KEY ELEMENTS FOR ENGAGING DAIRY FARMERS IN ACTION TOWARDS HEALTHY WATERWAYS: A CASE STUDY IN THE AORERE CATCHMENT, NEW ZEALAND

by

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Thesis

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ABSTRACT

Over the past few years, there has been increasing attention in New Zealand drawn to the pollution of water bodies from dairy farm effluent, and ways to mitigate this. The aim of this research is to identify the key elements involved in engaging farmers in community based action to mitigate agricultural water pollution. The study examines a Landcare project that has shown signs of apparent success, entitled the Aorere Catchment Project (ACP), in Golden Bay, New Zealand. The ACP was initiated after the Aorere River was found to have high pathogen levels, likely resulting from dairy farm runoff. This research evaluates the projects apparent success, and follows the evolution of the project to gain an understanding of the key success factors in engaging farmers. Surveys of dairy farmers in the Aorere valley were undertaken in 2007 and again in 2010 to identify management practices and identify changes in issues and farmer attitudes over this period. This study found that the ACP has had extensive success, both in resolving waterway issues and engaging farmers in action for healthy waterways. The underlying community led philosophy of the project has been vital in the success of this project. The key project principles, 'farmers as leaders', and 'experts on tap not on top' have contributed greatly to the projects uptake. There are however some catchment specific elements that have aided the apparent success of this initiative. The Aorere catchment project model unchanged would not be suitable for every catchment in New Zealand, as not all the elements of success were under the projects control. The model does however serve as a good example for similar projects in other New Zealand catchments, and also the importance of a suitable indicator of success.

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1. INTRODUCTION

This thesis assesses the effectiveness of a NZ Landcare Trust land management project to effectively engage dairy farmers in action to improve and protect water quality. The project, entitled 'Aorere Farmers as Leaders in Water Quality', or Aorere Catchment Project (ACP), has shown signs of apparent success since its inception in 2006, and has strong farmer and stakeholder involvement and support. This study was based primarily on a survey of Aorere dairy farmers aimed at assessing project effectiveness, identifying changes in issues and attitudes, examining current best management practices and project successes, and also makes comparisons with a similar survey undertaken in 2007. This first chapter presents the problem, contextualises its significance, and defines the research purpose and scope.

1.1. Problem Definition

The agricultural sector has been critical in shaping New Zealand's economy, society and environment. Agriculture physically dominates the country's geography with over half the land area classified as farmland (Statistics New Zealand, 2007). A further third of the country is conservation land, leaving only a small area for all remaining land uses. Not only is farming physically dominant but it is also a major sector of the New Zealand economy, particularly in the export sector and in employment. Overall, the primary sector accounts for 7.1% of GDP and contributes over 50% of New Zealand's total export earnings (The Treasury 2010).

The dairy sector in particular is fundamental to the country's economic performance, contributing approximately 25% of total merchandise export earnings ($NZ10 billion in 2008-09) (IDF World Dairy Summit 2010). While New Zealand produces only 2% of total world production at around 16 billion litres per annum, unlike most other countries, around 95% of its dairy produce is exported (IDF World Dairy Summit 2010). A rising demand from developing countries in recent years has seen a rise in dairy prices to their highest ever level (The Treasury 2010).

Given the nation's dominant land uses, farmers often find themselves at the center of discussions over the current level of environmental sustainability. The dairy industry in particular has come under increasing environmental scrutiny in recent times with the expansion and intensification of the sector eg (Dominion Post, 2010; Kissun, 2008). More recently this scrutiny has also been gaining international notoriety. A recent article by Sudesh Kissun in *Rural News* (Kissun, 2008) stated:

> *"A recent Environment Court fine handed down to a repeat New Zealand offender got coverage from both UK and the US media".*

As the need to meet the challenges of sustainable land management strengthens, farmers are increasingly subject to the advice, persuasion, political pressure and regulation of outside parties. Often this coercion comes from Regional Councils, the Department of Conservation, Fish and Game, or other resource management agencies. There are also increasing numbers of independent organisations involved in the promotion of sustainable management approaches within New Zealand. A common difficulty all the above parties face is the engagement of local landowners to implement strategies to improve or protect various natural resources.

The purpose of this research, therefore, is to look at one of the major New Zealand Landcare Trust projects in the Upper South Island. It will examine the apparent successes of the project, and also identify some key elements for engaging farmers in sustainable management action. The ACP is led by farmers in the Aorere catchment and facilitated by the New Zealand Landcare Trust.

1.2. Research Context

New Zealand depends greatly on our water and land resources, our 'natural capital' and the value of which is being increasingly recognized within farm business (Primary Sector Water Partnership, 2008; J. Robertson, Robertson, Stuart, & Peters, 2010). As a commodity good, dairy products are subject to daily price fluctuations based on global supply and demand. A rise in the world price for dairy can often create economic incentives to expand and intensify dairy production, regardless of associated environmental costs. This has been observed in the past few decades in New Zealand where the milksolids payout received by dairy farmers between 1990

and 2008 increased by 83%, while New Zealand's dairy cow population increased by 67% and the national stocking rate (cows per hectare) increased by 18% (DairyNZ, 2008). There is also a further argument used for increasing intensification: that as the value and scarcity of our natural resources increase, environmental legislation tightens, and many farmers argue they must increase returns from investment to make their businesses viable (J. Robertson, et al., 2010).

The international competitiveness of the New Zealand dairy industry is built on low cost ryegrass/clover-based systems and a favourable temperate climate that enables cows to graze pastures mostly all year round (Monaghan, de Klein, & Muirhead, 2008). Whilst this grazed pasture farming system is very efficient at producing milk, it has also been identified as a significant source of nutrients (N and P) and faecal bacteria (Monaghan, et al., 2008) which are recognised as a major cause of water quality degradation in many NZ regions (Hamill & McBride, 2003; Vant, 2001). Thus, reducing diffuse (non-point source) pollution from dairy farms remains a significant challenge in improving and protecting New Zealand's waterways. There has been increasing attention in recent years regarding how agricultural management affects water quality; dairy farmers especially are under growing criticism for 'bad' farm management. Fish and Game's 2001 'Dirty Dairying' campaign grabbed national attention, as did the recently released Environment Waikato report stating that a deterioration of water quality in the last decade has resulted in over 75 percent of waterways tested being unsafe even for livestock to drink (Environment Waikato, 2008). A 2010 report on lake water quality in New Zealand (NIWA, 2010) suggests 32 per cent of New Zealand's monitored lakes are likely to have poor or very poor water quality, and the lakes with the poorest water quality and ecological condition tend to be surrounded by pastoral land cover.

> *"It is unacceptable that 32 per cent of our monitored lakes have poor water quality and that more lakes are deteriorating in water quality than are improving." Dr Nick Smith (Watkins, 2010)*

In response to these concerns, a variety of mitigation measures available to farmers to reduce environmental emissions have been developed. These environmental best management practices (BMPs) are generally promoted and often enforced by local government guided by the principles of the Resource Management Act (RMA)

(1991). In addition to this has been the development of 'The Dairying and Clean Streams Accord,' a voluntary agreement between Fonterra, the Ministries of Agriculture and the Environment, and Regional Councils. Signed in May 2003, the Accord sets out five targets for farmers to meet and failure to meet these targets may result in farmers facing industry-imposed penalties. There is doubt however, that Fonterra will be willing to pursue stringent enforcement of each target if non-compliance is especially high, or if non-compliers include farmer-shareholders who are politically influential (Jay, 2007). Although progress towards both the Council and the Clean Streams Accord goals continues to be steady in most areas (Fonterra, Ministry for the Environment, Ministry of Agriculture and Forestry, & Local Government NZ, 2008) challenges remain in the effective engagement of farmers to adopt such practices. Fonterra's 'Snapshot of Progress 2006-2007' report states that: "*farmers are experiencing difficulties in complying with Regional Council regulations and that level of non-compliance remains much too high*".

Engaging farmers in sustainable management offers many challenges. External parties will be dealing with a farming community that is weary of 'new' solutions, threatened by urban recreationalists/environmentalists/consumers, and overloaded with printed material and advice on the latest solutions. However, under the current economic climate dairying has been relatively profitable, leading to suggestions the timing is right for investment back into the environment.

> *"At its annual meeting yesterday, Fonterra said its balance sheet is in the best shape it has ever been but its sustainability record still needs work" (ONE News, 2010).*

Additionally, despite the fact that most human activities affect water quality, the recent Lincoln College survey: *Public Perceptions of the New Zealand Environment* (Kaine & Higson, 2006), showed that people believe water pollution and water quality issues are the most important environmental problems facing New Zealand. There is widespread awareness of environmental issues throughout the farming community, dairy farm businesses are generally profitable, and there is a good level of national investment in sustainability research.

Given all of the above, any model that appears to reverse the alleged environmental trends demands close attention.

1.3. Aims and Objectives

This research aims to assess the effectiveness of a New Zealand Landcare Trust initiative, a project designed to engage farmers in actions to improve local water quality: The Aorere Catchment Project (ACP). This research will focus on the merits and effectiveness of the project's key principles: empowering dairy farmers to be leaders, and utilisation of technical experts 'on tap not top' approach to improve overall catchment water quality. It will assess the value of this initiative as a model for further use in other catchments. I will also investigate whether motivating farmers and encouraging local knowledge, leadership and peer mentoring does lead towards implementation of best management practices ultimately leading to an overall healthier catchment.

By examining and assessing the Aorere Catchment Project (ACP) this thesis will aim to answer the following underlying research question that motivates this research; "*What are the key elements involved in engaging farmers in community based action for healthy waterways?*" There are two key research objectives to answer this question:

1. To evaluate the apparent success of the project in engaging farmers to take action to improve and protect local waterways
2. To follow the evolution of this project and to use its experiences to give an understanding of the key success factors in engaging farmers

The following chapters are used to set the scene and give a background to the case study used in this research. The methods section will outline the process used for gathering the empirical information for this research, with specific focus on the ACP.

2. DAIRYING AND WATER QUALITY – SETTING THE SCENE

2.1. Water Quality in New Zealand

The fresh water of New Zealand sustains our economic growth, natural environment, cultural heritage and the health and well-being of our people. New Zealand's economy is driven principally by agriculture and tourism both of which rely heavily on access to clean fresh water. Not only is water essential to providing life and economic benefit, it is also central to the New Zealand way of life.

> *"Ask New Zealanders about things that make living in New Zealand special and they will include being able to safely take fish, swim and go boating in our lakes, rivers and streams" (New Zealand Business for Sustainable Development, 2008)*

Maori value wai (water) for its life giving force, the food resources it provides, including watercress, eels (tuna), and whitebait, and also for its spirituality (Ministry for the Environment, 2007). Freshwater-based recreation is a common and important pastime for New Zealanders and agricultural systems based on the availability of water have been critical to building the rural towns and communities fundamental to the country's culture. The diverse range of aquatic environments from mountain springs to coastal estuaries, connected by an intricate network of rivers, lakes, wetlands, estuaries and groundwater systems gives New Zealand some of its great beauty.

Globally, water sources are coming under increasing pressure and deterioration as populations grow and countries industrialise. Even though much of New Zealand's fresh water is still relatively clean and abundant compared with global standards, the deterioration in the quality of a number of our lowland rivers, streams and lakes is causing concern (Land and Water Forum, 2010). This degradation of New Zealand's fresh water is being increasingly recognised by the wider public (Hughey, Kerr, & Cullen, 2008). There are expensive clean-ups in iconic lakes and rivers taking place and questions being raised regarding the state of our groundwater (Land and Water Forum, 2010). The issue of fresh water quality does not stop at the coast; everything

that happens to our streams and rivers in turn affects our coastal environment: estuaries, beaches and marine life. These impacts in turn can affect marine farming and fisheries that the New Zealand economy is also reliant on.

Until the 1970s, the major cause of deterioration in water quality in New Zealand was the direct discharge (point source) of pollutants from poorly treated sewage, stock effluent and other wastes from primary production and industry directly into water bodies. The introduction of the Water and Soil Conservation Act 1967 and the Resource Management Act 1991 has bought stricter controls on the discharge of effluent directly to water, and a resulting continuing trend towards applying effluent to land. The main source of waterway pollution in New Zealand now comes from diffuse sources, i.e. non-point-source pollutants with no single point of origin (e.g. land runoff) (Ministry for the Environment, 2007). Although the elimination of the majority of direct discharges has contributed to the improvement of many waterways (Ministry for the Environment, 2007), diffuse agricultural pollution of waterways is recognised as a major cause of water quality degradation in many NZ regions (Hamill & McBride, 2003; Vant, 2001). This remains a significant challenge in improving and protecting New Zealand's waterways. There has been increasing attention in recent years regarding how agricultural management affects water quality; dairy farmers especially are under growing criticism for 'bad' farm management and 'dirty dairying'.

Since 1985, when the New Zealand Government withdrew subsidies and almost all other forms of support from agriculture, a market driven approach to farming has been promoted (Jay, 2007). New Zealand farmers are fully exposed to market competition in the global market. The largest agricultural industry, New Zealand dairy is neither static nor reliable and is enormously influenced by world-wide shifts and changes in agri-food systems. This is more so than New Zealand's dairy competitors such as Canada, the United States and the European Union, all of whom still receive government subsides. Little strategic direction has been provided by central government and, relative to other OECD countries, there has been little intervention into environmental issues relating to farming (J. Robertson, et al., 2010). However, sustainable agriculture is becoming a more important aspect of New Zealand's

environmental policy of late, especially in regards to impact on waterways (Ministry for the Environment, 2008).

2.2. Fresh Water Policy and Regulation in New Zealand

The Resource Management Act 1991 (RMA) is the key piece of legislation governing the management of freshwater resources. The RMA promotes sustainable management of natural resources in an effect-based tenor rather than being prescriptive. Under the RMA, Regional and Unitary Councils throughout New Zealand are responsible for making decisions on the allocation and use of water within their boundaries and for managing water quality. The RMA requires councils in all regions to develop and give effect to a regional policy statement. The purpose of which is to: *"enable regional councils to provide broad direction and a framework for resource management within their regions".* Regional policy statements must give effect to national policy statements and be consistent with water conservation orders (section 62(3)).

Legislation governing water quality and the management of water resources is going through some major alterations at present. The Minister for the Environment is currently leading the most comprehensive reform of the RMA to date: Resource Management (Simplifying and Streamlining) Amendment Act 2009, enacted on 1 October 2009. In mid 2010, the National Government introduced a new fresh water management strategy entitled: New Start for Fresh Water. It sets out the Government's new direction for water management in New Zealand, and outlines some of the choices we face and the implications of those choices (Ministry for the Environment, 2010). The government has also proposed a National Policy Statement for Freshwater Management aiming to "*ensure the enhancement of the overall quality of freshwater resources as well as managing the increasing demand for water"* (Ministry for the Environment, 2010: 2). The proposed national policy statement is intended to "*enhance management of New Zealand's freshwater resources so that, by 2035, these meet the needs and aspirations of all New Zealanders"(Ministry for the Environment, 2010).*

The apparent government focus on water quality enhancement provides additional rationale to closely examine and critique any model that appears to effectively and efficiently engage farmers in community-based water quality improvements.

2.3. Past And Present Pressures On The New Zealand Dairy Farm

This study takes the position that the farmer is an important decision maker influencing the management of diffuse agricultural pollution in the water environment. Much of the diffuse water pollution comes from the agricultural sector, and farmers in many rural catchments hold the majority land share. It is therefore critical to try to understand the reasons for their decisions and behaviour when endeavouring to engage farmers in community-based approaches to mitigate agriculture's impact on water quality. Thus, the following section outlines the evolution and recent history of farming in New Zealand to provide insight into the attitudes and values of the current dairy farming community.

2.3.1. A Brief History of New Zealand Agriculture

New Zealand's initial agricultural practices involved a slash and burn mentality aiming to convert native vegetation to farmable landscapes. This was an understandable world-view when there were so few people in an apparent 'alien' environment. Over time agricultural New Zealand has formed a strong basis for the national economy. The period between 1840 and 2002 has been categorized into five overlapping major phases of agricultural development: colonisation, expansion, early intensification, diversification, and later intensification (Glasby, 1991; Langer, 1990; Molloy, 1980; PCE, 2004). A brief introduction into these five phases of New Zealand farming is outlined below:

Colonisation (~1840-1870)

The colonisation phase took place in the period between 1840 and 1870, when large areas of indigenous grasslands were burnt for grazing and the sheep population increased dramatically (Langer, 1990; Molloy, 1980).

Expansion (~1870-1920)

The first major agricultural expansion of New Zealand took place between 1870 and 1920 (PCE, 2004). In the 1870s a wheat boom and minimal energy inputs into grasslands contributed to rapid depletion of soils (MacLeod & Moller, 2006) and a quick depletion of pasture resulting in a decline in sheep numbers (MacLeod & Moller, 2006; PCE, 2004). The introduction of refrigerated shipping in 1882 and expansion of the railway system enabled exports of meats, butter and cheese. During this time a permanent grassland system began to evolve.

Early Intensification

The early phase of intensification took place between 1920 and 1940-1970 (there is some dispute about when this period ended (MacLeod & Moller, 2006)) with many farms establishing following World War 1. Facilitated by the application of new soil science, fertilisers, and improvements in plant and animal breeding production improved dramatically. The area of pasture remained fairly stable in this period but the number of stocking units increased by about 150% (Molloy, 1980). Concurrently, dairy productivity doubled (Langer, 1990).

Diversification

During the 1950-1970s period, development of successful pasture species (such as perennial ryegrass and clover) contributed to the grasslands revolution while affordable sources of phosphate fertiliser also began to lift productivity. New technologies such as tractors, shearing plants, milk tankers, milking sheds and aerial topdressing also brought major operational changes. After WWII 90% of farm products were exported to Britain. In 1973 Britain joined the European Community and New Zealand's status as 'Britain's other farm' ended (Langer, 1990; Molloy, 1980). New products such as casein and milk powder were developed and exported to new markets. By the 1960s and 1970s state policy assisted and supported agriculture to produce a near doubling of production between 1960 and 1980 (Le Heron, 1991).

Later Intensification

A later phase of intensification is thought to have started in the 1980s and continued to the present day (PCE, 2004). In the 1980s a global downturn in commodity prices caused increased costs for production incentives and subsidies. During this period

there was a growing public opposition to production-focused state policies. Urban-centered political support initiated the withdrawal of all agricultural subsidies by the fourth Labour Government in 1985. The policies of central government since this time have continued to resist all forms of assistance to agriculture and exposed New Zealand agriculture to the full force of global competition (Jay, 2007). The decade from 1986 when subsidization ceased, saw the rural community enter survival mode. Many farmers were making a loss and bankruptcy was not uncommon (PCE, 2004). Since the mid 1980s successive Governments within New Zealand have promoted a market driven approach to farming. However during this time production did not decrease and by the 1990s a lift in milk product prices resulted in an increase in farmer income (PCE, 2004). Certainly, there is evidence of a general trend towards ongoing intensification of existing dairy farms as well as extensive dairy conversion (MfE, 2010).

2.3.2. *Today* - Productivism to post Productivism?

Today, New Zealand's agricultural system has been described as intensive, expansionist, and based on the expansion of world trade in food, ever increasing farm sizes, and the use of technology to increase output (MacLeod & Moller, 2006). Numerous British scholars have used the term 'Productivism' to describe this form of intensive agriculture that predominated in the United Kingdom between the Second World War and the beginning of the 1990s. As Jay (2007) suggests, while New Zealand's situation does differ somewhat from this British agricultural regime, the key elements of the expansion of production and economic efficiency remain the same.

During the production era many new ideas were presented, subsidised and rapidly employed. Over time many of the solutions offered by technical experts have been proven ineffective or environmentally disastrous. Examples are crack willows, tile drains, drainage of wetlands, wilding pines, growth hormones, construction of homogeneous drains, marginal land development, and DDT use (PCE, 2004). Today, farmers have become very wary of technical solutions due to their ever-changing nature, cost and lack of immediate economic benefits (Robertson, n.d.).

Post-Productivism is a regime described by R. B. Le Heron (1993) in which farmers' main aim is no longer to maximize productivity, but to put a higher emphasis on quality of life, resiliency and efficiency. Thus the focus becomes choosing alternatives, such as higher food quality, the production of environmental goods, and a more diversified rural economy, with the market for mass-produced food more open to global competition.

This shift has also been described as a movement toward a 'sustainable era' (PCE, 2004; Robertson, n.d.). Both regimes may insinuate that environmental sustainability has been attained, however in reality, this is not yet the case. To date, there is still a conflicting pressure to increase production whilst retaining environmental values (PCE, 2004; Robertson, n.d.). The industry is still incentivising intensification and a productivist culture. The perceived requirements for success on the global market place are reiterated by an address to shareholders from a Fonterra senior executive:

> *'…New Zealand's dairy farmers are world class performers in terms of being low cost producers… So when Fonterra came to develop its strategy, a key theme was maintaining this very competitive position of being the lowest cost supplier of commodity and dairy products… With record milk volumes generated by suppliers each season and continued forecasts of growth in supply, Fonterra will always be in the commodity market. The challenge we face is to lock down our low cost position, by being relentless about operational excellence and exploiting every opportunity to improve our efficiency…' (Ferrier, 2004 as cited in Jay, 2004).*

2.3.3. Dairying and the economy

A single dairy company dominates the New Zealand dairy industry, Fonterra Co-operative Group. The co-op is owned by more than 11,000 farmer shareholders and processes 14.67 billion litres of milk into more than 600 products (e.g., desserts, milk powders and proteins, cheeses and cheese ingredients, and pharmaceuticals), exporting to 140 countries (Fonterra, 2010a). In response to public concerns over its environmental impacts, the New Zealand dairy industry has responded by bringing environmental concerns within the scope of dairy farm management (Fonterra, 2010b).

2.3.4. Clean Streams Accord

In May 2002 the Dairying and Clean Streams Accord was introduced, an accord in which Fonterra Co-operative Group, the Minister for the Environment, the Minister of Agriculture, and Regional Councils agreed to work together to achieve clean, healthy water in dairying areas. The Clean Streams Accord promotes sustainable dairy farming in New Zealand in an effort to reduce the impacts of dairying on the quality of waterways. The Accord specifies targets to keep dairy cattle out of streams, lakes and wetlands, to treat farm effluent, and to manage the use of fertilisers and other nutrients.

While the snapshot of progress report (Fonterra, et al., 2008) shows there has been success in meeting some accord targets, others fall short. There has also been wide criticism of the progress reporting as well as the accord itself. For instance:

> *"The Accord has always been a stop-gap programme and fundamentally incomplete, is voluntary not mandatory, included less that 100% target, has no riparian buffer zone requirements, doesn't deal to small streams, only includes Fonterra suppliers, and never focused on measurable improvements in water quality. It is input focused, not environmental outcome focused."*
> *Fish and Game media release (Johnson, 2009)*

The accord offers no measure of success in terms of environmental outcomes.

3. LITERATURE REVIEW

To provide focus for this report, this chapter addresses the following research question, which is an element of the overall focus of this report and project framework: *To identify the key elements involved in engaging farmers in community based action for healthy waterways by examining and assessing the Aorere 'Farmers As Leaders In Water Quality' Project.*

This research makes a contribution to the broader literature on natural resource management (NRM), which emphasises community and stakeholder involvement. Integrated Catchment Management (ICM) and similar terms such as Landcare and Community-Based Natural Resource Management (CBNRM) will be used with the intention to emphasise specific characteristics of successful catchment management with a particular focus on one NZ Landcare Trust Landcare program.

It is widely accepted that the field of behaviour change is very complex. It has now been recognised that simply disseminating information, while important, is not in itself sufficient to enact change (Allen, Kilvington, & Horn, 2002; Kollmuss & Agyeman, 2002). Numerous theoretical frameworks have been developed to explain the gap between the possession of environmental knowledge and environmental awareness, and displaying pro-environmental behaviour. (Kollmuss & Agyeman, 2002) present an extensive review of the many available frameworks, imparting a model that illuminates the complexity of this field (Fig. 1). While this model omits some important influencing factors such as our desires for comfort and convenience and our habits (Kollmuss & Agyeman, 2002), it is a useful illustration of the difficulties of engaging a community in action.

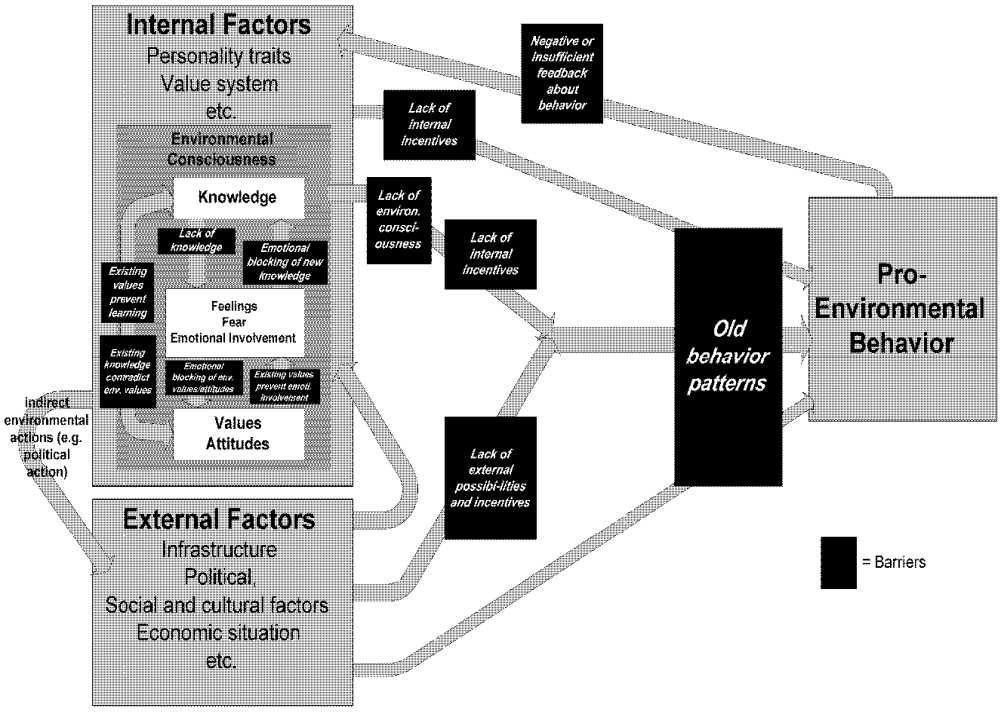

Figure 1: Model of pro-environmental behaviour (Kollmuss & Agyeman, 2002: 257).

There seems to be a continuing gap between scientific knowledge and the translation of that knowledge into environmentally sustainable land management practices (Buchan, Meister, & Giera, 2006). This is particularly recognised in New Zealand agriculture with an apparent distrust of science by farmers in regards to techno-fixes due to the failings of so many proposed solutions in the past (i.e. crack willows, tile drains, drainage of wetlands etc) (Jay, 2004; PCE, 2004; Gretchen Robertson, n.d.). There is a growing body of literature concerned with environmentally related behaviour change by farmers highlighting the range of institutional mechanisms that can be used to influence farmers in response to environmental concerns. These include: legal instruments, economic rewards, and the provision of information and advice (Blackstock, Ingram, Burton, Brown, & Slee, 2010; Wondolleck & Yaffee, 2000). In addition, the need for farmers to take voluntary action to protect waterways has increasingly been recognised in both the water management and agricultural sustainability literatures (Aslin & Brown, 2002; Blackstock, et al., 2010; P. Sabatier et al., 2005). Furthermore, it is argued that behaviour change leading to voluntary action will continue over time as it is more likely to become embedded in social norms (Ayer, 1997; Blackstock, et al., 2010). However, international literature demonstrates that whilst voluntary approaches can be effective to a degree, such approaches often

fail to achieve the desired rate of progress without strong community engagement (Buchan, et al., 2006). Effective community engagement is often difficult and complex, demanding a flexible adaptive approach. Many challenges are present as an inherent result of working with any typical community with heterogeneous social structure and multiple and somewhat conflicting interests. An integral part of gaining engagement from a community is an understanding of positions within the communities and ensuring a high level of involvement.

3.1. Participatory theory

Traditionally, natural resource management (NRM) efforts focused on the dissemination of technical knowledge towards the end users who were then expected to use them. It was soon discovered that insufficient technical knowledge was not the only barrier to implementation of best management practices, especially with the observed public scepticism about science and techno-fixes (Richards et al., 2004; (Reed, 2008). The realization that the complex environmental and social problems could not be adequately addressed using an 'outside expert' approach to research saw the emergence of more participatory models in the 1950s and 1960s (Minkler and Wallerstein 2003).

The last two decades have witnessed a paradigm shift in the area of natural resource management from a protectionist, state-centered approach (Berkes 2007; Chapin 2004; Gavin et al. 2007; Meffe et al. 2002; Robinson & Redford 2004) towards a more inclusive multi-stakeholder approach (Rodríguez-Izquierdo, 2009; Shackleton, Campbell, Wollenberg, & Edmunds, 2002). The literature suggests that a more participatory approach to natural resource management seems to have the greatest potential for generating a legitimate and inclusive management process that is more likely to bring about permanent and positive change ((Brechin, Wilshusen, Fortwangler, & West, 2002)Brechin et al. 2002; da Silva 2004; Haller et al. 2008; Wilshusen et al. 2002). Local community participation is demonstrated by numerous studies to be a crucial component of natural resource management (e.g., Adams & Hulme 2001; Carpenter 1998; Horwich & Lyon 2007; Kothari 2006; Ostrom 1990; Spiteri & Nepal 2006; Tai 2007; Thakadu 2005). Furthermore, participatory approaches that include the full range of stakeholders knowledge systems seem to

have a real ability to shape and help implement change (Aslin & Brown, 2002) by increasing compliance and reducing conflicts (Agrawal & Gibson 2001; Berkes 2007; Brechin et al. 2002). The United Nations Conference on Environment and Development (UNCED) suggested that "sustainable development" should be based on local-level solutions derived from community initiatives (D. Ghai, 1994; D. Ghai & Vivian, 1992; Leach, Mearns, & Scoones, 1999).

Since the early participatory models in the 1950s the approaches used have diversified considerably offering a 'multiplicity' of terms used for various models. As Minkler and Wallerstein (2003) describe, the various terms do not imply there are different methods applied, but rather represent different 'orientations to research', all sharing a common goal of engaging the community in action. The various types of participatory management models include: "community-based natural resource management" (CBRM), "collaborative resource management" (CRM), "grassroots conservation", "internally-motivated conservation programs", "integrated conservation and development projects" (ICDPs), and "community based conservation" (CBC) (Berkes 2007; Brechin et al. 2002; Chapin 2004, cited by Rodríguez-Izquierdo, 2009). There are differences among these terms in relation to what the projects' goals are and the scale of the projects (Horwich & Lyon 2007), but all seek to involve local communities in conservation to varying degrees (Menzies 2007).

3.1.1. Community-Based Natural Resource Management

Community-based Natural Resource Management (CBNRM) is a term often used to describe natural resource management in developing countries, and emphasises the critical importance of community engagement. This is a participatory approach based on the principle that the local community should be the focal point for natural resource management. CBNRM is broad in scope and overlaps with ICM but emphasises the crucial importance of active participation and steering from the local community. CBNRM is generally described as largely a grass roots approach which aims to devolve authority for ecosystem management to the local community level (Fabricius & Collins, 2007). However, it has also been applied to approaches where local communities play a central but not exclusive role in natural resource management (Rotha et al. 2005). CBNRM operates under the premise that local

communities able to take a leading role in managing their own local resources, empowers and creates a social movement around managing local natural resources. A further element to CBNRM is a macro-level, top-down effort organised by multilateral funding agencies, bilateral donors, and international NGOs and organizations devoted to CBNRM work and research.

CBNRM is a term largely used in developing countries where previously protectionist, top-down approaches are rife. As a representative democracy with a relatively high level of community involvement, New Zealand has instead favoured terms such as ICM and Landcare.

3.1.2. Integrated Catchment Management

Integrated Catchment Management (ICM) is a natural resource management model, which takes into account the complex relationships between social, economic, and environmental factors within an ecosystem, within an identified catchment system in the landscape context. ICM favours partnerships between government, community and industry thus bringing together responsibility for natural resources.
(Batchelor, 1999) defines ICM as:

> *"the co-ordinated planning and management of land, water and other environmental resources for their equitable, efficient and sustainable use at the catchment scale."*

The health of a waterway is not only an indicator of the environmental condition, but also the overall health of a catchment (Robertson, n.d.). Within an ICM framework, catchment health is regarded as an integration of social, economic and environmental states, and is firmly centered on a strong sustainability model in which environmental health is fundamental to achieving other forms of health and prosperity (Robertson, n.d.). ICM initiatives tend to let the issues (eg. sediments, water, nutrients) provide focus and common currency, allowing the various disciplines and groups to interact with one another. ICM is adaptable thus allowing for a dynamic system.

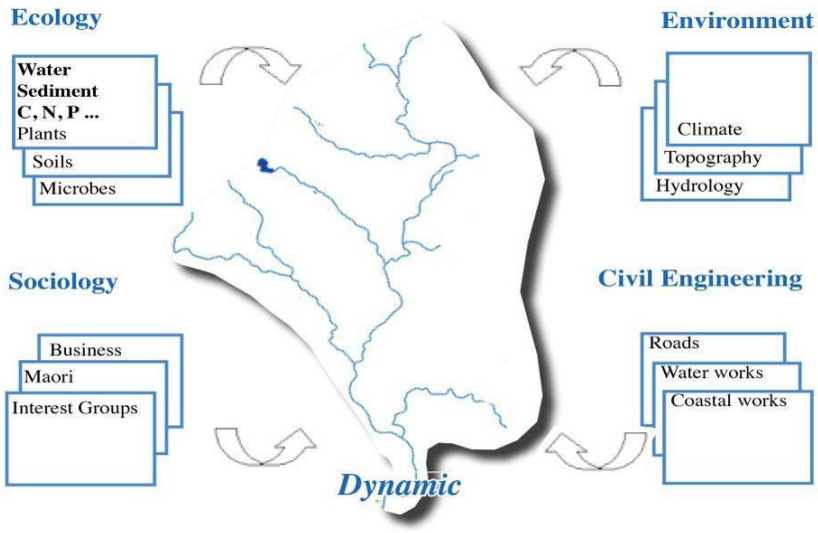

Figure 2: An ICM framework adapted from (W. Bowden, 1999)

ICM evolved in Australia during the 1980s as a way of "resolving land and water degradation by improving coordination of state agency policies and activities, and by increasing public involvement in identification of problems and implementation of alternative solutions" (Mitchell & Hollick, 1993: 735). By the late 1980s ICM was adopted as policy by many Australian State governments (Mitchell & Hollick, 1993). ICM is adaptable and therefore can be tailored specifically to suit various regional situations. It tends to operate on a management focus at catchment scale rather than administrative boundaries.

A related key initiative in Australian natural resource management has been the "Landcare" movement, which has now become a tool for implementing and delivering ICM. This movement started initially with agricultural coordination at a local level, and has since evolved beyond the agricultural sector towards a more inclusive holistic approach. Both Landcare and ICM are relatively new to New Zealand but have gained credibility rapidly as effective mechanisms for sustainable natural resource management (Catacutan, Neely, Johnson, Poussard, & Youl, 2009). Within New Zealand prominent existing projects focus on the Motueka (W. B. Bowden, Fenemor, & Deans, 2004), Taupo, Rotorua, Waikato (Hungerford, 2010), Brunner, and Taieri (Tyson, Panelli, & Robertson, 2005) catchments.

Historically, local ownership was not a major focus of integrated catchment management studies; instead the focus was on increased dialogue and knowledge sharing between scientists and politicians (Tyson, et al., 2005). ICM has evolved toward the current approach to encourage all key stakeholders to be directly involved in local environmental management. However, there have been some shortcomings of many ICM programs in gaining active participation from the local community. (Tyson, et al., 2005) argue that the key to ICM success is involvement of the local community in a partnership approach between agencies, local government authorities, community organisations, corporate groups and individuals. Previous ICM programs may have met with more success had they engaged local communities and landowners more effectively, however achieving active participation and buy-in from the grass roots levels is a challenge and gaining farmer involvement is no exception to this.

3.2. The Landcare Movement

The Landcare movement, a partnership between the community, government and business, originated in Australia which is currently home to over 4,000 Landcare and 2,000 Coastcare volunteer groups (Landcare Australia, 2010). Landcare is a grassroots movement that brings together a wide range of individuals and groups with a common ethos: caring for the land. The Landcare ideal was initially employed as a mechanism for improved agricultural productivity through sustainable land management, but has since evolved towards a broader focus on sustainable management of all of Australia's natural resources (Landcare Australia, 2010). The Landcare model has proved to be relatively successful which is thought to be in part due to its bottom up philosophy similar to that of CBNRM mentioned above (Landcare Australia, 2010). The inception of a Landcare group tends to occur when a common objective or goal brings community members together (Catacutan, et al., 2009: 41 - 53). A study by (Wilson, 2007) suggested that the Landcare movement has contributed substantially towards changing environmental attitudes, with both farmers and the wider Australian public. In particular, Landcare's approach involving interactive on-farm visits, and an emphasis on the implementation of 'best practice', has led to both an increased awareness of land degradation problems and the creation of grassroots 'information networks' (Wilson, 2007).

There has been some criticism of the Landcare movement with researchers suggesting that while awareness of land degradation across the whole population in Australia has significantly increased, this has not led to a reduction in the growing level of natural resource degradation (Duxbury, 2005). Although the level of community engagement is relatively high, significant behavioural changes in resource management have not followed. Thus Landcare Australia has recently shifted its focus from that of simply engagement to engagement in action. A recent project entitled the Watershed Torbay initiative (Duxbury, 2005) has set out to do this. The project aims to link community engagement to behaviour change through a clear framework of decision making underpinned by practical research and is showing promising signs of being successful (Duxbury, 2005).

The Landcare movement is now seen as an international model, which has since been taken up in New Zealand, the Philippines and South Africa, to name a few (Duxbury, 2005). The Landcare concept was introduced to New Zealand in the early 90s with groups meeting to discuss, in those early days, rabbit control in the high country of the South Island. These early meetings sparked the development of the NZ Landcare Trust (NZLCT), an organisation based on the Australian Landcare model. Consultation and community involvement were essential elements of the NZLCT approach from conception, as was the initiation of research and monitoring and dissemination of results (Catacutan, et al., 2009: 41-54). NZLCT works with farmers, landowners and community groups to improve the sustainability of our landscapes and waterways (NZLCT, 2010).

Presently, with funding from Transpower, the Ministry for the Environment and others, the Trust employs regional co-ordinators to encourage, facilitate and work with over 350 Landcare groups throughout New Zealand. Trustees include Federated Farmers, Fish & Game, Federation of Mountain Clubs, Rural Women, Forest and Bird, Ecologic Foundation and Federation of Maori Authorities (NZ Landcare Trust, 2010). Landcare groups are generally formed in response to issues the community consider locally important and are assisted in working through those issues in their own ways. This means the success of Landcare projects depends on self-motivated communities responding to community issues as opposed to external agency pressure.

As asserted by participatory theory, such grassroots approaches are more likely to bring about permanent and positive change (Brechin et al. 2002; da Silva 2004; Haller et al. 2008; Wilshusen et al. 2002).

There have been multiple Landcare initiatives throughout New Zealand, all having varying degrees of success (Catacutan, et al., 2009: 41-54). They include: sustainable land management projects in the Northland and the Aorere; catchment management projects in the Waikato and Upper Taieri; farm resilience and climate change in Northland and Starborough/Flaxbourne; and biodiversity enhancement projects in Northland and Southland. Many of these projects have been quite successful in engaging the community, but there is limited quantitative data to substantiate claims of project success. The TAIERI Trust project, an ICM in the Upper Taieri Valley in Central Otago, represents not only one of the best examples of a community based approach to natural resource management in NZ (Tyson, 2004), but is also one of the only New Zealand examples present in peer reviewed academic publications. An evaluation of this project asserts that effective communication and information exchange among stakeholders characterizes successful ICM (Tyson, et al., 2005). Under this assertion the project can claim success in a social manner, however there is limited data showing any success in BMP uptake in this catchment. That is not to say there has been limited BMP implementation in any of these projects but that there has been limited quantitative evaluation of the action landowners have taken. There was also limited data on water quality, or quantity improvement (Tyson, et al., 2005).

3.3. Community Engagement in Action

In New Zealand much of the diffuse water pollution comes from the agricultural sector, therefore the farmer is an essential decision maker to influence when managing water quality. Farmers are not only important decision makers to influence, but they can also be greatly affected by water degradation. However, gaining farmer participation and engagement is complex and can be difficult.

In line with the idea that behaviour changes are unlikely to occur merely as a result of increased information, McKenzie-Mohr (1999) proposed community-based social marketing (CBSM) as an alternative to the conventional information intensive

approaches. CBSM uses a pragmatic approach. By identifying the land management issue and the barriers to the related sustainable behaviour, one can then design a strategy that utilizes various behaviour change tools to overcome those barriers. The CBSM strategy begins by seeking to understand why people behave as they do and to identify what might support more sustainable behaviour (Dresser, 2008; McKenzie-Mohr & Smith, 1999). For this, McKenzie-Mohr (1999) suggests the use of surveys and focus groups to assess what people already know and believe, and then work with communities to redesign and provide appropriate tools to remove or circumnavigate barriers and to support new action. The CBSM model has proven to be effective in encouraging sustainable behaviour (Armijo-de Vega, Ojeda-Benítez, Aguilar-Virgen, & Taboada-González, 2001; McKenzie-Mohr & Smith, 1999) and is therefore a useful approach for disseminating information and encouraging landowners to adopt best management practices (BMPs).

Many initiatives attempting to change behaviour typically form around offering farmers advice on best management practices. How advice is given, who gives advice and what the message is, are all important factors. Dwyer et al (2007) undertook a study to investigate *"how the advice provided by the Department for Environment, Food and Rural Affairs (Defra) in the UK and its agencies, can best be delivered to encourage and enable long-term, positive behaviour change in farmers and land managers, with a major focus on change in environmental behaviour with respect to water"*. The main findings of this study were that:

- farmers expressed interest in initiatives or practices which enable them to raise their environmental profile with the public, with the local community and consumers,
- in order for advice to resonate with farmers it also needed to be seen as relevant and to demonstrate financial dividends,
- farmers also appreciated advice that helped farmers address current issues faced, such as: new legislation, grant schemes, timesaving techniques or business innovations, and
- there is high value in tapping into farmers' own social networks.

Various mechanisms for delivery of advice are available, and the most appropriate depend on the specific audience. However, studies (Dresser, 2008; Robertson, n.d.) have found that one-on-one advice and group events are popular although some publications can be effective if the format is appropriate. Research also suggests the promotion of best management practices is most effective when the farming community are involved at all stages of the project (design, implementation and review of results) (Dresser, 2008; Edgar, Nimo, & Ross, 2005; Robertson, n.d.). NZ Landcare elements (farm plans, field days etc) all help engagement on some level, but in most cases there is little empirical data on their role in the level of engagement or the link between engagement and action.

4. CASE STUDY

The following section will give an overview of the case study: covering site description and how I came to choose this case study.

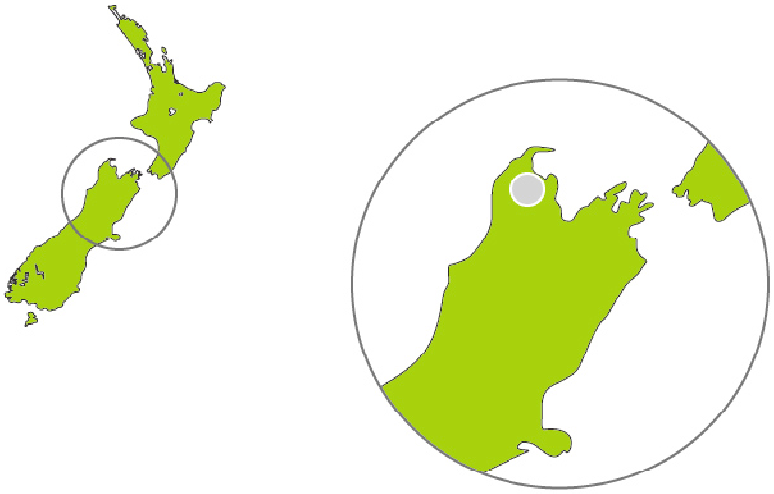

Figure 3: Golden Bay, New Zealand (map adapted from Edgar 2010)

4.1. Study area

The research project was done in the Aorere River Catchment located in Golden Bay at the top of the South Island, New Zealand (Figure 3). The Aorere River begins with its headwaters in Kahurangi National Park, and flows for 40 kilometres, before draining into the Ruataniwha Estuary by the town of Collingwood (see Figures 4, 5 and 6). The estuary covers 1610 ha and is listed as nationally significant. Dominated (80%) by native vegetation (Kahurangi National Park), this catchment has only 16% agriculture (Robertson & Stephens, 2007). Dairying is the most common farming type with approximately 11,000-13,500 cows within the catchment (Robertson & Stephens, 2007). The Aorere catchment is subject to high rainfall (average of 3.5-4.5 m/yr), with an average of 6 flood events annually (Ministry for the Environment, 2009). Given that many farms are located on flood plains, management of effluent and riparian areas is especially difficult. Although water quality is generally good, high rainfalls exacerbate contaminant runoff. The region has also just seen a

particularly bad flood in December 2010 which took bridges out, left houses flooded, damaged fences and killed stock, many farmers are still cleaning up 3 months later and dealing with a large loss of production.

Figure 4: The Aorere River (Photo by Barry Robertson)

Figure 5: The Aorere River entering the Ruataniwha Estuary by Collingwood, Golden Bay (Photo by Barry Robertson)

4.1.1. Aorere community

The following is a brief introduction to the make-up of the dairy farming community in the Aorere catchment. Because various engagement techniques work differently in different circumstances, this section is aimed at giving an idea about the farming and situational variables present in the Aorere community. This will give an indication of the type of community this project model works with.

The following community statistics are summarised from the 2007 Aorere Dairy Farming Survey (Peters, Robertson, & Fitzgerald, 2007): Dairy farming households in the Aorere are generally small, averaging 3 family members. There are relatively few males and females in their 20s and 30s while older (40 – 65yrs) and younger (5 – 19 yrs) males and females are well represented (Peters, et al., 2007). Time spent living in the district averages 42 yrs for farmers and dairy farming on the home property averaged 24 yrs. Overall, 64% of non-household members (working on-farm) are male. Male farm workers generally hold a wider range of positions than female farm workers. All farm manager positions are held by males while an equal number of males and females hold assistant manager positions. Most women are either dairy / farm workers or relief workers (28%). A profile of farm businesses reveals that half are family partnerships, and that 58% of farmers are owner-operators on the property (without a farm manager).

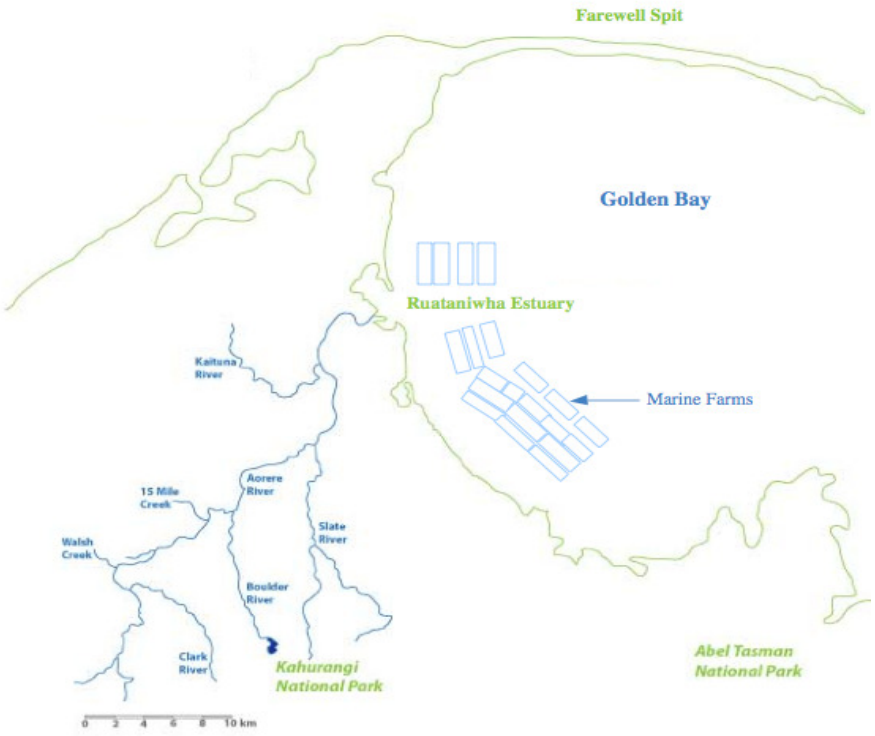

Figure 6: Aorere catchment map showing mussel farms (Adapted from Edgar, 2010)

4.2. The Aorere Landcare Project

Over the past few years, there has been increasing attention drawn to the pollution of our water bodies with effluent from dairy farms. The Aorere, Golden Bay is one such catchment that in 2004-6 was depicted as a high level polluter in media articles and at community meetings (Robertson & Stephens, 2007). In particular, microbial contamination from dairy pollution was highlighted as restricting the local shellfish industry to harvesting windows as low as 30% of the year (Robertson & Stephens, 2007).

> *"Initially the industry could harvest 70% of the time. As high E. coli results have occurred during lower salinity conditions, aquaculturalists now harvest only 30% of the time. Closure of the $15M Aorere aquaculture industry is a real threat."* ***(Rural Delivery, 2007)***

Subsequent reports from Aorere farmers indicated that these concerns stimulated the farming community to undertake their own investigations to determine the legitimacy of these allegations. NZ Landcare Trust, offered to help by facilitating the formation of a dairy community-lead project entitled: "The Aorere Catchment Project" (ACP).

Figure 7: Front cover of the Aorere Catchment Project Booklet, a booklet available for farmers and public outlining the project and associated achievements

In 2006, the Aorere dairy farmers initiated a catchment project entitled "Aorere Farmers as Leaders Project" with the assistance of the Sustainable Farming Fund and coordination support from the NZ Landcare Trust. The project presented an opportunity to regain local pride and respect (lost through negative attention from perceived poor water quality) while future-proofing local farming operations. This case study is rather unique in that the reduced harvest time for the marine farmers offered a 'canary in the coalmine' situation from another primary producer with a similar earning potential. The project also differs from many others around the country, in that it focuses on faecal bacteria run-off rather than nutrient run-off (a function of the sensitive marine receiving environment with its shellfish harvesting operations).

For the past three years the project has undertaken a number of key initiatives including; an initial specialist overview of nutrient and pathogen impacts to waterways, presentations to farmers, interviews with farmers, field days and tailored farm plans. To date the project has shown apparent success, both in resolving an

identified waterway issue and engaging farmers in action for healthy waterways, however, this will be discussed and examined further in this study.

During the Aorere-specific, initial specialist overview of nutrient and pathogen impacts to waterways, farmers were told there was in fact a problem with faecal contamination and it was caused largely by the increased development of dairy farmers in the area (Robertson and Steven, 2007). High pathogen levels in high water periods (i.e. floods) were to be expected, however, the spikes of high pathogen levels during low water periods were of concern and were unnecessary. Giving farmers information pertaining to the implications of certain on-farm activities at certain times appears to have had positive effects on the local waterways.

Figure 8: Mussel farms off the coast of Collingwood, Golden Bay (Photo by Barry Robertson)

The main indicator for this has been New Zealand's mandatory shellfish quality assurance program for all mussel-harvesting areas showing a large reduction in closures of local aquaculture farms and wild-catch areas due to high faecal contamination (NZ.Aquaculture, 2008). Shellfish analysis in Collingwood Bay by the Marlborough Shellfish Quality Program has shown an increase in average harvest days from 29% in 2002 to 79% in 2009 (Brown, 2009).

The Tasman District Council has also run a quarterly base flow monitoring regime since 2000, giving 10 years of base flow water quality data. The most recent monitoring results (James, 2010) indicated there may have been a reduction in

disease-causing organisms in the Aorere catchment since the project inception. However, since this monitoring has taken place over a relatively short period of time, it is difficult to detect a statistically significant trend at this stage. The council monitoring takes place at five sites in the Aorere River and at a major tributary, the Kaituna River. Each site is monitored quarterly at any flow, which is not an ideal monitoring regime (James, 2010). This type of regime often shows so much variability in the data that it is very difficult to detect any trends within a useful timeframe. Data collection is typically undertaken on fine weather days, therefore it has generally not been possible to differentiate water quality during particular periods of the year when dairying impacts are likely to be accentuated (e.g. elevated runoff in high rainfall events).

4.3. Key project initiatives

This project operates under the following guiding principles: empowering dairy 'farmers as leaders', and utilising technical experts 'on tap not top' to motivate farmers and encourage local knowledge, leadership, peer mentoring, practical tools and a willingness to implement best management practices. I will give a brief outline of these principles as they are critical to the projects success.

The project is based on participatory theory, which, as previously mentioned, asserts that to establish best management practices one must actively involve the farming community at all stages of the project (design, implementation and review of results). The ACP involved the rural community from day one, establishing a management group consisting of all willing members of the local dairy farming community, thus establishing goodwill and a sense of ownership early on. Having the project led by the local community has been very successful; the management team has been able to invite stakeholders and agencies it desires to work alongside, thus forming valuable partnerships and creating an ICM type support system. A further key principle used by the ACP was to employ the use of scientific "experts on tap, not on top."This expression, 'experts on tap, not on top', in this case means that the services of scientists should be available, but that the scientists should not be in charge. Rather than being "on top" i.e. in charge, or being the boss, experts such as scientists or

engineers should be "on tap" i.e. available, like water is available from a tap. This principle comes from the premise that farmers are in their own right the experts when it comes to farming issues and how to deal with their own land. The ACP encourage and support its farmer leaders to share their knowledge at conferences and other gatherings involving presentations from sustainable management experts, believing that too often the major players in the field are forgotten – the farmers themselves. One of the ideas behind this is that if ACP event organisers want to attract the attention of the farming community they must first give them the standing they deserve. Talks from those who have actually implemented change on their farm will be far more powerful than a scientist talking about their laboratory research, especially if the farmers are seeing real economic returns and other benefits from implementing sustainable practices. This said however, utilising the influence of prominent farming figures to represent farmer interest is also a key strategy of the ACP.

Figure 9: Aorere Catchment Project event: an on-farm community effluent management problem solving day, with scientific experts on tap

4.3.1. Project milestones

Based on the above principles the ACP has seen many key milestones reached during the life of the project, and all have played a role in engaging farmers. The following is an overview of these milestones, events and publications to give an understanding of the multiple methods the ACP has used to engage and inspire farmers in action for healthy local waterways.

- Formation of a dairy community-led project management team
- Intensive modeling of nutrient and pathogen impact from landuse and on-farm management within the catchment and the surrounding bay
- Presentation of the modeling results to the local dairy farmers
- Follow–up presentation of modeling results to the Tasman District Council and local marine farmers
- Identification of the key contaminant issues within the catchment and receiving environment
- Interviews with 31/33 dairy farms within the catchment to tailor project deliverables to farmers' needs
- Community problem solving field days hosted on local farms utilizing farmers as experts and scientists on tap – not on top leading to derivation of accepted best management practices for the catchment (see Figure 10)
- Tailored individual farm planning available to willing farmers to address specific water quality issues with practical voluntary 5 year plan and budget.
- Meeting for Aorere dairy farmers hosted by the aquaculture industry – a thanks to farmers for the water quality improvements and increased harvest days
- Large scale catchment field day celebrating on-farm improvements and the Aorere River and coast
- Farmers playing leadership role wider than the Aorere.

Figure 10: Jan Derks (TACCRA) and dairy farmer Steve Garret working on an individually tailored environmental farm plan, and discussing Steve's travelling irrigator (Photo by Jodie Robertson).

4.4. How I got involved

Over the summer of 2010 I took a summer internship with the New Zealand Landcare Trust (NZLCT) in the Nelson/ Marlborough area. The ACP, being one of the main NZLCT projects in the area, was a major part of the job. At the beginning of the ACP (2007) a survey had been undertaken to gain insights into the local dairying community's makeup, goals, issues, perceptions, and information gaps. I believed that 3 years on, this was the perfect opportunity to undertake a follow up survey - based on the initial survey - to examine the changes in attitudes and actions of the farmers over the project period and determine whether farmers believed the ACP's initial aims were being met.

5. METHODS

The research conducted for this thesis was completed through a qualitative mixed methods approach including participant observation, interviews, and textual analysis. By approaching my questions through multiple methods of inquiry, I hoped to gain a richer insight into my objectives and research question.

5.1. Survey Design

In 2007, the NZ Landcare Trust carried out a survey of 30 dairy farming households in the Aorere catchment to gain insights into the local dairying community's makeup, goals, issues, perceptions, and information gaps. In 2010 I conducted follow up interviews with all of the willing dairy farms in the catchment (31/ 34). The follow up survey had two aims; (i) to assess the project's progress so far and give feedback as to where farmers would like the project to head in the future, and (ii) to give feedback on what were the key factors of the project that encouraged farmers to take action if they did. The methodology here was predominantly based on questions posed and results given in the previous interviews undertaken in the same area designed by Gretchen Robertson (NZLCT) and sociologist Gerard Fitzgerald (Fitzgerald Applied Sociology). This followed discussions with a previously formed Aorere Catchment Project management team consisting of interested members of the dairying community and NZLCT staff. Any major changes were guided by the survey guidelines outlined in the International Handbook of Survey Methodology (Dillman, Leeuw, & Hox, 2008). The similar nature of each survey enabled comparisons to be made, thus highlighting changes in farming, situational and attitudinal variables.

5.1.1. The Initial 2007 Survey

In early May 2007, every dairying property within the catchment was contacted by the Aorere project management team to gauge their receptiveness to being interviewed as a part of the Aorere Catchment Project. In this report, survey participants (though technically farming households / families) are all referred to as farmers, regardless of their actual on-farm position. A total of 30 farm households

participated in the survey. These included 2 households that live locally but currently lease their farms to other dairy farmers. A further 4 farm households were unable to be interviewed due to busy farm schedules.

The surveys took place in May and June 2007, with NZ Landcare Trust staff (Gretchen Robertson, Shelley Washington, Kristina Townsend and Monica Peters) administering the questionnaire in face-to-face semi-structured interviews. Each interview took between 30 mins and 2 hr 30 mins depending on the level of detail of the answers provided, the number of household members present, and the amount of discussion generated around particular questions. Answers to open-ended questions were recorded in full, and later analysed for their main themes and coded accordingly for statistical analysis. Gerard Fitzgerald and Monica Peters carried out data analysis using statistical data analysis software.

5.1.2. The Follow Up Survey in 2010

Again in early February 2010, every dairying property within the catchment was contacted to gauge their receptiveness to participating in a follow up survey. I conducted the survey in February 2010, with the help of NZ Landcare Trust staff Barbara Stuart and Monica Peters, using a face-to-face structured questionnaire to survey local dairy farmers. Contact details for the Aorere dairy farmers were attained from the NZLCT database and checked for relevance by a local farmer. Participants were contacted by phone previously to assess willingness and set up interview times. Each interview took between 20 minutes and 2 hours, depending on the level of detail of the answers provided, the number of household members present, and the amount of discussion generated around particular questions. Answers to open-ended questions were recorded in full and analysed for their main themes (with relevant coding for statistical analysis). A total of 30 farm households participated in the survey. A further 4 farm households were unable to be interviewed due to busy farm schedules. The main aims of the survey were to:

- Review the effectiveness of existing project initiatives
- Understand any changes in attitudes and current knowledge

- Quantify current investment in Best Management Practices and plans for further implementation
- Determine the most memorable/significant project initiatives for farmers thus far.

Additional questions were also added to the survey to assist the Aorere Catchment Project management team in designing effective achievement milestones for the remaining two years of the project. The answers to these questions are included in the results; however those that do not have much relevance to the objectives of this research are not discussed in detail.

Survey Questions

The structured questionnaire had 37 questions in total and was separated into eight sections as follows:

1) Farm Background: The first section of the survey gave some preliminary 'census' type questions with two aims. Firstly, this section provided a profile of Aorere dairy farms and covered questions relating to current farm, pasture, and herd size. These results are able to indicate a level of change since 2007. Secondly these questions are used as an icebreaker, and to enable more time to build trust before getting into the more personal questions.
2) Key issues: Farmers were asked to identify key issues facing the Aorere dairying community as a whole, and issues faced as individual dairy farmers. These questions were open ended (no pre-set list of answers was provided) to capture farmers' unprompted perceptions of both the range of issues and relative importance of each issue. Farmers were also asked about the perceived seriousness and urgent nature of each issue. Answers were split into the following categories for analysis: Economic issues (e.g. profitability, debt levels and the increasing costs of running a viable business), compliance related issues (e.g. with Fonterra and TDC, and the increasing cost of compliance in relation to environmental on-farm works), climate and flooding, staffing, and effluent disposal.
3) Health of waterways: This section was aimed at providing insight into the perceived health of local waterways from the farmers' perspective. These questions were asked in the 2007 survey and therefore can be compared for

changes. Additionally, this section asked how farmers thought the local council would rate the health of the rivers, thus revealing any differences in water quality standards between farmers and local council.

4) Attitudes: To assess current attitudes toward current issues farmers were presented with a series of statements on local issues, similar to statements presented to farmers in the 2007 survey, or gauging response to developments since 2007.
5) Best Management Practices (BMPs)/ Influences in implementing BMPs: To quantify the recommended BMP implementation during the project, and examine the reasons farmers have for implementing such BMPs.
6) Effective information dissemination and change since 2007: To determine the most effective information dissemination techniques from a farmers point of view.
7) Planning: Related to Section Five, farmers were asked whether they had an environmental farm plan. In most circumstances this related to individual environmental farm plans created by Jan Derks who worked one-on-one with farmers to review current systems and develop an environmental farm plan.
8) Aorere project effectiveness: To assist in answering both objective one and two by getting the farmers perspective on the effectiveness of the project so far.
9) Needs of farmers for further information.

6. RESULTS

This results section presents the data from the follow up "Aorere Farmers as Leaders Project" dairy farmer survey. In this section, survey participants, although technically farming households / families are all referred to as 'farmers', regardless of their actual on-farm position. A total of 30 farm households participated in the survey. A further 4 farm households were unable to be interviewed due to busy farm schedules. At the time of the February 2010 survey, the project had been running for a total of 3.5 years.

6.1. Farm background

The first section of the survey covered questions relating to current farm, pasture, and herd size. This created a profile of Aorere dairy farms and highlighted any changes in the past 3 years. This information is summarised in Table 1.

Table 1: Aorere dairy farm statistics

	Count	Average	Median	Sum
Farm size (ha)	29	176	140	5102
Effective area 2010	30	137	116	4116
Effective area 2007	30	150	142	4492
Current herd size 2010	30	369	300	11073
Herd size 2007	28	399	330	11160
Cows per hectare 2010	30	2.67	2.62	
Cows per hectare 2007	30	2.50	2.58	

6.1.1. Average farm statistics

The current average Aorere dairy farm herd size of 369 represents a reduction in the past 3 years from 399 (2007). This slight decrease in herd sizes over a 3 year period goes against the national trend which shows continued increases over the last 30 seasons (DairyNZ & LIC, 2010). Nationally there was a slight increase in the total

number of herds (in the 2009/10 season the herd number increased by 73 to 11,691). Despite this, average herd sizes (369) are comparable to the national average (376) (DairyNZ & LIC, 2010), and are 10% higher than the Tasman / Nelson City regional average of 334 (LIC, 2008). The average effective area of pasture has also reduced in the past 3 years from 150ha (2007) to 137ha currently, but is still slightly above that of the Tasman / Nelson City regional average of 121ha. Average cows per hectare (2.67) is slightly lower than the regional average (2.81) but has increased by 1.5% over the past 3 years as a result of reducing effective pasture area. Median scores show a slightly different picture due to the wide distribution of data in certain categories – herd sizes in particular.

6.2. Current farming systems

In this section of the survey farmers were asked to describe their current farming systems in the following categories: effluent irrigation method, degree of permanent waterway fencing, number of stream crossings or culverts, winter feeding methods, fertiliser application, nitrification inhibitors, and effluent pond design.

6.2.1. Effluent irrigation method

The majority of farmers (67%) spread effluent on paddocks using a travelling irrigator (Figure 11 & 12). A low rate application using k-line irrigation was the second most common method (17%). This is a major improvement from 2007 where no low rate irrigation was used. One farmer used a tractor mounted pump, another used a combination of a travelling irrigator and k-line, while 7% of farmers used other methods. One farm did not use any effluent irrigation method; instead dung is picked up into 44-gallon drums and dried.

Implementation of low rate effluent application is gaining momentum in the region, and some farmers are expected to invest in a LARALL (low application rate and low labour) (Figure 13) effluent application system in the near future.

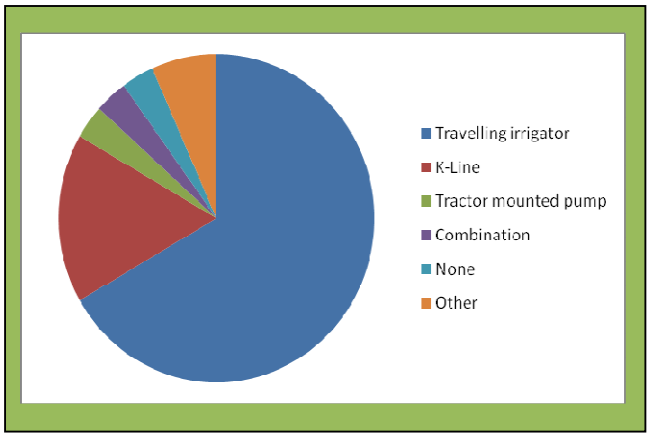

Figure 11: Effluent irrigation methods

Figure 12: One pod of the LARRAL effluent irrigation system working (Photo by Jodie Robertson)

6.2.2. Degree of permanent waterway fencing

Farmers were asked to provide the percentage of waterways permanently fenced on both sides on their own property, as well as the degree of temporary fencing (i.e. hotwire when stock in paddock). Farmers in the Aorere had an average of 75% of their waterways fenced permanently, and an average of 7% fenced temporarily. This gives a total of 82% of waterways excluded from stock, noteworthy considering the high number of streams and drains in this high rainfall area. Fencing efforts were helped by the TDC fencing programme offering free materials. According to Fonterra's Clean Streams Accord (Fonterra, et al., 2008) requirements, dairy cattle must be excluded from 50% of streams, rivers and lakes by 2007, rising to 90% by 2012. All except 4 farmers have at least 50% of their waterways fenced, and 16 farmers are already meeting 2012 requirements by having at least 90% of their waterways excluded from stock.

6.2.3. Number of stream crossings or culverts

Farmers were also asked to provide a count of the number of stream crossings bridged or culverted versus the number unbridged or unculverted on their property. A total of 169 waterways were bridged or culverted (84%) in the Aorere catchment compared to a total of 32 crossings yet to be bridged or culverted. Fonterra require 50 per cent of regular crossing points to have bridges or culverts by 2007, rising to 90 per cent by 2012. Four out of the 30 respondents do not currently meet the 2007 requirements, however, 19 farmers (63%) already meet the 2012 requirements, with others well on their way.

6.2.4. Winter feeding methods

Most farmers interviewed used a combination of feeding methods (Figure 14), however answers were divided into single feeding methods to aid analysis. Shifting stock off farm was the most favoured of any single feeding method (50%), closely followed by standoff pads (37%), and standing off in laneways (37%). A further 20%

of farms used other wintering methods such as rotation grazing, and 13% made use of a sacrifice paddock. The number of farmers using standoff pads is notable considering they were scarce on farms in 2007 at the beginning of the project. Standoff pads have a number of environmental and herd benefits such as protecting pastures from pugging, capturing effluent, maintaining healthy well-fed cows, and offering ease of feeding supplements.

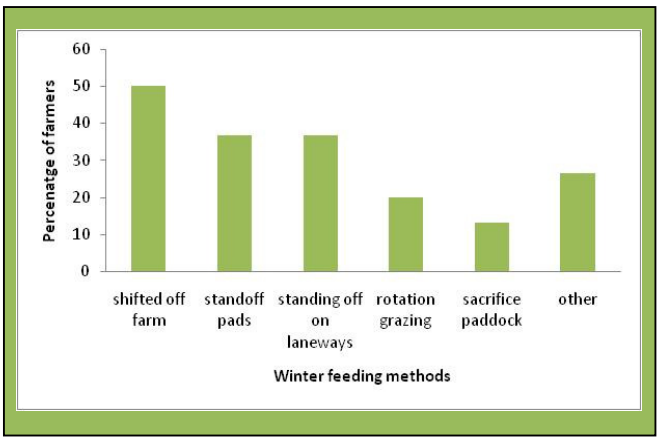

Figure 13: Winter feeding methods used in the Aorere catchment

6.2.5. Fertiliser application

Farmers were asked to describe how they determine what fertiliser application is right for their farm. Most farmers made use of a fertiliser representative and soil and herbage test to create a nutrient budget. As per the Clean Streams Accord requirements, 100% of dairy farms are to have systems in place to manage nutrient inputs and outputs by 2007. A few farmers went beyond this and employed the use of a nutrient management plan (typically prepared by diligent fertiliser representatives). This differs from a nutrient budget in that it acts as a plan for the future. A couple of farmers operated organic dairy farms and therefore did not use synthetic nitrogen fertilisers but used potash, super phosphate and lime instead, and were careful of stocking numbers.

6.2.6. Nitrification inhibitors

Nitrification inhibitors slow down the conversion of ammonium in the soil to nitrate, therefore reducing nitrous oxide emissions (16% of NZ's greenhouse gas emissions (Di et al., 2009)) and nitrate leaching while enhancing pasture growth. Effectiveness can be reduced in warm wet climates (McDowall, 2010).

Farmers were asked whether they had used nitrification inhibitors before, and if so, whether they were pleased with the result. The majority of respondents (66%) had not tried nitrification inhibitors; however 34% (10 farmers) had used them. Those farmers that had used them gave possible economic and environmental benefits as reasons for trying nitrification inhibitors. Of these respondents many had not used nitrifications for long enough to determine effectiveness. A couple of farmers reported they had a "*better response from N that resulted in more feed"*.

6.2.7. Effluent pond design

Effluent pond design specification gave a variety of results (Figure 15). Although ponds were a common thread, their size and storage capacity varied markedly. Of the 30 farms interviewed 9 (32%) had a 1 pond system, 7 (25%) had a 2 pond system, 4 (14%) had a 3 pond system, and 1 (4%) had a 4 pond system. Weeping walls are becoming more prevalent in the Aorere with 5 (18%) farmers implementing this effluent system since 2007. A further 2 farmers (7%) had no effluent pond and used other effluent management techniques such as a slurry tanker and mechanical spreader.

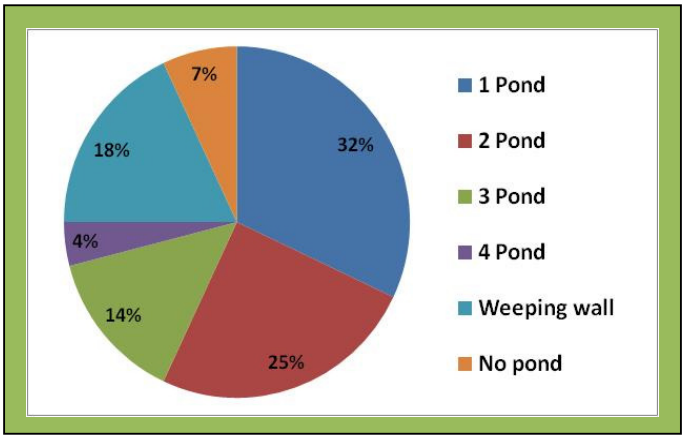

Figure 14: Effluent Pond Design Specification

Farmers were then asked to give their pond's storage capacity. 26% of farmers had less than a month of storage, 26% had between 1 and 2 months storage, a further 17% of farmers had between 2 and 3 months storage, and 17% of farmers had over 3 months effluent storage available. 2 farmers (7%) were not sure of their specific storage capacity, and a further 2 had no storage (due to using mechanical spreaders or slurry tanker).

Figure 15: Weeping wall effluent separating system (photo by Jodie Robertson)

6.3. What are the key issues faced by Aorere dairy farmers?

This next section asked farmers to identify key issues they faced as individual dairy farmers in the Aorere catchment.

These questions were open-ended (no pre-set list of answers was provided) to capture farmers' unprompted perceptions of both the range of issues and the relative importance of each issue. Farmers were asked to identify up to 5 issues affecting them as individuals, and in addition they were asked to rate the seriousness of each issue to them. The answers were grouped into categories for analysis and are tabulated below (Table 2). Answers are aggregated as categories overlap. Farmers were also asked to

indicate which one of the issues they identified was the most urgent. These results were also compared with the previous survey results to determine any changes in farmers' focus. Some issues differ markedly from 2007 to 2010, these are shown in Table 3.

Table 2: Key issues faced by Aorere dairy farmers

KEY ISSUES	INDIVIDUAL FARM ISSUES			
	2010		2007	
	Number of farmers	% of farmers	Number of farmers	% of farmers
Economics (profitability/viability, debt, costs, uncertainty)	27	90	12	40
Compliance/ regulatory processes/demands	9	30	11	37
Climatic factors	8	27	6	20
Effluent and nutrient management	7	23	3	10
Staffing/labour (availability and quality)	5	17	11	37
Isolation	4	13	0	0
Environmental compliance costs	3	10	2	7
Work-life balance/ lack of time	3	10	2	7
Effects of farming on the environment	2	7	1	3
Stock management	2	7	0	0
On farm environmental works	1	3	4	13
Age/demographic factors	1	3	5	17
External/public pressure re environmental performance	0	0	5	17
Other	11	37	4	13

6.3.1. Most frequently mentioned issues facing Aorere dairy farmers

Economics was the most frequently mentioned type of issue facing individuals in the Aorere catchment. A total of 90% of farmers mentioned some kind of economic issue. This was a huge increase from the 2007 survey where only 40% of farmers mentioned economic issues. Specific economic concerns included profitability, debt levels and the increasing costs of running a viable business, which a combined 41% of farmers considered as very serious issues. Many farmers were still struggling from the previous year's low payout, and therefore had debt management issues. Thus they

found it difficult to run a business with such an inconsistent payout. It is worth noting that the payout for dairy farmers was relatively high during 2010, and has increased further moving into the beginning of 2011. The huge flood that devastated the area in December 2010 has meant Aorere farmers have been unable to capitalise on the high payout due to low production.

Compliance related issues (e.g. with Fonterra and TDC), and the increasing cost of compliance, were mentioned as important issues by 30% of farmers, down from 37% in 2007. Thirty-eight percent of those who mentioned this issue considered the issue to be very serious. These issues generally related to obligatory on-farm works, cost of compliance and bureaucracy associated with local council and Fonterra requirements.

6.3.2. Other general issues facing Aorere dairy farmers

Other general issues raised during farmer interviews were diverse and varied widely in scale.

Climatic issues were regarded as an important issue by 27% of farmers, particularly the variable climatic conditions in the area, with comments including *"... [we need to] constantly search for new ways of coping with adverse events".* More specifically, heavy rainfall and adverse weather events damage fences, and contribute to issues of pugging and fertiliser run-off. One farmer mentioned the need to be able to be *"more sustainable [to] get through winter".*

Effluent and nutrient management was regarded as an issue by 23% of farmers, an increase from the 10% in 2007. A few farmers were concerned with how to dispose of the sludge in ponds once they are full, for example noting "…*we need a local contractor to de-sludge ponds".* Others are in the process of effluent system upgrade and are therefore aware of the, *"tough decisions they must make".*

Staffing/labour issues concerned 17% of farmers; predominantly the lack of skilled and reliable staff. In every case this related to the quality of staff available. One farmer suggested the nature of the Golden Bay area attracted the, *"wrong sort of workers".* Concerns relating to staffing were down significantly from 37% in 2007.

This can most likely be attributed to the general reduction in staff employed on-farm due to lower milk payouts.

Several farmers also mentioned other issues including isolation, work-life balance/quality of life, environmental issues, nutrient management, age/demographic factors/succession, and stock management. 'Effects of farming on the environment' was a key issue mentioned in 2007 but not in the 2010 survey. On-farm environmental works and age and demographic factors were also mentioned by a number of farmers in 2007 but by very few in 2010.

Table 3: Variations in key issues from 2007 to 2010

Significant changes from 2007 – 2010			
Issue	2007	2010	Possible reasoning
Staffing and labour	37%	17%	A general reduction in staff employed on-farm due to lower milk payouts.
Effluent management	10%	24%	Greater awareness now of the need to more responsibly manage effluent.
Economics	40%	90%	Economic impacts of previous year's low payout compared with 2007's high payout.
Compliance	37%	30%	Council have given farmers scope to self-manage environmental performance issues pro-actively.

6.4. What are the most urgent issues faced by Aorere dairy farmers?

As outlined in the previous section, farmers were asked to report up to 5 general issues facing themselves as individual dairy farmers. Farmers were then asked to identify the most urgent issue for them individually, of those initially reported. The most urgent issues identified are broken down in table 4.

Table 4: Most urgent issues faced by Aorere dairy farmers

MOST URGENT ISSUES	INDIVIDUAL FARM ISSUES	
	Number of farmers	% of farmers
Economics (profitability/viability, debt, costs, uncertainty)	8	27
Compliance (Regulatory processes/ demands/ costs)	5	17
Staffing/ Labour (availability and quality)	3	10
Effluent disposal and Nutrient management	3	10
Climatic factors	2	7
Work-life balance/ Quality of life	2	7
Age/Demographic factors/Succession	1	3
Environmental issues	1	3
Other	3	10

Specific reasons why economics, staffing / labour and compliance were selected by farmers as the most urgent issues are detailed below.

Economics emerged as the most urgent issue for 27% of farmers, up from 20% in 2007. Specific reasons centre on keeping the farm business viable: *"...need cashflow to make everything function and to run a sustainable business".* Several farmers struggled because of last year's low payout, which resulted in increases in workload

and reduction in staffing, e.g., *"...shortened labour, increased workload"*. Many farmers suggested this also resulted in postponement of on-farm improvements, including the implementation of best management practices. Despite this, many recommended best management practices were implemented in this period. Although data is not available for comparison prior to 2007, it appears likely that the past 3 years have seen a greater implementation of best management practices than any previous period. This indicates likelihood for positive progress into the future as payout forecasts improve.

Issues related to compliance costs from both industry (e.g. Fonterra) and agencies (e.g. Tasman District Council - TDC) were also identified as an urgent issue for 17% of farmers. This is the same percentage as in 2007. However, many comments in the 2007 survey regarding compliance issues related to the bureaucracy, amount of paperwork and lack of understanding from the council, whereas recent 2010 comments relate more to cost of compliance and the value of being pro-active and working with the authorities, e.g., *"project is good, means we are not playing catch up so much", "As long as it is a partnership everyone works together, that's why the ACP is successful"*. However some are worried about the increase in compliance requirements, e.g., *"Bar is getting higher, must be affordable", "People are bending over backwards to do the right things"*.

The category of staffing/labour was regarded as an urgent issue for 10% of Aorere catchment dairy farmers, down from 27% in 2007. Farmers reported difficulty when *"...getting them to realise the importance of environmental best practice"*. Some farmers also felt that the area attracts the wrong sort of workers, e.g. *"[it is] demoralising: energy and time spent, dealing with ACC corrections etc… thankless job"*. Staff shortages can limit the growth of the farm business and can reduce the resources available to implement environmental best management practices, and can also lead to a number of farm management issues e.g. timing/incorrect use of chemicals and plugged paddocks from not moving the effluent system.

The lack of labour has also had strong links to the economic situation, as many farmers have mentioned having to lay off staff as a result of a low pay out.

Effluent disposal and nutrient management emerged as an urgent issue for 10% of farmers, up from 2007 where no individual farmers considered this an urgent issue. For these farmers the issue was urgent due to the effluent upgrade needed on their respective properties e.g., *"My [irrigation] area is not big enough, [the] infra-structure [is] out dated"*.

Other urgent issues

Some farmers, in similar numbers to 2007, also regarded the following issues as urgent:

- climatic factors (7%)
- work-life balance/ quality of life (7%)
- age/demographic factors/succession (3%)
- environmental issues (3%).

Figure 16: Local Aorere dairy cows

6.5. What are farmers' attitudes towards current issues?

To assess farmers' attitudes to certain relevant issues, farmers were given twelve statements covering a range of topics to respond to (Figure 18). Farmers could give six possible answers ranging from 'strongly disagree' to 'strongly agree'; 'don't know' was also an option.

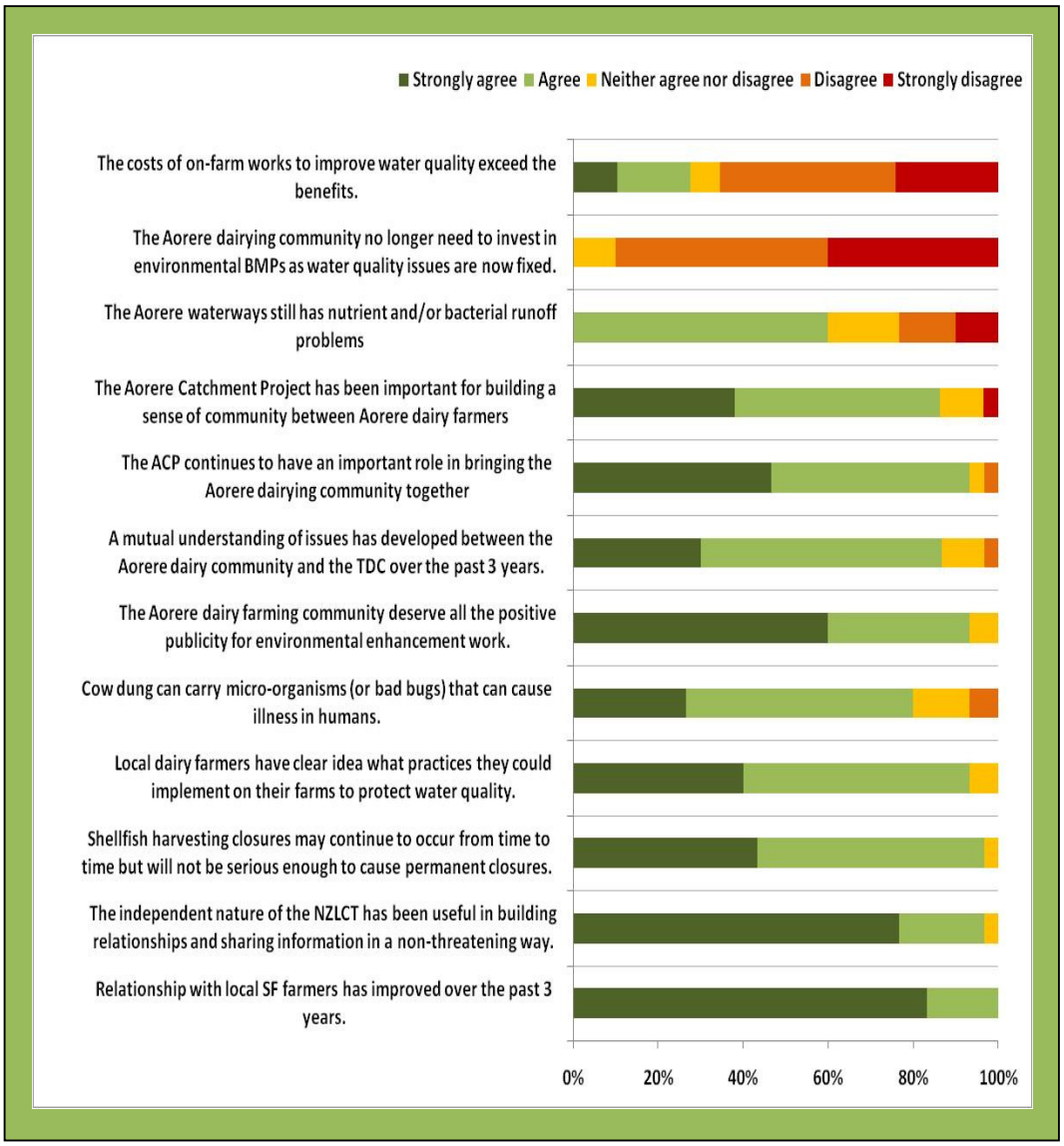

Figure 17: Farmers attitudes towards current issues

Many of the statements revealed a spectrum of opinions and range from 'strongly disagree' to 'strongly agree', covering all possible answers. However in most instances the data tends towards either disagreement or agreement, showing the average farmer's opinion.

Farmers generally disagreed with the following statements:

- 'The Aorere dairying community no longer needed to invest in environmental BMPs as water quality issues are now fixed' (90% in total disagree or strongly disagree).
- 'The cost of on-farm works to improve water quality would exceed the benefits' (63% in total disagree or strongly disagree).

Farmers generally agreed with the following statements:

- 'The relationship with local shellfish farmers has improved over the past 3 years' (100% agreed or strongly agreed).
- 'The independent nature of the New Zealand Landcare Trust has been useful in building relationships and sharing information in a non-threatening way' (97% agreed or strongly agreed).
- 'Shellfish harvesting closures may continue to occur from time to time but will not be serious enough to cause permanent closures' (43% strongly agreed, 53% agreed, 3% were unsure).
- 'Local dairy farmers have a clear idea what practices they could implement on their farms to protect water quality' (40% strongly agreed, 53% agreed, 7% were unsure).
- 'The Aorere dairy farming community deserve all the positive publicity for environmental enhancement work' (60% strongly agreed, 33% agreed, 7% were unsure).
- 'A mutual understanding of issues has developed between the Aorere dairy community and the TDC over the past 3 years' (60% strongly agreed, 33% agreed, 7% were unsure).
- 'The ACP continues to have an important role in bringing the Aorere dairying community together' (30% strongly agreed, 57% agreed, 10% were unsure).

Opinions were mixed regarding the following statements:

- *'The Aorere waterways still have nutrient and/or bacterial runoff problems'* (60% agree, while 23% disagree or strongly disagree, a further 17% neither agreed nor disagreed).
- 'Cow dung can carry micro-organisms (or bad bugs) that can cause illness in humans' (27% strongly agreed, 53% agreed, 13% were unsure, and 7% disagreed).
- 'The Aorere Catchment Project has been important for building a sense of community between Aorere dairy farmers' (30% strongly agreed, 57% agreed, 10% were unsure, 3% disagreed).

Over all these results are positive and indicate a strengthening of the Aorere dairy community, the development of understanding and trust between dairy farmers, the local Shellfish industry and Tasman District Council, a strong sense of pride within the community and a clear understanding of what farmers can do to improve water quality.

6.5.1. Change in farmer attitudes from 2007 to 2010

Some of the above statements were also present in the 2007 survey and are compared with the 2010 results (see Figure 19).

Notable changes were observed in relation to the following statements:
'Local dairy farmers have an idea what practices they could implement on their farms to protect water quality' (56% agree or strongly agree in 2007 to 93% in 2010).
'The cost of on-farm works to improve water quality would exceed the benefits' (63% in 2010 disagree or strongly disagree compared to 38% in 2010).

Attitudes to the statement: *'Cow dung can carry micro-organisms (or bad bugs) that can cause illness in humans'* were very similar to those gathered in 2007 for the same question.

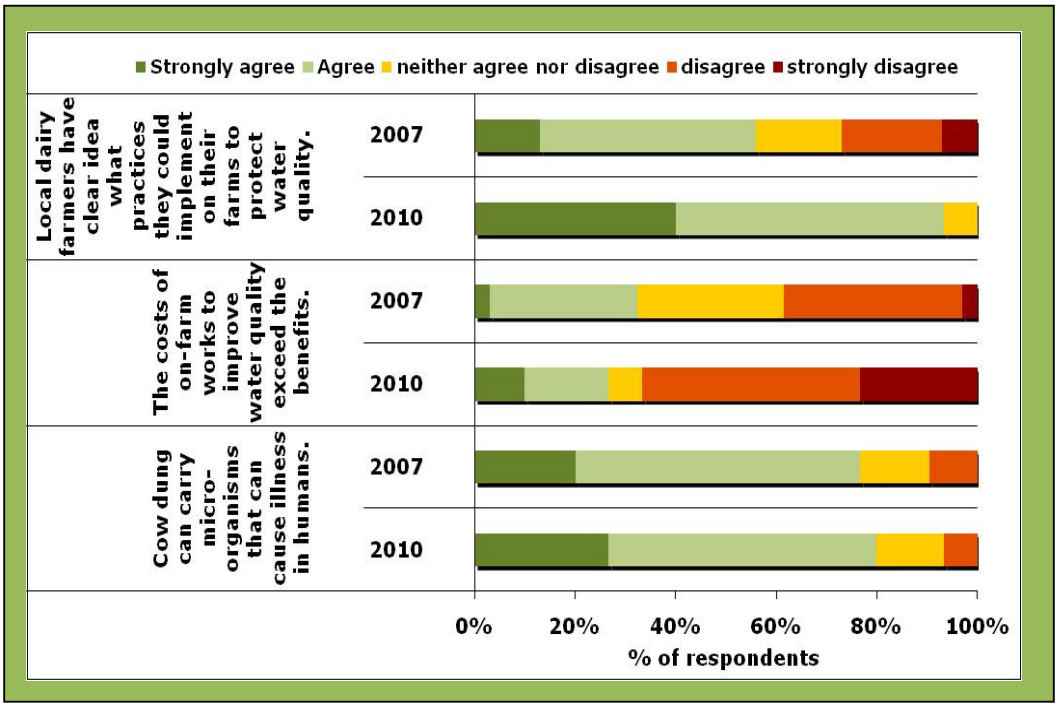

Figure 18: Comparison of attitudes from 2007 to 2010

6.6. How healthy is the water?

Farmers were asked to rate the waterways on their farm and in the Aorere using a scale of 1-5 (1 = not healthy to 5 = very healthy), and then give reasons why they chose that rating. Farmers were then asked what rating (using the same scale) they thought the TDC would give to the Aorere River as well as to provide reasons why. The term "waterways" in this report includes natural streams as well as man-made structures such as drains, providing they permanently hold water (this is to be consistent with TDC's definition of a waterway).

6.6.1. Farmer rating of waterway health on farms

A total of 87% of farmers described their farm waterways as being either healthy (53%) or very healthy (33%) (Figure 20). These perceived ratings of the waterways on farmers' own property were similar to three years ago with 90% of farmers rating their farm waterways as either healthy or very healthy.

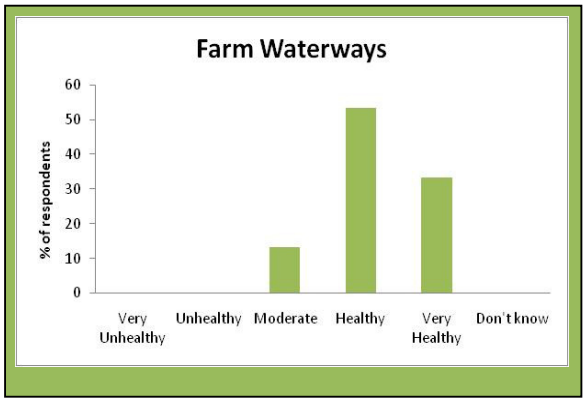

Figure 19: Farmers perception of the health of the waterways on their farms

When asked why a particular rating was given, farmers described a range of indicators of waterway health. These included: potability, flow rate /flushing, visual and olfactory qualities, use for recreation, stream life (flora, fauna), stock access/ farm pollution, quantitative testing, and improved water quality compared to the past or compared to other rivers.

When answers were split into individual categories the most common indicators were:

- Improvements expected due to management changes, e.g. preventing stock access combined with spraying effluent away from waterways (38%).
- The water looked clean and/or had no smell (20%).
- The ability to support stream life such as fish, eels, whitebait and waterfowl (13%).
- These indicators were similar to those mentioned in the 2007 survey.

6.6.2. Farmer rating of Aorere River health

All farmers gave the Aorere a rating of healthy (53%), or very healthy (47%) (Figure 21). This was a slight increase from the 2007 results where 55% of farmers rated the Aorere as healthy and 35% very healthy.

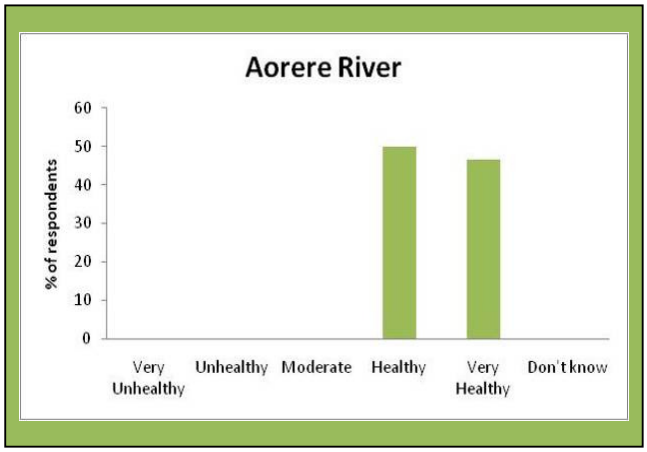

Figure 20: The perceived health of the Aorere River

Reasons for ratings included:

- predicted impacts of improved management practices (e.g. preventing stock access combined with spraying effluent away from waterways) (17%)
- the water looked clean and/or had no smell (13%)
- the ability to support stream life such as fish, eels, whitebait and waterfowl (10%)
- flow rate/flushing (10%)
- improved compared to the past or compared to other rivers (10%).

Many farmers (30%) used a combination of the above-mentioned reasons to rate the Aorere River.

6.6.3. TDC rating of Aorere River health

The majority of farmers (60%) thought the TDC would rate the Aorere River as healthy, with another 20% believing the TDC would likely rate it very healthy (see Figure 22). A small minority (7%) thought the TDC would give the river a moderate health rating while 10% of farmers replied, “don’t know”. These 2010 results are

more positive than those from 2007 when only a third (34%) of farmers thought the TDC would rate the Aorere healthy, 19% very healthy and 27% neither healthy nor unhealthy.

Reasons for suggested TDC (2010) ratings include:

- quantitative test results (15%)
- improvement compared to other rivers (11%)
- effort and progress (11%)
- different standards (7%)

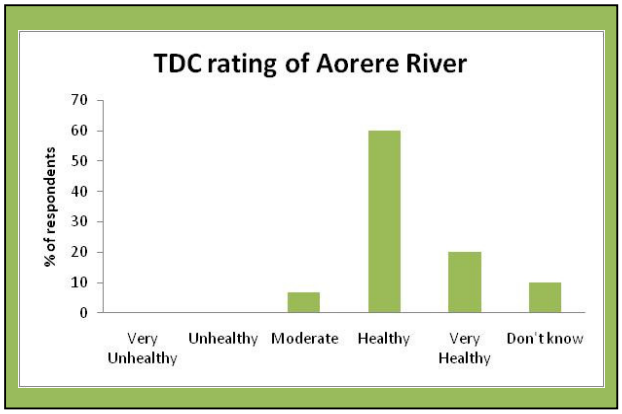

Figure 21: Farmers' expectations of how TDC would rate the Aorere River

6.6.4. Overall changes in perception of water quality from 2007 to 2010

Ratings given to the health of waterways did not vary dramatically from the 2007 survey results, as farmers already perceived the waterways as being healthy back then, especially with regards to the health of their own farm waterways. The perception of the ratings the TDC would assign to the Aorere River however, did change positively.

6.7. Which BMPs are being implemented by farmers?

Farmers were asked to list up to 5 environmental best management practices (BMPs) that they had implemented on their farms and to indicate why they had implemented these practices. For each of the environmental best management practices, farmers

were also asked how confident they were that their implementation would improve local water quality.

The results for BMP type clearly demonstrate a great improvement in BMP implementation over the past three years.

- The percentage of farmers that have improved (or plan to improve) their effluent management practices has increased from *87% to 100%.*
- Cases where farmers have installed (or plan to install) fences to stop stock entering waterways have increased from *83% to 100%.*
- The quantity of riparian planting in the catchment has grown from 33% to 57%.
- The percentage of farmers who have installed crossings/culverts has gone from *67% to 83%* (this will likely never reach 100% as not all farms have waterway crossings).

This increased implementation has resulted in a total of 75% of Aorere dairy farm waterways being fenced and 84% of waterway crossings bridged or culverted. The top 3 environmental BMPs implemented by farmers also correspond with the top 3 environmental BMPs that the farmers identified as being promoted locally for improving water quality on farms.

6.8. Confidence in best management practices

Farmers proved to be most confident in the effectiveness of responsible effluent management, fencing waterways and installing crossings as management practices for improving waterway health in the Aorere catchment (See Figure 23). These are also the BMPs suggested for the Aorere catchment through the Aorere Catchment Project and the involvement of scientific experts.

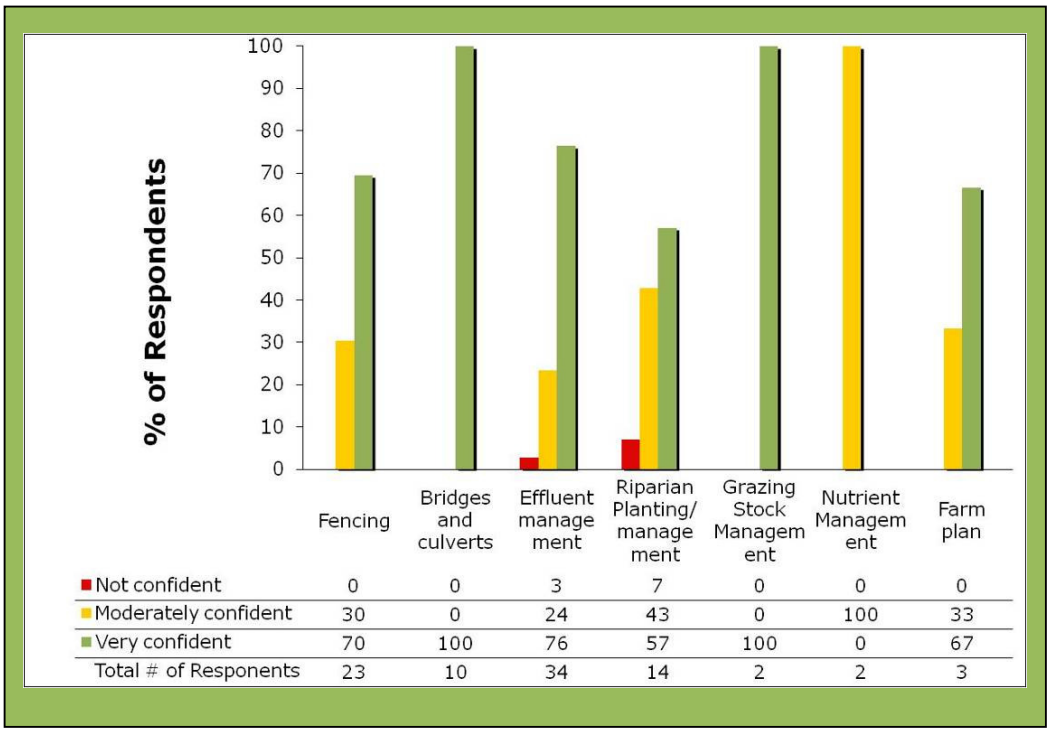

Figure 22: Farmer confidence in various best management practices

Comparisons between the 2007 and 2010 surveys showed that in general farmers' confidence in promoted BMPs has grown significantly. The percentage of farmers that reported being very confident in BMP effectiveness increased for:

- Effluent irrigation/management (76% in 2010 up from 54% in 2007)
- Fencing as an effective BMP (70% in 2010 up from 31% in 2007)
- Bridging and culverting stock water crossings (100% in 2010 up from only 16% in 2007).

Farmers were slightly less confident with regard to riparian planting and management but are still generally positive about its effectiveness as a best management practice. Farmers were also highly confident (100%) about the effectiveness of grazing and stock management while generally confident in nutrient management and individual farm plans.

The results of this question illustrate the growing knowledge and confidence in effective BMPs over the past 3 years.

6.9. Key influences on implementing environmental enhancement actions

Farmers were given a list of 9 possible motivating factors influencing their implementation of environmental enhancement actions on their farms. Each of the listed factors was rated on a scale of 1-5, with 1 = very unimportant to 5 = very important, results are graphed below (Figure 24). The farmers were then asked which of the factors had the most influence on them (see section 6.9.1).

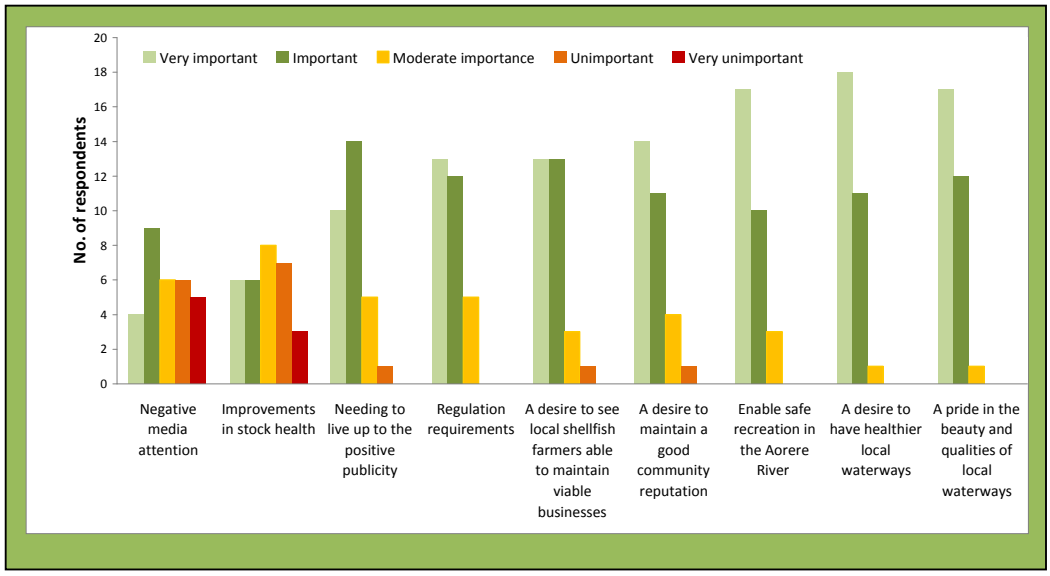

Figure 23: Influences on implementing environmental enhancement actions

The two most important influencing factors for farmers in implementing best management practices on-farm were a desire to have healthier local waterways (84% rated this 'important' or 'very important') and a pride in the beauty and qualities of local waterways (97% 'important' or 'very important'), showing Aorere farmers' consciousness and care for the intrinsic value of the environment, a distinctive feature of the Aorere community.

Enabling safe recreation in the Aorere River, regulatory requirements, a desire to maintain a good community reputation, a desire to see local shellfish farmers able to maintain viable businesses and needing to live up to the positive publicity, also influence farmers, though to a lesser degree.

Of minor influence were negative media attention on dairy pollution issues, and improvements in stock health.

The same question was included in the 2007 survey with 5 similar influencing factors offered as possible responses. The differences between the influence of those factors in 2007 and 2010 are shown in Table 5. A major notable change was the difference of 45% (a 109% increase) between the two surveys findings in regards to the desire to see local shellfish farmers able to maintain viable businesses. The influence of negative media attention gave a difference of 12% (39% increase) and regulation requirements gave a difference of 11% (15% increase).

Table 5: Variation in important influences from 2007 – 2010

Very important/ important influences	Negative media attention	Regulation requirements	Improvements in stock health	A desire by yourselves to have healthier local waterways	A desire to see local shellfish farmers able to maintain viable businesses
% in 2007	31	72	50	84	41
% in 2010	43	83	40	84	86
Difference	-12	-11	10	0	-45
Percentage change	+39%	+15%	-20%	0%	+109%

6.9.1. Most influential factor

Of the above influences, farmers were asked to choose the most influential factor. This gave some varying results, showing that a personal desire to have healthier local waterways (39%) was the most influential factor for Aorere farmers in 2010 in their decision to implement environmental enhancement actions on their farms. This was followed by the need to meet regulatory requirements e.g. Tasman District Council rules and the Fonterra Clean Streams Accord (32%). These results are interesting as they differ from the ratings given initially in terms of degree of influence.

6.9.2. Other motivating factors

Farmers were also asked if there had been any other factors motivating them to undertake environmental enhancement actions on their farm, and gave the following comments.

Some mentioned aesthetics and increase in biodiversity:

- “better trout spawning”
- “like farm to be "aesthetically pleasing" have pride in farm”.

For others, stock management advantages played a part:

- “cows don't fall in creeks”
- “ease of stock management i.e. planting trees for stock shelter”
- “improving stock flow over the creeks”.

Nutrient advantages were also a motivator:

- “able to harvest nutrients straight out of effluent”; “with low application plus ease of effluent management”
- “3 months storage will be useful”
- “effluent as fertiliser equals environmental and economic incentives, looking out for next generation”.

Many were simply motivated by a personal desire to own a farm operating in an environmentally considerate way:

- “personal desire to leave my property and management practice in a better state than I found it”
- “just for ourselves; kids etc; its who we are, part of our business plan”;
- “Pride and self satisfaction in being able to run a profitable small business unit in an environmental/ small footprint way”
- “want this farm to be tidy and sustainable, good stewards of the land with healthy good healthy productive cows”.

Other motivating factors were:

- “protection of the trust - not a lot of farmland in trust”;

- "momentum of the project has been hugely motivating - Get up to CSA requirement asap".

6.10. What are the best ways of receiving information?

Farmers were given a range of 5 options for receiving information and were asked to rate these in terms of their value (Figure 25).

One-on-one discussions with an advisor were regarded as very useful by 75% of farmers. Printed information sheets such as summaries and fact sheets from field days etc, were regarded as very useful by 43% of farmers. This was a decrease from 3 years ago where 66% of farmers deemed them very useful. Discussions with neighbours and fellow farmers were deemed more useful than they were three years ago, with 70% finding them very useful, compared with 53% previously. Local field days were regarded as very useful by 40% of farmers, this rose to 66% when field days involved independent specialists. At the other end of the usefulness scale, the internet rated poorly with 41% of farmers regarding this method as not at all useful for receiving information; this perceived value of the internet has not changed over the last three years.

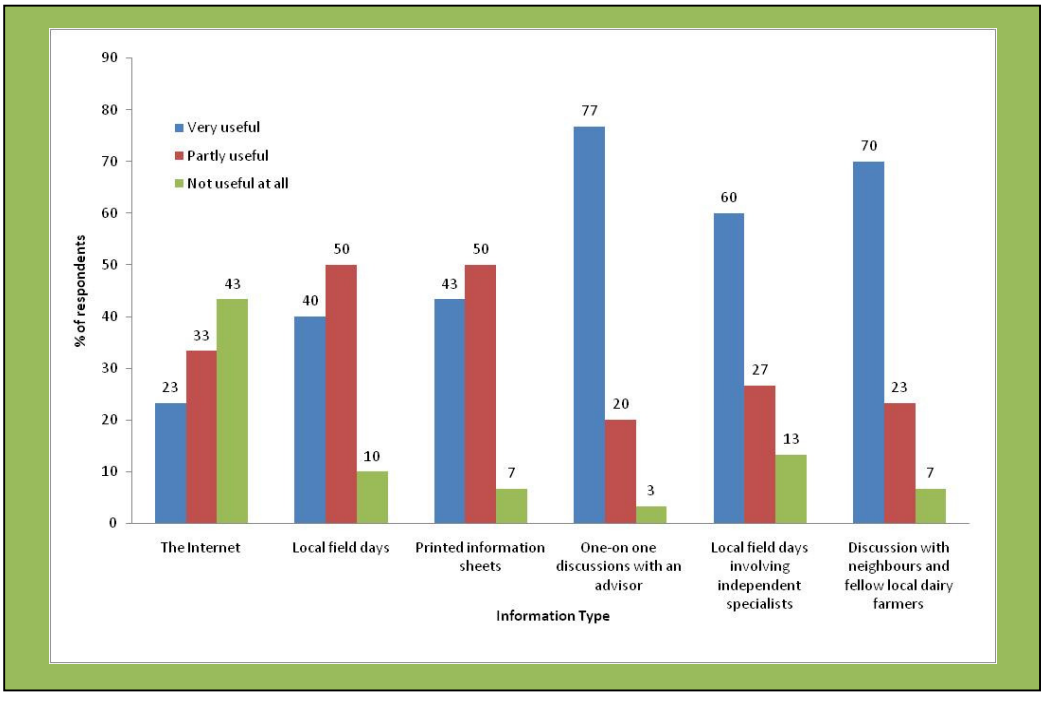

Figure 24: The value of various information types for Aorere Farmers

The variation from the 2007 survey demonstrates a movement of farmers from a previous preference for independent research with printed material, to the current preferences for one-on-one discussions and local field days involving independent specialists. These differences may reflect the improvement in one-on-one advice and field days available, and the increased involvement and quality of experts in the area.

6.11. What further information do farmers need?

Farmers were asked what further information would be useful to enable them to make environmental performance improvements on their properties (Table 6). The answers to this question showed a shift in information requirements from 2007. Farmers still call for further information regarding effluent management and nutrient leaching and run-off; however farmers now seem to have a good handle on water quality and general environmental issues. A summary of these findings, with specific needs identified by individual farmers, follows.

Table 6: Information gaps in the Aorere

Information required	% of respondents
Effluent management/irrigation	17
Nutrient leaching and run-off/nitrification inhibitors	13
Already well informed	13
Farm plan/farm specific advice	10
Grazing/stock/pasture management	7
Issues with current information	7
New Technology info - trials etc	7
The Survey/ACP data	3
Future regulation	3
Cost benefit analysis/economic	3
Other	23

Some farmers (17%) expressed a need for further information on effluent management; this was slightly down from 3 years ago where 25% requested more information on effluent management. Information requirements however, have moved

from a desire to have more integration in effluent systems research to a need for practical options such as information and solutions for the future disposal of solids from ponds and weeping walls. Farmers also sought practical and independent advice on effluent management technology improvements and individually tailored management advice, especially solutions for the future disposal of solids from ponds and weeping walls.

13% of farmers reported that nutrient leaching and run-off is an area where further information is needed. Previously (2007 survey), farmers were interested in gaining an idea of their direct inputs in waterways and their real contribution to catchment loadings, and better ways to accurately measure run-off from a farm. Farmers have gained knowledge on these processes and their focus is shifting towards solutions. Farmers are now concerned with gaining more independent information on nitrogen inhibitors and low rate effluent application systems, soils and effects of fertiliser. Many farmers would like to see more independent trials taking place.

Some believe they are already well informed, for example they, "*think there is enough of it [information] out there already*".

Some farmers were interested in getting freely available farm specific advice and individually tailored farm plan from Jan Derks. Unfortunately funding was only available for 16 farms plans, and all slots were booked, though more are available at farmers' own cost.

Other areas where farmers require further information have shifted since 2007 from a *"what is actually going on"* information requirement, to a more solutions based approach. Farmers are now interested in obtaining more information regarding grazing/stock/pasture management, information on new technologies, (e.g. trials, *"Better information about new systems - detailed but practical unbiased information", "Things that are cheap simple and work"),* The Survey and Aorere catchment project data (e.g. *"Regular newsletters with information")*. Further information requested include direction from the council on future regulations to enable pro-active behaviour, and a cost benefit analysis of new technologies.

6.12. Environmental farm plans

Farmers were asked whether they had an environmental farm plan (Table 7). In most circumstances this related to individual environmental farm plans created by Jan Derks. Jan offered his availability to visit the Aorere and work one-on-one with farmers to review current systems and develop an environmental farm plan. Of the 30 farmers interviewed 16 (53%) stated they had developed environmental farm plans. Notable, project funding was only available for these 16 farms plans, and all slots were booked. All who had received their plan reported having implemented it, while a few had not received the plan so were unable to implement it. Of those who did not have a farm plan, 7 had considered undertaking an environmental farm plan.

A few farmers have gone ahead and made some large BMP investments without a farm plan by employing their own advisors and doing their own research.

Table 7: Environmental farm plans

	Environmental farm plan	Have you been implementing plan?	Have thought about employing an environmental farm plan
Count	30	15	13
Yes	16	14	7
No	14	1	6

6.13. Aorere project effectiveness

6.13.1. Aorere project events

Farmers were asked which Aorere project events they had attended since the beginning of the project (see Table 8).

Table 8: Aorere project event attendance

Aorere catchment project events	Attended ?	
	Yes	No
Wriggle Water Quality Report Release (Bainham Hall)	10	20
Management Team meetings	18	12
Field days such as effluent system design (e.g. at Haldane's and Nalder's properties)	16	14
Chowder lunch with local shellfish farmers (Pakawau Hall)	11	19
3 year celebration event (Kahurangi Function Centre)	11	19

Significant project events, publications or moments

Farmers were asked to identify any Aorere catchment project events, publications or moments that came to mind (whether they were directly involved or not) as particularly memorable, important or significant. The following events were mentioned:

- field days such as the Aorere best management practice field day ('Handling the Wet')(e.g. at Haldane's and Nalder's properties)
- Wriggle Water Quality Report Release (Bainham Hall)
- Management Team meetings
- chowder lunch with local shellfish farmers (Pakawau Hall)
- 3 year celebration event (Kahurangi Function Centre)
- environmental award
- boat trip (Figure 26)
- first meeting with shellfish farmers
- booklet/newsletters
- field days with experts.

83% of Aorere dairy farmers attended at least one of the above events.

Figure 25: Dairy farmers and Shellfish farmers share a beer on the boat trip (photo by Gretchen Robertson)

6.13.2. Was the project useful?

Farmers were asked whether they thought the Aorere catchment project has been useful and why. 100% of the Aorere dairy farmers interviewed reported that the project had been useful. Farmers gave many reasons why, including:

- "cleaning up farms and valley; long term benefits to catchment to marketing education; laid back good delivery"
- "makes us into a group; increases peer pressure to get more to tow the line - has enabled many thinkers to come up with solutions to the problems"
- "increased awareness - helped people discuss what they are going to do"
- "farmers have the power, credit back to farmers"
- "gives us a bit of direction; a bit of motivation further than just being left up to council enforce; made farmers be more proactive"

- “extremely! everyone’s perception has changed… they have moved to a much more holistic [approach] a huge shift in peoples attitude. Not as much criticism as has been in past, ACP got farmers together”
- “if project had not happened - mussel industry would have taken TDC to court, so avoided legal action and increased environmental performance”
- “united farmers; helped farmers to be proactive; council have been easier because of this open group - farmers willing to share information”
- “we've seen results; driven by enthusiastic people”
- “got farmers thinking about effluent and where it ends up”.

What the future will hold?

To help determine future project direction, farmers were asked what they would like to see the project include and/or achieve over the coming few years. Many were interested in continuing to build on what the project has achieved so far and engaging with those who are not yet involved, their comments included:

“reinforce messages, get all farms on board putting effluent on farms in the best and most efficient and cost effective manner. i.e. refining and advancing technology”

“keep trucking - look out for road blocks and find a solution to each of them”.

Farmers asked for the project to assist them with continued monitoring of progress, and to offer facilitation in regards to farmer education, e.g. more field days. Others suggested an ongoing role in facilitation of more riparian planting and fencing. There was strong interest in extending the project to other areas, especially Golden Bay, and using the Aorere project as a model to improve other areas. Some farmers wanted a shift in focus towards responsible fertiliser and nutrient use.

7. DISCUSSION AND CONCLUSIONS

This chapter brings together the original objectives and the findings of the survey, case study and literature review.

7.1. Evaluation of the success of the project

The first objective of this thesis was to evaluate the apparent success of the project in engaging farmers in community based action for healthy waterways. There is often a gap between environmental awareness and knowledge, and the demonstration of pro-environmental behavior (Buchan, et al., 2006; Duxbury, 2005; Kollmuss & Agyeman, 2002). Therefore this thesis does not simply look at farmer engagement in a Landcare project but moves to examine farmer engagement in action to improve waterways. Based on an ICM framework this study uses the following three characteristics as indicators of farmer engagement in action for healthy waterways: 1) The health of the waterways themselves, 2) the actions farmers have taken to improve and protect their waterways, and 3) community involvement.

7.1.1. The health of the waterways

As mentioned in the case study the main indicator for water quality improvements has been New Zealand's mandatory shellfish quality assurance programme for all mussel harvesting (MSQP). This monitoring has shown a large reduction in closures of local aquaculture farms and wild-catch areas due to high faecal contamination and an increase in average harvest days from 50% to 71% in the space of the project (Robertson, 2008).

This result was partially backed up by a recent TDC presentation to the Aorere dairy farmers in November 2010 regarding the council monitoring results that indicated there may have been a reduction in disease-causing organisms in the Aorere catchment since the project inception. These results, however, were not statistically significant due to the relatively short monitoring period (10 years). The council monitoring takes place at five sites in the Aorere River and a major tributary, the

Kaituna River (see Figure 5). The monitoring regime is not ideal with measurements taken quarterly at any flow. This type of regime often shows so much variability in the data that it is very difficult to detect any trends within a useful timeframe. Data collection is typically undertaken on fine weather days; therefore it has generally not been possible to differentiate water quality during particular periods of the year when dairying impacts are likely to be accentuated (e.g. elevated runoff in high rainfall events). A more frequent monthly monitoring regime would give the opportunity to sample at any flow (i.e. including water quality affected by rainfall events) and would also provide superior data. This monitoring regime however, would be very expensive (about 10 times the cost of monthly monitoring for TDC), therefore TDC are unable to employ it at present. The existing monitoring may also not be sufficient to detect more subtle long-term changes in water quality, such as those that can be attributed to particular dairy management actions (James, 2010).

The farmers' perceptions of the health of waterways did not vary dramatically from the 2007 survey results. This is likely due to farmers already perceiving the waterways as being healthy in 2007. The 2007 survey was undertaken before the farmers received an independent assessment of the health of their waterways, and before this many farmers questioned whether there was a water quality issue. If the survey was administered following this, the results may have been different. Faecal contamination is also very difficult to identify visually. The perception of the ratings the TDC would assign to the Aorere River however, did change positively.

It could also be argued that water quality may have improved independently of farmers' actions. Prior to the inception of the project there was already an increase in shellfish farm harvest days from 29% in 2002 to 50% in 2006 (Brown, 2009; Robertson, 2008). This is unlikely however, as the lowest shellfish harvest days recorded in 2002 corresponds with many high rainfall events and bacterial contamination is naturally bad in high rainfall: R. Muirhead (personal communication, March 15, 2010). The issue was identified as excessive pathogen spikes in low to medium rainfall conditions causing shellfish farm closures (Robertson & Stephens, 2007). Furthermore, because dairy farming in the Aorere was the most likely cause of water quality degradation (Robertson & Stephens, 2007) the

apparent improvement of local water quality is most likely due to the on-farm management practice improvements by local dairy farmers.

7.1.2. Actions farmers have taken to improve and protect their waterways

This study identified and quantified the catchment's many management practice improvements. Most notably, there were large improvements to effluent systems and increased riparian fencing, plantings and stock crossings (bridges or culverts). These were best management practices specifically designed (by farmers and scientific experts) to reduce bacterial contamination. The introduction of standoff pads for winter-feeding – allowing for greater effluent collection - had also begun in many farms. All these improvements, and others mentioned in the results (section 6.2) show a willingness to invest personal capital in the improvement of waterways. It is possible that this investment could be attributed to the local council's stricter attitude towards compliance, or the introduction of the Fonterra Clean Streams Accord; however these measures are in place in many similar catchments with limited results (i.e. limited capital investment) (Fonterra, et al., 2008). The results also showed that a personal desire to have healthier local waterways was the most influential factor for Aorere farmers in their decision to implement environmental enhancement actions on their farms.

It is difficult to compare these results with similar projects around New Zealand as there is limited data quantifying BMP implementation post project inception. An ICM evaluation report of a similar project in the Waikato (Hungerford, 2010) quantified action implemented since farmers were given farm plans. Almost half of the recommended actions had been completed since farm plan delivery, and the authors concluded that the ICM project had been a key factor in encouraging action uptake. Another project: The Taieri Trust, is currently surveying the project participants after an extensive 9-year long ICM project looking at water quantity in Central Otago.

A further significant finding was the change in attitudes towards best management practice implementation over the past three years. The most notable changes were the increased belief that: '*Individual farm changes will improve Aorere water quality'* and

the strong disagreement that '*Costs for water quality improvement will exceed the benefits*'. Both of these changes reflect a change in the perception of the degree to which dairy farmers can affect the water quality. This change in perception is most likely linked to the farmers' awareness of the water quality improvements to date, and their understanding of how their farm management practices have contributed to this. In addition, comparisons between the 2007 and 2010 surveys also showed farmers confidence in promoted BMPs has grown significantly. For example, confidence in bridging or culverting stock crossings as a measure to improve water quality increased dramatically from 16% to 100% over the survey period. This may highlight a lack of confidence and trust the farmers had in the practices recommended by industry and government before the project began. Furthermore, the BMPs that farmers were most confident in coincided with those advocated as part of the ACP. Farmers also seemed to realise that investment in maintaining water quality in intensively farmed catchments is ongoing, and disagreed that the *'Aorere dairying community no longer need to invest in environmental BMPs as water quality issues are now fixed'*.

7.1.3. Community Involvement

As participatory and ICM theory assert, local community participation is a crucial component of natural resource management (e.g., Adams & Hulme 2001; Carpenter 1998; Horwich & Lyon 2007; Kothari 2006; Ostrom 1990; Spiteri & Nepal 2006; Tai 2007; Thakadu 2005.; Robertson, n.d.; Tyson, et al., 2005). In any natural resource management project, the community is unlikely to become involved if they do not consider the venture useful. Therefore an important indicator of engagement is the value of the project from a community perspective. From the perspective of an Aorere dairy farmer, the project has definitely been useful. Not one farmer answered otherwise. The various reasons given by farmers share one major theme: the farmers were engaged in the project. Some further key themes noted from all the farmers comments were that the ACP has helped to: give the power back to the farmers and has allowed farmers to become proactive in environmental issues rather than remaining a step behind the council; bring the community together and unite towards a common goal; changed perceptions, and brought the issue into the light. The final theme refers to the way in which the ACP put farmers in the driving seat to come up

with their own solutions to the defined water quality problem. The farmers recalled one of the most memorable project actions as being the community problem solving field days. These events, such as the effluent system design field day, enabled farmers to discuss the best ways to solve effluent management problems amongst each other with experts on hand to answer any questions. In other studies farmer engagement is quantified and assessed in a variety of different ways making comparisons difficult. A recent evaluation of an ICM project in the Waikato (Hungerford, 2010) reported 60% of eligible farms were engaged. Being 'engaged' in this project was defined as the farmer having agreed to participate in ICM. The ACP took a different approach, and never asked farmers to agree to be involved, instead treating the engagement process in a continual and adaptive manner. This approach is consistent with the idea that participation in conservation is not one thing, but rather an evolving process of empowerment (Adams & Hulme, 2001; Rodríguez-Izquierdo, 2009; Slocum, Wichhart, Rocheleau, & Thomas-Slayter, 1995). This allowed for farmers to have varied levels of participation and allowed them to take part at any point in the project. Farmers recalled other memorable project event/initiatives as the three-year celebration and booklet launch, the dairy/shellfish farmers' joint chowder lunch, newsletters, winning a TDC environmental award and a boat trip out with the local mussel farmers. The majority of farmers were aware of and interested in the project, with 83% of farmers attending at least one project event with many attending multiple.

7.2. Key engagement elements

The second objective of this thesis was to examine the success factors in farmer engagement in action and assess the effectiveness of different mechanisms. Similar projects have been criticised for not involving the local community, more specifically landowners enough. Others have been successful in engaging the local community, but such engagement has not resulted in any significant changes in behaviour (Duxbury, 2005). As the results and above discussion demonstrate, the ACP has been relatively successful in both regards. The following section will aim to tease out the reasons for such success.

7.2.1. Community led initiative

A key component of the ACP was to involve the landowner community from the very beginning, and is built upon the principle of 'farmers as leaders'. The initial engagement process is often a challenge (Robertson, n.d.) and has been a problem in a very similar NZ Landcare Trust project in the Rai Valley. In contrast the ACP project differed from many because it was initiated by the members of the dairy farming community, they approached NZLCT for facilitation assistance but remained the leaders of the project; hence the Projects full name: Aorere Farmers as Leaders in Water Quality Action Project. This made initial engagement easier, however there were still difficulties in whole of catchment initial engagement.

In CBSM theory, a promoted way to engage the community is to form a community advisory board; this involves forming a group of stakeholders or people who are interested in a certain issue, which is then used to collect data on a target audience, determine the benefits and barriers of promoting a specific behaviour change, and implement a campaign, evaluate the campaign and change as necessary (McKenzie-Mohr & Smith, 1999). In contrast, the Aorere project took a more local approach, forming a dairy community-led project management team, open to all dairy farmers in the Aorere Catchment, and facilitated by NZ Landcare Trust staff. The ACP management group consisted of local dairy farmers and NZ Landcare Staff and was made up of a core group of farmers, however all farmers were invited to attend any meeting and the recent survey showed that almost 70% of farmers attended at least one meeting. The group was similar in role to a community advisory board. However, wider key stakeholders were not directly part of the management group, but were involved in targeted consultation. Similar studies have shown the benefit of these regionally developed processes, for example a study by Aslin and Brown (2004) indicated that the ability *to "talk to local people, work with someone we know, and talk to colleagues informally"* is of benefit to farmers.

As other Landcare initiatives have found having the project led by the local community has been very successful; the management team has been able to invite stakeholders and agencies it desires to work alongside, thus forming valuable partnerships and creating an ICM-like support system. "[This] *leadership strategy has*

encouraged farmers to have confidence in their expertise to present information to others"(Riley, 2009: Michelle Riley, Dairy Chair of Golden Bay), including fellow farmers, TDC, Fed Farmers, Side, and MAF. Some Aorere dairy farmers have also played leadership roles wider than the Aorere since the project inception, for example taking roles such as Federated Farmers Dairy Executive, and Conservation Board member.

7.2.2. **Issue identification**

In line with the social marketing theory, Edgar et al. (2005) point out that there must be some recognition within the farming community that a problem exists, and a definition of exactly what the issue is (Dresser, 2008).

In this study, the farmers were able to come to a clear understanding of the problem faced by mussel farmers affected by poor water quality. The issue in this case was able to be clearly defined and quantifiable, the economic losses faced by the mussel farmers due to degraded water quality was an issue the farmers could readily empathise with. Most water quality issues related to intensive farming are nutrient issues, which have many direct, and indirect environmental impacts, many of which are difficult to identify and quantify. In this particular situation, the issue (bacterial contamination of waterways leading to reduced mussel harvest days) was easily identifiable, quantifiable, economic and also somewhat visible. This issue also had social implications, as marine farmers were also part of the Golden Bay community. An interesting question for further study would be whether the same urgency and readiness to respond to the issue would have been forthcoming if the concerns had been primarily environmental rather than economic and social.

However, there were questions and uncertainty over the cause and extent of the water quality issue, so the ACPs first port of call was to elucidate the water quality issue. Dr Barry Robertson and Leigh Stevens, of Wriggle Consulting, were employed to give a detailed assessment of the water quality issues in the Aorere catchment. Dr Robertson and Mr. Stevens specialise in the assessment, monitoring and management of coastal resources. They gave a presentation of their findings to a farmer-only group in an approachable manner, allowing for much discussion and questions. The farmers were

then able to eliminate other perceived pollutant sources (such as swans and dry stock farmers) and could then focus on the defined issue: excessive faecal bacteria in low to medium flows, primarily from intensive dairy operations. These were independent scientists and therefore had no hidden agenda, something farmers can be very wary of (Brown, 2009).

The farmers then decided to present the modeling results to the Tasman District Council and local marine farmers. This opened the lines of communication between the stakeholders and sparked an important collaborative approach. The ACP was careful to choose scientists who were willing to gain an astute understanding of the personalities involved in the project, and how the local community operated, as this has been found to increase effectiveness (Dresser, 2008). A further study by Wriggle Coastal Management to examine water quality improvements since their assessment at the beginning of the project has not been possible due to lack of funds.

7.2.3. Understanding the community

For any natural resource manager there can be many hurdles to jump prior to even entering through the farm gate. Understanding the background, history and challenges is crucial to gaining the respect and goodwill of the farming community (Edgar, et al., 2005). Throughout New Zealand one can encounter a variety of farmer mentalities (Waugh, 2005). A resource manager that aims to understand and identify the diversity of farmer types and attitudes and all the challenges involved in engaging them will be far more effective.

Following from this assertion, the ACP conducted interviews with 31 of the 33 dairy farms within the catchment towards the beginning of the project in an effort to better understand the specific community they were working with. The information gathered allowed project coordinators to tailor project deliverables to farmers' needs. The survey was also useful in identifying barriers to actions to improve and protect water quality. As the community based social marketing approach suggests: if any form of sustainable behaviour is to be widely adopted by the public, barriers to engaging in the activity must first be identified (McKenzie-Mohr & Smith, 1999). Once these barriers had been identified (e.g. many farmers were sceptical the water quality was

sub-standard, others were sceptical about farmers being responsible for the poor water quality, and most identified economic and time barriers), the ACP was then able to develop a social marketing strategy to remove them. The act of trying to understand and interact with a community also goes some way towards tapping into farmers' own social networks, something Dwyer et al (2007) note has high value when encouraging farmers' to improve local water quality.

7.2.4. Experts and scientists on tap – not on top

Following the assessment and defined water quality issues, an expert scientist specialising in the management of faecal bacteria was contracted to be involved in a community problem solving day to assist farmers developing best management practices most suited to the specific area (high rainfall etc). The problem-solving day (and more since) utilized the 'experts on tap not on top' philosophy and led to the derivation of accepted best management practices for the region. By understanding the problem and the catchment conditions it was possible to whittle down the best management practices to those which would 'make the difference' to water quality, thus avoiding unnecessary spending and work. Since then further community problem solving field days hosted on local farms and utilizing farmers as experts and scientists on tap – not on top have been run in the catchment. A further initiative following this principle has been tailored individual farm planning available to willing farmers to address specific water quality issues with practical voluntary 5-year plan and budget.

7.2.5. Farm Plans

Environmental farm plans are generally accepted by New Zealand local government as an effective method of achieving good environmental outcomes in a non-regulatory way (Blaschke & Ngapo, 2003). In the case of the ACP environmental farm plans were used specifically to help farmers reduce faecal bacteria getting into waterways. While environmental farm planning is reasonably widespread in New Zealand, there has been limited uptake by dairy farmers (Blaschke & Ngapo, 2003).

Another important element of the ACPs model was to offer dairy farmers individual environmental farm plans. These were created by Jan Derks who worked one-on-one

with farmers to review current systems and develop a 5-year environmental farm plan. Research suggested the success of environmental farm plans relied on the fundamental principle that the implementation of a plan is a voluntary undertaking by the landowner (Blaschke & Ngapo, 2003), therefore both the uptake and implementation of farm plans were voluntary.

The survey asked first whether a farmer had a farm plan, and if not would they consider getting one. This gave important information to the ACP management team as to who would like the remaining farm plan allotments, but unfortunately neglected to give important information as to how helpful farmers who had farm plans were finding them.

7.2.6. Communication

A further key success area was communication. All farmers within the Aorere catchment were sent initial information about the project, and invited to a farmer only meeting to discuss project goals. Communication of experiences and knowledge between members is through meetings, which are called when there are matters to discuss. The group has also held a number of practical workshops and field days within the Aorere region, designed to feedback on activities undertaken as well as to challenge local farmers to think differently about their farm management practices. A newsletter has been published and is provided regularly to group members and other interested parties. During the project farmers have either phoned project contacts to discuss project activities, or have been contacted by the project coordinator or other farmers in the management team. Invitations to project events are given in multiple ways including email, posted invite, or phone call from fellow farmers. In some cases all three methods are employed. As other studies (Dresser, 2008; Edgar, et al., 2005) have shown, regular communication between researchers/coordinators and the community are necessary to build trust and understanding.

A major element of the ACP was to ensure effective information dissemination. Many different techniques were used and constantly assessed for usefulness. The 2010 survey found that certain techniques for disseminating information to Aorere farmers were better than others. Of the techniques used, one-on-one discussions with an

advisor were regarded as the most useful way of receiving information, followed by discussions with neighbours and fellow farmers, and field days involving independent specialists. The Internet, on the other hand, rated poorly and the perceived value of the internet has not changed in the last three years. The 2007 survey showed a previous preference for independent research with printed material. The variation towards the current preferences for one-on-one discussion and local field days involving independent specialists may reflect the improvement in one-on-one advice and field days available, and the increased involvement and quality of experts in the area. However, as (Allen, et al., 2002) note, an information system cannot be regarded simply in terms of its transfer component (e.g. a field day, workshop, newsletter). Rather, such a system is better viewed as a 'social system' within which people interact to create new knowledge, and broaden their perspective of the world.

The ACP has been featured positively in many newspaper and magazine articles, and has also recently been featured in a documentary about water management.

7.2.7. Feedback

According to the pro-environmental model developed by Kollmuss & Agyeman (2002) (Figure 1) negative or insufficient feedback about behaviour is a major barrier to pro-environmental behaviour. The ACP has used various methods of feedback including water quality updates showing the progress towards the ultimate goal i.e. improving waterway quality. The improvements farmers have made have been celebrated in many ways including: A large scale catchment field day celebrating on-farm improvements winning a TDC environmental award, a dairy/shellfish farmers' joint chowder lunch, newsletters, and a boat trip out with the local mussel farmers.

7.2.8. Facilitation

As Dresser (2008) affirmed, researchers who insist their approach to a problem or the proposed management tool is the correct and only approach will lose farmer support very quickly. A pragmatic approach to project facilitation is needed, and was used in the ACP. The project facilitators took time gaining an understanding of the issues,

attitudes, knowledge and aspirations of the Aorere farming community in an on-going manner.

7.2.9. Working with stakeholders

Although not an explicitly ICM project, a major part of the ACP has been to work closely with wider stakeholders. Due to the grassroots nature of the project, the community was able to choose which stakeholders they wanted to bring in to the project. This started with a small group of stakeholders, and continually widened as the project went on to eventually include all major stakeholders as trust and relationships grew. This stakeholder collaboration and relationship building has been and will continue to be an on-going and adaptive process.

As an example, at the beginning of the project, the relationships with the shellfish farmers were on rocky terms, with the shellfish farmers releasing damaging media releases and threatening legal action. Three years later the dairy farmers and shellfish farmers have got together on many occasions – including a trip out on the 'Stray Cat' boat to see mussel farming in action – to share stories and try to begin to help each other. A notable change was seen in the '*desire to see local shellfish farmers able to maintain viable businesses'* where there was a 109% increase from the 2007 to the 2010 survey, showing a general mindset change towards shellfish farmers that may well have come from one of the projects' focuses to build relationships between the terrestrial and marine farmers. E.g. dairy farmers joining the marine farmers out on the boat finding out what it is to be a mussel farmer. Shellfish farmers, as part of the community have become actively involved in the ACP. As well as taking farmers out on their boat and coming to meetings, the local industry has donated money towards a local stream-care group and created an award for the dairy farmers.

7.2.10. Community Values

Arguably the most important element leading to success in this project was the community themselves. According to the 2010 survey the two most important influencing factors for farmers in implementing best management practices on-farm were '*a desire to have healthier local waterways*' and '*a pride in the beauty and*

qualities of local waterways', showing Aorere farmers' consciousness and care for the intrinsic value of the environment, a distinctive feature of the Aorere community. The survey found that a personal desire to have healthier waterways was regarded as the most influential factor in regards to BMP implementation, followed by the need to meet regulation requirements. The pride and the beauty and qualities of the Aorere are influencing factors that are not prevalent in all New Zealand catchments. Without this, the ACP may well have been much less successful. The farmers themselves were shocked in the first place at hearing they had a water quality problem and were the ones to approach the NZLCT for help with try to rectify the issue. There may be a need to begin initiatives in other areas with more celebration, knowledge sharing and education into the ecological value of the specific area. For instance electric fishing demonstrations in fresh waterways to show the life held within them.

7.2.11. Assumptions and limitations

The interview recruitment process can be considered very successful. Of the 34 dairy farmers in the study catchment, only four were unable to take part due to busy schedules. The results of this interview however are subject to several limitations. I undertook this survey assisted by three New Zealand Landcare Staff members, and so the results may be subject to several biases. A major concern was 'response bias' (Grimm, 2010) in which respondents may give responses they think the interviewer would desire rather than choosing responses that are reflective of their true feelings. The project coordinator at the time, Gretchen Robertson, was not involved in surveying to somewhat reduce the response bias. Social desirability bias, a term to describe the tendency of respondents to reply in a manner that will be viewed favourably by others was also of concern. This would lead to the possibility of over reporting good behavior or under reporting bad behavior, especially in regards to BMP implementation. The wording and order of each question was carefully chosen to reduce the possibility of the biases previously mentioned.

This research also identifies the limitation involved with having the researcher so closely aligned to the project (i.e. as project coordinator). There is a natural bias in having a desire for the project to be successful, and therefore I have tried to stay as objective as possible.

7.3. Conclusion

New Zealand as a whole is looking for ways to reduce the environmental impact of the dairy industry without greatly harming the economic benefit the industry brings. In regards to water quality improvement, the Aorere is a catchment that appears to have done this.

This research identified many key elements involved in engaging farmers in community based action for healthy waterways, based on the Aorere catchment project. These include: inherent community values, working with stakeholders, facilitation, feedback, communication, farm plans, experts and scientists on tap – not on top, understanding the community, issue identification and community led initiatives. All these elements have played a part in engaging the community in action, however it is difficult (maybe impossible) to isolate and show relative causation between each individual element and engagement success or BMP implementation in any empirical sense. There are however, certain elements of this project that stand out as the critical success factors.

The underlying community led philosophy of the project has been vital in the success of this project. Both the key project principles, 'farmers as leaders', and 'experts on tap not on top' were based on this participatory philosophy, and have contributed greatly to the projects uptake. The 'farmers as leaders' model, allowed dairy farmers to take ownership of their own environmental performance, and moved the issue of environmental performance in to mainstream thinking and acting.
There are however some catchment specific elements that have aided the apparent success of this initiative. The Aorere catchment project model unchanged would not be suitable for every catchment in New Zealand, as not all the elements of success were under the projects control. The pride in the beauty and qualities of the Aorere are influencing factors that are not prevalent in all New Zealand catchments. Also, the community was self-motivated in responding to a common community issue. Without this, the ACP may well have been much less successful.

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8. APPENDIX

2010 AORERE DAIRY FARMER INTERVIEWS

Interviewer's Initials…… Date ……..

Respondent's Name/s: …. . .....

……

Contact Details (phone and email) .....

- **Explanation of purpose of the interview in relation to the project.**
- **Explain about confidentiality of their responses and privacy of the questionnaire forms.**
- **Confirm they are willing to participate.**

1. Background

1.1 **How big is this farm?** (in hectares)	
1.2 **What is your effective pasture area?** (ha)	
1.3 **What is your current herd size**?	
1.4 **What was your herd size three years ago**?	

2. Issues facing dairy farming

2.1 **What are the current main issues facing you as an Aorere Valley dairy farmer**? ►

Issue	*code*	*seriousness*
1.		
2.		
3.		
4.		
5.		

2.2 **Can you rate the seriousness of each of these issues to you- using the scale *1= mildly serious 2=moderately serious 3 = very serious***

2.3 **Of the issues you noted, which one do you think is the most urgent for you?**
(write issue number in the box)

2.4 **Why?**

……..

……..

3. Health of Waterways

3.1 **On a scale from 1= very unhealthy to 5 = very healthy, how would you rate the health of the waterways on your property? ►**

3.2 **Why did you give them that rating?**

…….....

……..

3.3 **Using the same scale, how would you rate the health of the Aorere River? ►**

3.3 **Why did you give the river that rating?**

……

……

3.5 **Using the same scale, what rating do you think the Tasman D C would give to the health of the Aorere River and its main tributaries? ►**

3.6 **Why do you think they would give it that rating?**

……..

……..

4. Current catchment attitudes

4.1 To what extent do you agree or disagree with the following statements? ► use the scale 1: strongly agree, 2: agree, 3: neither agree nor disagree. 4: disagree, 5: strongly disagree . *(enter 9 if they say don't know)*

1.The Aorere catchment still has problems associated with nutrient and/or bacterial runoff into waterways.	
2. The relationship with local shellfish farmers has improved over the past 3 years.	
3. Local dairy farmers have a clear idea what practices they could implement on their farms to protect water quality.	

4. Cow dung can carry micro-organisms (or bad bugs) that can cause illness in humans.	
5. The Aorere dairy farming community deserve all the positive publicity they have received for environmental enhancement work.	
6. A mutual understanding of issues has developed between the Aorere dairy community and the Tasman District Council over the past 3 years.	
7. The costs of on-farm works to improve water quality exceed the benefits.	
8. The independent nature of the New Zealand Landcare Trust has been useful in building relationships and sharing information in a non-threatening way.	
9. It is likely that shellfish harvesting closures will continue to occur from time to time but will not be serious enough to cause permanent aquaculture closures.	
10. The Aorere Catchment Project has been important for building a sense of community between Aorere dairy farmers	
11. The Aorere dairying community no longer need to invest in compliance and water quality enhancement as water quality issues are now fixed.	
12. The Aorere Catchment Project continues to have an important role in bringing the Aorere dairying community together to share ideas, encourage good practice and build relationships.	

5. Actions for waterway health

5.1 **What 'best management practices' have been promoted recently by the Aorere Project as being effective for improving local water quality?**

practices	*code*	*confidence*
1.		
2.		
3.		
4.		
5		
6.		

5.2 **On a scale where 1= not confident, 2= moderately confident, and 3= very confident,**
how confident are you (in each of these practices) that they will improve water quality if all Aorere dairy farms implemented them? ►
(put confidence score beside each on table above).

5.3 Would you like to comment further on why you rated your confidence scores as you did?

……
……

……
……

5.4 What practices/infrastructures have you invested in or implemented on this farm over the past 3 years (if anything) that will improve waterway health in the Aorere catchment?

action	*code*
1.	
2.	
3.	
4.	
5.	
6.	

5.5 Describe your current farming systems under the following categories

Questions	*Answers*
1. Effluent irrigation method (e.g. k-line, travelling irrigator, etc)	
2. Degree of permanent waterway fencing (% of waterways permanently fenced on both sides) *Degree of temporary fencing (i.e. hotwire when stock in the paddock)*	……% permanent ……% temporary
3. Number of stream crossings bridged or culverted vs unbridged/unculverted	*Bridged/culverted……..* *Unbridged/unculverted……*
4. Winter feeding methods (e.g. standoff pads, standing off on laneways, sacrifice paddock, shifted off farm, rotation grazing etc)	
4. How do you determine what fertiliser application is right for your farm?	
5. Have you ever used nitrogen inhibitors? *If yes, what motivated you to try these?* *Were you pleased with the outcome and why?*	Y / N …… ……
6. Effluent pond design *Include number of days storage capacity*	…… days storage

5.6 On a scale where 1= very unimportant and 5= very important, how important have each of the following been in your decision making to implement environmental enhancement actions on your farm? ►

	rating
1. Negative media attention focusing on pollution problems from the dairy industry	
2. Regulation requirements e.g. Tasman District Council rules and the Fonterra Clean Streams Accord	
3. Improvements in stock health	
4. A desire by yourselves to have healthier local waterways	
5. A desire to enable safe recreation in the Aorere River	
6. A desire to see local shellfish farmers able to maintain viable businesses	
7. A feeling of needing to live up to the positive publicity local dairy farmers have received	
8. A desire to maintain a good community reputation by not letting down fellow Aorere dairy farmers	
9. A pride in the beauty and qualities of local waterways	

5.7 Have there been any other motivating factors for you to undertake environmental enhancement actions on your farm?

……
……

5.8 Which of the factors above would you say has had the <u>most influence on you</u> to date? Choose up to 2

<u>6. Information & advice</u>

6.1 Where, and who, would you go to for advice if you were looking to implement environmental best management practices/ [water/stream quality improvements] on your farm?

Source of advice	*code*	*Have used*

1.		
2.		
3.		
4.		

6.2 Which, if any, of these sources have you already sought advice from?
(put a 1 in the right had box above if already used the source)

6.3 What further information would be useful for you to enable you to make environmental performance improvements on your property?
information

	code
1.	
2.	
3.	
4.	

6.4 On the scale where 1= not at all useful, 2= partly useful, and 3= very useful, - how useful would you find each of the following for getting information on ways of improving your environmental performance? ►

1. the Internet	
2. Local field days	
3. Printed information sheets	
4. One-on one discussions with an advisor	
5. Local field days involving independent specialists	
6. Discussion with neighbours and fellow local dairy farmers	

7. Planning

7.1 Do you currently have an environmental farm plan? Y/N	
7.2 Have you been implementing the plan Y/N	
7.3 If you do not have a plan, have you considered implementing an environmental farm plan? Y/N	

7.4 If you do have an environmental farm plan, have there been any barriers to implementing the plan?

.....
.....

8. Aorere project effectiveness

8.1 Have you attended any of the following Aorere Catchment Project Events?

1. Wriggle Water Quality Report Release (Bainham Hall)	
2. Management Team meetings	
3. Field days such as effluent system design (e.g. at Haldane's and Nalder's properties)	
4. Chowder lunch with local shellfish farmers (Pakawau Hall)	
5. 3 year celebration event (Kahurangi Function Centre)	
6. Other (please name)…	

8.2 Are there any Aorere catchment project events, publications or moments that come to mind (whether you were directly involved or not) as particularly memorable, important or significant. Please name any:

8.3 Event, publication, moment	8.4 Why significant

8.4 Why do you think this/these were of particular significance? *(record above)*

8.5 Do you think the Aorere catchment project has been useful?
Y / N (circle)

8.6
Why?.....
.....

8.7 What would you like to see the project include and/or achieve over the coming few years?

……
……

Ask if there is **anything else they would like to comment on**….. *Put any additional notes, comments, advice or observations here or over page:*

Wind up the interview, thanks etc.

Brechin, S. R., Wilshusen, P. R., Fortwangler, C. L., & West, P. C. (2002). Beyond the square wheel: Toward a more comprehensive understanding of biodiversity conservation as social and political process. *Society & Natural Resources, 15*(1), 41.