.5*	
Knowledge generation and exchange (esp. relating to monitoring and research)	*9.0*	
Types of Stakeholders (farmers, community agencies, research)	*9.0*	
Land-Use and type of development		34.3
Water Quality		30.7
General Pollution/Waste		29.8
Water Quantity issues (excluding floods)		29.8
Lifestyle: Recreation and habitat preservation and conservation		27.7
Environmental Issues/Problems (excluding drought and flood)		20.5
Health, safety and risk		20.5
Land and soil		15.4
Floods		14.5
Infrastructure and services		13.9
Ecosystem services as the basis for socio-economic development		9.0

Total is more than 100% since some responses covered several categories

Table 7 distinguishes between descriptions of resource management problems, and principles and priorities (*in italics*) for how these problems could be addressed. Single responses often described several principles for catchment management, and demonstrated the interaction between social and ecological concerns:

> *Understanding and respect for the property rights of landowners with regard to land use options and water use options associated with irrigation. Encouragement for the sustainable management of land and water resources because they are key elements in assuring a viable community. A flexible attitude to land/water use is of paramount importance* (upper catchment, male, local resident for 25 years).

This comment exemplifies the integrated view of catchment and community health issues described by many respondents – spanning issues of governance (respect for property rights, flexible approach, 'encouragement' for sustainable management), ecosystems (land and water resources as key elements) to social systems and health (viable community). The links between community 'viability' and land and water resources exemplify the interaction between social and environmental concerns, and are also reflected by the sustainability and equity themes referred to by 17.2% of respondents (Table 7). The scope and variations of concerns relating to the themes of sustainability and equity are exemplified by the respondent descriptions provided in Table 8.

Table 8 Sustainability and equity as catchment management principles (Q13)

Sustainability and/or equity theme	Example (Selected comments from 332 responses to Q13)	Source
Present /future generations	*Preserve and improve the current state for future generations whilst allowing the use of the resource for industry and employment growth'*	lower urban, male, local resident 20 years
	Key priority should be the sustainable use of resources so future generations are not disadvantaged. Also resources should be managed so all interests are catered for-one group shouldn't have rights that exclude others	lower rural, male, local resident 39 years
Sustainable land use/management	*Present grazing and cropping must use the land without abuse. Sustainability is use without abuse (not preservation as some environmentalists push for). The economy needs to be reasonable as people will over-use the land to meet debt and living expenses if pushed especially if also competing with rabbits.*	lower rural, male, local resident 29 years.
	Reduction in pollution of rivers and streams and ground water. Further enhancement and encouragement of sustainable land management practices and biodiversity	lower rural, female, local resident 40 years.
Sustainable water resource	*Sustainability of water quality. Sustainable minimum flows*	lower urban, male, local resident 13 years
	Sustainable land use, aiming for '2020 organic NZ', improve the quality of all waterways that as soon as possible no pollutants enter any waterways, from private, industrial and agricultural use. Teach people to save water…Develop regeneration projects on the waterways, wetlands, private land. Develop a National Park in Otago	lower rural, female, local resident 1 year
Balance between socio-economic and environmental outcomes	*I believe it is essential that careful* balance *be maintained between commercial and recreational uses of water and land. The scales perhaps tilted slightly toward commercial as this provides the employment for future generations*	upper catchment, male, local resident 2 years.

Knowledge generation and exchange were also identified as a priority for future catchment management (Table 7). This finding was supported by the following results:

- Only 32.9% of respondents indicated that local people have high or very high awareness about water, land and catchment issues in the Taieri region, with upper catchment respondents indicated a significantly higher level of local community awareness than lower urban respondents (Q8).
- Almost all (95.6%) rated 'development of solutions for and better understanding of environmental problems' (Q14d) as moderate, high or very high importance (Figure 9).
- The same proportion (95.6%) respondents indicated that 'raising level of local awareness and knowledge of environmental issues" was of moderate, high or very high importance (Q14b), see Figure 9.

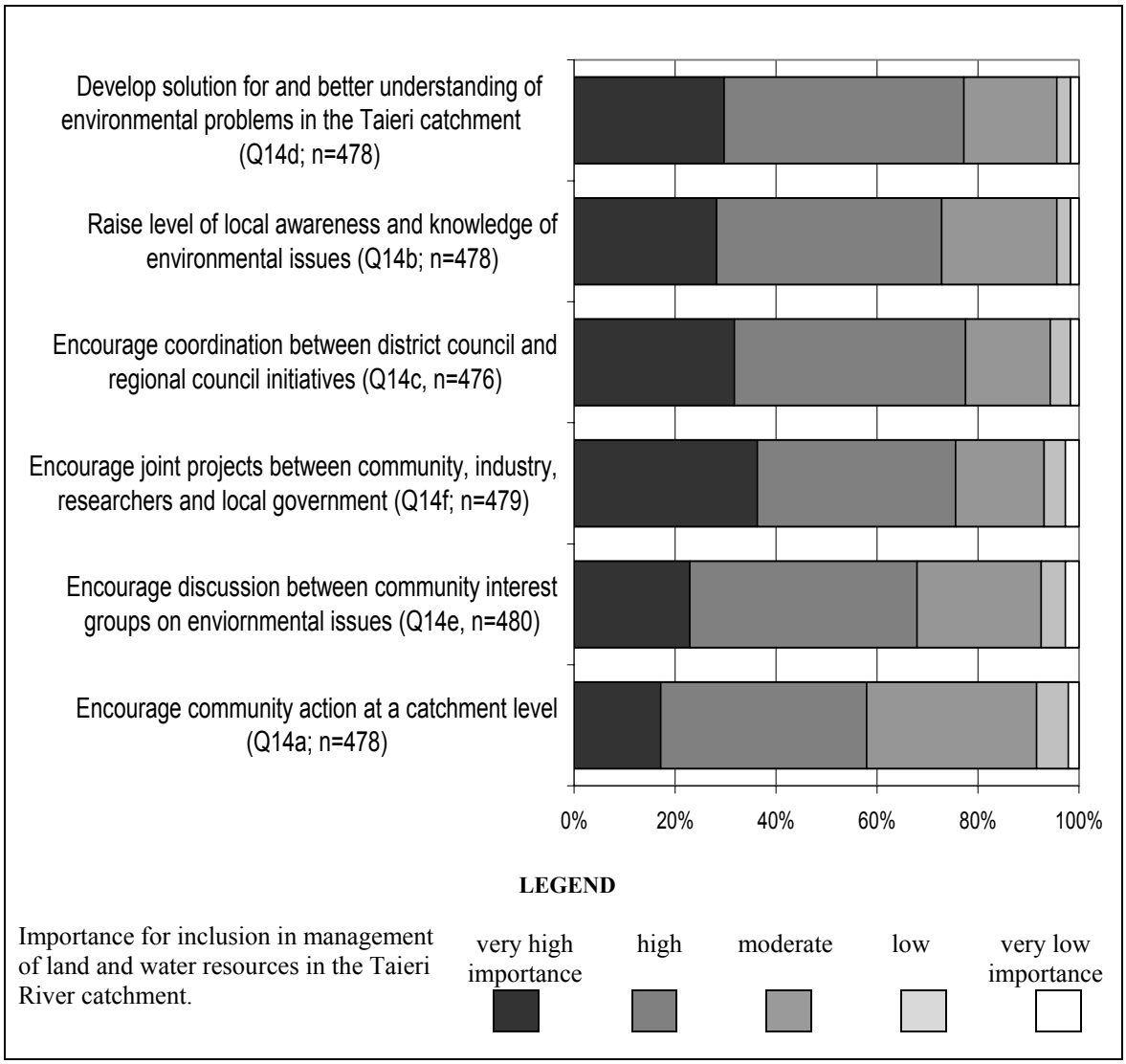


Figure 9 Importance of catchment management initiatives

Source: Question 14, TC&CH Survey Questionnaire (see Appendix A)

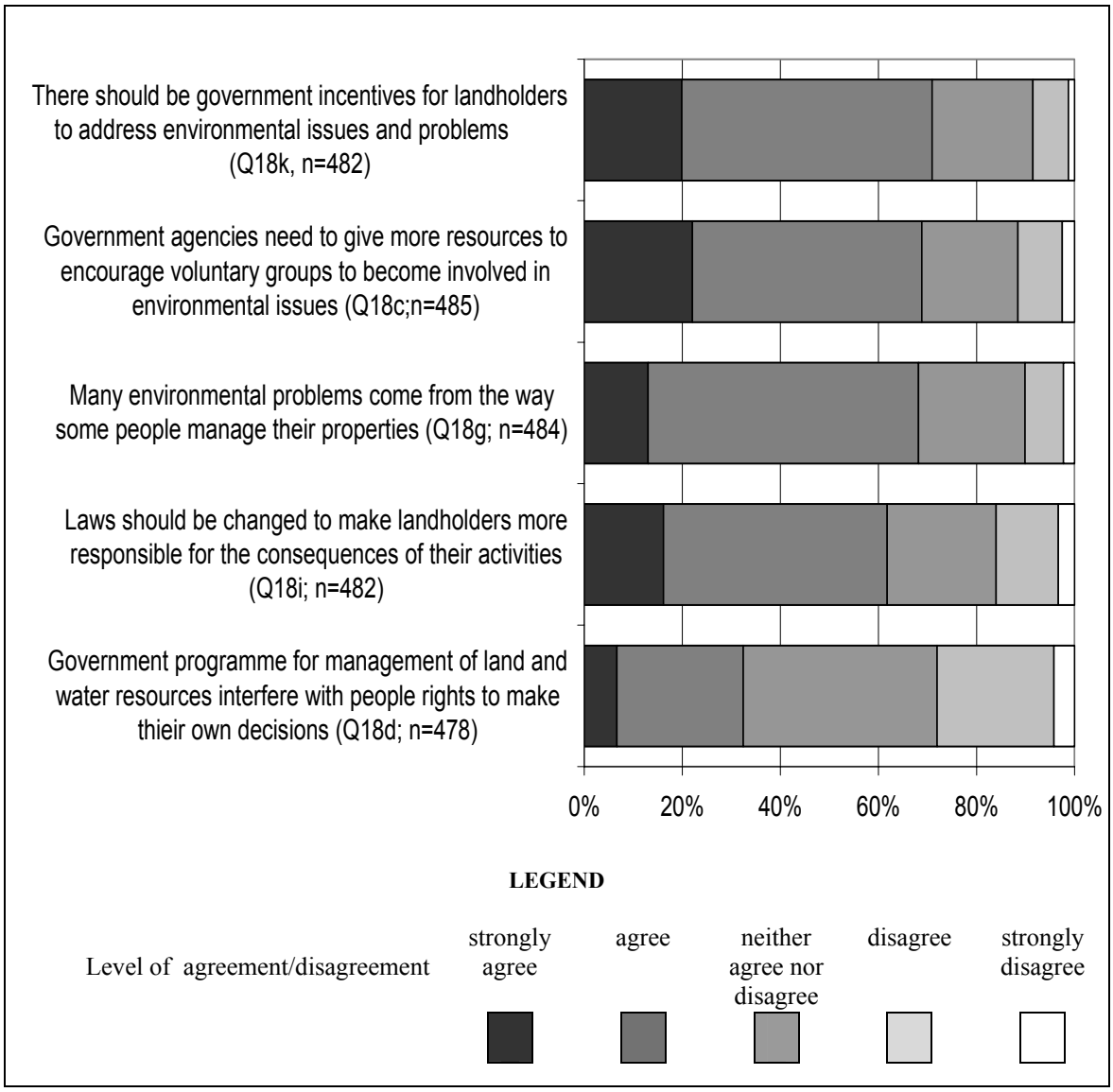


Figure 10 Priorities for future catchment management

Source: Question 18,TC&CH Survey Questionnaire (see Appendix A)

While increasing knowledge and awareness were important for respondents, so too was the importance of respecting and benefiting from the knowledge of local and particularly farming communities – for example:

> *Farmers should be left to get on with what they know best. They are among the best in the world at balancing production and the environment. Regulatory control should be confined to the Otago Regional Council* (lower rural catchment, male, local resident 23years).

Support for catchment initiatives: communication, coordination and community involvement

The support for specific catchment management proposals and questions of responsibility for catchment issues were assessed by questions in Q14 and Q18. The summary in Figure 9 shows that all proposed catchment management initiatives in Q14 were found to have high or very high importance by over 50% of respondents, and at least moderate importance by over 90% of respondents. There were no significant catchment differences for the results shown in Figure 9, other than for Q14d (developing solutions and better understanding). The themes raised in response to Q14 are reinforced through comparison with the findings from Q18 that are depicted in Figure 10. Most of the responses to Q14 and Q18 showed no significant differences between catchment areas – suggesting the relevance of the proposed initiatives across the catchment.

As well as the high ratings for increased knowledge and understanding (14 b and d), Figure 9 illustrates that 75% of all respondent gave high or very high importance ratings for encouraging joint projects between different stakeholders (community, industry, researcher and local government) and encouraging co-ordination between agencies (district and regional council).

Comparing findings Figure 9 and 10 illustrate the priority given to community involvement in catchment initiatives.

- The proposal to 'encourage discussion between community interest groups on environmental issues' (Q14e) was given high or very high importance ratings by 67.9% of respondents. 58.0% gave a high or very high importance rating to 'encourage community action at a catchment level' (Q14a) – see Figure 9.
- Around 70% were found to strongly agree or agree that 'government agencies need to give more resources to encourage voluntary groups to become involved in environmental issues' (Q18c), and that that there should be better government incentives for landholders to address environmental issues and problems (Q18k) – see Figure 10.
- Opinions were divided about whether government programmes for land and water management interfere with people rights to make their own decisions Figure 10.

Higher proportions of lower rural respondents agree that environmental problems are due to the way people manage their properties. Higher proportions of upper catchment respondents agreed that laws should be changed to increase landholder responsibility and that government programmes interfere with people's rights to make their own decisions.

Encouraging communication and coordination between catchment-related groups was rated as highly important and was also a frequently raised in open ended-questions. Table 9 presents comments regarding co-operation, coordination, community input, as the COs of catchment management. These are complemented by comments that highlight the 'CONs' of catchment management, including control, enforcement and conflict resolution. The comments illustrate respondent awareness of the forces that drive ecosystem and social change and the governance challenge of fostering appropriate mechanisms to address catchment issues in the future.

Table 9 COs and CONs of catchment management (Q13)

COs		
Cooperation	*I believe the key priority is to establish public responsibility in co-operation with local, regional and/or national groups*	lower urban catchment, female, local resident 34 years.
	Co-operation between all parties working toward a common goals to be specified	lower rural catchment, female, local resident 12 years.
Cohesion	*Cohesion in management more local input not so many consultants*	lower urban catchment, male, local resident 5 years.
Communication	*Consensus between involved groups and clear communication of information and intentions to the wider public, without politics or hidden agendas*	lower urban catchment, male, lived in catchment 28 years
Community	*The community should work with every one who has the knowledge to see that the best is gained for the management of the river and adjoining land*	lower urban, female, local resident for 20 years.
CONs		
Control Plans for catchment	*Establish a Total River Control Plan as in the Tennessee Valley in USA. Control of runoff, grazing practices, burn off, irrigation, etc. with tree planting intricated into the plan as well as retirement of land.*	lower urban, male, local resident for 12 years.
Conflict resolution	*Every group concerned should be working together to keep quality at an high level, not fighting each other*	lower urban catchment, male, local resident? years.
Control and enforcement	*1-careful fair monitoring of the resource for the benefit all in the Taieri River catchment*	upper catchment, male, lived in catchment 45 years
	2- weed and pest control and containment	
	The controlling of pollution by the enforcement of existing legislation. The regional council have the ultimate responsibility to enforce such legislation.	lower rural, male, local resident for 3years.

Overall, the survey showed support for a variety of catchment management initiatives and awareness of the range of stakeholders (individual landholders, local residents, government, and 'everybody that has the knowledge') who have a role to play in land and water management. Specific questions and open-ended responses highlighted that addressing catchment management challenges will require investment in human and financial resources and incentives, as well as attention to management priorities such as equity, co-operation, communication and local community participation.

4 CONCLUSION AND RECOMMENDATIONS

Prior to the Taieri Catchment & Community Health Project, there was minimal awareness of community knowledge, experiences and concerns regarding health, freshwater resources and sustainability issues in the Taieri River catchment. The survey findings have increased understanding of the range and sophistication of community knowledge regarding catchment and community health issues. Specifically, in response to the specific objectives outlined in the Introduction, the survey has:

- contributed to knowledge of the links between freshwater ecosystems and the determinants of health in the Taieri River catchment;
- highlighted the important contribution of community knowledge in understanding and responding to catchment and community health issues;
- identified opportunities and barriers for community involvement in catchment management in the Taieri catchment; and
- provided a point for reference for future catchment management and research in the Taieri River catchment.

The conclusions and recommendations are based on these four main contributions.

First, the survey findings have provided a rich picture of the concerns and priorities of catchment residents and made a unique contribution to understanding the links between freshwater ecosystems and the determinants of health in the Taieri River catchment. The survey provides catchment-specific insights that complement findings from other studies regarding environment, health and community quality concerns in rural communities (Molinari et al., 1998; Butterworth et al., 1999; McCreddin and Syme, 1999b; Robson and Schneider, 2001). Furthermore, the survey findings have demonstrated that degradation of water quality and extremes of water quantity (drought and floods) have a range of impacts on human health by disrupting livelihoods, lifestyles and living systems.

Second, the survey findings have demonstrated the scope and potential of community knowledge as a contribution to understanding and responding to catchment and community health issues. Survey findings have also pointed to important challenges that need to be addressed in order to benefit from this community knowledge. These challenges include: the significantly different perspectives from people in different areas of the catchment; tensions and conflicts between personal and public good; and potential barriers to community engagement with catchment initiatives. Despite this, there was widespread support for increased information exchange, collaboration and communication between diverse stakeholder groups in order to turn knowledge into actions that improve health and sustainability in the Taieri.

Third, the community knowledge represented by the survey responses elucidated principles and priorities for future catchment management that can foster health and sustainability for the Taieri River and its communities. Principles identified include the need to recognise the fertile connections between physical and social environment; the benefits of local community knowledge when resolving place-based health and sustainability concerns; and the important of both collaboration and control when working toward sustainable driving forces (development, governance and power) in the catchment. The survey findings highlight the fertile tension between local priorities (with examples ranging from farming best practice to riparian planting identified in the open-ended responses) and processes concerning the interaction across the catchment as a whole.

Fourth, the survey findings have important implications for future research in the Taieri catchment. In particular, the survey highlighted the potential value of more detailed qualitative data techniques (personal interviews) as appropriate methods for examining historical and personal information regarding catchment and community health issues that were identified by the survey, but not examined in detail. Community Oral Histories are one of the initiatives proposed by the TAIERI Trust to examine these themes further, drawing on ongoing collaboration between local communities throughout the catchment, the Department of Geography and the TAIERI Trust. Furthermore, due to the considerable (financial and human) resources of conducting the TC&CH Survey, the need for careful survey design and question selection in any future survey has been emphasised. Lessons from this survey informed the design of a catchment questionnaire conducted as part of the review and evaluation requirements of the Taieri Trust (see www.taieri.net.nz).

Drawing on these four contributions, outcomes of the survey can also be summarised in terms of key findings and recommendations for understanding and responding to catchment and community health issues in the Taieri Catchment.

Survey respondents show diverse and sophisticated understanding of the relationships between health, freshwater resources and catchment management.

→ **Future catchment management should prioritise processes that include and value community knowledge as integral to understanding and responding to catchment and community health issues.**

While there is a high level of interest in Taieri catchment and community health issues the survey identified potential conflicts and challenges that could hinder community participation in catchment related activities, including a high level of existing voluntary activity and variation in interests between areas.

→ **In order to benefit from community knowledge and involvement, future catchment management must identify processes and activities that are relevant and compelling to specific catchment communities *in addition to* whole catchment initiatives.**

Survey findings reinforced the importance of catchment and community health concerns that extend beyond specific diseases to include the potential loss of livelihoods, lifestyles and healthy living systems through changes in freshwater resources.

→ **Orienting future catchment management toward a healthier river *and* a healthier community has the potential to improve environmental and socioeconomic determinants of health, and also to generate the commitment, collaboration and community involvement required to achieve a healthy, sustainable future for the Taieri River catchment.**

In summary, the survey has provided valuable information that was not previously available for the Taieri River catchment. New insights have been gained regarding community awareness and understanding of catchment and community health issues. The findings identify priorities and principles for future management as well as pointing to the potential role that local communities and individuals can contribute to catchment initiatives. The survey findings will contribute to ongoing communication between communities, researchers and agencies working throughout the region. The survey was also an important part of the Taieri Catchment and Community Health Project, and Dr. Parkes would like to reiterate her thanks to all who participated and supported the Survey.

REFERENCES

Alreck P and Settle R. (1995). The Survey Research Handbook (2nd ed.). Chicago, Irwin.

Baron J, Poff NL, Angermeier PL et al. (2002). ' Meeting ecological and societal needs for freshwater.' *Ecological Applications* 12: 1247-1260.

Bellamy J. Ed. (1999). *Land and Water Management in the Herbert River Catchment: Community Views.* Evaluation of Integrated Catchment Management in a Wet Tropical Environment: Collected Papers of LWRRDC R&D Project CTC7. Indooroopilly, Queensland, Australia., CSIRO Tropical Agriculture.

Bowden B. (1999). *Integrated catchment management rediscovered: an essential tool for a new millennium*. Manaaki Whenua Conference: A three day conference on science for resource management, Te Papa, The Museum of New Zealand, Wellington, 21-23 April, 1999., Manaaki Whenua:Landcare Research.

Butterworth J, Syme G and Nencarrow B., Eds. (1999). *Land and Water Management in the Herbert River Catchment: A Survey of Rural and Urban Residents*. Evaluation of Integrated Catchment management in a Wet Tropical Environment: Collected Papers of LWRRDC R&D Project CTC7. Indooroopilly, Queensland, Australia., CSIRO Tropical Agriculture.

Calahan C A and Schumm WR. (1995). ' An exploratory analysis of family social science mail survey response rates.' *Psychological Reports* 76: 1379-1388.

CWAP (2000). Watershed Success Stories. Applying the principles and spirit of the Clean Water Action Plan, US Departments of Agriculture, Commerce, Defence, Interior and the Environmental Protection Agency.

Davidson C and Tolich M. (1999). *Social Science Research in New Zealand*. Auckland, Longman.

Dillman D. (1978). *Mail and Telephone Survey*. New York, Wiley.

Dillman DA, Sinclair MD and Clark JR. (1993). ' Effects of Questionnaire Length, Respondent-Friendly Design, and a Difficult Question on Response Rates for Occupant-Addressed Census Mail Surveys.' *Public Opinion Quarterly* 57: 289-304.

Documenta Geigy (1962). *Scientific Tables. Sixth Ed.* Basle, Switzerland., Geigy Pharmaceuticals.

Dolsen D and Machlis G. (1991). 'Response rates and mail recreation survey resulst- how much is enough?' *Journal of Leisure Research* 23: 272-277.

Duncanson M, Russell N, Weinstein P, Baker M and Skelly C. (2000). 'Rates of notifiable cryptosporidiosis and quality of drinking water in Aoteroa New Zealand.' *Water Research* 34:26-34.

Ewing S, Grayson R and Argent R. (2000). 'Science, citizens and catchment: Decision support for catchment planning in Australia.' *Society and Natural Resources* 13: 443-449.

Eyles, R., Niyogi, D., Townsend, C., Benwell, G. and Weinstein, P. (2003). 'Spatial and Temporal Patterns of Campylobacter Contamination Underlying Public Health Risk in the Taieri River, New Zealand. *Journal of Environmental Quality* 32: 1820-1828.

Flora C. (1995). Social capital and sustainability : Agriculture and Communities in the Great Belt. *Journal paper J-16309*, Iowa Agricultural Home Economics Experiment Station. Project Number 3281.

Garrison MEB. (1998). ' Determinants of the quality of life of rural families.' *Journal* of Rural Health 14: 146-153.

Hamel J. Ed. (1998). *Research in the Taieri Catchment. Ecology Research Group, Occasional Paper No.1,* Ecology Research Group, University of Otago, Dunedin.

Massey University (1996). The New Zealand Values Survey: A Part of the World Values Survey 1998. Palmerston North, New Zealand, New Zealand Study of Values Trust in association with the School of Sociology and Womens Studies, Massey University.

McCreddin J and Syme G. Eds. (1999). *Land and Water Management in the Herbert River Catchment: A Longitudinal Study of Community Views.* Evaluation of Integrated Catchment management in a Wet Tropical Environment: Collected Papers of LWRRDC R&D Project CTC7. Indooroopilly, Queensland, Australia., CSIRO Tropical Agriculture.

McGinnis VM, WooleyJ and Gamman J. (1999). 'Bioregional Conflict Resolution: Rebuilding Community in Watershed Planning and Organising.' *Environmental Management* 24: 1-12.

Mills C. (2002). *Healthy River, Healthy People? A strategic overview of the Ruamahanga river catchment from a public health perspective*. Lower Hutt, (Project Report for Regional Public Health).

Ministry for the Environment (1997). *The State of New Zealand's Environment, 1997.* Wellington, New Zealand Ministry for the Environment.

Ministry for the Environment (1999). *Making Every Drop Count : The National Agenda for Sustainable Water Management. Action Plan. Draft for Public Comment.* Wellington, New Zealand Ministry for the Environment.

Ministry for the Environment (2001). Water tops the list of issues for New Zealanders. *Environment Update: The Newsletter of the Ministry for the Environment*. September-October 2001: 1.

Ministry of Health (1999). *Taking the Pulse: the 1996/97 New Zealand Health Survey.* Wellington, Ministry of Health.

Molinari C, Ahern M and Hendryx H. (1998). ' The Relationship of Community Quality to the Health of Women and Men.' *Social Science & Medicine* 47: 1113-1120.

Moore E and Koontz T. (2003). 'A Typology of Collaborative Watershed Groups: Citizen-Based, Agency-Based, and Mixed Partnerships.' *Society & Natural Resources* 16: 451-460.

Mullen M and Allison B. (1999). 'Stakeholder Involvement and Social Capital : Keys to Watershed Management Success in Alabama.' *Journal of the American Water Resources Association* 35: 655-662.

Otago Regional Council (1991). *Taieri River Catchment: Soil and water resources management issues and options.* Dunedin, Otago Regional Council Discussion Paper Series No.2.

Otago Regional Council (1999). *Taieri River Catchment Monitoring Report.* Report Number: 99/316 Dunedin, Otago Regional Council.

Parkes M. (2003). *Linking Ecosystems and Social Systems for Health and Sustainability: Public Health Lessons from the Taieri River Catchment.* A thesis submitted for the Degree of Doctor of Philosophy at the University of Otago, Dunedin, New Zealand.

Parkes M and Panelli R. (2001). 'Integrating Catchment Ecosystems and Community Health: The Value of Participatory Action Research.' *Ecosystem Health* 7: 85-106.

Parkes M, Panelli R and Weinstein P. (2003). 'Converging paradigms for environmental health theory and practice.' *Environmental Health Perspectives* 111: 669-675.

Parkes M and Weinstein P. (in press). An Ecosystems Approach to Environmental Health. *Environmental Health in Australia and New Zealand.* In S. Cameron, N. Cromar and H. Fallowfield Eds. Melbourne, Oxford University Press.

Parkes, M., Eyles, R., Benwell, G., Panelli, R., Townsend, C. and Weinstein P. (In press). 'Integration of Ecology and Health Research at the Catchment Scale: The Taieri River Catchment, New Zealand. *Journal of Rural and Remote Environmental Health*. Online at: http://www.wepi.org/jrreh/

Poore M. (2003). *Dairy Expansion in Southland: Implications for Public Health.* Dunedin, Department of Geography, University of Otago & Public Health South.

Pretty JN and Ward H. (2001). 'Social Capital and the Environment.' *World Development* 29: 209-227.

Robson M and Schneider D. (2001). ' Environmental health issues in rural communities.' *Journal of Environmental Health* 63: 16-19.

Statistics New Zealand (1996). *1996 Census of Population and Dwellings*, See http://www.stats.govt.nz/.

Statistics New Zealand (2001a). *2001 Census of Population and Dwellings.* See http://www.stats.govt.nz/.

Statistics New Zealand (2001b). Definitions and Questionnaires: 2001 Census of Population and Dwellings.

TAIERI (2003). *'Taieri Alliance for Information Exchange and River Improvement' website.* www.taieri.net.nz.'

Tarone RE, Alavanja MCR, Zahm SH, et al. (1997). 'The Agricultural Health Study - Factors Affecting Completion and Return of Self-Administered Questionnaires in a Large Prospective Cohort Study of Pesticide Applicators.' *American Journal of Industrial Medicine* 31: 233-242.

Tipa G. (1999). *Taieri River Case Study. Environmental Performance Indicators: Technical Paper No. 58. Māori Indicators Case Study. Prepared for the Environmental Performace Indicators Programme of the Ministry for the Environment by Gail Tipa on contract for the office of Te Runanga o Ngai Tahu.* Wellington, Ministry for the Environment.

Tipa G. (2003). *Indigenous Communities and the co-mnagement of natural resources: the case of New Zealand freshwater management.* A thesis submitted for the Degree of Doctor of Philosophy at the University of Otago, Dunedin, New Zealand.

Tong R and Cox G. (2000). *Clean and Green? The New Zealand Environment*. Auckland, David Bateman.

Townsend C and Riley R. (1999). 'Assessment of river health: accounting for perturbation pathways in physical and ecological space.' *Freshwater Biology* 41: 393-405.

TSRP (1994 -1999). *Taieri and Southern Rivers Programme Annual Reports.* Dunedin, University of Otago.

Wagner W, Gawel J, Furumai H, et al. (2002). 'Sustainable watershed management: An international multi-watershed case study.' *Ambio* 3: 2-13.

Ware J and Sherbourne C. (1992). 'The MOS 36-item Short-Form Health Survey (SF-36): 1: Conceptual framework and item selection.' *Medical Care* 30: 473–83.

APPENDICES

Appendix A TC&CH Survey –Questionnaire

(Note: original Questionnaire was full page size)

THE TAIERI CATCHMENT & COMMUNITY HEALTH SURVEY

- You have been **randomly chosen from people living in the Taieri Catchment area** to take part in this study.
- We hope that completing the survey will be interesting and informative for you. **It should take approximately 25 minutes of your time.**

What is the Taieri Catchment and Community Health Survey?

The survey asks you for your views about water resources and community health issues in the Taieri River Catchment. It forms part of the **'Taieri Catchment and Community Health Project'.** This University of Otago project aims to bring together community and scientific knowledge to work toward a sustainable, safe and healthy environment in the Taieri River Catchment. The community phase of the project was launched through a number of community meetings held across the Taieri area in April and May 2000. The *"Taieri Catchment and Community Health Survey"* is the next stage in this project.

Why should I participate?

The survey is an opportunity to share ideas and opinions about the Taieri area that are important to you and your community. The results will be directly reported back to communities throughout the catchment and will be used to encourage ongoing communication between communities, researchers and governmental agencies (city, district and regional councils) working throughout the region.

Is the questionnaire anonymous?

Yes. You do not need to write your name on the questionnaire, as we want to respect your privacy. A separate sheet is provided to indicate whether you would like to receive a summary of the survey results. However this information will be kept separately from the questionnaire, which remains anonymous. Some questions will ask about facts such as age, gender, ethnic background and the area you live, so that we can describe the group who took part in the study.

What is meant by the 'Taieri Catchment area'?

The area covered by the Taieri River Catchment includes the entire region drained by the Taieri River and all the tributaries received by the river between its origins in the Lammerlaw range of Central Otago, and its final destination at Taieri Mouth. The catchment therefore includes most of the streams, rivers and lakes in the Maniototo, the Strath Taieri, Clarkes/Hindon, Mahinerangi/Waipori, the Taieri Plains and Taieri Coast, including the coastal lakes of Waipori and Waihola. For simplicity, sometimes the words 'the Taieri', or 'the Taieri area' will be used to refer to the total Taieri Catchment area. All participants for the study have been randomly selected from people living in this Catchment area.

- Your participation in the Taieri Catchment and Community Health Survey would be sincerely appreciated.
- Please return the completed survey in the pre-paid envelope provided, to Dr. Margot Parkes, Ecology & Health Research Centre by **WEDNESDAY 13th SEPTEMBER** if possible.

THE TAIERI CATCHMENT & COMMUNITY HEALTH PROJECT
Ecology and Health Research Centre
c/o Department of Geography
UNIVERSITY OF OTAGO
PO Box 56, Dunedin

INSTRUCTIONS

How to fill out this questionnaire:

- Most of the questions do not have a right or wrong answer – we just want to know what you think about the issue.
- If you are unsure about how to answer a question, give the best answer you can.
- **Questions 3 to 20** ask for your *opinions* about land and water resources and life in the Taieri Catchment.
- **Questions 21 to 42** ask *background information* so that we can describe the group who took part in the study.

Answer the questions by:

- *circling the numbers that apply to your point of view*

eg.

1	2	3	4	5
very high importance	**high**	**moderate**	**low**	**very low importance**

OR

- *ticking the box that applies to you point of view:*

eg. Yes ☐ No ☐ Don't Know ☐

OR

- *writing in spaces provided*

eg. If yes, please specify year (s) *(eg. 1996, 1998)* _____

Please note: *Space is provided on the last page for additional comments you may have.*

It is estimated that the questionnaire will take 25 minutes of your time to complete.
Thank you for your participation.

IN RECOGNITION OF YOUR CONTRIBUTION

you are invited to enter a draw to win a $50 BOOK VOUCHER if your survey is received by Wednesday 13th September (see separate sheet provided).

1. **In which area of the Taieri River Catchment do you live?** *(please tick <u>one</u> box only)*

☐ Maniototo ☐ Mahinerangi / Waipori

☐ Strath-Taieri ☐ Taieri Plains

☐ Clarkes / Hindon ☐ Coastal Taieri (Henley, Waihola, Taieri Mouth)

☐ Other *(please specify)*_____

2. **If you live in a town, please name the town:**_____

Questions 3 to 20 *will ask your opinions about water and land resources, catchment management, and life in the Taieri River Catchment. There are no right or wrong answers we just want to know what you think about the issues.*

3. **What do you think are the major advantages of living in your area of the Taieri River Catchment?**

_____

_____

_____

_____

4. **Generally, what do you think are key issues facing people in your area?**

_____

_____

_____

_____

5. **Which of the following freshwater resources are of *benefit***

I. to you personally? *(for each resource, please tick one box ie.* Yes, No *or* Don't Know (D/K*)*

and

II. to people in the Taieri generally? *(for each resource, please tick one box ie.* Yes, No *or* Don't Know (D/K*)*

	I. Benefit to you personally			II. Benefit to people in the Taieri		
	Yes	No	D/K	Yes	No	D/K
a. Drinking water supply……..	☐	☐	☐	☐	☐	☐
b. Stock water……..	☐	☐	☐	☐	☐	☐
c. Water for irrigation……..	☐	☐	☐	☐	☐	☐
d. Dilution and removal of pollution…….	☐	☐	☐	☐	☐	☐
e. Water for industry……..	☐	☐	☐	☐	☐	☐
f. Hydro-electricity……. (eg. Loganburn or Waipori schemes)	☐	☐	☐	☐	☐	☐
g. Catching/hunting fish and game…….. (eg. Mahinga kai, eel, trout, whitebait, ducks)	☐	☐	☐	☐	☐	☐
h. Conservation areas……. (eg. wetlands, Sutton Salt Lakes, Scroll Plains)	☐	☐	☐	☐	☐	☐
i. Swimming……. (in streams, rivers, lakes)	☐	☐	☐	☐	☐	☐
j. Boating ……. (eg. canoes, rafts, outboard motors, jetskis)	☐	☐	☐	☐	☐	☐
k. Natural beauty……	☐	☐	☐	☐	☐	☐
l. Cultural and traditional values…….. (includes historical, whanau or family ties)	☐	☐	☐	☐	☐	☐

6. **In your opinion, how *important* are the following issues or problems in the Taieri area?**

I. to you personally? *(for each issue, circle one number only)*

and

II. to people in the Taieri generally? *(for each issue, circle one number only)*

(Use the scale below to indicate the importance of each issue.)

very high importance	high	moderate	low	very low importance
1	2	3	4	5

	I. Importance to you personally					II. Importance to people in the Taieri				
a. Water quality problems…….. (e.g. polluted, contaminated water)	1	2	3	4	5	1	2	3	4	5
b. Drought and water shortages……..	1	2	3	4	5	1	2	3	4	5
c. Flooding……..	1	2	3	4	5	1	2	3	4	5
d. Land and soil degradation……..	1	2	3	4	5	1	2	3	4	5
e. Riverbank stability & vegetation…….	1	2	3	4	5	1	2	3	4	5
f. Loss of biodiversity …….. (numbers of different species)	1	2	3	4	5	1	2	3	4	5
g. Weed Control……. (eg.Willow, Broom, Gorse)	1	2	3	4	5	1	2	3	4	5
h. Pest Control …….. (eg. Rabbits and Possums)	1	2	3	4	5	1	2	3	4	5
i. Nature Conservation Issues…….. (e.g. wetlands, habitat for Native species)	1	2	3	4	5	1	2	3	4	5
j. A sense of place…….. (eg. identify with landmarks, place names, areas of the river catchment)	1	2	3	4	5	1	2	3	4	5

7. **Following is a list of issues that some people think have *a negative impact* on life in the Taieri Region. In your opinion, how much do each of the following issues**

I. **affect you personally?** *(for each issue, circle one number only)*

and

II. **affect people in the Taieri generally?** *(for each issue, circle one number only)*

(Use the scale below to indicate the importance of each issue.)

very high degree	high	moderate	low	very low degree
1	2	3	4	5

Possible negative impacts on life in the Taieri	I. affects you personally					II. affects people in the Taieri				
a. Poor drinking water quality……..	1	2	3	4	5	1	2	3	4	5
b. Changing agricultural practices.……. (eg. intensification, increased fertiliser use)	1	2	3	4	5	1	2	3	4	5
c. Changing climate…….. (eg. seasonal changes less predictable)	1	2	3	4	5	1	2	3	4	5
d. Loss of farm productivity…….. (eg. more inputs required for same return)	1	2	3	4	5	1	2	3	4	5
e. Loss of environmental uses & benefits. (eg. Loss of wildlife habitat, Mahinga kai,)	1	2	3	4	5	1	2	3	4	5
f. Loss of recreational opportunities……. (eg. reduced water quality / quantity, lower fish numbers)	1	2	3	4	5	1	2	3	4	5
g. Loss of confidence in management of land and water resources…… (eg. by responsible authorities)	1	2	3	4	5	1	2	3	4	5
h. Stress of social & community changes.. (eg. loss of family or whanau traditions, local institutions and cultural/sporting activities)	1	2	3	4	5	1	2	3	4	5
i. Loss of population…… (eg. people moving out of the area)	1	2	3	4	5	1	2	3	4	5

8. **Generally speaking, what awareness do you think *local* people have about water, land and catchment issues in the Taieri region?** *(please circle one number only)*

very high awareness	high	moderate	low	very low awareness
1	2	3	4	5

9. **How much do you think *local* people are prepared to become involved in water, land and catchment issues in the Taieri region?** *(please circle one number only)*

to a very high degree	high	moderate	low	very low degree
1	2	3	4	5

10. **How much are *you* prepared to get involved in water, land and catchment issues in the Taieri region?** *(please circle one number only)*

to a very high degree	high	moderate	low	very low degree
1	2	3	4	5

11. **Are you aware of any programmes on environmental matters in the Taieri catchment that are funded by local, regional or national government ?**

Yes ☐ No ☐

If yes, please state what they are and write down any comments you have on them.

_____

_____

_____

12. **Have you seen the Otago Regional Council's 1999 Taieri Catchment Monitoring Report?**

Yes ☐ No ☐

If yes, please write down any comments you have on it.

_____

_____

_____

_____

13. **What do you think should be the key priorities for the future management of water and land resources in the Taieri River catchment** *(use back page to continue of necessary).*

_____

_____

_____

_____

14. **How important is it to you that the following initiatives are included in management of land and water resources in the Taieri River Catchment?**

(Using the scale below, please circle <u>one</u> number that applies to each activity).

	very high importance	high	moderate	low	very low importance
a. Encourage community action at a catchment level.....	1	2	3	4	5
b. Raise the level of local awareness and knowledge of environmental issues.....	1	2	3	4	5
c. Encourage coordination between district council and regional council initiatives.....	1	2	3	4	5
d. Develop solutions for and better understanding of environmental problems in the Taieri catchment...	1	2	3	4	5
e. Encourage discussion between community interest groups on environmental issues.....	1	2	3	4	5
f. Encourage joint projects between community , industry, researchers and local government..	1	2	3	4	5

15. **Here are two statements people sometimes make when discussing the environment and economic growth. Which of them comes *closest* to your point of view?**

(please tick <u>one</u> box only)

☐ Protecting the environment should be given top priority, even if it causes slower economic growth and some loss of jobs.

☐ Economic Growth and creating jobs should be the top priority even if the environment suffers to some extent.

☐ Don't Know/Don't agree with either of the above statements.

***Questions 16 to 20** ask your opinion about responsibility, influence and involvement in environmental and community issues in the Taieri Catchment. Use of the word* **government** *refers to relevant local, regional or national government agencies.*

16. **Responsibility for river catchment issues cuts across many agencies and individuals.**

For the Taieri area, what is your opinion about the *<u>current level of responsibility</u>* held by:

(using the scale below, please circle one answer next to each agency/group.)

	very high responsibility	high	moderate	low	very low responsibility	Don't Know
a. The Ministry for the Environment..	1	2	3	4	5	D/K
b. Department of Conservation	1	2	3	4	5	D/K
c. Ministry of Agriculture & Forestry	1	2	3	4	5	D/K
d. Ngai Tahu.....	1	2	3	4	5	D/K
e. Fish and Game.....	1	2	3	4	5	D/K
f. Otago Regional Council.....	1	2	3	4	5	D/K
g. District Councils..... Central Otago, Dunedin, Clutha, Waitaki	1	2	3	4	5	D/K
h. Industry ..... Mining, Hydro-electricity, Irrigation	1	2	3	4	5	D/K
i. Individual farmers.....	1	2	3	4	5	D/K
j. Other (please specify) _____	1	2	3	4	5	D/K
_____	1	2	3	4	5	D/K

17. **The future of the Taieri catchment will be influenced by the decisions of individuals and agencies involved with the land and water resources in the area.**

In your opinion, what level of *<u>future influence</u>* should the following groups have?

(using the scale below, please circle the one answer next to each agency/group.)

	very high influence	high	moderate	low	very low influence	Don't Know
a. The Ministry for the Environment..	1	2	3	4	5	D/K
b. Department of Conservation	1	2	3	4	5	D/K
c. Ministry of Agriculture & Forestry	1	2	3	4	5	D/K
d. Ngai Tahu.....	1	2	3	4	5	D/K
e. Fish and Game.....	1	2	3	4	5	D/K
f. Otago Regional Council.....	1	2	3	4	5	D/K
g. District Councils..... Central Otago, Dunedin, Clutha, Waitaki	1	2	3	4	5	D/K
h. Industry ..... Mining, Hydro-electricity or Irrigation	1	2	3	4	5	D/K
i. Individual farmers.....	1	2	3	4	5	D/K
j. Other (please specify) _____	1	2	3	4	5	D/K
_____	1	2	3	4	5	D/K

18. Using the scale below please rate how much you agree or disagree with the following statements.

(please circle <u>one</u> number that applies to each statement).

	Strongly agree	agree	neither agree nor disagree	disagree	strongly disagree
a. There are things I can do personally to help improve the environment……	1	2	3	4	5
b. It's too hard to think about land and water management for an area as big as the Taieri River Catchment	1	2	3	4	5
c. Government agencies need to give more resources to encourage voluntary groups to become involved in environmental issues…..	1	2	3	4	5
d. Government programmes for management of land and water resources interfere with people's rights to make their own decisions…	1	2	3	4	5
e. There are things local community groups can do to help improve the Taieri environment……	1	2	3	4	5
f. The local environment is no worse off than it was when I first lived here……..	1	2	3	4	5
g. Many environmental problems come from the way some people manage their properties…….	1	2	3	4	5
h. I could personally benefit from involvement in local catchment management projects……	1	2	3	4	5
i. Laws should be changed to make landholders more responsible for the consequences of their activities……	1	2	3	4	5
j. There aren't any environmental problems that need urgent action…..	1	2	3	4	5
k. There should be better government incentives for landholders to address environmental issues and problems	1	2	3	4	5

19. Thinking of the local community where you live, please rate how much you agree or disagree with each of the following statements.

(Using the scale below, please circle <u>one</u> number that applies to each statement).

	Strongly agree	agree	neither agree nor disagree	disagree	strongly disagree
a. I have almost no influence over what happens in this community…	1	2	3	4	5
b. It's very important to me to live in this particular community……..	1	2	3	4	5
c. People in this community are willing to help……..	1	2	3	4	5
d. I am very interested in local community issues……..	1	2	3	4	5
e. I and many others in this community share similar values….	1	2	3	4	5
f. I think this community is a good place to live……..	1	2	3	4	5
g. I don't have the time to become involved in local community issues	1	2	3	4	5

20. Can you please state which local community or neighbourhood you were thinking about when answering the last question._____

Questions 21 to 40 *will ask some background information, so that we can describe the group who took part in the study.*

21. What is your date of birth? _____/_____/19_____
(D / M / Y)

22. Are you?

Female ☐ Male ☐

23. Tick as many boxes as you need to show which ethnic groups you belong to.

- ☐ NZ Maori
- ☐ NZ European *or* Pakeha
- ☐ Other European → *Which of these groups?*
  - ☐ English
  - ☐ Dutch
  - ☐ Australian
  - ☐ Scottish
  - ☐ Irish
  - ☐ other
- ☐ Samoan
- ☐ Cook Island Maori
- ☐ Tongan
- ☐ Niuean
- ☐ Chinese
- ☐ Indian
- ☐ other (such as *FIJIAN, KOREAN*) → *Print your ethnic group(s)*

_____

24. What is your occupation? _____

25. How many years have you had this occupation? _____**Years**

26. Unpaid work. *In the last four weeks*, which of the following have you done, without pay, for people who do NOT live in the same household as you? *DON'T COUNT any you did for pay.*
(Tick as many boxes as you need to answer this question)

- ☐ looking after a child who does NOT live in the same household as you.
- ☐ unpaid household work, cooking, repairs, gardening, or looking after a person who is aged, ill or has a disability *(DON'T count work for your own household or people living there)*
- ☐ unpaid training, coaching, teaching or giving advice or counselling, helping at school, etc.
- ☐ attending a school committee meeting, or organization, administration, policy work, etc., unpaid, for group, church or marae
- ☐ unpaid fund-raising work, selling, etc., for group, church or marae.
- ☐ Other unpaid work
  - for people who do NOT live in the same household as you, or
  - for a group, church or marae

*Print the type(s) of work you did, for example: FIXING NEIGHBOURS CAR, DELIVERING MEALS ON WHEELS*_____

_____

27. In the *last 12 months*, have you been involved in any local community groups or associations?

Yes ☐ No ☐

If yes, please state which groups or associations and how often you participate.

_____

_____

_____

28. In the past five years, have YOU been diagnosed by a doctor with an illness caused by any of the following?

a) Cryptosporidium
Yes ☐ No ☐ Not sure ☐ **If yes, please specify when you were ill:** *(eg 1996, 1998)*_____

b) Campylobacter
Yes ☐ No ☐ Not sure ☐ **If yes, please specify when you were ill:** *(eg 1996, 1998)*_____

c) Giardia
Yes ☐ No ☐ Not sure ☐ **If yes, please specify when you were ill:** *(eg 1996, 1998)*_____

d) Salmonella
Yes ☐ No ☐ Not sure ☐ **If yes, please specify when you were ill:** *(eg 1996, 1998)*_____

29. Do you have any children?
Yes ☐ No ☐ *(→ if No, please go to Question 31)*

If yes, please fill in their ages *(in years)*

	Age		*Age*		*Age*
Child 1 (oldest)	____	*Child 2*	____	*Child 3*	____
Child 4	____	*Child 5*	____	*Child 6*	____
Child 7	____	*Child 8*	____	*Child 9*	____

30. In the past five years, have any of YOUR CHILDREN been diagnosed by a doctor with an illness caused by any of the following?

a) Cryptosporidium
Yes ☐ No ☐ Not sure ☐ **If yes, please specify which child and when they were ill** *(eg Child 1, 1998)*_____

_____

b) Campylobacter
Yes ☐ No ☐ Not sure ☐ **If yes, please specify which child and when they were ill** *(eg Child 1, 1998)*_____

_____

c) Giardia
Yes ☐ No ☐ Not sure ☐ **If yes, please specify which child and when they were ill** *(eg Child 1, 1998)*_____

_____

d) Salmonella
Yes ☐ No ☐ Not sure ☐ **If yes, please specify which child and when they were ill** *(eg Child 1, 1998)*_____

_____

31. Do you think that your own *physical* or *mental* health, or the health of members of your family have ever been affected by:

a) contact with the Taieri River or its tributaries or lakes? *(eg.swimming, stock water)*

Yes ☐ **No** ☐ **Don't Know** ☐

If yes, please specify or explain

_____

_____

b) changes to the environment in the Taieri area *(eg.drought, flood, access to water resources*

Yes ☐ **No** ☐ **Don't Know** ☐

If yes, please specify or explain

_____

_____

32. How long have you lived in the Taieri area? _____ Years

33. If you moved to the Taieri area in the last 10 years, what was the reason for your move?

*(eg, family, lifestyle, farming)*_____

34. Do you own and/or lease/rent agricultural land in the Taieri area?

(please tick as many boxes as apply)

Yes ☐ **OWN** **AND/OR** **Yes** ☐ **LEASE/RENT** **No** ☐ *(→ If No, please go to Question 37)*

35. Which one of the following *best* describes your *current* use of this land?

(please tick no more than three boxes)

☐ Pasture (Sheep) ☐ Pasture (Cattle)

☐ Crops ☐ Dairy

☐ Horticulture ☐ Forestry

☐ Other farming *(please specify)*_____

☐ Other *(please specify)*_____

36. What is the size of your property? _____ hectares *or* _____ acres.

37. What is your drinking water supply? *(please tick one box only)*

☐ **Individual water supply** *(→ Go to question 38)*
ie. A private rain, stream or bore water source for an individual farm or household supply.

☐ **Community water supply** *(→ Go to question 39)*
ie. Tap water comes from city/district council supply.

☐ **Private water scheme** *(→ Go to question 39)*
ie. Tap water comes from privately owned, shared water scheme.

☐ **Don't Know** *(→ Go to question 39)*

38. Is your *individual* drinking water supply treated in any way? *(please tick one box only)*

Yes ☐ **No** ☐ **Don't Know** ☐

39. Do you use a water filter on your drinking water supply *(please tick as many boxes as relevant)*

Not at all ☐ **At home** ☐ **At work** ☐ **At other times and places** ☐ *(please explain)* _____

40. How confident are you in the safety of your water supply? *(please circle one number only)*

1	2	3	4	5
very safe	**safe**	**Neither safe or unsafe**	**unsafe**	**very unsafe**

***Finally,** some general questions….*

41. Using the scale below please rate your level of satisfaction with the various aspects of your life at the moment? *(please circle one number that applies to each issue)*

	very satisfied	moderately satisfied	neither satisfied nor dissatisfied	moderately dissatisfied	dissatisfied
a. The area where you live	1	2	3	4	5
b. The community in which you live	1	2	3	4	5
c. Existing community facilities and services	1	2	3	4	5
d. Your standard of living	1	2	3	4	5
e. Your life in general	1	2	3	4	5

42. In general, would you say your health is:

1	2	3	4	5
excellent	**very good**	**good**	**fair**	**poor**

Thank you

Please use the back page for any additional comments.

Please provide any additional comments here:

Thank you very much for your time.

Note: If you would like to receive a **summary of the research results**, and/or **enter the prize-draw,** please provide your contact details on the separate sheet provided. This information will be kept separately from the questionnaire, which remains anonymous.

Research Use Only:								

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Appendix B Sampling frame and sample size for a whole catchment survey

Table C summarises the characteristics of the TC&CH Survey sampling frame and sample. The sampling frame was creating by pooling data from all age groups between 18 and 85 in the four Territorial Local Authorities that overlap the Taieri Catchment area. People on the New Zealand electoral roll are associated with a meshblock according to their address (see Note 1, Table C). All those in the sampling frame who lived in meshblocks within the Taieri River catchment boundary were selected as part of the survey population using ArcMap 8.1 (© 1999-2001, ESRI, Inc) Geographic Information System.

Table C Sample characteristics of the TC&CH Survey

Sampling frame = New Zealand Electoral roll	
Individual addresses only, 18-85 years, living in four Territorial Local Authorities overlapping the Taieri Catchment area (Dunedin City, Waitaki District, Clutha District and Central Otago District Councils)	
Spatial delineation of sample	
ArcMap 8.1 (© 1999-2001, ESRI, Inc) software used to delineate meshblocks corresponding with the Taieri River catchment boundaries. If meshblocks straddled the Taieri catchment boundary more than 10%, they were included as part of the catchment sample. Manual checking of addresses from boundary meshblocks enabled exclusion of addresses not within the catchment.	
upper and Lower sub-catchment populations identified by position of meshblock within the catchment in relation to geographical features and socioecological analysis (Chapter 4).	
Sample Units and Target population	
Individuals on electoral roll living within Taieri River catchment boundaries	*N* =12043
Sub-catchment populations (+*subcategories* for proportional sampling in rural areas [2])	*N* =12043
	1677
upper Catchment Total	*530*
-upper rural centres	*1147*
-upper rural	10366
Lower Catchment Total	*8404*
-lower urban areas and rural centres	*1962*
-lower rural	
Sample Size (11% from within sub-catchment populations and subcategories)	
Upper Catchment	184
Lower catchment - includes lower urban (924) and lower rural (215)	1139
TOTAL SAMPLE SIZE	*n* = 1324

Notes: 1. A meshblock is the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand, varying in size from part of a city block to large areas of rural land. Meshblocks are used to define electoral districts and local authority boundaries (Statistics New Zealand, 2001b).

2. Statistics New Zealand (2001b) classifies area units (aggregations of meshblocks with a unique name referring to a geographical feature or suburb) as *urban* and *rural,* as follows:

- 'Urban Areas' include minor (pop. 1,000–9,999), secondary (pop. 10,000–29,000) and main (pop. >30,000) urban areas

- 'Rural Areas' are those not specifically designated as 'urban' and include rural centres.

- 'Rural Centres' (pop. 300–999) and are not termed urban under standard international definitions, but are differentiated from 'true rural areas' and small 'rural settlements' (Statistics New Zealand, 2001b).

Figure 3 depicts the Taieri catchment's 'Urban Areas' (Mosgiel, Dunedin), 'Rural Centres' (Ranfurly, Outram) and 'Rural settlements' (Taieri Mouth, Waihola, Allanton, Middlemarch, Naseby).

Table C also notes the division of upper/lower sub-catchment populations into urban/rural sub-categories to ensure proportional spatial sampling in rural areas (see Table C, Note 2). Spatial distribution of the sample was achieved by proportionally sampling in 'rural areas' as distinct from 'rural centres' or 'urban' areas in both upper and lower catchment. There are no meshblocks in the upper catchment that are classified as urban areas under international definitions (Statistics New Zealand, 2001b).

The TC&CH Survey sample size (Table C) was calculated to ensure adequate power for statistical analysis of the upper catchment respondents (smallest sub-population) including stratification by potentially modifying independent variables. A sample size of at least 10% of the upper catchment target population was required to achieve these parameters. The sample size calculation took into account the potential for higher response rates in the upper catchment due to the smaller population and the increased likelihood that respondents would be aware of the 'Taieri Catchment & Community Health Project' (i.e. a higher exposure to publicity per population though community reference groups, local media advertising etc). The overall sample size of 1324 represents 11% of the total population (N =12043).

While the possibility of using the four sub-categories (Table C) for sample size calculation was considered, financial constraints meant that it was not possible to sample a large enough proportion of the smallest sub-population (Upper, Rural Centres) to ensure adequate numbers for cross-classification and statistical analysis. The division of the catchment into three catchment areas (upper catchment, lower rural and lower urban) for analysis, was based on the distribution of population distribution throughout the catchment, and survey sample and responses. More detail regarding this process of spatial sampling and analysis is provided in the author's PhD thesis (Parkes 2003).

Appendix C TC&CH Survey response rate: issues and implications

The overall response rate of 37.5% is lower than anticipated (Table 1). Dolsen and Machlis (1991) propose that response rates between 30-70% are acceptable for surveys using 'general public' sampling frames such as the electoral roll. However the TC&CH Survey response rate is still lower that expected or hoped for, resulting in a non-response bias that reduces the power of statistical tests and warrants caution in generalising the findings. Other sources of potential bias in the survey include: the increased response rate in rural catchment areas highlights a potential bias toward rural responses and a plausible response bias toward those involved with community activities.

Implications of the TC&CH Survey response rate are discussed here in relation to comparisons with other survey response rates; the strengths and limitations of the TC&CH Survey design; the role of the survey as one methods used within the multi-method design of the Taieri Catchment and Community Health Project and implications for future research.

- **Comparison with other survey response rates**

It is difficult to find other surveys of similar subject matter and methods to make direct comparisons as to acceptable response rates for this kind of health and sustainability survey. McCreddin and Syme (1999) report response rates of 59.6% and 49.4% in the longitudinal Herbert River community catchment study where preliminary telephone interviews were used to increase response from mail-out questionnaires. As part of the large US Agricultural Health study of farmers (n = 16,535) Tarone et al. (1997) describe a 47.5% response rate to a 17-page questionnaire regarding pesticide application. A random digit telephone survey assessing community quality and health had a response rate of 33% (Molinari, 1998). Robson and Schneider's (2001) survey of rural health care providers regarding environmental health issues in rural communities yielded a response rate of 17% (n = 2,248). The TC&CH Survey is within the lower range of these examples.

- **Strengths and limitations of Survey Design**

When considering factors that may have influenced TC&CH Survey response, the 'Total Design Method' (Dillman, 1978; Dillman et al., 1993; Calahan and Schumm, 1995) identifies six factors that are important influences on response rate: the covering letter, the follow-up, study importance readability, length and sample type. Based on these criteria, the covering letter, follow-up, and readability of the survey were considered positive features in survey design. However, to counter this, limiting factors may have included: the use of a 'general public' sample such as the electoral roll; the length of the survey (> 12 pages deemed a limiting factor by Dillman, 1978), and a potentially low perceived importance of the study, especially by urban respondents. This latter factor is supported by the bias toward rural responses indicated in Table 1.

- **Limitations of TC&CH Sampling Frame**

Limitations of the use of the electoral roll as a sampling frame became apparent once responses had been returned. Notably, at the end of the process it was apparent that there were only 1251 valid names and/or addresses in the initial sample of 1324 (9.5% invalid name/address). Invalid names were estimated from the number of questionnaires returned as 'gone, with no forwarding address' and phone-calls indicating incorrect address (n=55), plus those who indicated by phone or written response that the invited participant had died, was overseas, or was too old or infirm to complete the questionnaire (n=18). The proportion of invalid name or address is consistent a conservative estimate of 9.1% inaccuracy of electoral roll addresses in other NZ postal surveys (Massey University, 1996). If response rate is calculated based on this updated estimate of valid names/addresses, overall response rate would be 39.6% (496/1251).

- **The role of surveys as a collaborative research tool**

It is important to note that the TC&CH Survey was one part of a multi-method study design which enabled findings to be compared and triangulated with other types of data. Survey findings regarding the scope of community knowledge regarding catchment and community health issues and the importance of community involvement in catchment management processes were supported by participatory data collected from Community Reference Groups (see Parkes 2003, Chapter 5). Furthermore, discussion of catchment differences and survey findings in feedback meetings were met with interest by reference group participants – who found the results plausible and informative as fuel for discussion and confirmation of reference group concerns.

- **Implications for future research**

Both TC&CH Survey response rate and findings have important implications for future research in the Taieri catchment and for research of health and sustainability issues in general. More detailed qualitative data techniques (personal interviews) would be appropriate methods for examining the historical and personal information regarding catchment and community health issues that were identified by the survey, but not examined in detail. Community Oral Histories are one of the initiatives that will be initiated by TAIERI Trust in 2003, based on ongoing collaboration between local communities throughout the catchment and Dr. Ruth Panelli (Department of Geography) and the TAIERI Trust project co-ordinator. Furthermore, due to the considerable (financial and human) resources of conducting the TC&CH Survey, the need for careful survey design and question selection has been reiterated. On reflection, the scope of health and sustainability issues addressed by the TC&CH Survey led to an over-inclusive study design. Lessons from this survey have been useful to inform the design of a surveys conducted in June 2003 as part of review and evaluation requirements of the Taieri Trust.