The ***Wheel of Water***

Research Programme

Designing collaborative catchment decision-making processes using a WaterWheel– reflections from two case studies

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EXECUTIVE SUMMARY

Project and Client:

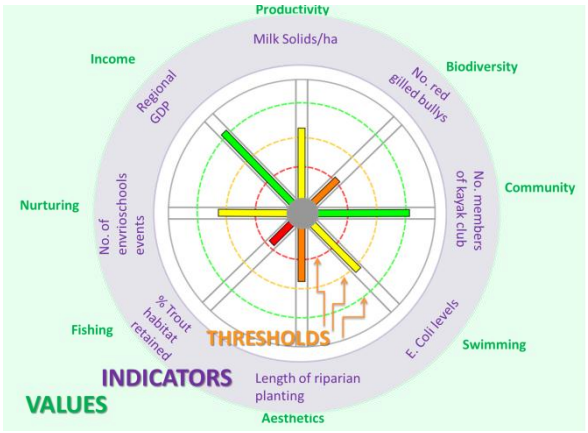
The Wheel of Water is a 3-year government funded research programme on collaborative water resource governance and management. The programme is led nationally by Aqualinc Research Ltd and involves Landcare Research Ltd, AgResearch Ltd, Tipa and Associates, Will Allen and Associates, Participatory Techniques Ltd, ESR Ltd, Lincoln Agritech Ltd and Lincoln University's AERU. The programme supports the national focus on improving water resource management, specifically the need to develop approaches that involve the wider community in determining acceptable limits to water extraction and water quality. This recognises that Government and industry cannot address New Zealand's freshwater challenges without significant involvement and collective action from catchment communities. The programme also aims to support integrated decision making and develop decision-making processes that take account of environmental, economic, social and cultural implications of those decisions.

Case study objectives:

1. To pilot a collaborative water resource management process in which participants develop a common understanding of their catchment, the interconnections between their values, and the trade-offs between these values that might occur under different land and water management scenarios.
2. To test the utility of the WaterWheel diagram as part of this process.

Method:

This report presents the findings from two case studies, in the Wairau Valley (Marlborough) and Mangatarere (Wairarapa) catchments. The case studies involved the formation of a representative collaborative group, and then a series of 4-5 facilitated workshops each led by a dedicated project team. Through these workshops we worked through content elements such as values, indicators, scenarios and the development of WaterWheel diagrams.



Through interviews with participants, pre-and post-workshop reflections, reflections of the project teams following each workshop, and then final reflections and analysis at the end of the workshop series, we were able to evaluate knowledge and skills developed by the participants and project teams, and critically analyse the tools and techniques used throughout the process. Based on the experiences and insights documented within this report, we have compiled a list of key design elements that we consider will be useful in the design of similar collaborative water management processes.

Outcomes:

The collaborative, facilitated approach used in the two case studies enhanced the exchange of knowledge and the development of a broader understanding of the catchment among participants.

Using processes and facilitation techniques that fostered safety and trust allowed the group to draw upon their collective knowledge, as well as other information sources. Participants also demonstrated an increased awareness of the complex interconnections among the values held in the stakeholder community. The WaterWheel diagrams made information more accessible and easier to understand, and the process used to develop them was inclusive such that the participants generally felt some level of ownership of the WaterWheel diagrams.Based on these observations we conclude that the Wheel of Water collaborative process, accompanied by the use of WaterWheel diagrams show significant potential as a process and tool combination that can contribute to the delivery of effective collaborative water resource management.

Key insights and design elements:

Based on the experiences and insights documented within this report, we have compiled below a list of key design elements that we consider will be useful in the design of similar collaborative water management processes.

Designing and managing a collaborative process

- ***Establishing a multi-disciplinary project team:*** *A multi-disciplinary project team comprising relevant technical, policy, facilitation and engagement skills, involved throughout will bring rigour to the process.*
- ***Outcomes driven:*** *Be driven by outcomes, but remain flexible on the processes that could be used to achieve these. Regularly revisit progress toward the planned outcomes with participants, and assess where the group is in the journey towards these outcomes.*
- ***Recruitment:*** *Criteria should consider geographical spread within the catchment; the primary land and water uses and interests, including agencies and Iwi; a balance of gender, age and worldviews; ability to listen and express views; and capacity to commit to the process. Particular attention needs to be paid to involve Iwi – both as Treaty partners and as local community members.*
- ***Roles and goals:*** *Clarify roles and goals at the start of the collaboration process with both the participants and the project team*
- ***Ground rules:*** *It is useful to enable participants to create their own ground rules to support creation of a safe and trusting environment.*
- ***Learning styles:*** *Recognise that people learn in different ways and use a variety of methods for sharing knowledge to accommodate this. A mix of breakout groups, plenary and presentation maintains engagement, and helps facilitate dialogue from all in the group.*
- ***Good facilitation:*** *Facilitation is needed to enable open conversations, and make the process enjoyable and engaging. The aim is to ensure the collaborative process is inclusive, supports sharing and understanding of others' knowledge, develops trust and manages power.*
- ***Working in a multidisciplinary team.*** *Project team members need to be open-minded, patient and respectful of the differing opinions that will arise when working in a multi-disciplinary team. Working with a multi-disciplinary team is likely to take 40% longer than might otherwise be expected.*
- ***Reflection and evaluation:*** *Incorporating participatory evaluation and reflection into the process design allows for the project team to improve and better meet the needs of all participants, as well as achieving desired outcomes from the collaboration.*

Knowledge sharing and developing a common understanding
• ***The importance of different knowledge systems:*** *There are multiple benefits of accessing and using the knowledge held within the collaborative group to help develop a rich picture of the catchment and its community. Care should be taken to provide a level playing field which encourages the use of knowledge from local, traditional and scientific sources.* • ***Involve scientists/experts as participants:*** *Engaging scientists as participants ensures that they are more aware of the context for their knowledge. This helps build trust in their work, and makes it more likely that their contributions are tailored to the local context.* • ***Take care to present in different ways:*** *Use a range of methods to present information. For example using low technology methods, not just PowerPoint, to present technical information can also make it more accessible to many people.* • ***Discuss what makes evidence credible:*** *There is a need to recognise that concepts of credibility change in a multi-stakeholder situation. More attention has to be paid to acknowledging the legitimacy of different kinds of evidence.* • ***Take care to provide context:*** *Ensure that the context for any lesson or piece of information is clear; technical information should be introduced to the group in a setting that makes it relevant for them.* • ***Use simple models to start with:*** *High level models can provide a useful first examination of scenario outcomes.* • ***Involve stakeholders in problem design and model development:*** *Predetermining the technical or policy issues and options may disempower a collaborative group. Instead, modelling should be responsive to the scenarios and questions of the participants.*

WaterWheel diagrams
• ***Simple visualisation tool****: WaterWheel diagrams help to present complex information in a visually simple and accessible way, but are not the only visualisation tool for planning and monitoring catchment management* • ***Exploring cause and effect****: By comparing WaterWheel diagrams between scenarios, communities can explore cause-effect relationships and trade-offs between different community values.* • ***WaterWheel diagrams require a systems process:*** *The process of developing the WaterWheel diagrams necessarily requires discussions about values, indicators, outcomes and limits of acceptability. Our experiences suggest that these discussions are fundamental to all collaborative water resource management.*

From Values to WaterWheel Indicators

- ***Define values clearly**: Defining what is meant by a 'value' and defining each value unambiguously enables faster agreement on the values which are most important for future management.*
- ***Prioritising values**: The process of prioritising stakeholders' values catalyses useful debate, but the lack of further consideration for lower priority values may cause concern among participants. It is important to use an iterative process and check that participants still feel that all important values have been taken into consideration in the process.*
- ***Uses of scenarios**: Scenario development provides a grounded context for participants to evaluate impacts on their values of plausible future changes in their catchment. If the group is involved in helping to develop the scenarios, then it is more likely that those scenarios will incorporate their local knowledge and values. It will also help to develop catchment management objectives.*
- ***Exploring trends and drivers:** Before developing scenarios, it can be useful to get participants to think about past trends and drivers. This helps draw out local knowledge and focus thinking about what might trigger future changes in the community, the economy, in or beyond the catchment and which of those changes is amenable to management.*
- ***Types of scenarios**: The facilitation team need to consciously define and clarify with the group what types of scenarios will be useful to help with the task at hand. To stay focused try to include just enough detail to provide the direction, model the system appropriately, and to communicate the anticipated conditions and needs of the catchment and community.*
- ***Indicators should represent the important values most susceptible to change**: The process of identifying important catchment values and then plausible long-term scenarios for change in the catchment assists groups to narrow their choice of suitable indicators to represent those values most vulnerable to change. Those values will be the ones which need to be addressed through policy or management actions.*
- ***Indicator complexity**: Because indicators should meet certain criteria, and there are a large number of indicators possible, the collaborative process will need to provide a considerable amount of guidance and assistance with indicator selection. Without this guidance participants can easily struggle to settle on an appropriate package of indicators.*
- ***Tools exist to quantify complex indicators**: Many values (e.g. "connected community") mean different things to different people. Rubrics are a tool that offer a collective process for measuring indicators of otherwise seemingly qualitative values*

1 THE WHEEL OF WATER RESEARCH PROGRAMME AND CASE STUDIES

1.1 Introduction

The Wheel of Water is a 3-year government funded research programme on collaborative water resource governance and management. The project includes the development of a WaterWheel diagram which helps catchment communities to easily view a range of key indicators (representing the four well-beings) in their catchment system. The programme is led nationally by Aqualinc Research Ltd and involves Landcare Research Ltd, AgResearch Ltd, Tipa and Associates, Will Allen and Associates, Participatory Techniques Ltd, ESR, Lincoln Agritech and Lincoln Agricultural Economic Research Unit. The objective of the programme is to research suitable processes of collaborative decision making for setting water quality and quantity limits in New Zealand, and to test the utility of the WaterWheel diagram as part of this process.

One component of this programme was the implementation of two proof of concept case studies. This report outlines the findings from the implementation of these case studies.

1.1.1 Context

Concerns about freshwater have triggered significant thinking about its management by government, industry and other stakeholder groups that is leading to reforms in the way it is managed. Firstly, the National Policy Statement for Freshwater Management (NPS) requires that clear (i.e. unambiguous and measurable) water resource use limits are established for all freshwater bodies in New Zealand (New Zealand Government, 2011). Secondly, reports to the government by the Land and Water Forum (LAWF 2010, 2012a, 2012b) have called for a fundamental change from expert led and often adversarial decision making to more collaborative approaches (Margerum 2011) to setting and living within water resource limits. These reforms will challenge the way water management decisions are currently made and water and land resources are managed.

Central to these changes is the recognition that water is fundamentally affected by both natural processes (e.g. climate) and human actions (e.g. urban, farming and river management activities). In addition, decisions about how to improve our management of land and water resources should take into account not only the economic and environmental consequences but the social and cultural ramifications as well, the so-called ‘four wellbeings’. These more holistic themes have led the drive towards more integrated management (an approach supported in the NPS for Freshwater Management) where the focus is on ways to better link land management with water impacts, and to mobilize people towards a systems view of the landscape (Fenemor et al 2011a).

The ideas of participation and integration in natural resource management are not new to New Zealand, and there are a number of examples of collaborative processes that have been used by councils, communities and research agencies that are important to build on e.g. reviews by Fenemor et al. (2011b), Feeney et al. (2010), and Dodd et al (2009).

1.1.2 Wheel of Water Research Programme

This programme recognises the national focus on water resources, and the need to develop approaches that involve the wider community in being part of processes that help determine acceptable water body limits. The project also aims to support integrated decision making and develop processes that take into account environmental, economic, social and cultural implications (the four "well-beings") particularly at the catchment scale. As part of this, the concept of a WaterWheel diagram was developed to enable catchment stakeholders to easily view a range of key indicators (representing the four well-beings) in their catchment system, and to aid their decision making processes around catchment limits and policy.

In the first half of the programme the Wheel of Water research team developed an understanding of the key process design elements that might be included in the Wheel of Water process, and conducted research into the background, theory and practical challenges associated with elements such as: collaborative process methods, catchment management indicator selection (Allen et al. 2012, Fenemor et al. in prep.), Maori co-management of water resources (Tipa, 2013; Nelson and Tipa, 2012), catchment economic flows (Guenther et al., 2013), challenges associated with spatial and temporal scales for the application of the WaterWheel diagram (Fraser et al., 2013; Fraser and Snelder, 2013) and the development of modelling tools to help populate WaterWheel diagrams throughout New Zealand (Snelder et al., 2013).

In the second half of the programme we sought to apply these learnings by piloting a collaborative decision making process, and to test the utility of the WaterWheel diagram as part of this process. Two case study settings were used: one in the Wairau Valley (Marlborough), and the other in the Mangatarere catchment (Wairarapa).

This report documents insights from the two case studies. It aims to assist council and government agency staff involved in designing, managing or supporting such processes, as well as Iwi, sector and community leaders, by identifying techniques and tools that we have evidence are successful, and by avoiding pitfalls that we came across throughout the case studies.

1.1.3 Methodology for evaluating insights

Action research was used to guide the overall approach to learning from our case studies (Kemmis 2009, Allen et al. 2014). We used three tiers of iterative learning cycles, each consisting of phases of planning, acting, observing and reflecting to assist us in identifying and documenting our research findings throughout the case study process.

i. Each workshop was planned and then evaluated both through immediate feedback from participants and a more formal debrief session involving the researchers. Workshop notes were provided to participants, and a brief reflective session was held on these at the start of each workshop.
ii. The workshop series was book-ended with individual interviews with participants, and these were also evaluated in another cycle of reflection by the research project teams.
iii. We reflected on our findings in the context of previous experiences documented in the literature from both New Zealand and overseas.

This report draws on this material. We broke the process into a number of sections, and within these reflected and synthesised insights from the varying perspectives represented within the project team. The insights have been developed through a number of steps:

- A round of brainstorming was done with a number of the team to identify key insights.
- We distilled a number of key themes from the brainstormed insights, and developed a structure for this report to reflect those themes.
- For each of these elements we took care (through a round robin approach) to develop a clear context that was understood by all the authors. This then formed the basis for articulating insights that could be traced back to case study experience.
- Finally we triangulated these insights with evidence from participant feedback and from the literature.

1.2 Report structure

The report is structured in four main sections, with supporting appendices. This first provides a background and overview of the project. The second section provides details of the case studies, set out in three parts:

- A description of the case study context
- A description of the different workshops, and activities in each workshop
- A brief outline of workshop outputs.

In the third section we present the insights we gained, structured in two groups:

- Design and management of effective collaborative **processes** (covering elements such as process planning, facilitation, sharing across knowledge systems and collaborative modelling)
- Understanding what is important for catchment management, through workshop **content** (covering elements such as participants' values, scenarios, and indicator development).

The insights derive from the challenges we came up against, the successes we enjoyed and those instances where we realise (with hindsight) that a different approach may have been more successful. We also detail some of the methodologies and tools we developed, or adapted, during the processes, particularly where we consider these may be of use to others working in catchment collaborative processes.

In the final section, we provide a summary of the key outcomes for the both the participatory groups and project teams and consider what the next steps might be for further exploring the value and utility of the Wheel of Water process and the WaterWheel diagrams.

2 THE WAIRAU VALLEY AND MANGATARERE CASE STUDIES

The case study process design began with a broader Wheel of Water programme team workshop for two days, reflecting on the background research that we had conducted, and considering what part of a full Wheel of Water collaborative process could realistically be conceptualised, negotiated, designed, tested and documented within about 18 months – which reflects the types of time constraints applying to many collaborative processes. In order to allow comparative insights, we ran two case studies in tandem, with one case study in a "well prepared" catchment (i.e. existing high levels of community engagement around water management, well studied biophysical setting and associated data), and the other in a "less well prepared" catchment. Our high level research objectives for the case studies were:

1. To pilot a collaborative water resource management process in which participants develop a common understanding of their catchment, the interconnections between their values, and the trade-offs between these values that might occur under different land and water management scenarios.
2. To test the utility of the WaterWheel diagram as part of this process.

Based on these discussions we developed a list of the factors we needed to incorporate into our process design, including:

- The workshops needed to be run as collaborative processes, with a representative group.
- The workshops needed to generate WaterWheel diagrams – this would necessitate some discussions about values, indicators and scenarios.
- We only had a six month period with the local community to conduct the case studies and we felt that a month between workshops was desirable (to allow for planning and information collection by the project team, to be reasonable in terms of demands on participants, and to allow participants time to digest new information and undertake 'homework').

Given the last constraint we felt we could achieve a maximum of six workshops, and based on the content constraint of the second point, that four meetings was the minimum requirement. In addition to attending the workshops, we also agreed that case study participants would be introduced to the project via an initial interview prior to the workshops and their overall insights on the process gained via a final interview, after the workshop series finished.

With the broad research aims of the case studies and the high level process elements defined, we began discussions with each of Greater Wellington Regional Council (GWRC) and Marlborough District Council (MDC). Meetings, email and telephone conversations were conducted, with the purposes of:

- Determining whether a case study would proceed in each region, and then once this was agreed upon,
- Merging the Wheel of Water research programme constraints and research aims with the more specific community-based and local council constraints and aims for taking part.

Following these meetings, two case study locations were selected: the Mangatarere Catchment (Wellington Region, "well prepared") and the Wairau Valley (Marlborough, "less well prepared"). Neither of the case studies was attempting to resolve a highly conflicted situation, nor was either part of a formal statutory process leading to setting limits on water or land use, both because of the time constraints of this study and because the two councils had not yet completed planning of collaborative limit-setting.

In this section, each case study is set out in three parts:

- A description of the case study context covering geographic, land use, environmental and socio-economic aspects
- A description of the different workshops, and activities in each workshop
- An outline of outputs from all the workshops

2.1 Case study context

2.1.1 Wairau Valley (Marlborough)

The Wairau Valley is a long thin glaciated valley, most (67%) of which is conservation estate. The area considered in this case study (approximately 2,348 km^2) extends upstream from the confluence of the Wairau and Waihopai rivers to the mountains of the Nelson Lakes National Park. Of the non-DOC estate areas in the catchment, 1.3% is in Dairying (1,000 ha), 2.4% in viticulture (1,900 ha), 37% in forestry (29,000 ha), 37% in high producing grassland (29,000 ha) and 22% in low producing grassland (19,000 ha). Most of the more intensive production occurs on the valley floor, where there are consented water takes from surface and groundwater for irrigation of both pasture and grapes. The population is around 900 and is mostly rural. Wairau Valley township (and surrounds), where the workshops were held, has a population of about 300. Land use change has been a feature of the valley over the past two decades with conversion of dryland sheep and beef farming to viticulture, forestry and in the lower reaches, lifestyle properties.

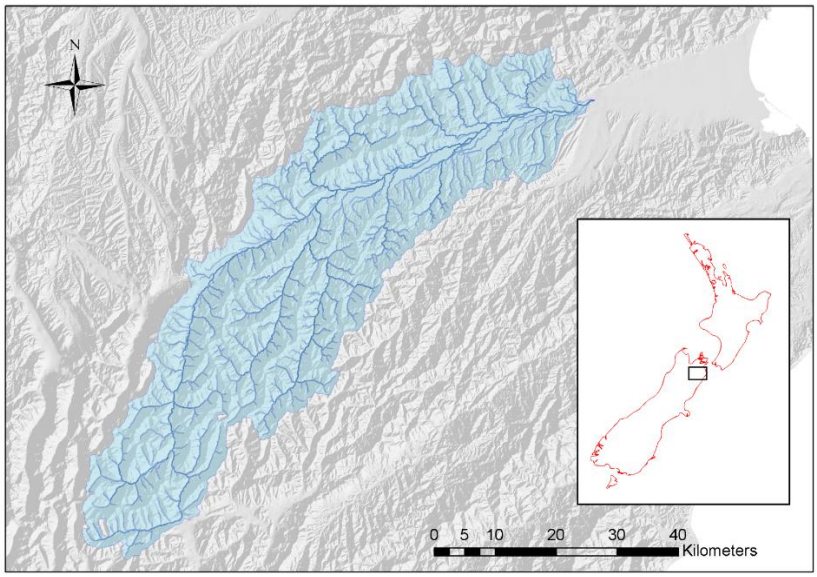


Figure 1: Location of the Wairau Valley case study catchment

While Marlborough District Council (MDC) maintains some long term river and climate monitoring stations within the catchment, the most detailed scientific information currently available was generated as part of the TrustPower hearing process. This hearing was for an application by TrustPower to divert water from the Wairau River into a large canal system for the dual purposes of power generation and irrigation. The application was highly contested and divided the local community (Wallis et al. 2010). Although the scheme was granted consent in 2008, development has been put on hold indefinitely at this stage.

Regional councils including MDC are required under the NPS for Freshwater Management to publicly notify their programme of catchment limit-setting. For the Wairau Valley, an allocation limit for water takes is in place already, and currently subject to technical review. For water quality limit-setting, MDC has no immediate plans to work on these in Wairau Valley (Pere Hawes, MDC, pers. comm.).

2.1.2 Mangatarere (Wairarapa)

The Mangatarere catchment is a small (157 km^2) catchment that is part of the Ruamahanga catchment. Approximately a third of the catchment is in the foothills of the Tararua ranges, mostly covered in indigenous forest and managed by the Department of Conservation (DoC). The remainder of the catchment is relatively flat land, dominated by intensive sheep and beef, and dairy farming. The catchment also includes most of the urban area of Carterton (population 8,241). Most of the urban storm water, as well as the town's wastewater treatment plant (WWTP) outfall, are directed into the lower reaches of the Mangatarere Stream. The town water supply is currently sourced from a small tributary to the Mangatarere, in the foothills of the Tararua ranges. There are also several surface water and groundwater takes for irrigation within the catchment. The Mangatarere Stream is currently under consideration as the potential location of a large storage dam, primarily as a source of irrigation water.

State of the Environment monitoring within the catchment conducted by Greater Wellington Regional Council (GWRC) identified the lower Mangatarere Stream as having particularly high levels of dissolved nutrients. In response to this, GWRC conducted a more detailed monitoring programme (GWRC, 2010) which also identified elevated *E. coli* levels within the catchment. It also identified the significant contribution of the WWTP to the observed phosphorous loads in the river and diffuse contributions from the rural landscape to elevated nitrogen levels.

The Mangatarere Restoration Society (MRS) is a volunteer stream care group consisting of landowners, industry, community, local government and Iwi representatives (http://www.mangatarere.org.nz/). The group is working to improve the health of the Mangatarere Stream using a community-owned approach. To date, the MRS activities in the catchment have been focused on riparian planting and raising awareness of the health of the river. The MRS received a Sustainable Farming Fund grant for 2013/14 to develop a whole-catchment action plan that considers both environmental and productivity impacts of water management in the Mangatarere sub-catchment of the Ruamahanga catchment.

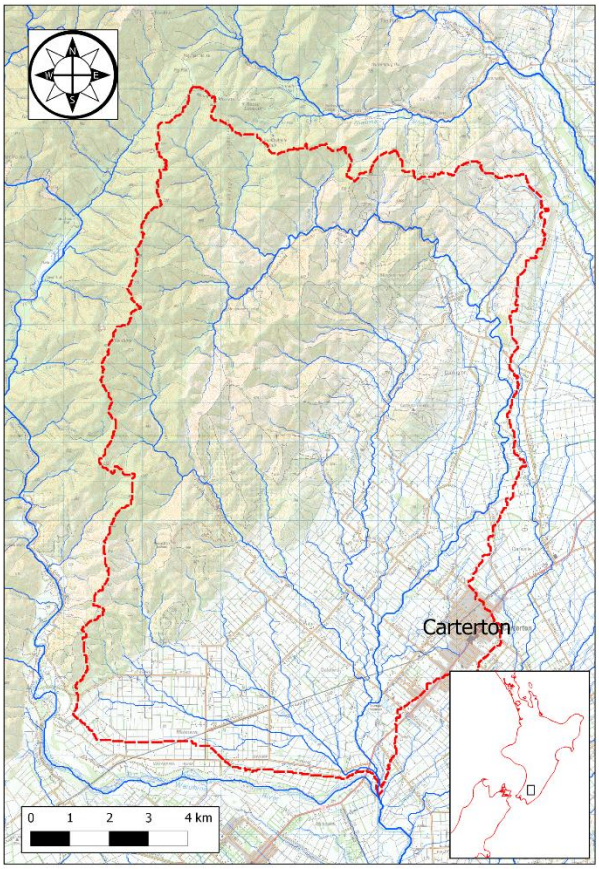


Figure 2: Location of the Mangatarere case study catchment

The key goals of the SFF project to achieve this are:

1. Develop a partnership forum to bring key water stakeholders together to discuss productivity, environment and water management
2. Use collaborative processes to identify participants' views on environmental problems and solutions associated with water management in the catchment while considering how these issues and solutions can impact on productivity
3. Design an Action Plan to allow a strategic approach to implementing solutions that meet both environment and productivity objectives.

Given the degraded state of the Mangatarere Stream identified by the 2009 GWRC monitoring, the relatively abundant amount of monitoring information available within the catchment, the diverse range of pressures (both current and future) as well as the existence of the MRS, the Mangatarere was identified as a suitable test catchment for our pilot study. Furthermore, both the MRS and the GWRC expressed an interest in being involved; the MRS particularly in terms of how the process could contribute to meeting the objectives of their SFF project, and the GWRC in terms of how the collaborative process was run and how the community responded (particularly as they are about to embark on a collaborative limits setting process for the Ruamahanga catchment). The Mangatarere case study for the Wheel of Water programme was jointly developed with the SFF Project Leader. This included the SFF Project Leader being an active member of the project team involved in design, implementation of and reflection on the Wheel of Water process, and the Wheel of Water process including a fifth workshop to facilitate the drawing of information from the process into the next steps to progress the final aim of the SFF project to design an Action Plan.

2.2 Case study Process and Activities

The two case studies took place between June and December 2013. Four workshops were held in Wairau Valley and five in Mangatarere. Each collaborative process was designed and run by a separate multi-disciplinary project team, but progress and learnings were shared as the workshops unfolded. Throughout the case studies there were a number of activities the project teams undertook responsibility for doing. These included:

- Initiating the collaborative process (e.g. identifying an overarching process design, recruitment of participants)
- Preparing for, and debriefing after, each workshop (e.g. developing runsheets, rehearsing meetings, deciding on 'homework' for participants between workshops) and
- Running the workshops (e.g. facilitation, presentation of technical information)
- Developing information for each workshop (e.g. modelling, collation of technical information)

Both case studies involved participants from as wide a range of perspectives as possible, and both included regional council staff (in the Wairau Valley as participants and in the Mangatarere as additional members of the project team).

In response to the differing contexts and needs of the selected catchments, communities and councils, there was some divergence in the process between the two case-studies (Table 1).

Table 1: Key process design differences between the case studies

	Wairau Valley	Mangatarere
Recruitment	Snowball sampling	Selection via MRS
Regional council involvement	As case study participants	As case study team members
Iwi involvement	Kept up to date through two hui, separate from the workshops	As a participant
Number of workshops	4	5
Workshop length	6 hours (with 1 hour meal break)	4 hours (with 15 min tea break)
Number of participants	13	16
Community objectives	To develop a stakeholder-led understanding of Wairau Valley catchment issues, by forming and facilitating the upper catchment's first participatory catchment group	To develop a stakeholder-led understanding of Mangatarere Valley catchment issues, and to contribute to the development of the MRS SFF catchment plan

All workshop participants contributed through:

- An initial interview with a researcher from the Wheel of Water project
- Attendance at four workshops (Wairau) or five workshops (Mangatarere)

- Homework exercises between workshops that promoted extra thinking and gathering of information
- A mid-point interview after workshop 3 to gain feedback on the workshop process to that point (Mangatarere) and to inform the design of two community indicators (Wairau Valley)
- A post-workshop interview to help evaluate the process and discuss possible future work.

A timeline for the two case studies, which were run in parallel, is shown in Figure 3.

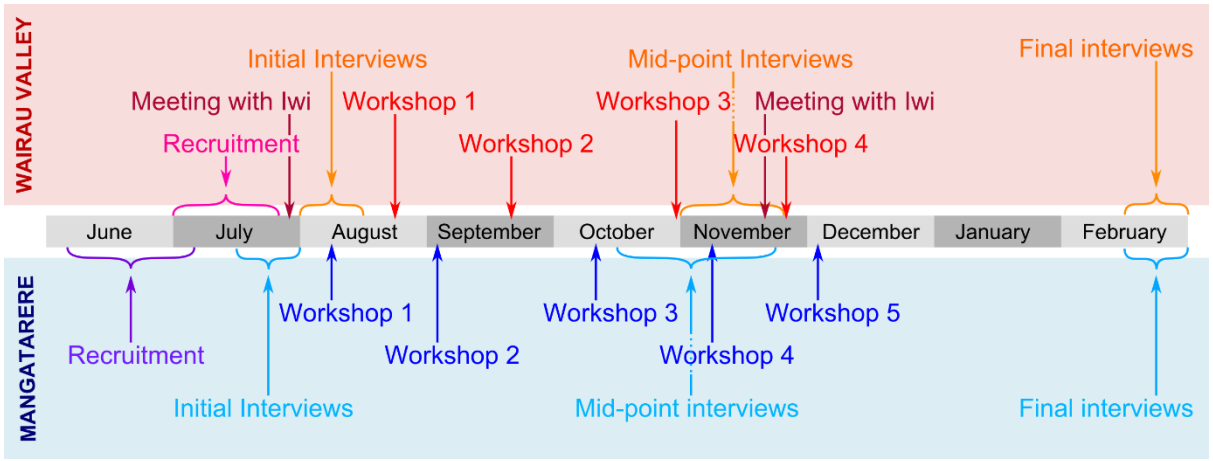


Figure 3: Timeline for the two case studies

Before discussing the content of the workshops, we define the terminology used in this collaborative process:

- **Values** – things that matter, and uses of water and land in the catchment
- **Indicators** – ways to measure those things
- **Thresholds** – the points at which indicators were deemed by the group to be excellent, good, fair and poor
- **Scenario** – a story about how the catchment could change in the future
- **Modelling** – methods to estimate the future levels of indicators.

While each workshop had its own specific needs and aims worked out with the participants involved there were common objectives for both workshop series. These covered:

- Developing an appreciation of the important **values** across the four well-beings that were held within the stakeholder community
- Developing collective thinking around broad catchment futures (**scenarios**), both good and bad that could plausibly occur
- Gaining an understanding of the catchment social, cultural, economic and biophysical system, and the **interactions** within that system
- Assessing and agreeing on packages of **indicators** and **thresholds** that could help assess the current or future states of important **values**
- Combining this information on **WaterWheel diagrams** to build an understanding about the **interconnections** in the catchment and about the trade-offs between **values** that may occur under alternative future **scenarios**.

The table below summarises the key activities in each of the workshops for the two case studies:

Table 2: Summary of workshop activities

Workshop	Wairau Valley	Mangatarere
1	Participants get to know each other by telling their stories, revealing the values important to them about this catchment and what may threaten these values	Pool knowledge of the catchment and build an appreciation of its values
2	Clarify and prioritise key values, identify past trends and develop 2 scenarios for the future of Wairau Valley	Choose some key values, select 7-10 indicators to measure these
3	Identify potential outcomes of the *Full Irrigation* scenario and an initial 12 indicators which are relevant to that scenario, the system model and the groups' prioritised values	Show indicators on a current day WaterWheel, identify past trends and develop 2 alternative futures for the catchment for modelling
4	Refine WaterWheel indicators to finalise a Wairau Valley WaterWheel. Evaluate the collaborative process	Use the alternative WaterWheels to discuss possible futures, and better understand connections, causes and effects
5	-	Reflect on the Wheel of Water process and map out next steps to prepare the MRS Catchment Action Plan

More details about the specific activities that were undertaken in each of the workshops are outlined in Appendix 1 (Wairau Valley) and Appendix 2 (Mangatarere).

2.3 Case study outputs

In this section we briefly review the overall outputs of each case study. Details about the specific outcomes for the participant and research groups are presented in sections 3 and 4.

Wairau Valley

- A research outline for the Wairau case study *Waters in Common – Te Mana o Wairau*
- A "rack" card for *Waters in Common – Te Mana o Wairau* as a communication aid
- Notes summarising the interviews, runsheets and outcomes of the four workshops
- A systems diagram incorporating the four wellbeings (below)
- A summary of the scenario discussed in

Mangatarere

- The Mangatarere process documentation comprising notes from the process (e.g. runsheets, meeting notes and copies of materials distributed to participants)
- Two fact-sheets with answers to questions posed by the group and additional supplementary information
- Summaries of the two scenarios developed by the groups
- Three WaterWheel diagrams showing the level of key stakeholder indicators,

detail by the group, 'Full Irrigation'

- A series of models developed to quantify some of the indicators on the WaterWheel diagrams under the alternative scenarios
- Tools (Rubrics) for evaluating indicators of: (1) connected communities and (2) using knowledge in decision making
- Three WaterWheel diagrams covering current and two future states of the Full Irrigation scenario (plus an additional WaterWheel for an urbanisation scenario – not presented in the workshops).

currently and under two alternative scenarios

- A systems diagram showing the connections among the environmental, social, cultural, economic, and policy systems in the catchment
- A series of models developed to quantify some of the indicators on the WaterWheel diagrams under the alternative scenarios
- A plan of activities through to 30 June 2014 for the Mangatarere Restoration Society to progress toward completion of an Action Plan for the catchment as part of their Sustainable Farming Fund programme.

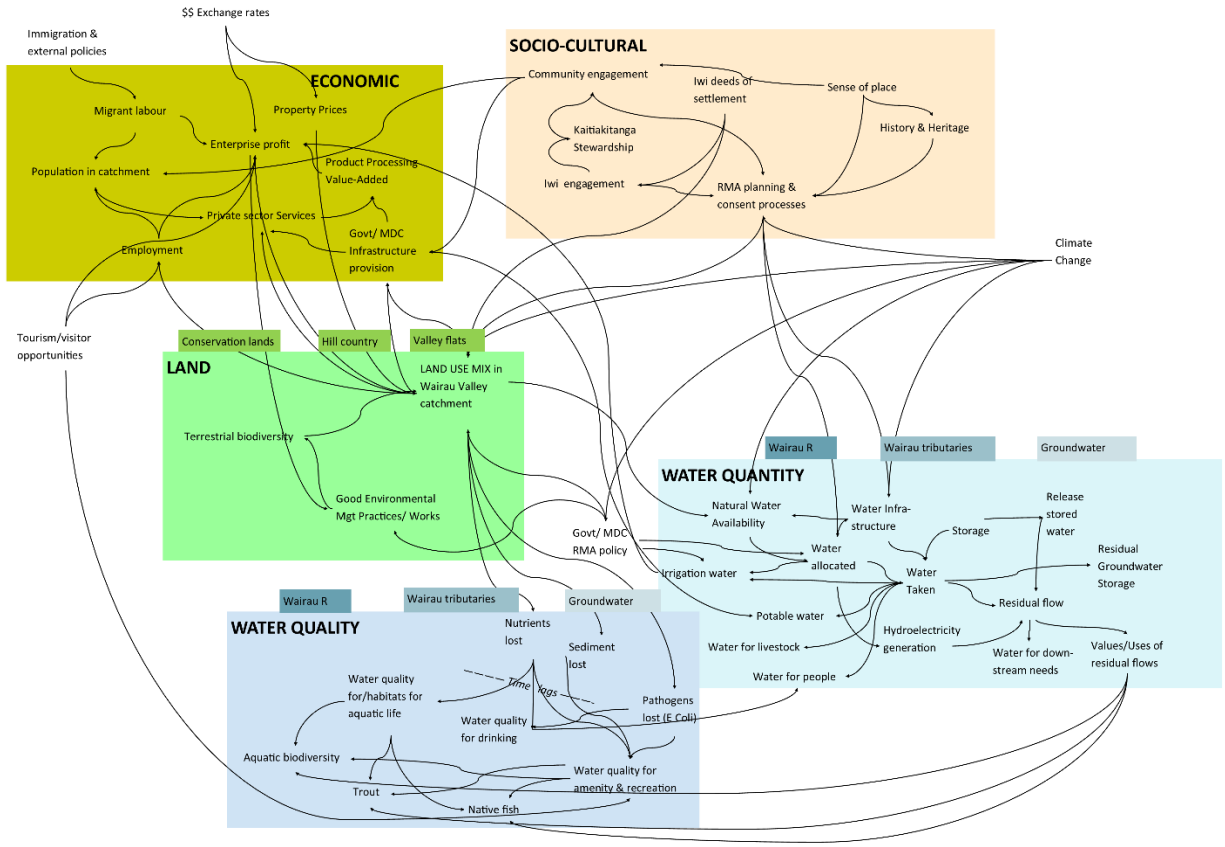


Figure 4: Wairau Valley systems diagram - showing interactions between water quality and quantity and land, economic and socio-cultural components

3 INSIGHTS FROM CASE STUDIES

We have divided the insights from the two case studies into those that relate to social process elements (running the workshops, sharing knowledge, etc.) and those that relate to the specific outcomes sought (content elements such as catchment values, indicators, catchment scenarios, etc.). Figure 5 shows these two key components of the case studies, along with a number of sub-components. The process elements could be applicable to a wide range of collaborative governance processes. They relate to the management aspects of collaborative initiatives in many different contexts. The content elements refer to the steps we devised for compiling the groups' description of their catchment system. This system understanding then helps to crystalize the objectives and methods that could be applied to manage towards outcomes desired by the group. Where possible, we have provided quotes from the workshops and interviews to support these insights; quotes from the Mangatarere group are signified with an 'M', and from the Wairau Valley group with a 'W'.

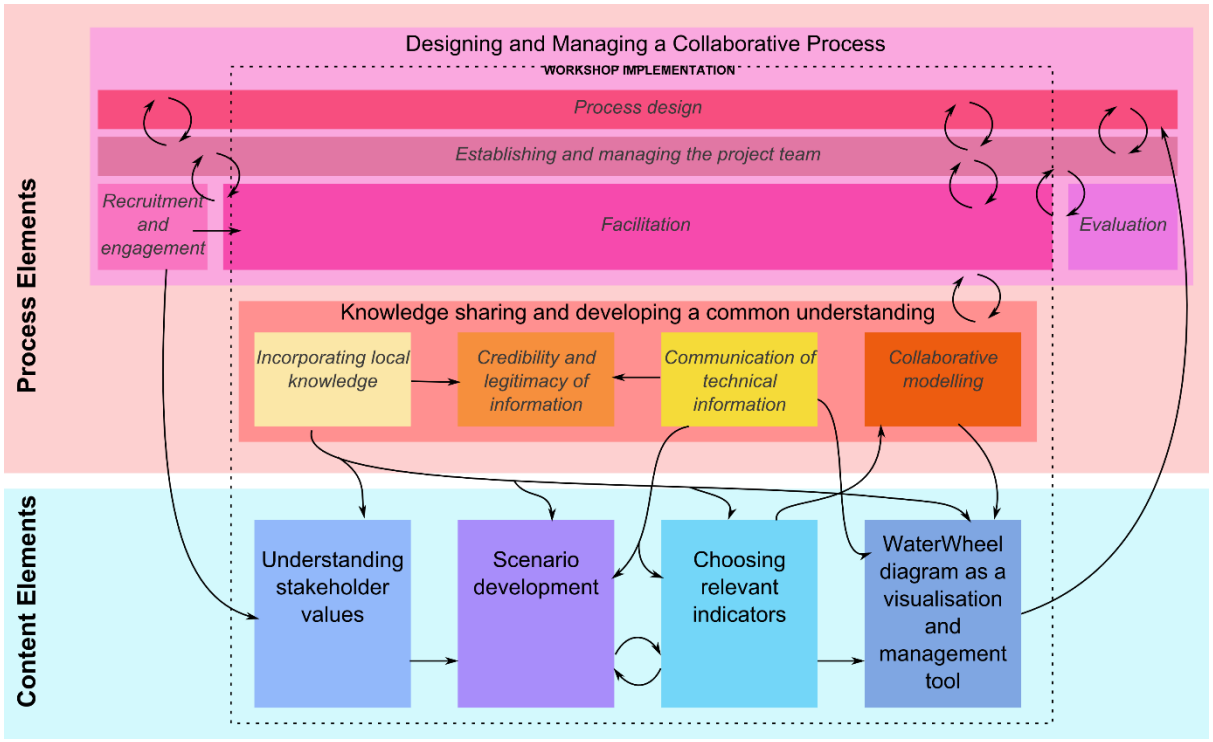


Figure 5: Schematic diagram of the case study process showing how it can be seen as a number of individual elements.

3.1 Key Insights – Process

Collaboration, as a way of operating, requires a very different approach to that of consultation, the mode in which stakeholders and the public are more commonly engaged at present in natural resource planning and decision making processes.

Consultation has a well understood meaning in law. Typically one or more options are put up for comment, suggestions received must be properly considered' and finally the decision maker must give a clear decision with reasons, to accept or reject the suggestion. Collaboration, on the other hand, carries with it an expectation of working together, of jointly identifying possible solutions

together, and of jointly reaching a decision that participants can live with (, Allen et al. 2002, DHS 2004, Margerum 2011).

In the context of our case studies, we gained a number of insights about collaborative processes for collective water management. In general, we found that these insights could broadly be categorised into the two themes of (1) designing and management a collaborative process and (2) knowledge sharing and developing a common understanding. This section summarises what we observed when addressing these components across our workshops.

3.1.1 Designing and managing a collaborative process

Establishing and implementing a collaborative initiative can be considered as a three-phase process:

- Initiation – planning and preparation
- Managing participation – workshop series implementation
- Evaluation and moving forward – for feeding back into the process or ending a process

Across these chronological activities, we identified a number of design considerations for which we were able to gain particular insights through the case study processes:

- Establishing and managing the project team.
- Recruitment and engagement
- Process design
- Facilitation

In the following sections we provide some context around these four themes and then present the key insights for each.

3.1.1.1 Establishing and managing the project team

The use of integrated multi-disciplinary teams to underpin the running of collaborative processes is increasingly seen as important (Allen et al. 2011, Margles et al. 2010, Haapasaari et al. 2012, Allen et al. 2014). Hence, early on in our planning we decided that each case study would have a dedicated multi-disciplinary or skill-based project team. We took care to ensure each project team had people that could provide at least one of technical, engagement and modelling expertise, although many project team staff were proficient in more than one skillset.

From a practical point of view, the number of staff in the project team was controlled by a number of factors including:

- The need for a range of disciplines and experiences in the project team.
- Having at least one project team member per four participants, in order to support small breakout groups during the workshops.
- Not having too many project team members at the workshops (we propose no more than a ratio of 1:3) so as not to dominate the proceedings.
- Having more than two team members allows debate and consensus (or at least a majority) view to be reached.

Ultimately, we had four team members for the Wairau Valley and six for the Mangatarere (this included a GWRC and a MRS representative).

We purposely decided that all project team members would be involved in all stages of the process, regardless of their area of speciality. This differs from many processes in which team members are used almost solely in respect to their expertise. This meant, for example, that the modeller participated in process design, briefing and debriefing and came to all workshops. This, in turn, meant that the modeller became aware of the range and context of other project team member and end user needs – and equally, provided the project team and case study participants with an opportunity to understand the modeller as a participant, not just someone providing a science perspective.

> *"[I] think it helped having the subject experts on hand, this helped, otherwise would have had to park a whole lot of questions and need to come back to them"*[M]

We found that clear communication was critical for the effective functioning of the project teams, both in planning and during the workshops. Because of our varied backgrounds, we discovered that it was not always possible to assume that what we each individually considered to be standard or typical approaches to performing any given task were the same; this created some tensions within the project teams. Some techniques that we found useful or consider desirable (in retrospect) to assist us develop a common understanding included:

- Entering into the team with an open mind and actively working to not become siloed into our respective disciplinary areas; this requires each discipline to pay attention to other perspectives and to change the way they go about using their skills in the programme.
- Agreeing in advance of workshops specifically what the roles of each team member will be in the workshop (down to the specifics of each individual task). This included two team briefings prior to each workshop, one a week before, the other on the day of the workshop.
- Including all team members in all communications (e.g. emails and conference calls). This led to high levels of email traffic, so we found that we needed to develop protocols to help make the traffic manageable e.g. changing email topic lines rather than just replying all when new ideas were raised.
- Including a reflection on "how we are working together" in each of the workshop debriefs, allowing for the team to purposefully adapt and improve between workshops.
- Entering into the team and process with the expectation that finalising any specific task will take longer than might be expected. It took around 40% longer and required more resourcing for the workshop planning stages, than we had originally planned. The estimated cost associated with personnel time and operating expenses for each of the cases was $50,000 to $80,000. This does not include the in-kind contribution of participants.

  > *"I appreciated the team work between us [the research team], there was more cohesion and clarity…[I] put this down to more discussion [and] negotiation in our team ahead [of the workshops]"*[W]

Through our experiences we found that this level of involvement by all project team members improved the process as it explored tensions around:

- Developing a common understanding and language amongst the project team, which in turn led to a more consistent message being transmitted to the case study participants.

- Allowing planning to account for the needs of all the project components (e.g. taking into account the time required for modelling when planning the timing between meetings).
- Providing for interdisciplinary contributions in research activities.
- Achieving a streamlined process at meetings with all team members fully briefed and prepared.
- Developing stronger relationships and trust between the project team members, as well as mutual respect for the value of the contrasting skill sets in the group.

The knowledge sharing section (3.1.2) includes additional insights for the project team related to the development of knowledge in a multi-disciplinary team.

3.1.1.2 Recruitment and Engagement

Once the two case study catchments were identified, we began the process of recruiting and engaging participants. At the outset we set a number of criteria for the groups (based on best practice and taking into account the specific constraints for our workshops):

- The group should provide a cross-section of the catchment community e.g. geographical spread within the catchment; the primary land and water uses and interests, including agencies and Iwi; a balance of gender, age and worldviews.
- Individuals needed to have the ability to listen and be open to alternative viewpoints, to be able to contribute their own perspectives, and have the capacity to commit to the full workshop series.
- There should be between 12-15 participants in total; this was decided to provide a balance between trying to gain greater representativeness within the group and in the recognition that more time is needed in a process where a larger group is engaged (i.e. time to ensure opportunities to input and understand), something not possible for these case studies which were constrained by a tight timeframe.

Following a recruitment process (see Appendix 1) the Wairau Valley case study ended up with 13 participants representing a range of production, environmental, community and recreational catchment interests. The original viticulture representative was not able to attend the workshops, and we were unable to get an alternative participant in time. We were also unable to gain involvement from Iwi. However, they were able to be engaged in the process through two hui over the course of the case study (Figure 3), which provided the opportunity for them to remain aware of the exercise and its outcomes.

Following a slightly different recruitment process in the Mangatarere (drawn from the MRS email list – see Appendix 2), a final group of 16 also represented a range of productive, environmental, community, Iwi and recreational catchment interests in that catchment. At the first meeting, questions were raised about whether business interests were adequately represented. A key local employer had been approached to participate but unfortunately was unable to join the process due to other commitments.

The missing representation in both workshop series was something that was noted by the participants (both where an interest was missing for the whole process, and also where one or more representatives were unable to attend some workshops). Participants questioned whether this

made the understanding of the system incomplete, and might affect the robustness of decisions made in a process such as the Wheel of Water, as the following quotes highlight:

> *"[We] didn't have full representation… process of selection not big enough, process not long enough… when a group comes to an end position … [the result is] only as strong as the buy in from the whole community"*[W]

> *"The gaps the group perceived (Iwi, viticulture, farmers with 40-50 years of history in the catchment) has implications for what we were doing – you need certain perspectives around the table – incomplete picture affects whole process"*[W]

> *"There was clearly a gap with the inability of [name] to come to all the meetings. Which suggests maybe we are relying too much on one person for that aspect.. I think we need some redundancy built in, in respect of particular viewpoints"*[M]

In both groups we had professional voices (e.g. DoC, Fish and Game, local and regional Council staff) and independent community voices. One Wairau participant reflected on how this might influence participation in a collaborative process:

> *"Drivers for being involved in this sort of process/project can be different – a paid person might not have deep concern and not have a personal interest in the outcome. A non-paid person may have a huge personal interest and live and work there and may not be able to attend because of working"*[W]

Before the workshop series started we conducted initial individual interviews with each participant of both groups. This was done in the form of a semi-structured questionnaire. This provided an opportunity for a member of the project team to develop a rapport with each participant, in order to encourage commitment to the workshops, an opportunity to describe the overall aim and help establish joint expectations around the planned outcomes. The interview also helped the project team gain an understanding of the catchment and the views of participants about life in their catchments. The information from the interviews was used as a benchmark for evaluating changes arising from participation in the process and to inform the design of the workshops.

> *"[the] interviewer prompted, led and got me involved"*[W]

> *"..made to feel comfortable by interviewer, especially before we met"*[W]

3.1.1.3 Process Design

Initiation

At the planning stage of the case studies, we developed a process and content design that we used as a high level guide for the workshop process (described in section 0). Although we had spent considerable time evaluating needs and constraints at this planning stage, we recognised that unforeseen needs, challenges and opportunities were likely to arise as the workshops progressed, hence each group tried to be driven by outcomes, yet remain flexible on process until just before each workshop.

Workshop design

Each project team developed a "runsheet" outlining aims, times, tasks and roles in advance of each workshop. These were used to deliver each workshop and debrief afterwards. While some broad topics for each workshop were set in the earlier initiation phase, we fine-tuned the activities undertaken in each workshop in response to the specific workshop aims and the progress being made by participants. The process of workshop design was therefore reflective and iterative. This involved regular structured reflection by the project team and participants. This allows flexibility in what can be achieved and participants can then contribute to process design, enhancing the outcomes.

The teams shared ideas through direct links between the facilitators (sharing run sheets, access to the participant interview raw data, and ideas), the same modeller was used in both projects, and a facilitator from one team ran a debrief for the other team following each workshop. We used this connection to:

- Transfer successful facilitation techniques between groups (e.g. bus stopping, sticky dot voting).
- Build on good ideas and refine them across case studies (such as the systems diagram concept which we initially presented to the Wairau Valley group, and then simplified and dramatized for the Mangatarere group).
- Manage expectations about the likely speed that we could progress through different activities and technical topics.

Both participants and the project team felt the tension of managing time for different activities. We were always caught between the desire to have more time to explore ideas further, conflicting with the practicalities of how much time participants and the project team were able to commit to the workshops and activities between these workshops.

> *"just a feeling of being rushed through the process.. no time to deal with ideas and thoughts and problems that arise as they go."*[M]

Upon reflection, we found that each project team member felt that they would have liked more time in the workshops to explore issues related to their own discipline, but had not necessarily recognised that this was the case for all the other disciplines as well. Achieving a balance between elements such as time spent developing trust and time spent developing the technical knowledge of the group was challenging (particularly when time is limited); compromises were required, and they were to some extent influenced by the perspectives and roles of different members within the project team. We expect that this tension is likely to exist in most collaborative processes.

Monitoring and evaluation

An important part of the overall process design was the incorporation of reflection and evaluation cycles. In the early stages of the project planning, a meeting to define and confirm the evaluation framework was held. This led to the following components being incorporated into the design of the case study evaluation framework:

- Initial interviews were undertaken to establish participant's baseline views, and provide them an opportunity to collect their thoughts about what was important in their catchment.

- Mid-term and final interviews were also held. The former contributed individual feedback to influence remaining workshops, while the last interview provided an opportunity to reflect on the whole collaborative process. The design of interview questions took into account insights from problem structuring research (Midgley et al 2013) by including questions relating to each catchment context, the purposes of the four workshops, the various methods used and outcomes sought.
- Beginning and closing reflection exercises during the workshops provided a collective idea of how things were progressing, as well as offering opportunities to reflect and amend past activities and to help plan future sessions.
- The project teams ran facilitated debrief sessions after each workshop. These fed into planning exercises that developed the next workshop. Each case study debrief was led by a facilitator from the other project team. A copy of the debrief template is provided in Appendix 3.
- A final cycle of reflection involved the research team thinking about the workshop series and the results of the evaluative activities listed above and developing their thoughts and insights through this report.

The monitoring and evaluation throughout the process served to:

- Allow the project team to proactively respond to feedback from participants to make improvements in workshop content and process.
- Check that the process was on track for meeting the research and community outcomes agreed at the outset of the case studies.
- Generate records of how capacity of the participants and project team was developing over time.
- Provide the project team with an opportunity to reflect on whether the workshops had gone to plan, considering successes and areas for improvement that could be incorporated into subsequent workshop run sheets.
- Collate insights from the process as a research output for the Wheel of Water programme.

3.1.1.4 Facilitation

Good facilitation is critical to ensure the process is inclusive, that participants feel safe and engaged and, for our case studies, that we were working towards our collectively agreed outcomes. In discussing stakeholder participation in resource management, Reed (2008) described the importance of these aspects of facilitation as crucial. “The outcome of any participatory process is far more sensitive to the manner in which it is conducted than the tools that are used” (Reed 2008).

General feedback that we received about aspects of facilitation that participants valued included:

- Supporting open discussions, including how technical information was incorporated into the discussion – “*Very good structure and facilitation – support crew being careful to put information in the arena without values/judgement*”, “*Open minded – free discussion*”, “*Everyone had a chance to say something and treated as equals*”.
- Making the process enjoyable and engaging - ”*lots of sessions which makes four hours go fast*”[M].
- Timeliness of completion - “*Finished tasks on time*”[M].

"The meetings were well facilitated – there was flexibility, inclusion, tone was well set, location was important (within study area, so more available for local people) and the food was good!"[W]

Engagement activities

Exercises which support constructive interaction and reflection are important, so we used a variety of methods to cater for a range of learning styles and to keep participants energised and engaged. Among those methods were:

- Small group sessions, with each group assigned separate tasks, such as developing indicators for a particular value.
- Plenary sessions to share summarised information from small groups.
- Speed dating to share views one-to-one with three to five other participants, as a safe way of sharing ideas and being exposed to others' views.
- Using dots or post-it notes to express views (or vote on preferences) without having to personally share these with the wider group.
- Story-telling to get to know each other through personal connection to the catchment.
- The use of maps as props for discussions about places within the catchment.
- Metaphor as a way to reveal the way participants could interact, for example the use of four C's in the Wairau case study (what makes good Collaboration; constructive Conversation; Camping out to let ideas emerge; the Cake is only so big).

  "[with a] variety of engagement processes – people relax, [are] more comfortable, [and] less defensive"[M]

We found that by using varying tools that the group remained engaged for longer and participated more freely (e.g. sticky dots on the wall, graphing trends in the catchment). In the last workshop when we had our final reflection on the activities we had done in the workshops, people remembered the post-it note and sticker sessions the most – probably because they were highly visual and interactive.

"Good because different techniques used e.g. one-on-one, group, big group. Variety good. Good not talking to the same people."[M]

Figure 6: Examples of alternative facilitation techniques (plenary, breakout groups, string game, stickers) used in the workshops

Clarity of purpose

During the whole process we aimed to provide a clear picture of the proposed steps. Methods we used to convey the purpose of the Wheel of Water process and each workshop included:

- A face-to-face meeting with the Mangatarere Restoration Society prior to the group agreeing to participate in the case study.
- A description of the project purpose and steps in the invitation to participate.
- Initial face-to-face or telephone interviews to understand participants' expectations and convey the project aims and purpose.
- At the start of each workshop reviewing the same timeline of meetings, which included the purpose of the project and of each workshop.

"The way you have the purpose and what you are trying to achieve on the paper. I will often just read stuff on the wall when reflecting back to the actual question set right back in September"[M]

"I like the fact that each month has clear purpose or agenda and that is maintained.. [I] feel it's quite efficient and that we are getting somewhere"[M]

By using these methods we aimed to provide participants with a sense that the outcome was not predetermined, and that they were there to create an innovative outcome as part of a collective endeavour. This involves participants to place a lot of trust in the process to get to a desired outcome. That some participants found this difficult was evidenced in both cases by quotes such as:

"*I initially found it difficult to understand what the purpose was.*"[W]

"*Until the third session I felt cynical, people were unsure about where it might be going.*"[M]

"*Perhaps could have been set out better at the start.*"[W]

However, even with the benefit of hindsight we realise that the need to place this trust in the process will often be new for some participants, and trust must be earned through participation in processes such as these. One insight we draw from this is the need to be clear from the outset that these processes involve a new way of working together, which requires different skills from consultative processes that participants may be more familiar with. This includes individuals being active participants in developing the outcomes and designing the process of reaching these outcomes. The end goal is thus determined by the range of people in the room working collaboratively. This also means that the collaborative process will take time and involve periods of uncertainty during the process.

Safety and trust

Throughout the series of workshops we sought to ensure participants felt safe and trusted each other and the project team, so that they would be able to share, listen and understand each other's views. Some methods that we used to create safety and build trust in both cases included:

- Participants developing their own ground rules for working together from the outset.
- Reflective sessions on constructive group dynamics (e.g. the four C's reflections described above).
- Including time to eat together during each workshop.
- Facilitation to support open discussions in which everyone was heard and listened to.

Ground rules for working as a group were developed by the participants in each case study during the first workshop. They included rules such as "the only dumb question is the one that isn't asked" and "let others finish speaking before you speak". We revisited these at the start of each workshop, and at the end of each workshop we also provided time for the groups to review the way they were working together. In both case studies time was set aside at the start of the workshop following the welcome and purpose for an activity to reflect on group culture.

"..ground rules [are] important for people to feel safe."[W]

We aimed to develop trust and understanding of the range of perspectives in the room early on in the process through providing participants with the opportunity to share their own stories about what they valued, what was really important to them in their catchments. Design of this process drew on earlier work by some members of the project team (Atkinson et al 2009). In the Wairau this process was initiated with stories, in the Mangatarere this was done with drawings and sharing valued objects (e.g. jars of water, family photos, fishing flies, plants) from the catchment. This invited participants to demonstrate a great deal of trust early on in the process.

"*Meeting face to face is powerful… in person we can realise we all have problems (great leveller) – having empathy is very important – your design/facilitation has been very good.. built a climate of trust and people have been themselves.. quieter ones have come forward… often get dominance.. and the rest of the group sits back*"[W]

"Probably intentional but the way the workshop began with giving people a sense of belonging – that their contribution mattered – the stories and how the sets of values were built up – something they believe of value ended up on the wheel and they could see it there – a connection to the wheel"[W]

Figure 7: Sharing a meal at Wairau Valley

We also took care to provide opportunities for relationships to grow. For example sharing a meal during each workshop allows personal interaction, which supports trust-building. It also provides an opportunity to reflect on progress, and a breather for properly organising the next session. As a participant in the Wairau case study described it "*…being able to share informally over cups of tea – things like 'did you understand what they meant there?' had real value and was a new and unexpected insight for me… it is hard to be angry with someone when sharing cuppa/food – the human common ground*"[W]

3.1.2 Knowledge sharing and developing a common understanding

An objective of our workshops was to develop a common understanding of the catchment and its important issues. Through this process we were mindful that we aimed to support the development of a holistic view of catchment system that seeks to combine environmental, economic and socio-cultural dimensions. We aimed to do this by:

- Incorporating local knowledge.
- Actively considering different ways to effectively communicate technical information.
- Acknowledging that different information sources may be viewed as having different degrees of credibility and legitimacy.
- Conducting modelling that was responsive to the interests and questions of the community, to ensure technical information was relevant.

3.1.2.1 Incorporating local knowledge

Typically decision making in natural resource management has tended to focus on information from formal disciplinary knowledge sources – geology, hydrology, climate, economics for example. However, stakeholders who live, work or recreate within the catchment are likely to have access to information and observations that may well not have been documented by traditional means. Hence, their knowledge can play an important role in helping gain a broader perspective of how the system functions and what is important for catchment management. In this regard local communities, Iwi and sector groups will all have valuable perspectives, knowledge and information that can collectively provide for a more complete picture to be developed.

In addition, when stakeholders are engaged from the outset in the process of defining the scope of the problem, collecting information, and contributing to wider system understanding (often with the

aid of model development), the findings may be perceived to be more relevant and legitimate and the subsequent decisions likely to be enduring (Voinov, 2008).

With this background in mind we encouraged knowledge and information sharing between all involved throughout the workshops through a variety of methods. These included providing opportunities for participants share their personal stories about their connection to place and to share objects that reflect what they personally value in the catchment. A number of other opportunities were provided for participants to work together in workshop sessions to

- Identify significant locations/events on maps/timelines.
- Identify trends and drivers (past, present and future).
- Develop scenarios (including building on a questionnaire about future and current states (e.g. Appendix 5).
- Select indicators and setting thresholds of acceptability.
- Develop assessment tools (rubrics) for some of the more qualitative, community focused indicators (see section 3.2.3 and Appendix 4).

"We all had the chance to say something, to make a contribution, we were treated as equals."[M]

In both of our case studies we began the process in our first workshop with information sharing between the participants, both as a way of introduction and building trust within the group (see section 3.1.1.4), but also as part of building a common understanding of the catchment. These exercises raised a number of issues about the acceptance, use and credibility of local and traditional knowledge systems, especially as they are regarded in relation to more research-based information.

> *"When I look around the room I see a whole lot of farming intelligence that hasn't been taken on.. quite a depth of knowledge that has not been taken on.. in terms of understanding the problem.. sometimes people's experience is not validated.. e.g. 2-3 generations of farming, 31 years working the river.. isn't 'anecdotal' a poor term for the knowledge of people with that many years of experience?"*[M]

We also had feedback from a participant that they felt that they were less able to contribute local knowledge as they had not lived in the catchment as long as others, implying that they felt that their observations might be less credible and relevant than those of a long standing catchment inhabitant. This, as well as other potential barriers to participation should be accounted for in the group management/selection.

> *"the depth people can have a discussion is dependent on things like their own perceived sense of self and knowledge – risk is that those more able could dominate"*[W]

> *"… it's not my area of expertise, so feel I've been taking more than I have been giving"*[M]

We found certain exercises worked particularly well for surfacing local knowledge. For example, in one exercise we asked participants to develop timelines of different changes that had happened in the community – e.g. community composition, land-use changes. This provided participants a chance to share relevant history with each other and the project team. In other cases individuals with specific knowledge around a sector were able to share more information about that sector, for example, farmers inform others about the realities of farming systems.

3.1.2.2 Communication of technical information

Science (and other external or technical information) may be introduced into the process through science experts actively participating in the process (as project team members and potentially as participants) or through science presentations as part of a workshop agenda (as in Canterbury water management zone committee processes). From our experiences in these case studies our preference is the former, as the science can then be responsive, help guide the group discussions and be introduced as just another component of the rich picture of catchment, rather than being something elite and separate.

When communicating technical information to the stakeholder groups, it is important to recognise and manage participants' differential learning and contribution capacities and the project team needs to take care that the language used is understood by participants, and that no one is left behind. One of our participants suggested "*KISS – keep it simple scientist, so everyone can understand the science*". We found that the speed we went was too slow for some participants and likewise too fast for others; it is important to recognise that this is inevitable in these sorts of processes.

> *"Sometimes hard to follow flow – but 9/10 times it did make sense as we went on"*[W]
>
> *"… feel trusting of technical input – didn't always understand though"*[W]
>
> *"at stages is was a bit beyond me – it was all those charts, modelling – took a bit to get my head around"*[W]

Not only is the speed and depth of content an important consideration in effective communication of the technical information, but the way in which the information is delivered is also important for its uptake, both in terms of the context for the information as well as the methods used. This is in fact true for all knowledge, not just science.

Constantly linking back new technical information presented to the values and concerns raised by the group helps to make the information relevant and provides continuing context and ownership of the process. In one of our case studies, when we didn't do a particularly good job of this (this was in respect of our presentation of the current day WaterWheel to that group). It led to an adverse reaction from some participants that the information we were presenting was in some way manufactured by us and therefore not representative of the community. This is in spite of the fact that we believed that what we were presenting was just a reorganised version of the outcomes from the previous workshop. Upon reflection, we considered that this could have been avoided if we had made more of an effort to remind the group at every step that what was being presented had been drawn from what they had previously developed, particularly highlighting any changes in language or content that might have made the link less obvious.

We used a variety of methods to share technical information within the case studies. These included:

- A narrative, animated PowerPoint showing the stories of different raindrops as they travelled through the catchment
- Fact sheets that participants took home to read (based on questions that arose in the interviews or workshops that were not addressed directly within the workshops)

- Plenary sessions with printed visual aids
- Plenary sessions with PowerPoint
- A plenary session where a systems diagram was drawn up, while the WaterWheels were gradually constructed alongside, making the links between the two clear.

We received positive feedback about all of the different approaches, and suggestions for further alternatives, which is probably a reflection of the variety of learning styles that we had within the group (see discussion about variety in facilitation methods – section 3.1.1.4).

> *"The initial thing [fact sheet] was really good, I have referred to that a few times, it was really good value"*[M]

> *"if it started again, a few field trips where we go into the area, and look at things,… would really help"*[M]

> *"I know we are a diverse bunch there from those with little knowledge to those with good scientific understanding. I thought we could have been directed in on targeted reading, you guys can hone in on good information to read, reading up on things you felt would have been valuable to help us form our opinions and help us paint a picture of our own catchment, that would have been useful"*[M]

A lot of work went into planning each exercise. To provide an example we provide here a description of a stepped presentation of a systems diagram combined with building the WaterWheel diagrams using coloured card spokes with the Mangatarere group, and a similar sequential wheel-building process with the Wairau Valley group. We worked our way through each of the indicators on the wheel, adding them as elements onto an evolving systems diagram (Fig. 7) on a whiteboard and at each step then identifying the connections between the new element and those already shown on the systems diagram. The success of this activity may have been due to it taking place later in the process, and hence it built upon the knowledge that the group had developed in earlier workshops. However, we found that that the slow, stepped development of a systems diagram was extremely effective in helping the group understand the complexity and connections within the system. It was described by participants as a valuable way of getting a more "*holistic perspective*" and "*appreciation of connections*". Using low-tech visual aids (e.g. drawings on the whiteboard and physical cardboard props) seemed to be more accessible than using PowerPoint, which seemed to add to the preconception amongst many participants that "science" was separate and distant from their own understanding of the world.

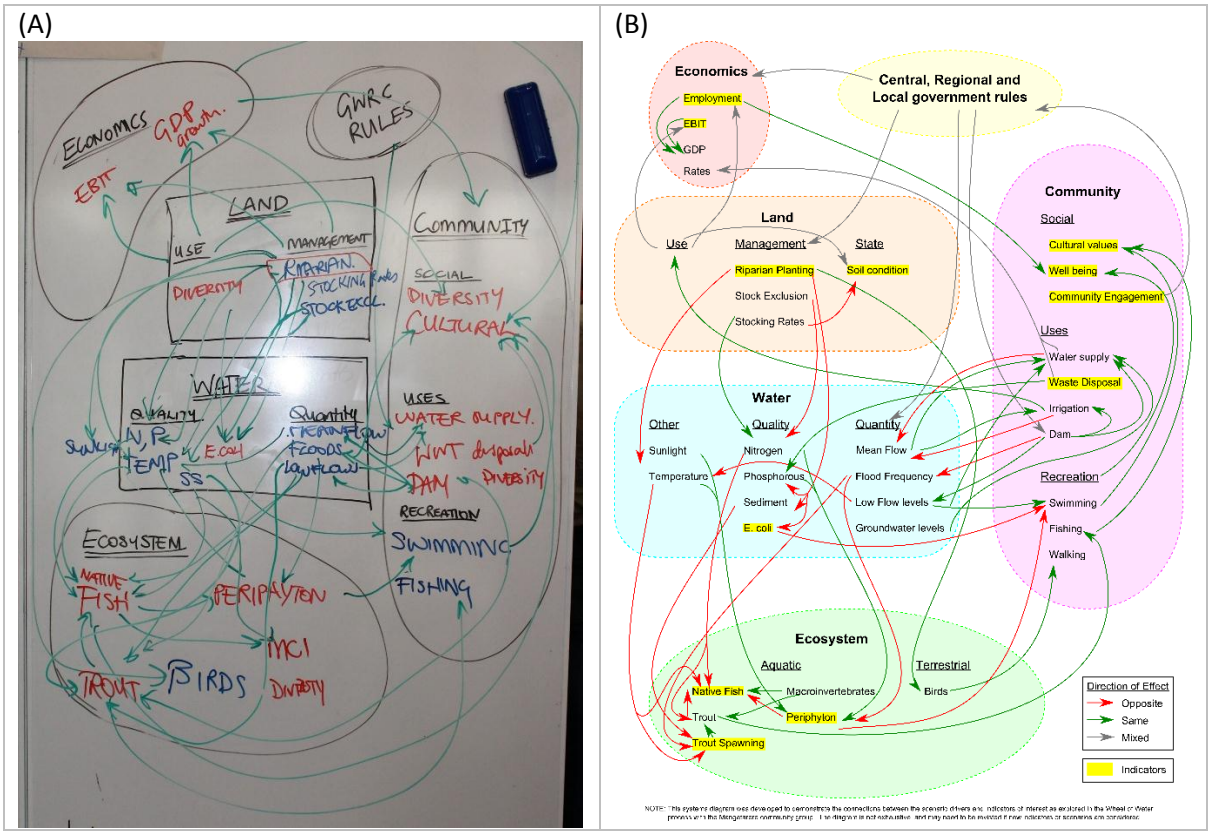


Figure 8: (A) Systems diagram as developed on the whiteboard for the Mangatarere group. (B) The same systems diagram "tidied up" for the Mangatarere Restoration Society to keep and use

3.1.2.3 Credibility and legitimacy of information

Our hypothesis has been that better progress towards a policy goal will be made if the collaborative process is as equal as possible for all participants including scientists and technical experts. However, having attempted to provide equal opportunity for all sources of information to be shared with the group, some questions were raised (by participants and project team members alike) about the credibility, reliability and legitimacy of the different pieces of information. This will be of even greater importance when groups are asked to set policy or make binding decisions.

On the one hand, it seems reasonable that the knowledge base should be validated and evidential. This may be simple to achieve for some of the more technical and tangible models and indicators (e.g. nitrate levels in a river or regional GDP). However, as we have found in our case studies, not all of the values that are represented on the WaterWheel diagrams can easily be validated or have evidence provided for them. This is particularly true for complex values, such as some of the more social or management-oriented ones. Although we explored methods for making more robust measures of these complex values (for example the rubrics of community engagement – see section 3.2.3), issues about the credibility and legitimacy around measures that are not common in mainstream science are likely to remain.

Issues around the credibility of different information were reported by a number of participants. These related particularly to whose views should be recognised as credible.

> *"Some people held deep prejudices and keep wanting to go back in time (found it monotonous)… setting a limit won't be able to please everyone – this process helped cyrstallise some issues – made it more difficult for them to fall back on unsupported views"*[W]

"For what it's worth [I'm] quite happy I've been able to contribute.. you get plenty of opportunities both within the group , and when the group is reporting to the total audience, you get a chance to say your bit as well.. happy with that. Equally, there were times when you're liable to get a misguided or uneducated comment, whatever you like to call it. Sometimes I think, for god's sake, shut up and let someone else talk."[M]

When to bring in discussions that encourage the group to consider the credibility of different viewpoints is also an important consideration. Too early and it may seem rather leading or confronting (with the consequence that people do not venture further lest it be challenged), too late and you may find misconceptions have been interpreted as fact. In the first workshops there were several statements of "scientific fact" from community members that were incorrect. We learnt that it was important that methods for how to appropriately deal with this should be agreed prior to the workshops, across all team members. It also highlighted that there is a real need to continually emphasise the importance of ensuring that any "piece" of knowledge is understood in the context it is given. This requires a process of active listening, helping ensure that people have taken the right message away from the sharing.

The compressed time frame for the case studies meant that limited time was available for sharing technical information with the groups. It also meant misinterpretations were sometimes not able to be adequately explored and discussed. In a statutory limit-setting process more time would be required to share, debate and interpret a range of information sources.

3.1.2.4 Collaborative Modelling

Modelling of the interrelationships among the indicators identified by each group was carried out after the workshops about values, indicators and scenarios. This meant the requirements of the modelling were already much more tightly defined than if we had to develop the model in advance of the workshops, which is perhaps a more common approach currently used in these types of processes. Although this approach significantly reduced the amount of time available for model development (all modelling had to occur between two successive workshops) it meant that the overall model development was more efficient, as it was customised to those indicators and scenarios that were of interest to the community. Further, by involving a stakeholder group in defining the modelling question (in this case the scenarios and indicators), it is generally found that the model results are likely to have greater acceptance as a level of ownership of the model is developed (Voinov et al., 2008; Voinov & Bousquet 2010).

In these case studies, we used models that were high level and modular, using only the minimum level of detail possible to explore the scenarios defined by the participatory group. Although we recognise that once final decisions about resource allocation need to be made that more complex models may be required, we consider that the high level modelling that we used in our case studies was appropriate as a first step in an iterative modelling and learning process. In general, we found that the output that we had from these simple models was sufficient to improve understanding of the system within the community, identify areas of greatest concern and to provide guidance about where best to invest future modelling or monitoring efforts. However, we did receive feedback from a number of participants that they would have liked to have had more time spent on explaining how the models worked.

Collaborative processes require new roles for scientists beyond being providers of technical knowledge, one of which is, being a participant in the process. Often in other processes, the science team who conduct the modelling and other technical support tasks are not involved directly in the stakeholder workshops. Whilst this may be to "protect" the group from complex language, or because science staff have limited time available, it does not consider the benefit to the scientists of being exposed to the stories, values and perspectives of the participatory group. In particular, we found that when we contracted modelling out that certain important aspects of the context were lost, but when we had a scientist as a participant it helped them to:

- Improve their understanding of the real issues that the community were interested in, and to reflect this in the modelling.
- To tailor the collection, collation and presentation of technical information so that it reflected the interests, knowledge levels and language of the participatory group.
- To make technical decisions (if the participatory group were unable to do so themselves) with the sentiment and intentions of the group in mind.

We also found that community participants placed value on technical people on the project team who are passionate about the place and catchment and are grounded in the catchment (e.g. people who have personal or professional history in the area).

3.2 Key Insights – Content Elements

For our two case studies, primary outcomes sought were to develop a common understanding of the catchment system and to represent that system as a WaterWheel diagram. To achieve this, each case study worked through a sequential process to identify values, indicators and future scenarios.

Water wheels were then constructed, discussed and various components adjusted. This enabled us to assess the utility of the WaterWheel diagram both for evaluating future impacts, and for evaluating the effect of different management decisions on the system.

This section summarises what we observed when addressing the design of the content components – values, scenarios and indicators - across our workshops.

3.2.1 Understanding stakeholder values

In both case studies we applied a range of approaches during the first two workshops to enable participants to articulate what was really important to them about their catchment. Research challenges arise in how to reach consensus around values e.g. how can we describe values, what and whose value sets traditionally get left out of decision-making, and what methods can best be used to elicit and describe what a collective of stakeholders really values? We observed that the process does not need to reach consensus, but it should help participants to understand why others hold their particular perspectives.

To avoid uncertainty about what is meant by 'values', we defined values as including uses of land and water (such as agricultural and recreational uses), as well as the things that matter to people (such as their sense of place) in the catchment. The latter category can easily be overlooked (Tadaki and Sinner 2014) especially if a more utilitarian definition of values is applied. Without any directed

prompting participants provided both broader 'held values' and specific 'assigned values' (Adamowicz et al. 1998; Brown 1984). Held values are those ethical values or beliefs that individuals and groups hold. They may reflect the goals or ends that one seeks in life, or the processes or means by which one lives one's life. Assigned values are defined as the relative value or worth of things – goods, services and opportunities – and are more likely to be influenced or changed by other peoples' views.

In the Wairau these efforts to elicit participant values began with the initial participant interviews, but not in an explicit way; it is difficult for anyone to respond to a question like 'what are your values in relation to this catchment?' Asking participants to tell a story about their experiences in the catchment provides rich insights into the values that they hold dear. The values expressed in the initial interviews were summarised into a generic list to use in the first workshop by the project team. The stories shared by participants in the first workshop led to identification of particular values to discuss with the group. The initial aggregation of values into a generic list of 17 resulted in such confusing high level descriptions of values (e.g. diversity) that the project team ran a second exercise in workshop 2 asking participants to prioritise their top 10 from the list of 58 'values statements' (e.g. "I value species richness and protection of threatened/endangered species").

> *"We got hung up on the definition of "values" – could we have said what we were looking for more clearly [possibly by giving some examples?]"*[W]

Each participant identified their prioritised values using sticky dots on a master list on the wall. Participants were able to review the list and add values they thought were missing. In a final session, participants then clustered similar values bearing in mind the later objective would be to decide how best to measure changes in those values by selecting suitable indicators. The overall priorities of the group were determined from the numbers of sticky dots against each cluster.

In the Mangatarere case, the design was oriented more towards encouraging participants to provide their own information about the catchment. This was begun with the preliminary interview, and carried on in the first workshop with a 'bus-stop' exercise that invited participants to share information about: i) life in the catchment, ii) natural resources; and iii) the history of the catchment. A second exercise then asked participants to draw things they valued. These drawings provided a springboard for participants to share values. Finally an initial master list of values was created and displayed on a wall, and their importance to the group was indicated by the placement of coloured dots. In the second workshop a further exercise was held to identify the values on this list that were most likely to be directly affected by land use change, to aid selection of values for the WaterWheel.

Table 3 shows the types of values identified as important to each of the case study groups. Prioritised values listed for the Wairau group represent aggregations from an original list of 53 values statements. So, for example, *Objective science knowledge used to make good decisions* was agreed by the group as comprising these more specific values statements:

- Resource management is effective, fair.
- Ways to monitor catchment over time.
- Efficient water use, not wastage.
- Equitable sharing of resources.
- Kaitiakitanga, guardianship.

Table 3: Values identified by each group for their catchment

WAIRAU VALLEY VALUES	MANGATARERE VALUES
• Objective science knowledge, used to make good decisions • Productive land/water uses	• Diversity - ecology, community, uses, and their interaction • Social value for humans, walking, listening to birds, seeing fish - sensory
• Healthy biodiversity, aquatic habitats, ecosystems • Sustainable development, holism, 'healthy' valley	• Habitat biodiversity - water and land, connections/corridors • Business/commerce/economic as an enabler of achieving whatever we want to achieve - people can live here - social infrastructure
• People have ownership & responsibility for what they do • Landscape character, riverscape	• Nursery/nurturing - fish, bird, wildlife, trees, youngsters • Productivity of land
• Able to swim, canoe, kayak, raft	• Spiritual Connection - Ko ahau to awa, ko te awa ko au
• Potable water, clean groundwater	• People to People Connection
• People able to financially support themselves, economic output • Stable Wairau River, flood passage maintained	• Improvements and upgrading over time and personal satisfaction of that • Assimilative capacity (flow not peaky - short headwaters provide buffering)
• Stability – how it is now	• Passion and enthusiasm of the people
• Social connections, family ties, whakapapa	• Place to play - swimming, BBQ's, killing things, mud pies, huts
• Able to gather food, mahinga kai	• Human history and its uniqueness including lots of hard work
• Access, sharing of people's properties	• Aesthetic appeal - look and smell
	• Mahinga kai - longfin tuna, whitebait, bully, spawning river for trout • Health of headwater forests
	• Technology to communicate/connect
	• Showcase ecotourism/brand

As can be seen in Table 3, in the absence of a specific scenario the ranking of values tended to result in more holistic values (e.g. healthy ecosystem, connected community. good use of knowledge) as being more highly ranked by the group, and more specific values (e.g. flood passage maintained) lower ranked. However, these overarching holistic values made the later discussion on suitable indicators more challenging.

> *"I like the process to get down to core values and was surprised how easily agreement was reached"*[W]

In fact, once we moved to indicators, it became clear that what the groups meant by any given holistic value could be something completely different in each of the catchments, and quite often even something completely different between participants in the same group. This is not surprising because clearly there are so many dimensions by which you might assess what makes a "healthy

ecosystem" or "connected community". However, it did highlight to us that time needs to be allowed to tease out the different meanings of these terms, and gain an understanding of what different groups – and individuals – mean when they use them. One approach that we explored in relation to unpacking these more holistic concepts was through the use of rubrics – see Appendix 4. The thoughts that these values raised among participants is illustrated by the following comments:

> *"I feel that if the group had had more structure in sorting through the values, by that I mean that there are some value categories you could have identified right at the start… if we had had this structure … think we would have honed in much better… when I look at values as they are I don't think they are coherent enough"*[M]

> *"do we need a holistic indicator like the good knowledge/good decision making one or is the wheel itself a holistic concept?"*[W]

In both case studies these values lists were not regarded as closed, they could always be added to through reflections in subsequent sessions. In the Mangatarere group a value that had not made the prioritised list early on was reincorporated at a later stage following a group discussion; having this flexibility was appreciated by the participant who first raised this:

> *"I would like to acknowledge that difficult aspect (when I said that I felt I was being sidelined), it was handled not just well, but accommodating from that point on… I was quite surprised… at the measure of good will too"*[M]

In subsequent exercises around the development of scenarios and system models, we took care to provide opportunity to reflect back and check that any final package of indicators checked back against the stakeholder values map.

3.2.2 Scenario development

In both case studies we invited participants to develop one or two scenarios (or futures) that provided a context for thinking about what might happen in the catchment, uncovering what that might mean in terms of ecological, economics/production and socio-cultural interactions. This also acted as a guide around which the group could develop a package of indicators, and underpinning models, to assess progress towards desired outcomes and away from undesired ones (Fulton & Scearce 2004).

We preceded the development of a scenario in both workshops by exercises that were designed to help the wider group focus on the realities of the external environment facing their catchment, and to help ensure people had thought about what has happened in the past and likely drivers of change in the future.

The project team needs to consciously define and clarify with the group what types of scenarios will be useful for the purposes, and what will not. In the Wairau case, when we just asked participants to devise catchment scenarios in terms of a movie metaphor (horror = worst case; fantasy = best case; documentary = status quo) participants came up with unrealistic scenarios involving earthquakes, and mega floods, which were less useful for thinking about how values may be affected by future change. However, scenarios do need to encompass sufficient change to allow changes to the groups' priority values to be envisaged, and facilitate understanding of the system (Preiess and Hauck 2014).

"[it was] surprising how robust [the] cumulative group scenario work was"[W]

In the Wairau case, participants were asked to think about 25-year scenarios prior to Workshop 3. We then prefaced the scenario development with two exercises. The first invited breakout groups to graph a history of their catchment across a number of different themes (e.g. social changes, landscape changes, and community connectedness). The second exercise invited them to share and brainstorm likely drivers that are or may influence their catchment. This rich background provided some system context for the group to develop scenarios – with the rider that we are looking 25 years into the future, that we are interested in scenarios that we can realistically manage, and that catchment futures are actually unlikely to be linear extrapolations of past trends, and more likely to be step-changes such as the 1980s abolition of farming subsidies. The final scenarios were chosen as: i) "urban": unconstrained subdivision and population growth and ii) "full irrigation" a mixture of dairying and viticulture on the valley floor, with the balance of hill country going into forestry.

"[I] liked the balance between the introduction/information (formal) sessions and the breaking into workshopping [informal] ... liked applying the information we had heard to certain situations [scenarios]"[W]

In the Mangatarere case, workshop 2 included a "wave analysis" (Figure 9, where trends are grouped into past, current, near future and distant future and placed accordingly on a picture of a wave) to provide an interactive and short way to identify and think about incoming and outgoing trends, paradigms and practices. With the benefit of this picture of the catchment situation participants then chose two alternative futures: (i) "Everyone lifts their game": best management practices on farm, and the WWTP no longer discharges to the stream; and (ii) "irrigation dam": a dam is built in the headwaters and is accompanied by increased farming intensity.

Figure 9: Discussing the "wave analysis" with the Mangatarere group – a technique used to lead into scenarios

Given the limited time frame, there was some upfront discussion between the participants and the modeller as to what degree of details could feasibly be modelled prior to the next workshop (e.g. that we would not likely be able to have every farm in the catchment individually represented). Although restricting the group in this way was not desirable, we preferred to be open about these

limitations at this stage, rather than coming back to the group with model results of scenarios that were not as they had described.

With the Mangatarere we use the terminology "futures" rather than "scenarios". Upon reflection, we found that this may have led to some confusion for group members, particularly as this group entered the process because they all had an interest in restoring the Mangatarere Stream, and hence "futures" may have been mistaken for targets or visions. However, the purpose the project team had in mind with this task was to use alternative futures/scenarios as a way of learning about interactions within the catchment, rather than devising actions to reach some desired outcome (which could be a next step). This highlights the importance of the choice of language and clear communication about the purpose of all the activities

> *"I didn't totally understand the choice of future scenarios; I think it was for the purpose of testing whether what we've come up with was good enough to show a contrast between different futures, but then it morphed into an assumption that these were the possible futures, yet we never really had a discussion about how likely these futures were, or whether we wanted them [to eventuate]"*[M]

3.2.3 Choosing relevant indicators

It is often tempting in a collaborative process to discuss indicators too early in the process. Scene-setting through identifying important values then constraining those through discussion of realisable future scenarios makes it easier to limit the scope of potential indicators (Allen et al. 2012).

> *"the list of indicators [that we came up with as a group] are a big improvement on my own list… so pleased with the collaborative process"*[W]

There is a plethora of indicators possible, many of which have been used and thought about before. A facilitation challenge is how to introduce this institutional knowledge to the group without leading them unduly. In our case studies, we started by discussing what makes a useful indicator using the graphic in Figure 10, and presented some examples of widely used indicators to guide thinking about what a useful indicator looks like. We then asked the participants to brainstorm indicators that represented their values identified earlier.

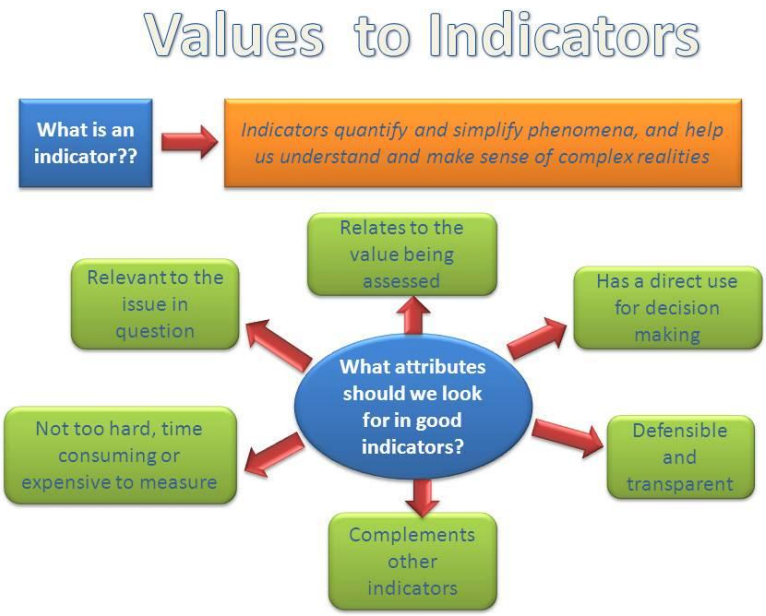


Figure 10: Attributes of a suitable indicator, as discussed with the Wairau Valley and Mangatarere groups (source: Allen et al 2012)

There was discussion about different ways of framing the choice of indicators. For example, the use of the Pressure-State-Response framework encourages thinking about indicators not just of the state of the system but what changes are coming and whether management actions are working. Equally the suggestion was made by a participant to think of leading and lagging indicators, i.e. input vs. outcome measures of the system, such as length of riparian planting vs. nutrient concentrations in the river. Some of the useful indicators are not just measures of the outcome per se (which is often how futures and scenarios are framed), but are measures of the process followed to achieve that outcome (e.g. the Wairau group prioritised as a value the importance of equitable sharing of resources).

In the Mangatarere case study we selected indicators prior to discussing scenarios. An advantage of this was that we were able to maintain a more explicit connection between specific values identified by the group and their corresponding indicators. However, because the number of indicators was limited to 12 (due to constraints that we set for the WaterWheel diagram; adding more spokes decreases the clarity/simplicity of the graphic) we found that the indicator set didn't always adequately describe the catchment system under all possible scenarios. For example developing a scenario to upgrade the Waste Water Treatment Plant –but without adding an extra indicator for water quality downstream of its discharge– meant we could only see the negative impact on the economic indicators and no improvements in the environment). In the Wairau case study, scenario development preceded selection of indicators, but ended up needing different indicators for the two scenarios, which is also not desirable if the main aim is a comparison between scenarios. These issues highlight a drawback in limiting the number of indicators available for the WaterWheel to only 12 (done mainly to aid graphical clarity). It suggests that an iterative approach between scenarios and indicators is required in order to develop more robust and versatile indicator sets.

Choosing indicators meeting the criteria in Figure 10 means the group has to get very specific. This raises a number of technical questions about exactly how, where and when the indicator is

measured. This specificity created some concerns in our groups about whether choosing such specific indicators creates gaps in how well the resulting WaterWheel diagram represents their view of the whole system. It also created challenges as in many cases significant technical knowledge is required to develop such specific indicators. It is also possible that the same indicator may mean different things or represent several values (for example, river algae coverage might be an indicator of suitability for swimming, or of ecosystem health), so defining the indicator, how it is measured and continuing to tie it back to the value or values that it represents is important for interpreting the ultimate WaterWheel diagrams.

> *"..at the moment with the indicator list... we don't have the richness to describe the logic they used to come up with this indicator in relation to the original values.. if we had this logic we could more easily find another indicator if the one they have chosen doesn't work [in the modelling/application] for some reason"*[W]

In both case studies, indicators and thresholds were not completely defined by the groups within the workshop timeframes that we had set. We underestimated the complexity of this task, and the significant learning that was required for the group to be able to completely define suitable indicators and thresholds.

> *"Indicators [are the] most complicated [part]. Quite a lot of rationalisation required. Not sure if we have enough."*[M]

Defining thresholds without specific knowledge of the range and variability that might be expected for a given indicator is challenging even for technical specialists, and was nearly impossible for our participants.

> *"People generally understood the point of thresholds, but struggled with the environmental data and setting of the thresholds per se."* [M]

> *"Can we really identify thresholds before we've got information of the current state?"*[M-]

We found that some better ways for the participants to define thresholds for many of the indicators (other than providing a numerical threshold) included asking the group to provide: narrative thresholds (e.g. *it wouldn't be acceptable if every time I went swimming the river I couldn't see my feet because it was so cloudy*), thresholds related to historical outcomes (e.g. *it wouldn't be acceptable for river flow to go below the level in 1975*), or using photos to define them (e.g. we developed an online survey for the Mangatarere group to poll how acceptable photos of different % algae cover in the streambed were in terms of their swimming enjoyment - Appendix 5).

The case studies brought home the importance of ensuring the chosen indicators relate to the most sensitive or pressing issues identified within the catchment; such indicators function like the 'canary in the coal mine'. That means they may relate to quite specific choke points in the system, or specific times of year, e.g. a river reach where maintaining a minimum flow is critical to fish passage, or a crop harvest period when labour or irrigation water is critically needed to achieve an economic outcome. This highlights the tyranny of averages – an averaged indicator may tell us nothing about a critical period or locational issue like those examples.

Considerable scientific research has been done on quantifiable environmental indicators, because resource management has traditionally focussed on managing to 'bottom lines' or thresholds. Environmental indicators are easier to define than social, cultural or even economic indicators, which instead may have no optimal or agreed outcome, and may be highly qualitative. Both case study groups identified many socio-cultural and economic values as priorities in their catchments, but it was more difficult for them to agree suitable indicators of those values and how one would measure changes in those values. This led to discussion about, and the development of, "rubrics", which helped the groups to quantify indicators such as connected community (Wairau Valley) and an index of wellbeing (Mangatarere). Appendix 4 describes how to develop a rubric and provides the two examples developed by the Wairau group.

A rubric outlines the criteria that make up the indicator and a scale or metric for measuring them in order to quantify the overall indicator. Writing rubrics involves:

1. Defining the task to be rated. This can include consideration of both outputs (things completed) and processes (level of participation, required behaviours, etc.).
2. Developing scales, which describe how well any given task or process has been performed. This usually involves selecting 3-5 levels. Scales can use different language such as:
    a. Advanced, intermediate, fair, poor.
    b. Exemplary, proficient, marginal, unacceptable.

Following preliminary selection of indicators by the two case study groups, and then looking at the outcomes for these indicators under current day and future scenarios on WaterWheel diagrams, we reviewed again to what extent the chosen indicators represented the prioritised values identified earlier in the process. In both case studies, the groups chose to change some indicators and thresholds. Reasons for replacing an indicator or changing thresholds included:

- Its lack of sensitivity to likely changes in the catchment (e.g. Macroinvertebrate Community Index in the Wairau River).
- It being a part of the assumptions in the scenario represented by that WaterWheel rather than an indicator of catchment response (e.g. the catchment area irrigated).
- Some of the four wellbeings not being adequately represented.
- A similar (correlated) response from two indicators, meaning only one was needed.
- The thresholds did not reflect the realistic ranges for a given indicator in that catchment (usually because we didn't have any information about the indicator in the workshop where we originally defined thresholds).

The resulting indicators from the two case studies are shown in Table 4. Comparison of the lists shows that two catchment systems may not necessarily end up with the same balance of indicators across the wellbeings; that depends on the values that a stakeholder group considers most important in that catchment. Although sometimes frustrated by it, Mangatarere participants commented after the first indicator selection process that they would rather have empty spokes in the WaterWheel (i.e. indicators for which current and/or future states could not be evaluated at this time) than to replace these indicators with something less representative of their values of interest.

Table 4: Indicators chosen for the WaterWheels for Wairau Valley and Mangatarere catchments coloured based on the well-beings that they represent (yellow = socio-cultural; blue = economic; green = environmental)

WAIRAU VALLEY INDICATORS	MANGATARERE INDICATORS
Knowledge use in decision making (rubric)	Index of Wellbeing (rubric)
Connected community (rubric)	Level of engagement for catchment improvement
Cultural Health Index	Cultural indicator (TBC)
River recreation index	Trout spawning for future angling (TBC)
Catchment Earnings before Interest & Tax (EBIT)	Mean annual maximum Periphyton at Belvedere Rd swimming site
% employment in catchment	*E.Coli* at Belvedere Road swimming site
Reliability of water supply	Earnings before Interest & Tax (EBIT)
Terrestrial Mitigation	Full time equivalent employment in catchment
Common Bully Habitat in Mill Creek	% time wastewater plant can't discharge to river
Nitrate concentration in Mill Creek	% riparian planting in catchment
E Coli in Mill Creek	State of native fishery (Expert opinion/TBC)
Mean river flow at the Narrows	Visual soil assessment index

3.2.4 The WaterWheel diagram as a visualisation and management tool

A WaterWheel diagram displays the assessed values of several indicators on a single plot (Figure 11). Each spoke of the WaterWheel represents an indicator. The length and colour of the spokes indicate the acceptability of the indicator value on a scale defined by four categories: poor, fair, good and excellent. Long green spokes indicate that the outcome for a particular indicator is excellent. Yellow, orange and red spokes of decreasing length show the indicator is at a good, fair or poor level.

A WaterWheel diagram represents a static snapshot of the level of its indicators at a chosen point in time. It may also be developed to apply at a particular part of a catchment (e.g. the catchment outlet, integrating upstream factors) or have indicators which apply at various points in the catchment. Therefore the ways in which a WaterWheel can be used will depend on how, when and where it has been defined.

Having selected indicators, there are two key types of input to constructing a WaterWheel diagram. Firstly there is the assessment or prediction of indicator values for the scenarios. This may be technical information that is produced by experts using information sources such as observations, models or other approaches, or qualitative information provided by the group. The second input is the determination of the category thresholds for each indicator. The category thresholds are socio-political decisions that reflect the acceptability of certain outcomes. For example, category thresholds may reflect decisions about the acceptability of risk to human health or of levels of water supply reliability. These thresholds are not determined by experts, however experts can provide guidance and help to interpret the meaning of certain levels for an indicator. Because the category thresholds determine the length and colour of the spokes on a WaterWheel diagram, altering them can alter the appearance of a WaterWheel and therefore the ultimate acceptability of the scenarios.

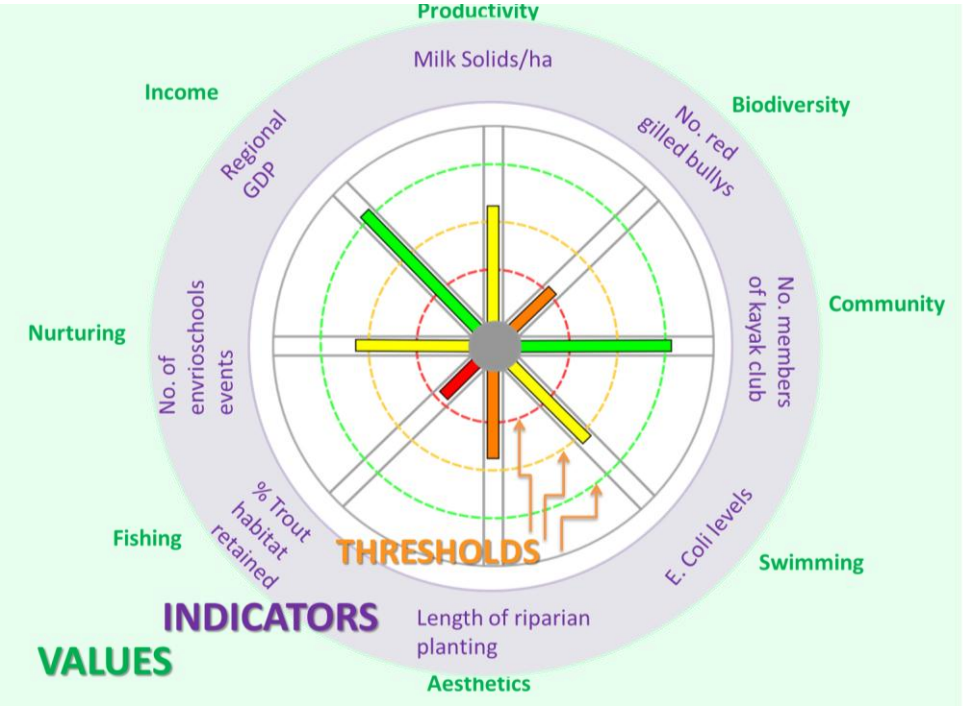


Figure 11: Example of a WaterWheel diagram

Both case studies were designed with the development of WaterWheel diagrams in mind. The steps that we followed in the workshops: discussing values, developing indicators and thresholds, and exploring scenarios were all necessary in order to develop WaterWheel diagrams. We received feedback from the participants that the WaterWheel diagram makes complex information more digestible than a table with the same information and that the graphics were useful as they allowed you to evaluate multiple outcomes in one visual diagram.

> *"The nice things about the WaterWheel is that it doesn't weight those things [the values and their associated indicators]. In the past I have been in processes where you had to weight the components to get an aggregate. Because we are not doing this, they can just be looked at alongside. When people look at the picture, they will make up their own mind about the weighting"*[M]

> *"Whole discussion on WaterWheel new knowledge or perspective – how things fitted together and how they changed in relation to each with different impacts... the massive wine growth, dairying scenario and translation into WaterWheel was fascinating"*[W]

> *"the visual representation meant the values of all of the participants were put right in front of you, you could see the interconnectedness; If you move this one, it moves that one; no actions are independent of another action; the actual construct of the wheel make that blatant in a way that a table or graph doesn't"*[M]

Although this feedback was not quite unanimous:

> *"…with final wheel there are things that are missing, can't be represented – personally several graphs would have been more useful"*[W]

The participants also generally recognised that the process of developing the WaterWheel diagrams (i.e. the discussions and decisions made in the earlier workshops) was a critical part of the WaterWheel diagram. There was some concern expressed that if the final WaterWheel diagrams were not taken in the context that they were developed, with all the supporting information used to create them, that they might be misinterpreted. This concern was more widely expressed within the Wairau Valley group, which probably reflects the degree of scepticism and mistrust around resource management within the catchment following their past experiences with the Trustpower hearing.

> *"Reducing the state of the catchment to a set of indicators on a WaterWheel is a great concept, but this discussion shows how complex each indicator can be for understanding… important that the fine print behind each indicator is available to support discussions using the WaterWheel"*[W]

> *"Simplifications of the catchment down to these indicators requires a lot of qualifiers. The product [the WaterWheel] and the process for getting there are both important"*[W]

We had more positive feedback when we presented a cardboard version of the WaterWheel diagrams, which had stuck on, adjustable spokes, than when we presented a printed or PowerPoint version of the same WaterWheel. There are a number of reasons that we consider explain why the cardboard versions were more successful, including:

1. The cardboard versions were not permanent i.e. they weren't likely to be taken away and used by the council to make some decisions
2. Participants were able to remove and/or change the spokes; this seemed to create a greater feeling of ownership and also engaged them to think about what exactly was on the WaterWheel and what was missing
3. There was a certain theatre about the way that the cardboard wheels were built, making the process more entertaining and fun.

Figure 12: Discussion of the cardboard WaterWheel diagrams and hand drawn systems diagram in Workshop 4 - Mangatarere

Along with the positive feedback about the WaterWheel diagrams, we also received some constructive feedback about the weaknesses of the WaterWheel and potential future improvements. This included observations that the WaterWheel diagrams do not currently:

- Demonstrate the relative sensitivity of the different indicators.
- Display the uncertainty in the indicator measurements or predictions.
- Account for the varying timelines for achievement.
- Display information about the trends observed in the indicators.
- Allow for interactive updating of the scenario assumptions.
- Easily accommodate more than 12 indicators (more decreases the clarity of the diagram).
- A clear way of retaining the connection with the process used to develop the WaterWheel.
- Represent the full complexity of the system.

Some of these weaknesses have been addressed in software developed to display WaterWheel diagrams. Based on the thinking and insights gained through these case studies and the wider Wheel of Water research programme, we think that WaterWheel diagrams, along with other graphical and visual tools, are useful for:

- Summarising in a visual manner the indicators most responsive to management actions.
- Comparing possible system outcomes for various catchment scenarios.
- Comparing system performance between catchments – but only if the same values and indicators have been chosen for each catchment.
- Evaluating trade-offs among the values represented by the WaterWheel – and this is most easily seen by comparing WaterWheels when sensitivity analyses are carried out on the model(s) and rubrics which produce the indicator scores.
- Setting achievable catchment limits and targets – especially because the WaterWheel readily shows that because of trade-offs among values, it may simply not be possible to achieve green scores for all indicators at once ("you can't have your cake and eat it too").
- Use by a stakeholder community group as an oversight performance monitoring and reporting tool, as a way of showing the way forward and measuring progress so that the group is able to see value in being involved.
- Providing a focus and structure to the collaborative process.

The Water Wheel building process increases a group's understanding of each other as well as their understanding of the catchment system.

> "*The stepping system is important because you have to have a beginning, then work through each step before move onto the next; it's systematic, you don't just put the glass pane in the frame without preparing the frame first.. you have to prepare."* [M]

The layers of discussion required to construct a Water Wheel allow a group to share what is important to them in a non-confrontational way (e.g. by identifying values and indicators before any change scenarios are introduced). Discussions occur while looking at the Water Wheel, rather than facing off against each other, and in this sense the Water Wheel can be a useful 'boundary object' – a material resource that facilitates discussion between parties (Fuller, 2009).

> *"the structure provided by the WaterWheel – it provided a focus"* [W]

4 SUMMARY OF OUTCOMES

Each of the case studies led to a range of overall outcomes. There were a number of outcomes that participants noticed as a direct result of their involvement in the Wheel of Water workshops. These included knowledge gains; enhanced community connections; and insights into both the reality of, and the value, of a collaborative process. These outcomes are outlined here in relation to each case study.

4.1 Wairau Valley

The final interview was undertaken 8-10 weeks after the final workshop. This gave participants the benefit of having distance between their participation in the workshop series and the final reflections they gave on the process.

4.1.1 Knowledge gains

Nearly all (9/11) participants commented that they gained new knowledge and understanding. This was most often reported as gaining new perspectives from hearing others in the group.

> *"[I] gained knowledge of other people's perspective – also around the interplay of different representatives, how they regarded each other. Never been in a room where all the sectors within one room for Upper Wairau."*[W]

> *"I have noticed since the end that when reading news articles and council matters in the paper – water issues for example – it has enhanced my understanding of things such as all the interactions involved"*[W]

> *"Gained knowledge of other people's perspectives – also around the interplay of different representatives e.g. how large scale farmers view lifestyles, others regards forestry"*[W]

> *"Appreciation of different points of view brings about a challenge because our preconceptions are challenged … never listened to F&G [Fish and Game Council] person before for example, process was so inclusive, all these people freely discussing, like F&G and dairying there and talking was balanced"*[W]

There were also a number of reflections that acknowledged how the WaterWheel brought the range of information developed through the workshops together.

> *"The structure provided by the Waterwheel tool – it provided a focus. Most of what affected my perceptions was through discussion – hearing the stories, the connections."*[W]

> *"[The] WaterWheel tool was a focus and a way of displaying multiple competing values."*[W]

A number of comments also reminded us that sharing knowledge and developing a shared understanding need to be regarded as a process that requires a number of iterations.

"When we got to end of the wheel – some things that were too difficult and those not included (not a priority) were absent – I was not comfortable with this"[W]

"WaterWheel as a visual tool – I liked the concept, but not sure we got to a final wheel that was as well scaled as it could be – small medium, large ...it needs finer tuning (something to gauge against)"[W]

Participants noticed the gaps in representation (missing Iwi and viticulture) as important because it meant that their views were missing from the discussion and the collective outcomes of the process.

4.1.2 Enhanced community connections

Using sequential facilitated workshops developed and strengthened connections within the community. We had feedback from the Wairau group that they found that the workshops were a great opportunity to connect with other people in the community, particularly as many of the other mechanisms where the community used to engage (e.g. church, school, sports clubs) are less available now. All but one participant provided comments through the final interview that acknowledged that the process left them, and the group, with improved relationships.

"Yes, [the] group did develop new relationships – I could see discussion between people and sectors - – and that interaction had humour and respect, a great sign."[W]

"Yes, [I] developed an ease with people in group …. I am [now] more likely to pick up phone to, or them [to] me."[W]

"Yes, [the] group developed – people who had never met, held different points of view, now know where others coming from, both parties shifting a bit of ground on how things were done."[W]

4.1.3 Collaborative process – awareness and skills

All participants (bar one) commented that they had observed the process of developing a shared understanding in practice. Some of these comments related to how participants had observed others in the group responding during the process, while others reflected on their own responses.

"Experiencing the passage of four workshops – [I] saw people shift position –for example [name] said in first meeting he 'expected to battle' – [and] instead found a lot in common in quick time."[W]

"[I] came in thinking this seemed to be a waste of time – but stuck at it- and came out the other side with a different point of view."[W]

Well over half the participants (8/11) directly commented that they, or the group, had learnt process skills. These were acknowledged as being likely to help them as participants in similar processes. In a few cases participants acknowledged that they had learnt skills that they would, in turn, use in other situations.

"[The] way the process was directed was effective for getting people to open their minds –… new skill for the group ."[W]

"The process was like being coached into dealing with differences."[W]

"I picked up a few bits – if I am involved in another meeting may try a few things."[W]

"Made me more willing to take part in group work – our level of interaction was appropriate (as opposed to those ones when you read programme sessions and it sounds very touchy-feely."[W]

4.2 Mangatarere

Final interviews with participants were undertaken 9-10 weeks after the final workshop, and just before the group reconvened to begin their work on the Mangatarere Catchment Action Plan.

4.2.1 Knowledge gains

As a result of the process there was evidence that about half of the participants had developed and took away new skills, knowledge and attitudes. The variation related to the starting point of the participants: those in the group with a stronger initial knowledge were less likely to report changes in their understanding of catchment and water issues, compared with those who went into the process with less existing understanding. A project team member observed:

"If I had to work with that group now, we're in a far better position to work and go forward – they have a far better understanding of water quality and I see them as on the journey as opposed to a cold start."

Participants gained an understanding of the values others in the catchment hold and the trade-offs amongst those values. A number of participants described gaining a wider understanding of stakeholder values, and mentioned that the WaterWheel diagram supported this by representing multiple community values together in one diagram, along with how these values are affected in different ways by scenarios. The role of the Water Wheel diagram in supporting a wider understanding of values was described as

"*It represents what the community wants, not what a single individual wants.*" [M]

and as a

"*Mechanism for the community to identify and come to some decisions about the trade-offs."*[M]

Gains in knowledge, and shifts in understanding of stakeholder values are described in these two quotes from the Mangatarere group:

"I have a totally different outlook on where things [are] going. It's not just about the river but the activities around it. People have to make a living, also the recreation…regeneration of native trees along river reserves, better quality of water getting back to river from water races or farming practices. I never worried about where 'cockies' put their dung sprayers, now I have a better overview that the catchment is wider than the river itself; it affects the whole district."[M]

"I still think farming is contributing heavily to environmental degradation, but in a different way, and it's not them specifically. Initially I hadn't considered the town and its wastewater having any impact, but obviously the urban environment is having a huge impact too."[M]

4.2.2 Enhanced community connections

Many of the Mangatarere participants said that they appreciated and benefited from the opportunity to connect with others in the community as part of the Wheel of Water process. In particular this was described as a beneficial opportunity to hear others' perspectives that they might not have heard otherwise.

"*Having an opportunity for everyone to come together all at once, and have a conversation all at once, I think that was very valuable.*"[M]

The participants mentioned that this opportunity to connect also helped to develop the trust and respect within the group as

"Overriding take home message is that everybody did respect that there are multiple value sets, and everyone is looking for an outcome of balance"[M]

There was also a sense of the group having a collective knowledge from coming together as part of the Wheel of Water process:

"The process from start to finish was excellent in that the interest groups all got to have their say, and contribute data that supported their view; then we were able to discuss those things; and having that [systems] diagram was a very easy and succinct way for thinking through the process and receiving the process."[M]

4.2.3 Collaborative process – awareness and skills

Mangatarere participants mentioned that they gained an understanding of and respect for working collaboratively.

"I liked how we are working together as a team to develop the best programme to suit our area, and it [the Wheel of Water process] can be modified to suit other areas; other catchments can be shown what was done, and see the similarities for their situation."[M]

Several participants also commented on the importance of the facilitation that was used in the case study for a collaborative process to progress without being manipulated by individual participants or the facilitators:

"I got an appreciation of the level of commitment for good collaboration, both from attendees where you have different philosophies, outlooks etc and also from the facilitator level, the facilitation is quite important. I have been reading a conference proceeding on community consultation (for health) but the model is the same: the amount of background work you [the facilitator] have to do. The facilitator has to be careful not to shepherd or guide, and yet also needs to keep progress towards the outcome."[M]

"We all had the chance to say something, to make a contribution, we were treated as equals."[M]

> *"You (project team) were very skilled at helping people to come to a decision. Just the way you (the project team) worked. You led and we fed you and you gave it back to us. It wasn't yours, it was ours. You kept asking us for information. Then we made the decision on what was important. Then you refined it, asked us a question about it. It was very good leadership."*[M]

The science contribution was also described as important by participants, especially in terms of providing answers to questions the group identified or where there were differences of opinion within the group:

> *"We were able to use the scientific fraternity to help us. We were able to work with the scientists, and tap into them, e.g. when we have a dilemma… can tap into the scientists or the facilitators. You [project team] don't go home and shut the door…. You have all that knowledge that we can tap into if we come to a sticking point in our group. Good to have those people outside of our core group to give us a different perspective."*[M]

The opportunity to contribute knowledge and learn from others was another important aspect of being part of a collaborative process described by a number of the Mangatarere Group. This included sharing of knowledge within the group; "*All interests got to have their say and contribute data that supported their view. Then able to discuss in the wider group*." as well as among the participants and the project team.

4.2.4 Next steps for the Mangatarere Restoration Society

The Mangatarere Restoration Society planned to use the experience of, and results from the Wheel of Water process as a contribution towards the development of an action plan. At the time of writing this report the Society has held two of three workshops with one more scheduled, to develop and complete its Action Plan. There was a strong sense that involvement in the Wheel of Water project had set them up well for this work:

> *"The process has empowered the community – we can keep momentum going for Mangatarere Restoration Society"*[M]

The group identified a number of specific ways that being part of the Wheel of Water process had assisted them progress the development of the Action Plan, as evidenced in the quotes above from the group. The first was the relationships and trust built up within the group that was described as helping them to continue to work together. The second was a greater appreciation of the many different things about the Mangatarere that are valued by the people living, working and playing in the catchment. The third was developing a broader systemic view of the Mangatarere catchment. This last is captured in the following quote

> *"People seem more committed to the whole catchment – they were really narrowly focused, just on the Mangatarere (when there at first), not further out (whole catchment). I think these people will be looking at the streams more now. There is more thinking about the whole Ruamahanga."*[M]

Looking beyond the completion of an Action Plan, one of the ways the group identified they could use the WaterWheel in an ongoing way, was through using it as a monitoring tool.

5 DISCUSSION AND CLOSING COMMENTS

5.1 Insights from overall process

> *"[I liked] the way the workshops began with giving people a sense of belonging – that their contribution mattered – the stories and how the sets of values were built up – something they believed of value ended up on the wheel and they could see it there – a connection to the wheel."*[w]

The above quote reminds us that these multi-workshop collaborative processes are in themselves journeys. These processes take time and need to be developed with a clear expectation of a shared outcome in mind, even though the exact shape of the outcome cannot be specified in advance. In each of our projects we were looking to develop a shared understanding of the catchment and to end up with a package of indicators that would safeguard the key values through subsequent limit setting and management activities.

A planned multi-stage approach

It was important in both case studies to design a staged process to build a shared understanding with participants, layer by layer. The outcome the staged process was working towards, was an end point where participants were able to visualise their catchment system and the values jointly held about it as a whole, with an eye towards what could be practically done, whether through citizens' actions or through council policy.

Each case study process began with identifying, and understanding the catchment values important to the group. Latter steps, done in a different order in each case study, included generating future development scenarios for the catchment; selecting indicators to represent one or more values; and identifying thresholds for these indicators.

After using appropriate modelling tools or current day observations to quantify the states of the indicators under each of the scenarios, the components were then combined in a WaterWheel diagram. This provided the visual for seeing the system as a whole, and for discussing and evaluating the effect of management decisions on the system.

By thinking through an outcomes-based approach in this way we ended up with a planned multi-stage approach to both case study settings. We used a range of exercises with participants to both surface, and reap the benefits of contributing their own unique perspectives and ideas along the way. Often too the exercises were staged in sequences with earlier ones providing the range of views in the room, and later ones helping the group to synthesise and prioritise.

We would recommend this approach to other groups, but recognise that it needs more planning than is often undertaken. It requires the use of a multi-disciplinary team with a mix of technical, management/policy and facilitation and engagement skills. This also highlights the importance of the facilitation team in collectively understanding and designing approaches that simultaneously take account of both "process" and "content".

Facilitation principles are more important than facilitation style and exercises

As the above discussion highlights, although our two case studies could be seen to have started from very different social and management starting places, both were informed by similar underlying process elements. Although the overall processes were similar, each case study took a slightly different approach to the way in which ideas were generated and synthesised, and the way in which the groups were facilitated on the day.

In reflecting on our debrief session documentation, it did seem to us that facilitation styles will always be different, reflecting both the different experiences and styles of the facilitation teams and their attempts to provide an experience tailored to the needs of the specific group they work with.

What comes through strongly in participant feedback and our debrief notes however, is the central importance of a facilitated process that emphasises integrity, respect and a desire to help bring the range of voices out within a fair and useful decision making structure.

5.2 Performance against research objectives

The research objectives for the case study phase of the programme were to pilot a collaborative water resource management process, and to test the utility of the WaterWheel diagram as part of this process. Taking into account the constraints for our research programme, these objectives were refined to be:

1. To pilot a collaborative water resource management process in which participants develop a common understanding of their catchment, the interconnections between their values, and the trade-offs between these values that might occur under different land and water management scenarios.
2. To test the utility of the WaterWheel diagram as part of this process.

This report and associated appendices document the 'process' and 'content' elements that we employed in our case studies. We found that the collaborative, facilitated approach enhanced the sharing of knowledge and the development of a broader understanding of the catchment of the participants. Using processes and facilitation techniques that fostered safety and trust allowed the group to draw upon their collective knowledge, as well as information from other sources. Most participants in both case studies considered that they had developed a greater understanding of their catchment, and many specifically mentioned the particular importance of gaining knowledge from their fellow participants.

At the end of the case studies, participants also demonstrated an increased understanding of a broader picture (beyond the river itself and encompassing the whole catchment) and the complex interconnections between the different values that they hold. The use of multiple scenarios with outcomes demonstrated across multiple WaterWheel diagrams were generally observed by participants as being key to the development of this new understanding, along with the support of systems diagrams. In general, we received feedback that the WaterWheel diagrams made information more accessible and easier to understand, and that the process used to develop them had felt inclusive such that the participants generally felt some level of ownership of the resultant WaterWheel diagrams.

Based on these observations we conclude that the Wheel of Water collaborative process, accompanied by the use of WaterWheel diagrams show significant potential as a process and tool combination that can contribute to the delivery of effective collaborative water resource management.

5.3 Summary of insights and key design elements

Based on the experiences and insights documented within this report, we have compiled below a list of key design elements that we consider will be useful in the design of similar collaborative water management processes.

Designing and managing a collaborative process

- ***Establishing a multi-disciplinary project team:*** *A multi-disciplinary project team comprising relevant technical, policy, facilitation and engagement skills, involved throughout will bring rigour to the process.*
- ***Outcomes driven:*** *Be driven by outcomes, but remain flexible on the processes that could be used to achieve these. Regularly revisit progress toward the planned outcomes with participants, and assess where the group is in the journey towards these outcomes.*
- ***Recruitment:*** *Criteria should consider geographical spread within the catchment; the primary land and water uses and interests, including agencies and Iwi; a balance of gender, age and worldviews; ability to listen and express views; and capacity to commit to the process. Particular attention needs to be paid to involve Iwi – both as Treaty partners and as local community members.*
- ***Roles and goals:*** *Clarify roles and goals at the start of the collaboration process with both the participants and the project team*
- ***Ground rules:*** *It is useful to enable participants to create their own ground rules to support creation of a safe and trusting environment.*
- ***Learning styles:*** *Recognise that people learn in different ways and use a variety of methods for sharing knowledge to accommodate this. A mix of breakout groups, plenary and presentation maintains engagement, and helps facilitate dialogue from all in the group.*
- ***Good facilitation:*** *Facilitation is needed to enable open conversations, and make the process enjoyable and engaging. The aim is to ensure the collaborative process is inclusive, supports sharing and understanding of others' knowledge, develops trust and manages power.*
- ***Working in a multidisciplinary team.*** *Project team members need to be open-minded, patient and respectful of the differing opinions that will arise when working in a multi-disciplinary team. Working with a multi-disciplinary team is likely to take 40% longer than might otherwise be expected.*
- ***Reflection and evaluation:*** *Incorporating participatory evaluation and reflection into the process design allows for the project team to improve and better meet the needs of all participants, as well as achieving desired outcomes from the collaboration.*

Knowledge sharing and developing a common understanding

- ***The importance of different knowledge systems:*** *There are multiple benefits of accessing and using the knowledge held within the collaborative group to help develop a rich picture of the catchment and its community. Care should be taken to provide a level playing field which encourages the use of knowledge from local, traditional and scientific sources.*
- ***Involve scientists/experts as participants:*** *Engaging scientists as participants ensures that they are more aware of the context for their knowledge. This helps build trust in their work, and makes it more likely that their contributions are tailored to the local context.*
- ***Take care to present in different ways:*** *Use a range of methods to present information. For example using low technology methods, not just PowerPoint, to present technical information can also make it more accessible to many people.*
- ***Discuss what makes evidence credible:*** *There is a need to recognise that concepts of credibility change in a multi-stakeholder situation. More attention has to be paid to acknowledging the legitimacy of different kinds of evidence.*
- ***Take care to provide context:*** *Ensure that the context for any lesson or piece of information is clear; technical information should be introduced to the group in a setting that makes it relevant for them.*
- ***Use simple models to start with:*** *High level models can provide a useful first examination of scenario outcomes.*
- ***Involve stakeholders in problem design and model development:*** *Predetermining the technical or policy issues and options may disempower a collaborative group. Instead, modelling should be responsive to the scenarios and questions of the participants.*

From Values to WaterWheel Indicators

- ***Define values clearly****: Defining what is meant by a 'value' and defining each value unambiguously enables faster agreement on the values which are most important for future management.*
- ***Prioritising values****: The process of prioritising stakeholders' values catalyses useful debate, but the lack of further consideration for lower priority values may cause concern among participants. It is important to use an iterative process and check that participants still feel that all important values have been taken into consideration in the process.*
- ***Uses of scenarios****: Scenario development provides a grounded context for participants to evaluate impacts on their values of plausible future changes in their catchment. If the group is involved in helping to develop the scenarios, then it is more likely that those scenarios will incorporate their local knowledge and values. It will also help to develop catchment management objectives.*
- ***Exploring trends and drivers:*** *Before developing scenarios, it can be useful to get participants to think about past trends and drivers. This helps draw out local knowledge and focus thinking about what might trigger future changes in the community, the economy, in or beyond the catchment and which of those changes is amenable to management.*

- ***Types of scenarios**: The facilitation team need to consciously define and clarify with the group what types of scenarios will be useful to help with the task at hand. To stay focused try to include just enough detail to provide the direction, model the system appropriately, and to communicate the anticipated conditions and needs of the catchment and community.*
- ***Indicators should represent the important values most susceptible to change**: The process of identifying important catchment values and then plausible long-term scenarios for change in the catchment assists groups to narrow their choice of suitable indicators to represent those values most vulnerable to change. Those values will be the ones which need to be addressed through policy or management actions.*
- ***Indicator complexity**: Because indicators should meet certain criteria, and there are a large number of indicators possible, the collaborative process will need to provide a considerable amount of guidance and assistance with indicator selection. Without this guidance participants can easily struggle to settle on an appropriate package of indicators.*
- ***Tools exist to quantify complex indicators**: Many values (e.g. "connected community") mean different things to different people. Rubrics are a tool that offer a collective process for measuring indicators of otherwise seemingly qualitative values*

WaterWheel diagrams

- ***Simple visualisation tool**: WaterWheel diagrams help to present complex information in a visually simple and accessible way, but are not the only visualisation tool for planning and monitoring catchment management*
- ***Exploring cause and effect**: By comparing WaterWheel diagrams between scenarios, communities can explore cause-effect relationships and trade-offs between different community values.*
- ***WaterWheel diagrams require a systems process:** The process of developing the WaterWheel diagrams necessarily requires discussions about values, indicators, outcomes and limits of acceptability. Our experiences suggest that these discussions are fundamental to all collaborative water resource management.*

5.4 Closing Comments

The recent LAWF initiatives and emerging catchment initiatives in New Zealand have issued a strong call for catchment communities to work together in a more co-ordinated and collaborative way. Successful catchment management is inherently a collective endeavour. Policy makers and agencies cannot address the country's freshwater challenges without significant goodwill and collective action from stakeholder communities.

Importantly, while collaboration itself is not a new concept, this emerging use of collaborative initiatives to support the country's freshwater management does bring its own particular challenges. There will always be tensions as the boundaries between land and water use and the wider environment continue to be debated by society as they change. However, with the help of appropriate mixes of policies, science and well-crafted collaborative initiatives it is most likely that

future initiatives will aim to meet the values and needs of those involved, and develop constructive responses that help achieve our collective aims. In this context this report has sought to introduce concepts that articulate and frame some of the social directions, collaborative processes and content/technical inputs required for more coordinated, enduring and collective action to manage freshwater values.

We see this as a multi-decade journey. Much as we worked with participants to better understand the journey of a raindrop starting in the headwaters and as it flows down the catchment, so too we must look at these collaborations as learning exercises, that we can learn from and share ideas along the way.

5.5 Acknowledgements

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Research such as that described here is not possible without the support of the wider community and we would like to record our appreciation for the insightful comments provided by the case study participants. We would also like to thank the reviewers of this report who have all helped frame the insights in creative and perceptive ways. Thanks also to others who helped in the research, including UCLA intern Shelby Petro who assisted in the early stages of the Wairau Valley case study; Tracy Payne from AgResearch for assisting with the compilation of participant interviews; and Simon Harris, Ned Norton and Amanda Thomas for contributing to our post case study workshop.

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APPENDIX 1 WAIRAU VALLEY CASE STUDY SUMMARY

A.1.1 Wairau Valley case study participants

Collaborative Group: *Alison Parr (lifestyle landowner), *Angela Woolf (Wairau Valley resident), *Harry Fowler (sheep and beef farmer), *Lloyd Mapp (North Bank sheep and beef farmer), Andy Karalus (Nelson Forests Ltd), Peter Jerram (chair MDC Environment Committee), *Spencer White (North Bank dairy farmer), Dave Hayes (DOC partnerships manager), *Liz Sherp (long time valley resident), Carey Cudby (angler and recreational advocate), Alan Johnson (MDC Environment Manager), Val Wadsworth (MDC hydrologist and valley resident), Ron Sutherland (RMA consultant)

* Currently resident within Wairau Valley case study area

Iwi liaison in lieu of their participation: Paia Riwaka-Herbert (Ngāti Apa ki ti Ra To Trust), Tracy Williams (Ngati Toa), Richard Bradley & Jim Ward (Rangitane)

Research Team: Andrew Fenemor (Case Study Leader – Landcare Research), Will Allen (Facilitator – Will Allen and Associates), Caroline Fraser (science support and modelling - Aqualinc), Maggie Atkinson (Facilitator – Landcare Research)

A.1.2 Wairau Valley Case Study Phases

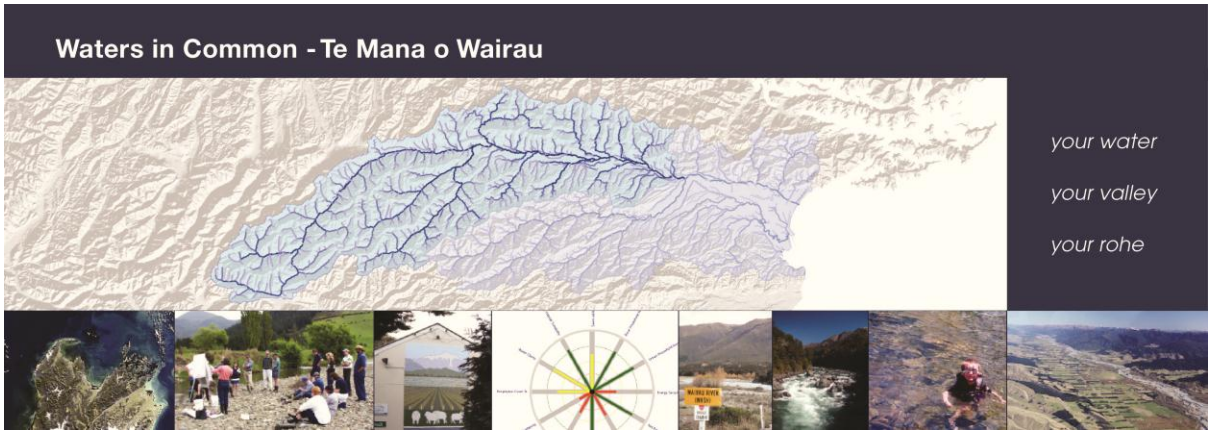
A.1.2.1 Case study & process design

Initial options for a case study catchment in Marlborough were canvassed with MDC staff. These were Rai/Pelorus, Wairau Valley or Flaxbourne catchments. Wairau Valley was chosen because MDC has done little water management consultation in this catchment, apart from the contentious resource consent hearings for the proposed Trustpower hydro scheme. We discussed and agreed design objectives with MDC environmental investigations manager Alan Johnson and his staff. Long and short versions of the overall research methodology were developed and compiled. A guiding social research ethics process was also developed.

A.1.2.2 Recruitment

The Wairau Valley process was initiated in an area that did not have any collective catchment, community or landcare group. The council provided some initial contacts and expressed their own interest in the exercise as a way to develop a wider discussion in the area around catchment management – both for the benefit of community participants and for their own understanding of residents' aims and needs. We also carried out a stakeholder analysis and developed an ethics protocol to provide further guidance. A snowball technique was then used to phone a range of people in the catchment about who they thought would be best placed to participate as a group of 12-16 people.

Criteria for selection included experience of the major land and water uses in Wairau Valley, geographic spread including the north and south bank of the Wairau River, participation from agencies responsible for land and water management, and knowledge of the social and cultural fabric of the valley. Participants also needed to be able to articulate ideas, and be willing to listen to others.



Waters in Common - Te Mana o Wairau

is a research project in the Wairau valley catchment exploring how people and communities can be more directly engaged in making decisions about the future of their rivers, streams and underground waters and of the lands which influence those waters. Bringing the many relationships together that we have with our water resources is central to this project.

Water flow and water quality are the sum of what has happened upstream. This research will combine perspectives to better understand these complex matters, especially towards establishing agreed goals and limits for water quality and use.

The results of this research in the upper Wairau Valley catchment, and participants' contributions will help build national and regional expertise for collaboratively managing Aotearoa New Zealand's water resources sustainably for the future. We are grateful to all who assist in this.

The 'Wheel of Water' research programme is government funded and a partnership between Aqualinc, Landcare Research, AgResearch, Lincoln University and Tipa Associates.

Individual interview .....
Group meeting 1 .....
Group meeting 2 .....
Group meeting 3 .....
Group meeting 4 .....
Individual interview .....

Contact

Maggie Atkinson Community & landscape Researcher, Landcare Research, Nelson 03 545 7712
Andrew Fenemor, Catchment management researcher Landcare Research, Nelson 03 545 7710
Will Allen, Collaborative researcher, Learning for sustainability, Christchurch 03 980 4216

Potential participants were contacted by phone and sent the 'rack card' above as a prompt about the project, and a 2-page description of the project. The following summarises how we described the purpose of the project to potential participants:

> *This project aims to help communities to find out what different people value about the Wairau Valley catchment, to identify some futures that you see for the catchment, and to explore how those futures affect the things you value about the catchment… Your involvement in this project will help to contribute to guidelines and a tool that can be used by other communities and regional policy makers.*

We also met with Iwi at Rangitane House on 29 July to describe the project and encourage their participation.

A.1.2.3 Initial Interviews

Once confirmed as a participant, an initial interview of about 1 hour each was carried out by phone, to help frame the design of the workshops. The interviews covered these questions:

1. What's important and special about the Wairau Valley to you?
2. What's your view of the current health of the catchment? (prompts include – environmentally, economically, socially)
3. How would you characterise relationships in this catchment?
4. What do you see as the greatest opportunity in this catchment?
5. What do you see as the biggest risk(s) to the catchment?

6. What do you want for the catchment in 20 years' time, and what are the implications of that?
7. What should we be monitoring (keeping an eye on) to be aware of potential risks?
8. Is there anything that you personally could do to help achieve this?
9. As we begin, how are you feeling about (OR what would you most like to see come out of) the Waters in Common – Te Mana o Wairau project?
10. At this stage is there anything else you would like to contribute, comment on, or ask?

A.1.2.4 Workshop 1 – reveal values through stories

22 August 2013

Original Purpose – by the end of Workshop 1, participants have shared something of importance to them about the Wairau Valley, and have a sense of other participants' values. Work has begun on envisioning scenarios of the future. (Evening workshop)

Activities

#1 Plenary: Project and purpose of the 4 workshops explained
Participants locate themselves on a large map of the valley

#2 Plenary: Participant stories about the catchment
Breakout groups identify what values and Risks/Opportunities were revealed by each story
Recap on values and risks on butcher's paper

#3 Breakout groups prioritise catchment values using cards listing values from initial interviews, and stickers
Breakout groups create some extreme scenarios for the future in this catchment

#4 Plenary: Recap where this is taking us next, including some homework for next workshop
Feedback about this workshop

Outcomes

- Participants identified missing stakeholders include Iwi, viticulture, other significant landowners
- Protocols for good collaborative practice (1st of four C's around group dynamics) were developed by the group
- Values held by participants for Wairau Valley were identified from stories brought to the workshop by each participant (values being uses, or things that have meaning)
- 53 values derived from the initial interviews had been aggregated by the researchers into 17, and some missing ones were added by the group
- Each of 3 breakout groups identified and ranked in importance the 17 aggregated values using stickers and cards
- The idea of futures scenarios for Wairau Valley was discussed by the group

For Workshop 2, as the group had had some difficulty with ranking such highly aggregated values, we pre-circulated the full list of 58 values statements (e.g. I value a self-sufficient community here) and asked participants to identify their top 10. They were also asked to think about realistic scenarios for Wairau Valley possible over the next 20 years.

A.1.2.5 Workshop 2 – understand and identify indicators for important values

19 Sept 2013

Original Purpose – by the end of Workshop 2, the group has agreed three scenarios (collective stories or rich pictures; packages of outcomes) for the future of the Wairau Valley which incorporate the important values identified in Workshop 1. They have started to identify opportunities and threats to different sets of values, and have gained an understanding of how these might affect the catchment. A beginning has been made on identifying key indicators.

Activities

#1 Plenary: Recap and purpose of this workshop, including 2 new introductions
Posting place for unresolved questions

#2 Breakout groups draw on A1 sheets some past trends in Wairau Valley
Plenary summary of each groups trends

#3 Plenary discussion on scenarios and their uses
Breakout groups identify 2 plausible scenarios for the future of Wairau Valley catchment
Plenary report back for group to select 2 overall preferred scenarios to explore

#4 Speed dating: pairs of participants explain their top 3 values to each other
Sticky wall: cluster and prioritise (using sticky dots) statements of catchment values to reach a group consensus, based on number of dots on each value

#5 Short presentation in what an indicator is, using a health analogy, using A2 images (not PPT)
Breakout discussion of indicators suitable for 3 wellbeings
Plenary report back and farewell

Outcomes

- Discussion about constructive conversation and the desirability of moving from a position of "I" to "we" (2nd of four C's around group dynamics)
- 3 breakout groups developed trend graphs for Wairau Valley covering changes in population, river recreation, numbers of community groups, land uses, landscape character and economics
- Breakout groups used this thinking to develop 2 scenarios each for the valley. These turned out to be remarkably similar for each group: (1) full irrigation (2) urbanization or deregulated subdivision
- As a sticky sheet exercise, the 58 values statements were prioritised by each participant using coloured stickers, then those values were clustered by the group, and clustered scores were summed. Top 3 clustered values from the group were (a) Objective science knowledge used to make good decisions (b) Productive land & water uses (c) Healthy biodiversity habitats & ecosystems
- A discussion followed on what an indicator is. Then 3 breakout groups brainstormed some indicators that they thought would be relevant for socio-cultural, economic and environmental values of the Wairau Valley catchment

For Workshop 3, the researchers compiled and pre-circulated a more detailed description of the two scenarios, now labelled Full Irrigation and Population Swells. 16 potential indicators relevant to the prioritised values were also suggested for discussion.

A.1.2.6 Workshop 3 – modelling trade-offs among our values, with the WaterWheel

31 Oct 2013

Original Purpose – by the end of Workshop 3, assisted by exploratory modelling of the catchment 'system', the group has developed a short list of key attributes and their indicators as a means to measure the achievement of critical values. They have some understanding of the interactions between those values. Discussion about key indicators will span environmental, economic/productivity, social/organizational and cultural dimensions.

Activities

#1 Plenary: Recap and purpose of this workshop, including introduction to system thinking

#2 Plenary discussion of detailed assumptions behind the chosen Full Irrigation scenario
Breakout groups discuss and record what they think the outcomes of that scenario would be
Plenary summary of each groups thoughts on this

#3 Plenary presentation of 12 indicators presented on wall using cardboard spokes and explaining each as they were attached to wall, for present and Full Irrigation scenario
Breakout groups discuss and report back their thinking on the indicators, including suggesting alternatives and discussing thresholds for some

#4 Breakout discussions continue, given complexity of the task and wide-ranging views
Plenary recap on which indicators could be left out and others needed, including agreement that participants will be telephoned about 2 community indicators, before the last workshop

Outcomes

- Recapped progress in thinking about how to measure changes in the values of our catchment, using indicators and conceptual models of how the system works
- Discussion about 'camping out' (Kahane, 2004) as a metaphor for thinking about complexity including flexible and creative listening, opening to others, and inclusive decision making (3rd of four C's around group dynamics)
- 2 breakout groups discussed what they thought would be possible environmental, economic and socio-cultural outcomes if the Full Irrigation scenario occurred
- Then 12 draft indicators on a WaterWheel were introduced and their relevance for the Full Irrigation scenario was discussed, keeping in mind the prioritised catchment values developed earlier. Missing indicators and where/when to measure an indicator were some concerns raised.
- Draft waterwheels for the current (baseline) state of Wairau Valley and for the Full Irrigation scenario were discussed.

A.1.2.7 Indicator Telephone Interview to develop Rubrics

Prior to Workshop 4, each participant was interviewed by phone to provide their views on how to develop indicators for assessing: (1) How connected a community is; and (2) How well knowledge is

used in environmental decision-making. Participants were asked the following sets of questions to develop appropriate criteria for each value element:

1. What are the characteristics or attributes of a connected community for you?
2. What would you see in a well-connected community?
3. Conversely, what would you see in the opposite of connected community?
4. How would you score the current situation (1 .... being exemplary practice, 4 ... being very poor practice, 3 being just satisfactory and 2 being reasonably good)
   and
5. What are the characteristics or qualities of the knowledge needed for making good environmental decisions – what would give you confidence that the 'right' knowledge is there for decision making?
6. What would you see in a catchment community where decision making is based on sound knowledge?
7. What would you see in a catchment community where knowledge wasn't used?
8. How would you currently score (for the Wairau Valley) an indicator labelled 'Adequate knowledge leading to trusted decisions' and why? (1 .... being exemplary practice, 4 ... being very poor practice, etc)

From the collective responses two rubrics were developed for those two indicators (Appendix 4).

A second meeting to brief Iwi on progress was held at Rangitane House on 22 November.

A.1.2.8 Workshop 4 – understanding limits and thresholds for Wairau Valley

26 Nov 2013

Original Purpose – by the end of Workshop 4 participants have evaluated the usefulness of the WaterWheel, based on a collective big picture of the future of the catchment comprising the group's critical values, attributes and measurable indicators. Participants clearly recognise the nature of trade-offs among different values.

A recap on thresholds or targets for the set of WoW indicators, then an evaluation session to fill gaps, discuss how this approach has or hasn't worked for all, and how a Phase 2 could move to agreeing limits or standards for water allocation and water quality protection in the Wairau Valley.

Activities

#1 Plenary: Recap and purpose of this workshop

#2 Plenary summary of suggested changes to the WaterWheel indicators based on workshop3 discussions, and discussion of rubrics developed from the phone discussions with individuals
Breakout discussion to score indicators using the rubrics
Plenary report back on the scoring exercise
Cutting the cake for a participant's birthday

#3 Plenary discussion on other replacement indicators, standing around the wall
Plenary presentation of WaterWheels for Baseline and Full Irrigation scenarios
Breakout groups discuss adequacy of the WaterWheels, and how they could be used
Plenary feedback from groups

#4 Bus stop session: participants in groups jot sticky notes to record their views about 7 components of the whole workshops process
Plenary discussion on the workshop series, possible next steps, and farewell

Outcomes

- Recapped progress on 7 components of the workshop series, which were later commented upon by the group: (1) Interviews & Homework (2) Understanding our Values (3) Developing Scenarios (4) Working with indicators to measure state and change (5) The WaterWheel as a visualisation tool (6) Working together (7) Facilitation & Science Support.
- Discussion about the catchment Cake only being so big, therefore there are limits (4th of four C's around group dynamics)
- Three replacement indicators were discussed: the two rubrics developed in the phone interviews, plus a Terrestrial Mitigation indicator. A way of quantifying the River Recreation indicator was also discussed.
- The finalised WaterWheel was critiqued by the group, including discussion of interpreting the indicators, how and where a WaterWheel could be used and how it could be further improved.
- Wrap-up evaluation discussion included a commitment to report back what we've learnt and what could be done in a Phase 2 workshop series.

A.1.2.9 Final Interview Form

A final interview of about 1 hour each was carried out by phone, to help evaluate the process. This was undertaken in February 2014 and the interviews covered these questions:

Question 1 When you reviewed the answers you gave for our initial interview, what, if any of your answers would be significantly different now you have been through the whole process?

- Which questions
- What answers would you give now
- And why?

Question 2 What new perspectives did you gain from your involvement in the Wairau water wheel process?

Question 3 What was it about the process that enabled this new perspective?

Question 4 What else for you was valuable about the process, and why?

Question 5 What don't you like about the process?

Question 6 What other situations could this collaborative process be used?

Question 7 Currently in NZ there's a lot of interest in setting limits for waterways through collaborative processes. Limits include restrictions on water takes and rules to

safeguard water quality. Another way of looking at limits is that we need to find collective solutions when resources are limited.

We didn't get that far here, but from your experience with the collaborative process, to what extent could you see it adding value to a community looking to set limits in a catchment?

Why?

Question 8 Has your experience in this research project encouraged you to want to be involved in this sort of collaborative process in future (Yes/No?)

Why?

APPENDIX 2 MANGATERERE CASE STUDY SUMMARY

A.2.1 Mangatarere Catchment Case Study Participants

Collaborative Group: *Aiden Bichan (dairy farmer), *Dave Fairbrother (dairy farmer), *Marty Sebire (Carterton District Council, lifestyler), *Melvin Pike (Carterton District Council, knowledge of local waterways), Geoff Copps (Grow Wellington, water use), *Jill Greathead (Carterton District Councillor), Liz McGruddy (Federated Farmers), *Sandy Shivas (Sheep, beef and pig farmer), *Rawiri Smith (Ngati Kahungunu), *Don Bell (local expert on tree management), Geoff Doring (Forest & Bird), *John Cullinane (local expert on fishing), *Seymour Harris (Carterton community representative), *Tina Faulkner (Carterton community representative, lifestyler).

* Currently resident within Mangatarere catchment case study area

Research Team: Esther Dijkstra (MRS and SFF Coordinator), Michelle Rush (facilitator – Partcipatory Techniques), Helen Ritchie (facilitator - Partcipatory Techniques), Elaine Asquith (GWRC science coordinator), Richard Parkes (GWRC Land Management Officer), Caroline Fraser (science & catchment modelling - Aqualinc), James Turner (Case Study Leader - AgResearch)

Across this team disciplinary knowledge and skills included resource economics, social science, hydrology/engineering, land management, freshwater science, and participatory methods.

A.2.2 Mangatarere Catchment Case Study Phases

A.2.2.1 Case study & process design

Case Study selection began with a meeting with Greater Wellington Regional Council science, planning and land management staff. This included firstly identifying the existing community processes underway in the region; development of the Whaitua process, regional planning consultation, and the Mangatarere Restoration Society (MRS) Sustainable Farming Fund (SFF) project. Secondly, the needs of the Greater Wellington Regional Council were identified; to gain insights from the Wheel of Water process for design of the Whaitua process. Thirdly, possible case studies were identified, with the Mangatarere catchment seen as most likely due to the outcomes the Wheel of Water process was seeking aligning with the goals of the MRS.

A second meeting with Greater Wellington Regional Council and the SFF Project Leader then presented an initial outline of the collaborative process to be tested in the case study. The purpose of this was to check the process would deliver to the SFF project and MRS needs.

A third meeting was held with the MRS and the case study team. The purpose of this was to put the case study in the context of other Greater Wellington Regional Council activities, such as the Whaitua, and to present and outline of the collaborative process. Prior to this meeting the SFF Project Leader had initially checked the MRS member interest in participating in the case study.

A fourth meeting with Greater Wellington Regional Council was then held to confirm the role of the GWRC in the case study. This included confirming a member of the science team to be part of the case study team. It was also important to ensure that information produced by the process participants as part of the case study would not be used in any statutory processes.

A.2.2.2 Recruitment

The Mangatarere recruitment was from subscribers to the Mangatarere Restoration Society (MRS) email list (which is over 200 individuals). The MRS is a volunteer stream care group consisting of landowners, industry, community, local government and Iwi. The group is working to improve the health of the Mangatarere Stream. The MRS has received a Sustainable Farming Fund grant for 2013/14 to develop a whole-catchment action plan that considers both environment and productivity impacts of water management in the Mangatarere sub-catchment of the Ruamahanga Catchment. The SFF project will achieve this by facilitating a collaborative and community owned approach to improving water quality in the Mangatarere Catchment.

From the list of MRS subscribers, 15 individuals were chosen from different interests in the catchment. This included individuals who live within the catchment, or had some particular connection (often a professional or recreational connection) to the catchment. They were initially contacted by email. The group included the committee members of the MRS (in total 4), and then other participants were regardless of their degree of involvement in the MRS in the past. Participants were provided with a Terms of Reference detailing the purpose of the case study and the SFF project, their role in the process and a timeline of workshop dates.The following summarises how we described the purpose of the project to potential participants:

> *The Mangatarere 'Wheel of Water' forum will bring together people with diverse backgrounds who all have one thing in common – a strong connection to the Mangatarere catchment. This group will come together for a series of workshops to find out what different people value about the Mangatarere catchment, and to explore some possible futures for the catchment. The Wheel of Water team will introduce a graphic tool that is under development, to show how various actions would impact on what people value in the catchment. The Mangatarere Restoration Society will draw on this information, and the views expressed by those in the forum group, to create a community Action Plan for the catchment.*

A.2.2.3 Initial Interviews

30 June – 15 July 2013

Two weeks before the first workshop all of the case study participants were interviewed for about 1 hour face-to-face by one of the case study team facilitators. The purpose of the interviews were to (i) identify initial views of what the Mangatarere catchment means to them, (ii) potentially desired futures, and (iii) expectations for the collaborative process. The information from the interviews was used as a benchmark for evaluating changes arising from participation in the process and to inform the design of the workshops. The interviews covered these questions:

- What's your view of the current health of the catchment?
- What do you see as the biggest risk(s) to the catchment?
- What should we be monitoring to be aware of potential risks – and are we currently monitoring the right things?
- How would you characterise relationships in this catchment?
- What do you want for the catchment in 10 years' time?

- Assuming we achieve this, what would be any downsides?
- Is there anything that you think you need to change?
- How are you feeling about the process?
- Is there anything else you would like to ask, or comment on, at this stage?

A.2.2.4 Workshop 1 – Pooling knowledge

8 August 2013

Original Purpose – By the end of Workshop 1, participants will have pooled their knowledge of the catchment and developed an appreciation of what they each value in the Mangatarere catchment

Activities

#1 Prior to the workshop participants were circulated a fact sheet and brief agenda. The content of the fact sheet was informed by participant questions from the initial interviews and covered the physical environment, ecology, state of the river and how human activities affect the catchment

#2 Introduction of project and case study as well as context of the case study within GWRC processes (i.e. Regional Planning, Whaitua) and purpose of meeting

#3 Developing ground rules for how workshop participants will work together

#4 Small group work: brainstorm what you know about this project and any questions you have

#5 Animated PowerPoint of the story of some rain drops in the catchment to introduce the interaction of land use and water in affecting water quality and quantity

#6 What do we know about the catchment? Rapid appraisal activity including 3 bus stops: History of catchment, natural resources, life in the catchment. Participants used sticky notes on maps to share their knowledge

#7 Condition of the catchment. Synopsis by GWRC freshwater scientist using printed pictures/graphs

#8 What we value about the catchment. Draw pictures of things we value. Share in small groups. Combine these to form a single list for the whole group. Get people to put sticky dots next to the 5 values they see as most important

#9 Feedback from participants using an "H" form

Outcomes

- Ground rules for working collaboratively as a group were developed by the group, e.g. "*Treat each other with respect – let people finish [and] debate ideas, not people*" and "*Real value of process is having it go further*"
- In sharing their own experiences of the catchment, there was a sense from the project team that participants shared what they knew, rather than what they'd seen happen. For example, the participants did not add anything when asked to share "what was something new?"
- Values held by participants for Mangatarere catchment were identified from discussion and sharing pictures of what participants value about the catchment (values being uses, or things that have meaning)
- A prioritised list of 18 values identified by participants, e.g. "*diversity – ecology, community, uses, and their interaction*"

- Participant feedback on what they did, did not like and ideas for next time, e.g. "*Very well facilitated and good group interaction*", "*some aspects a bit rushed*" and "*circulate material beforehand (time to think first)*"

Participant Homework Prior to Next Workshop

Prior to the next workshop participants were asked to talk with others in the catchment about something they identified as important from the workshop.

A.2.2.5 Workshop 2 – key values and indicators

3 September 2013

Original Purpose – By the end of Workshop 2, participants will have chosen some key values and selected 7-10 indicators that can measure these. Additional purposes of the workshop were to

- Explain the WaterWheel diagram and relationship of values (what's important to us) to indicators (how we can measure it over time)
- Identify values that would be at risk/ would be affected by water management (actions the MRS might take/put in their action plan)
- Sharing information about indicators (science measures and community indicators)
- Choosing indicators for the key values and setting thresholds

Activities

#1 Introduction: reiterate project purpose and the purpose of workshop 2

#2 Group culture exercise (plenary): How can we all be Tangata Whenua? This arose from a question a participant added to the H-form as part of the reflection at the end of Workshop 1

#3 Report back on community conversations about values people hold and trends in the catchment. Speed dating exercise

#4 PowerPoint presentation introducing the WaterWheel diagram, and link between indicators and values

#5 Understanding our indicators of catchment health. Each participant had 1 minute to show a symbol of catchment health that they had brought from home, e.g. photo of fenced off riparian margins on dairy land, credit card (money flowing through the economy), fishing fly and insects found in stream and photo of several generations (families working on the land in a continuous cycle). These were linked back to values list developed from workshop 1.

#6 Prioritising values based on how important they are and how likely they are to change based on changes in land or water use within the catchment. Using a prioritisation matrix (sticky wall), working in small groups followed by plenary to agree on shortlist

#7 Developing indicators. Small group work to identify appropriate indicators for the prioritised values. Each group supported by a project team member. Worked in plenary to agree on final list of indicators. Reconvened in small groups to select thresholds.

#8 Reflect on how we are pooling information and questions – plenary. Present where we are going next. Reflect on today's workshop.

Outcomes

- Six values were chosen as priority values derived from the Mangatarere catchment and for which indicators were to be identified, e.g. "*Nurturing and social value for humans, walking,*

listening to birds, seeing fish – sensory" and "*Business/commerce/economic as an enabler of achieving whatever we want to achieve – people can live here – social infrastructure*"

- 1-2 indicators of each value and where possible thresholds for the indicator being Poor, Fair, Good and Excellent were developed by participants. An example was GDP growth (5%/yr) in the catchment relative to Wairarapa regional average as an indicator of Business/Commerce/Economics. The research team then reviewed these next day and prepared documentation of the workshop indicators and research team suggestions for possible revision of indicators and/ or thresholds, which were shared with participants in the workshop notes
- Participant feedback on highs (e.g. "*easier than last time*"), challenging moments (e.g. "*the values and a sense they were all joined together, which made it hard to separate them out*"), how the group is going (e.g. "*can work together*") and suggestions for future workshops (e.g. "*don't change anything*" and "*Homework to be armed for the next workshop. Provide information – sooner the better*.")

Participant Homework Prior to Next Workshop

Prior to Workshop 3 participants were asked to confirm a revised or alternative indicator and its thresholds; and / or provide or help to gather data from others in relation to an indicator and send to Research Team. This information was needed so that a WaterWheel representing the current situation could be shown at Workshop 3. To this end an online survey was sent to participants for them to provide thresholds for periphyton levels (Appendix 5) and a questionnaire for evaluating diversity in the catchment (Appendix 6) were provided to participants.

A.2.2.6 Workshop 3 – alternative futures

10 October 2013

Original Purpose – By the end of Workshop 3, participants will have developed 3 alternative futures for the catchment to model using the WaterWheel and compare with the current situation in the catchment. Additional purposes of the workshop were to:

- Look at the WaterWheel diagram developed for the current situation and share its story
- Consider trends affecting our catchment (land and water use)
- Generate ideas about alternative futures we could model
- Choose the 2 alternative futures we want to model using the WaterWheel diagram

Activities:

#1 Introduction: reiterate project purpose and today's workshop purpose

#2 Group culture exercise: reflecting on Tangata Whenua exercise from workshop 2

#3 Pooling our knowledge of trends affecting our catchment: Wave analysis, where trends are grouped into past, current, near future and distant future and placed accordingly on a picture of a wave, to provide an interactive and short way to identify and think about incoming and outgoing trends, paradigms and practices. In pairs identifying uses, activities, impacts, influences that are dying out, mainstream, emerging, future. Stick to big wave on the wall.

#4 PowerPoint presentation reporting back on current day WaterWheel diagram. Participants to reflect on current situation.

#5 Plenary session to identify criteria for selecting futures for the WaterWheel diagram. Discussion towards selecting some futures – small facilitated groups, then reporting back to the whole group. Agree on 2 alternative futures to model.

#6 Reflect on how we are pooling information and questions – plenary. Present where we are going next. Reflect on today's workshop

Outcomes

- Reflection on the WaterWheel diagram constructed for the current situation, e.g. "*reconsider whether to take a range of locations into account*" and "*EBIT economic indicator – is it sensitive enough to catchment changes?*" This included discussion of other indicators for values and values (such as social connection within the catchment) that were missing from the WaterWheel
- Participants identified key trends affecting the Mangatarere catchment (e.g. "*more collaboration – people are working together well to fix up the Mangatarere Stream*") and key pressures and drivers of these trends (e.g. "*population churn increasing (people staying shorter times – less settled/stable) – relates to lifestyle blocks and as farms get bigger (employees move on)*")
- Two futures were selected to model on the WaterWheel diagram, which were subsequently written up into more specific "futures statements" and circulated to participants to guide them in their homework. A brief description of the futures were
    - Everybody lifts their game - In this future, the whole community has greater access to the river, and is more engaged in caring for the catchment. Everyone has committed to lifting their game
    - Water reservoir is constructed and provides more water for a range of uses - In this future, the existing proposal for a dam in the catchment has been approved and constructed. The reservoir has created new and different recreational opportunities for swimming and boating, more water is available for rural and urban use and the flow regime in the main stem is no longer natural, but managed by releases from the dam
- The research team were asked to investigate and report back to participants on community health indicators, an alternative cultural indicator, sustainable farming indicators and indicators that could measure community engagement and connection
- Participant feedback on workshop in terms of high points, low points, how they are going as a group and suggestions for next time.

Participant Homework Prior to Next Workshop

Prior to workshop 4 participants were asked to survey community members they know on what they think of the two alternative futures and whether they feel positively, negatively or neutral about each future. The participants' survey findings were shared on an H-form at the start of Workshop 4

A.2.2.7 Midpoint Interviews

October 2013

Following Workshop 3 all of the case study participants were interviewed for about 1 hour either face-to-face or by phone (based on the participants' preference) by one of the case study team

facilitators. The purpose of the interviews were to (i) understand how participants were feeling about the process in terms of workshop activities and provision of technical information, and (ii) evaluate the extent to which participants felt they were able to contribute knowledge. The information from the interviews was used to inform the design of the final two workshops. The interviews covered these questions:

- How are you feeling about the process? (at this stage)
- How are you finding the processes we are using in the group?
- How are you finding the way we are providing the technical information?
- To what extent do you feel you have been able to contribute your knowledge?
- Is there anything else you would like to ask, or comment on, at this stage?

A.2.2.8 Workshop 4 – Explore alternative futures and confirm indicators

7 November 2013

Original Purpose – By the end of Workshop 4, participants will have used the alternative WaterWheels to discuss possible futures, and from this, understand connections and, causes and effects. Additional purposes of the workshop were to

- review and confirm a final set of indicators for the WaterWheels
- Identify the implications for the Mangatarere Restoration Society vision and action plan
- Determine what needs to be covered at the next workshop

Activities:

#1 Introduction: reiterate project purpose and today's workshop purpose

#2 Group culture exercise: reflecting on what the group said was important to them last meeting in terms of: engaging the community; action, not just words; community involvement in monitoring, not just science

#3 Building the WaterWheels and system diagram. Plenary session with presenter building a systems diagram and 3 team members adding the spokes to large cardboard wheels. Working through indicators one at a time and showing how these are connected with each other in a systems diagram that was also gradually built up during the session

#4 Reflect on differences between WaterWheel diagrams across current situation and the two alternative futures

#5 Reflect on indicators on the WaterWheels. Plenary session on What can we do about missing spokes? Are all of your values represented? Negotiate changes in indicators and/or thresholds

#6 "Respoking the wheel". In small groups work on new indicators and thresholds, which included information from research team on alternative cultural, sustainable farming and community engagement and connection indicators. Make changes to the cardboard wheels to reflect these changes.

#7 Reflection on what the WaterWheel diagrams have shown us. Plenary

#8 Reflect on how we are pooling information and questions – plenary. Present where we are going next. Reflect on today's workshop.

Outcomes

- Three initial WaterWheel diagrams for the current catchment situation and two alternative futures, along with a systems diagram showing the connections among indicators
- Feedback from the participants on the WaterWheel diagrams for the alternative futures in terms of what was surprising (e.g. "*Lack of change across scenarios – have we got the thresholds right? For example GDP is not sensitive and cost of pumping is too sensitive*" and "*The number of things we don't know!*"), what the WaterWheel diagrams were telling the group (e.g. "*Benefit may occur downstream, or outside of the catchment*" and "*Need to do lot of work to get good indicators*"), and what the graphics were not telling the group (e.g. "*Risks – uncertainty and sensitivity of these things – risk factors such as not diversifying, of relying on capital-intensive industries*" and "*Doesn't show people's awareness [of catchment issues] of lack of it*").
- Three WaterWheel diagrams for the current situation and two alternative futures with changes in indicators and thresholds made by the workshop participants. For example, there was a sense that GDP and farm EBIT indicators were a double up, so measures related to employment or wellbeing were suggested as an alternative to GDP
- Reflection on what the WaterWheel diagrams have shown the group included discussion of changes, concerns and connections. Examples of concerns shared were: "*Would like to view a changing future from a range of social measures – good to see wellbeing and employment there*." and "*Concern about assumptions behind the environmental indicators for dam scenario – not confident about those assumptions*". Examples of connections identified by participants were "*General wellbeing employment and engagement connected (People have time and dollars)*" and "*More community engagement leads to more riparian planting*"
- Implications for the MRS Catchment Action Plan were identified including: "*Access will enhance engagement*", "*Focus on achievable things and small steps*", and "*Action plan won't cover lots of things up there – accept we won't change those things but we do have liason/networking*"
- Reflection on the workshop included identifying recommendations to MRS, such as "*Important component is holding the theme of working together to achieve results, such as strategic actions like riparian planting.*"

Participant Homework Prior to Next Workshop

Prior to workshop 5 participants were asked to survey community members they know to identify ways to engage the community in the Catchment Action Plan that the Mangatarere Restoration Society was preparing. Participants were given a recording sheet on which to capture names, contact details and responses to three questions:

- What would make you want to be more involved?
- Would you be interested in helping to create a Catchment Action Plan for the Mangatarere?
- How would you like to help create the Plan?

A.2.2.9 Workshop 5 – Reflection and next steps

2 December 2013

Original Purpose – By the end of Workshop 5 participants will have drawn together threads of our learning from last time, reflected on the Wheel of Water process and mapped out next steps to the MRS Catchment Action Plan

Activities:

#1 Introduction: reiterate project purpose and today's workshop purpose

#2 Consolidate learning and gather up threads: Connections activity – Assign group member an element in the catchment, e.g. indigenous forest, waste water treatment plant, nitrate, then in a circle, get members to build and explain connections between the elements using a ball of wool.

#3 Consolidate learning and gather up threads: Remembering the wheels through a plenary reflection on the WaterWheel diagrams built in the last workshop.

#4 Developing a plan for the MRS action plan. In small groups write down things you find in an action plan. Develop a "contents page".

#5 Engaging the community in the catchment. In small groups brainstorm ways that you could engage the community involvement in the action plan.

#6 Develop a calendar for achieving a final action plan.

#7 Reflecting on the WaterWheel and our process: timeline scan for reflection. Have a sticky wall with the workshops labelled and get everyone to add activities that they remember to the timeline. Add favourites and frustrations.

#8 Reflecting on the WaterWheel and our process: Bus stops. One question per station 5 min per stop. Research team can join in. Sheets headed up "What was useful/What could be improved": (1) How the group has worked together and the workshop techniques used; (2) Information shared and knowledge gained; (3) The WaterWheel itself

#9 Plenary session on recommendations to another community embarking on a similar project

Outcomes:

- Mangatarere Catchment Action Plan calendar, showing activities, responsibilities and timeline for completion of Catchment Action Plan as part of the Sustainable Farming Fund project
- Reflections on the Wheel of Water process and WaterWheel diagram in terms of
    - Favourites (e.g. "*Periphyton online survey – interactive*")
    - Frustrations (e.g. "*Respoking the Wheel – wheel needing more work*")
    - How the group worked together – what was useful (e.g. "*Variety of engagement processes – people relax, more comfortable, less defensive*") and could be improved (e.g. "*Could have invited specialists*"
    - The WaterWheel – what was useful (e.g. "*Cardboard version better than Powerpoint – can grasp it, change it*") and could be improved (e.g. "*missing information is a frustration*")
    - Information shared and knowledge gained -what was useful (e.g. "*Increased collective knowledge – names and faces of others in the catchment*") and could be improved (e.g. "*Executive summary from each meeting*")

- Future uses of the WaterWheel, e.g. "*Use the WaterWheel as a monitoring tool for the future*"
- Feelings as this part of the process draws to a close, e.g. "*Learnt a lot, worth coming to, got to meet others. Long days but couldn't see another way*"

- Actions to continue with from the Wheel of Water process into the Catchment Action Planning process (e.g. "*carry on the work the way it has – good communication*") and recommendations to other communities (e.g. "*Make sure you have a wide range of people – with different views or Water Wheel would be unbalanced*")

Participant Homework Prior to Next Workshop

Prior to final interviews participants were asked to write down their key reflections and personal learning from the process and put it in a safe place until February

A.2.2.10 Final Interviews

February 2014

Two months after Workshop 5 all of the case study participants were contacted and some interviewed for about 1 hour either face-to-face or by phone (based on the participants' preference) by one of the case study team facilitators. The purpose of the interviews were to (i) provide an opportunity for the participants to reflect on any changes in their thinking and new perspectives from the initial interviews as a result of being part of the process, (ii) what they liked and did not like about the process and (ii) other uses of the Wheel of Water process. The information from the interviews was used to evaluate the extent to which the Wheel of Water process achieved its original aims and what influenced any changes. The interviews covered these questions:

1. When you reviewed the answers you gave for our initial interview back in July, what, if any of your answers would be significantly different now you have been through the whole Wheel of Water process?
2. What new perspectives did you gain from your involvement in the Wheel of Water process?
3. What was it about the Wheel of Water process that enabled this learning?
4. What else was valuable about the Wheel of Water process?
5. What don't you like about the Wheel of Water process?
6. What other ways could the Wheel of Water process be used?
7. Currently in NZ there's a lot of interest in setting limits for waterways through collaborative processes. We didn't do that here, but to what extent could you see the Wheel of Water process adding value to a community looking to set limits in a catchment? Why?
8. Has your experienced in this research project encouraged you to want to be involved in this sort of collaborative process in the future? Why?

APPENDIX 3 WORKSHOP DEBRIEF TEMPLATE

Debriefing an experience (such as a workshop, or workshop series) helps those involved to reflect, and connect lessons and activities they gained from the experience. It is a very important piece of programming and learning as a whole. If the team fails to collectively and rigorously reflect on their experiences and relate them to their wider work area, then a lot of the learning may be lost. So including debriefing is a really valuable part of the wider process. If running a series of workshops then the debriefing sessions support an active process of fine tuning the larger initiative. The following template formed the basis for the team debriefs.

Time	Activity	
	Introductions – to people and to the debrief agenda - set the scene – looking for a safe, yet reflective session. Learning from successes and challenges.	
	How did it go? (Lets people get things off their chest, make fairly fast round – just to unload or pick up on tensions, streses, etc.) • Individually write down 5 things that stood out • Think about what were the key surprises or successes or frustrations of the workshop • Feedback the most important … but hang on to the rest • Depending on issues may be able to defer discussion	
	What was supposed to happen (This ensures the process is outcome focused – and so practical and useful. Pay attention that people have an idea of the short and medium-term outcomes that they could expect. Ensure outcomes are developed that recognize all stakeholders and cover quadruple bottom line.) • This workshop is just a part of a series and has a lot of different stakeholders • Think about key outcomes for series as a whole (write down 2/3) • Think about key outcomes from workshop 1 as a part of getting to the bigger set (write down 2/3) • Share back & discuss	
	What actually happened • Work through workshop process sequentially • For each activity go round the circle filling in the story: ○ **Quick overview** of what each workshop session was aimed to achieve, then describe in terms of ○ **Culture** – energy levels in room, attitudes, feelings, levels of participation ○ **Process** – facilitation, timing, tasks, resourcing, etc. ○ **Content** – what came out, whose views, who provided material and ideas – who didn't ○ **Technical** – re model development and science translation if applicable	
	Where to from here • So is the project on target – given our expected outcomes • What went well – why and what can we take forward from that • What needs to go better – why and how can we do that • Aiming for concise, specific agreed objectives • Have we missed anything from your first exercise writing down surprises, successes, frustrations	

APPENDIX 4 RUBRICS

Developing rubrics

We often struggle to assess complex social or management tasks or behaviours, even though their importance in environmental management is well known. However, assessment approaches are becoming available to help out in these areas. Rubrics are one such approach that are increasingly being used in areas such as community development, and environment and health management.

Developing rubrics help clarify the expectations that people have for different aspects of management and social performance by providing detailed descriptions of collectively agreed upon expectations. Well-designed rubrics used for assessment increase the reliability and validity and ensure that the information gathered can be used to help people assess their management efforts, and improve them. They work especially well when they have been developed in a participatory manner.

In this programme we worked with the Wairau participants to develop draft rubrics for assessing: i) connected community; and ii) the use of knowledge in decision making. These are provided overleaf, but first we provide some basic instructions which provide a sense of how these rubrics were developed, and how workshop participants contributed to their development.

Writing rubrics requires:

1. Defining the task to be rated. This can include consideration of both outputs (things completed) and processes (level of participation, required behaviours, etc.)

2. Developing scales which describe how well any given task or process has been performed. This usually involves selecting 3-5 levels. Scales can use different language such as:

    a. Advanced, intermediate, fair, poor
    b. Exemplary, proficient, marginal, unacceptable

3. Defining dimensions to be assessed. These should represent the component elements that are required for successful achievement of the task to be rated. Parts of the task need to be set out simply and completely.

Involving people in developing rubrics requires:

1. Work with the group to define the task to be rated, and provide some agreed description around the task along with a basic scale
2. Ask people what are the component elements that they see involved in achieving the task (gets them thinking about the task involved)
3. Ask people what elements they might expect to see in a community where the task is being done in an exemplary fashion – the top category.
4. Ask people what elements they might expect to see in a community where the task is being done in an unsatisfactory manner – the bottom category.

5. Develop a first draft of the rubric, and circulate for comment.

A.4.1 Knowledge in decision making rubric

[Note: This rubric provides 4 levels of assessment around which elements of the topic are to be assessed. Detail around the dimensions of the area to be assessed is provided for the highest and lowest levels. This was chosen as the lowest level of detail that could be used by the group to trial the process for this particular task.]

(Adequate knowledge – trusted decisions)

Good use of knowledge

- Good evidence of a healthy catchment and catchment communities
- Evidence that decisions are guided by considerations of desired long-term outcomes and a sense of community/catchment history and connections.
- The decision-making process supports ongoing learning by all parties which supports collaborative adaptive knowledge. This involves participation (bringing in logic and emotion/head and heart), develops a shared understanding and helps link different knowledge systems to develop responses
- Adaptive management is practiced at all levels/scales and we see change and its action - and adapt accordingly. Monitoring is used to keep an eye on progress and help keep the system on track.
- Clear use of science that is evidence-based and from a credible source, including verification by long-term monitoring data where possible.
- Clear use of local knowledge from land managers, council staff and community residents. Covers both social and bio-physical (conservation, forestry, viticulture and farming). Need to consider social systems (and social consequences) as well as bio-physical systems.
- Clear use of Iwi knowledge – tikanga and matauranga
- Information is both accessible and easily disseminated – because people know how to use it (good use of extension and education).
- People motivated to be part of decision-making, better buy-in and confidence in final decision.

Reasonably well connected

-

Satisfactorily connected

-

Not at all connected

- A lot of tensions between sectors and individuals
- Ignorance leads to negative capital
- Poor/bad practice – loss of water quality. Social and environmental degradation
- Polarized community
- Lack of consideration for people living there

A.4.2 Connected community rubric

[Note: This rubric provides 4 levels of assessment around which elements of the topic are to be assessed. Detail around the dimensions of the area to be assessed is provided for the highest and lowest levels. This was chosen as the lowest level of detail that could be used by the group to trial the process for this particular task.]

Very well connected

- There is clear evidence of a common place-based identity and strong sense of care of place.
- There is a high level of civic engagement and involvement *(people get involved, lot of social activity, many groups and groups meeting, groups talking to each other, meetings about work and neighborliness (food), covers a range of community issues, everybody knows each other. Forums established to talk through issues. People helping each other.)*
- There is evidence of good communication, within groups and between groups. People seek to understand the different perspectives and expertise in the wider community and across different sectors. Dialog aims to find solutions that meet the wider community needs**.**
- There is clear evidence of leadership skills within the range of community groups and sectors which support different views to be heard, encourage linkages across groups, and support innovative and creative outcomes for the benefit of the community.
- There is clear evidence of vibrant networks that help link individuals and groups and share information and knowledge horizontally across the community, and vertically between community and sectors and agencies.

Reasonably well connected

-

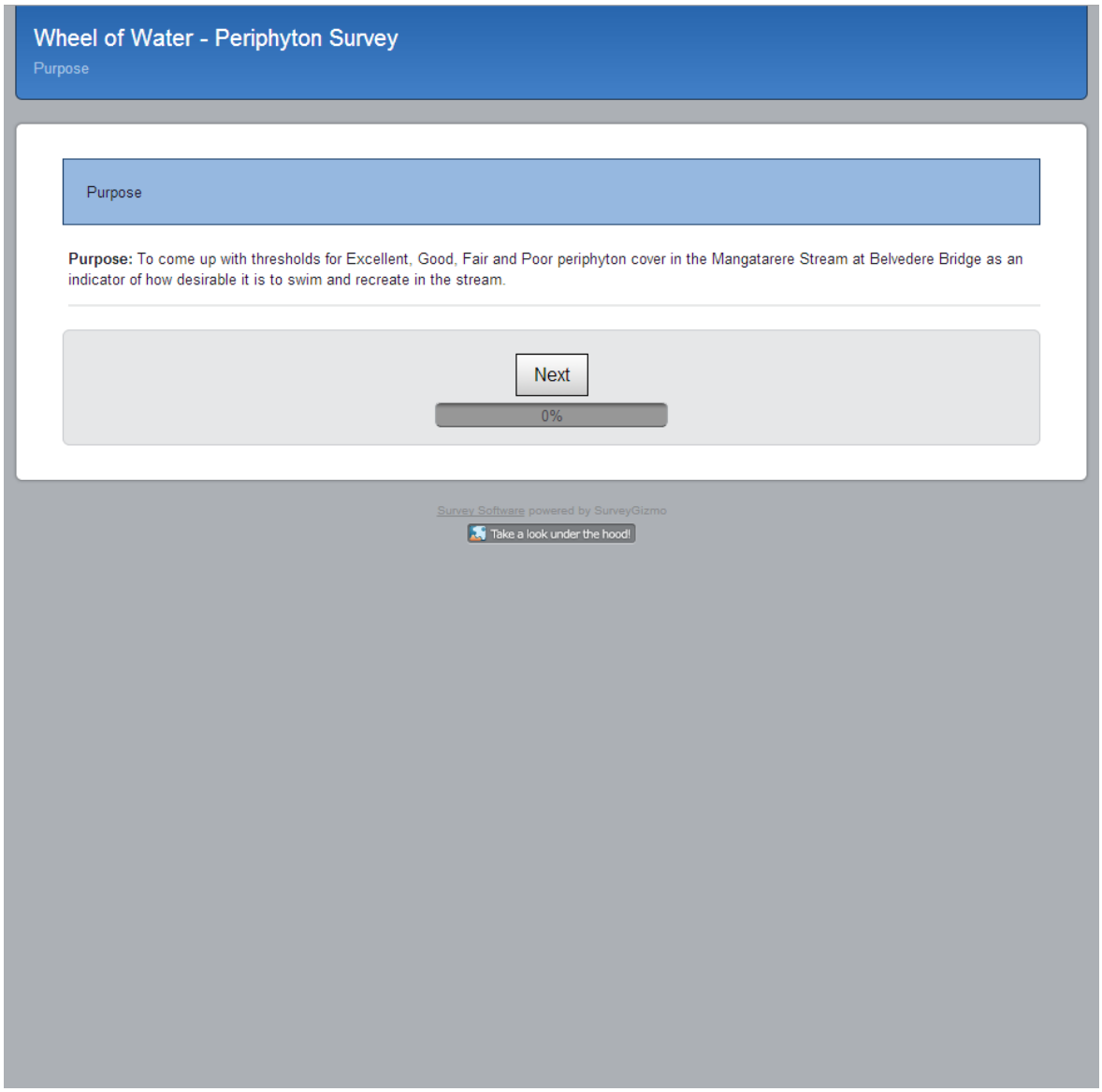
Satisfactorily connected

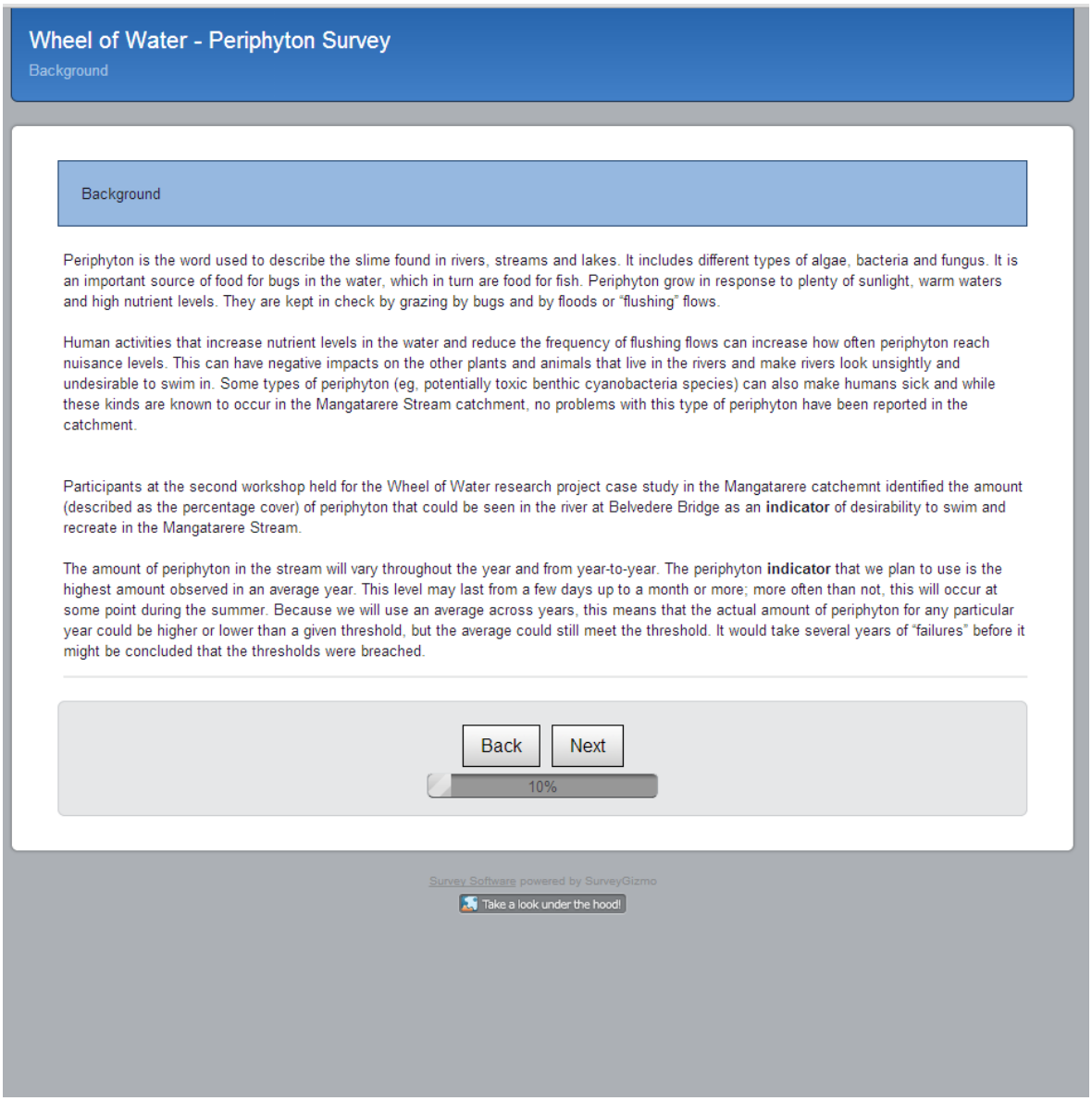
-

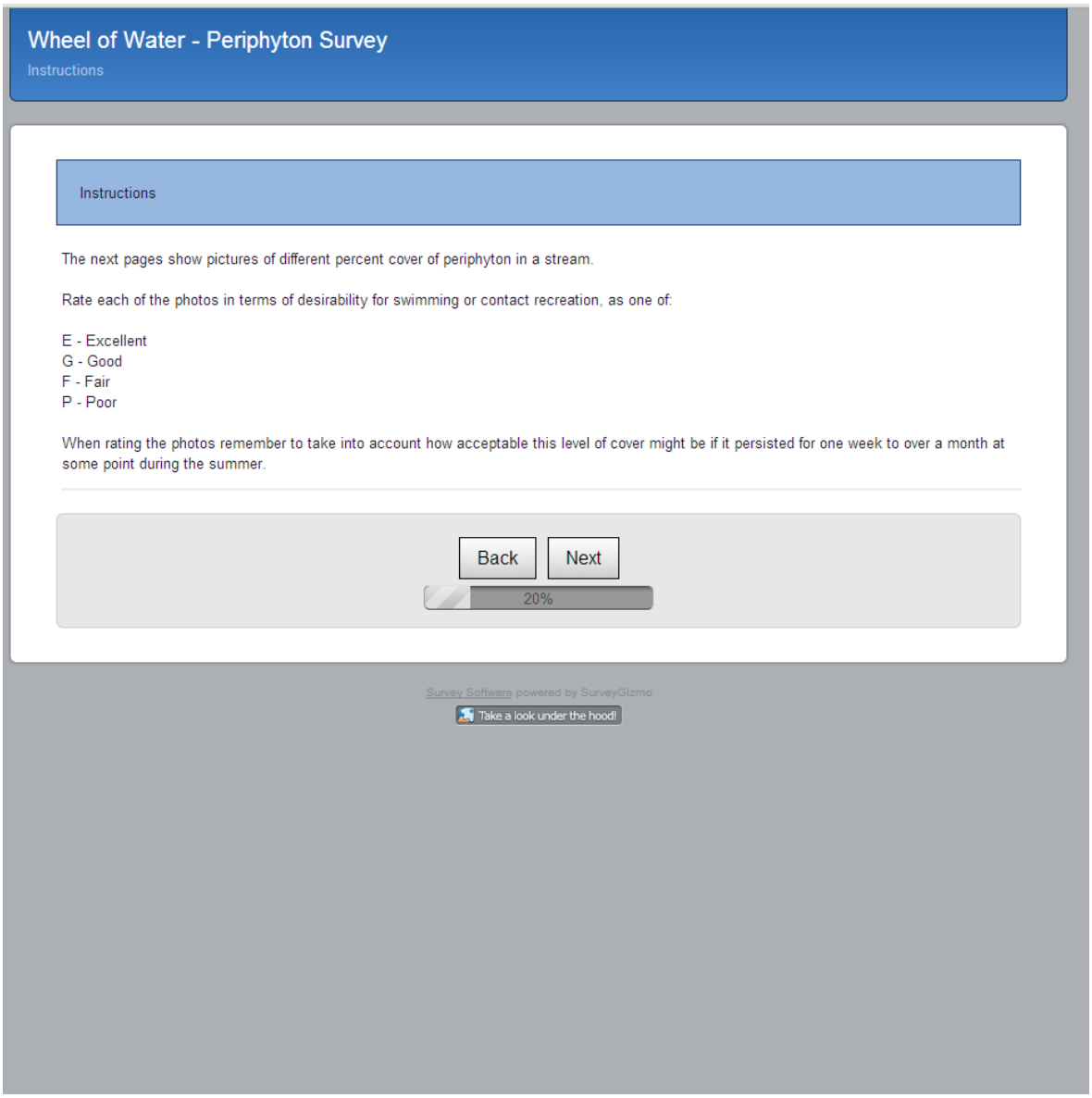
Not at all connected

- No common aim – see selfish behaviour. No willingness to compromise or see other viewpoints. Issues personalized.
- No dialog – no forums set up to include and canvass other views. Lack of knowledge for what is happening in community (socially and environmentally)
- Groups and cultures separate – no coming together, or understanding each other's views.
- Tensions between sectors and individuals – lots of silos evident, intolerance
- People don't know each other (on a personal basis)
- No support for local events
- Bad neighbours – no consideration, suspicion of other groups

APPENDIX 5 PERIPHYTON THRESHOLD SURVEY




Wheel of Water - Periphyton Survey
Background
Background
Periphyton is the word used to describe the slime found in rivers, streams and lakes. It includes different types of algae, bacteria and fungus. It is an important source of food for bugs in the water, which in turn are food for fish. Periphyton grow in response to plenty of sunlight, warm waters and high nutrient levels. They are kept in check by grazing by bugs and by floods or "flushing" flows.
Human activities that increase nutrient levels in the water and reduce the frequency of flushing flows can increase how often periphyton reach nuisance levels. This can have negative impacts on the other plants and animals that live in the rivers and make rivers look unsightly and undesirable to swim in. Some types of periphyton (eg, potentially toxic benthic cyanobacteria species) can also make humans sick and while these kinds are known to occur in the Mangatarere Stream catchment, no problems with this type of periphyton have been reported in the catchment.
Participants at the second workshop held for the Wheel of Water research project case study in the Mangatarere catchemnt identified the amount (described as the percentage cover) of periphyton that could be seen in the river at Belvedere Bridge as an indicator of desirability to swim and recreate in the Mangatarere Stream.
The amount of periphyton in the stream will vary throughout the year and from year-to-year. The periphyton indicator that we plan to use is the highest amount observed in an average year. This level may last from a few days up to a month or more; more often than not, this will occur at some point during the summer. Because we will use an average across years, this means that the actual amount of periphyton for any particular year could be higher or lower than a given threshold, but the average could still meet the threshold. It would take several years of "failures" before it might be concluded that the thresholds were breached.
Back
Next
10%
Survey Software powered by SurveyGizmo
Take a look under the hood!


Wheel of Water - Periphyton Survey
Instructions
Instructions
The next pages show pictures of different percent cover of periphyton in a stream.
Rate each of the photos in terms of desirability for swimming or contact recreation, as one of:
E - Excellent
G - Good
F - Fair
P - Poor
When rating the photos remember to take into account how acceptable this level of cover might be if it persisted for one week to over a month at some point during the summer.
Back
Next
20%
Survey Software powered by SurveyGizmo
Take a look under the hood!

Wheel of Water - Periphyton Survey

20% Cover

1. How would you rate this river in terms of desirability for swimming and contact recreation?

-- Please Select --

-- Please Select --
Excellent
Good
Fair
Poor

Back Next

30%

Survey Software powered by SurveyGizmo

Take a look under the hood!

Wheel of Water - Periphyton Survey

30% Cover

2. How would you rate this river in terms of desirability for swimming and contact recreation?

-- Please Select --

-- Please Select --
Excellent
Good
Fair
Poor

Back Next

40%

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Wheel of Water - Periphyton Survey

40% Cover

3. How would you rate this river in terms of desirability for swimming and contact recreation?

-- Please Select --

-- Please Select --
Excellent
Good
Fair
Poor

Back Next

50%

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Wheel of Water - Periphyton Survey

55% Cover

4. How would you rate this river in terms of desirability for swimming and contact recreation?

-- Please Select --

-- Please Select --
Excellent
Good
Fair
Poor

Back Next

60%

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70% Cover

5. How would you rate this river in terms of desirability for swimming and contact recreation?

-- Please Select --

-- Please Select --
Excellent
Good
Fair
Poor

Back Next

70%

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Wheel of Water - Periphyton Survey

95% Cover

6. How would you rate this river in terms of desirability for swimming and contact recreation?

-- Please Select --

-- Please Select --
Excellent
Good
Fair
Poor

Back Next

80%

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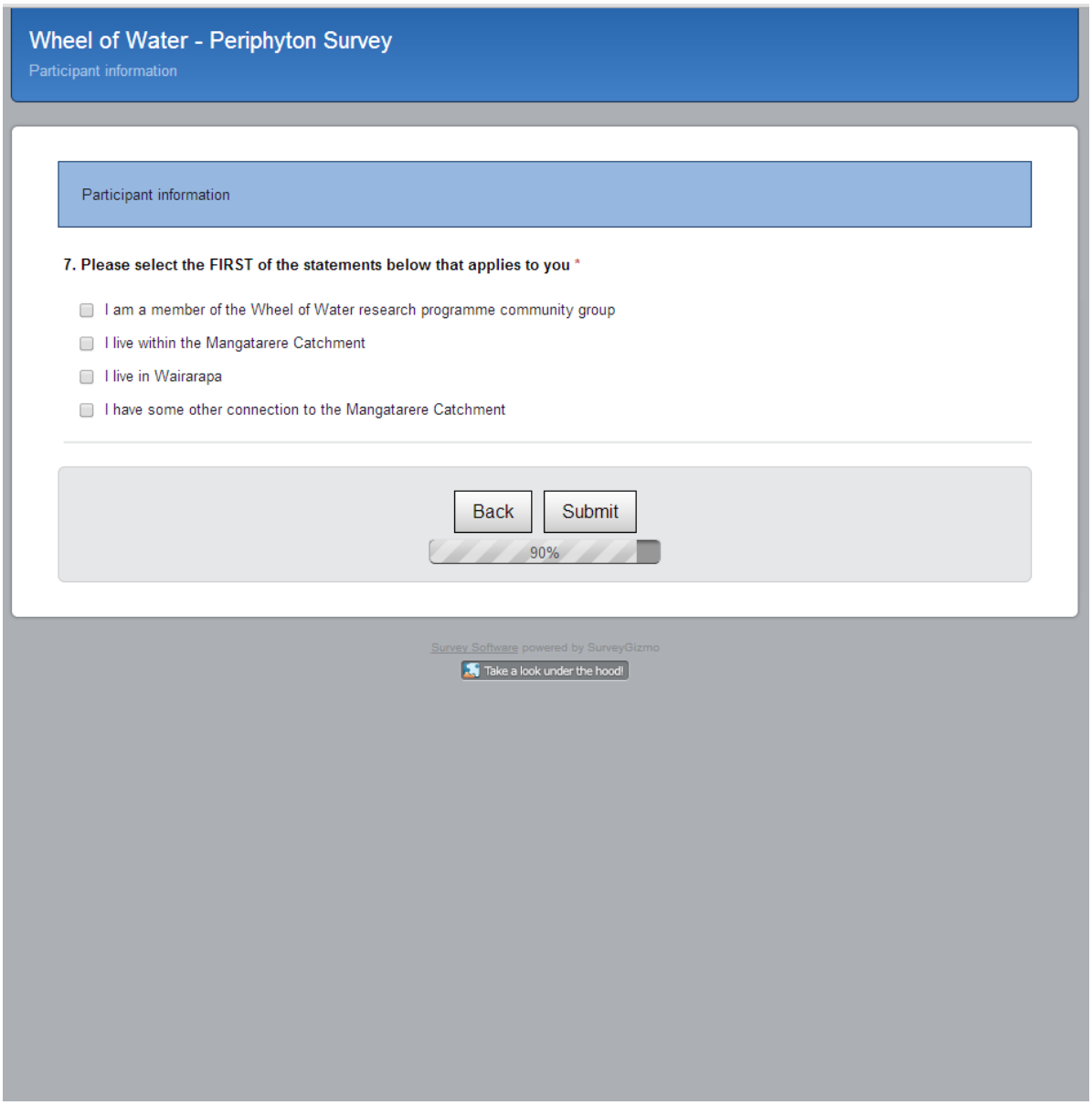
Wheel of Water - Periphyton Survey
Participant information
Participant information
7. Please select the FIRST of the statements below that applies to you *
I am a member of the Wheel of Water research programme community group
I live within the Mangatarere Catchment
I live in Wairarapa
I have some other connection to the Mangatarere Catchment
Back
Submit
90%
Survey Software powered by SurveyGizmo
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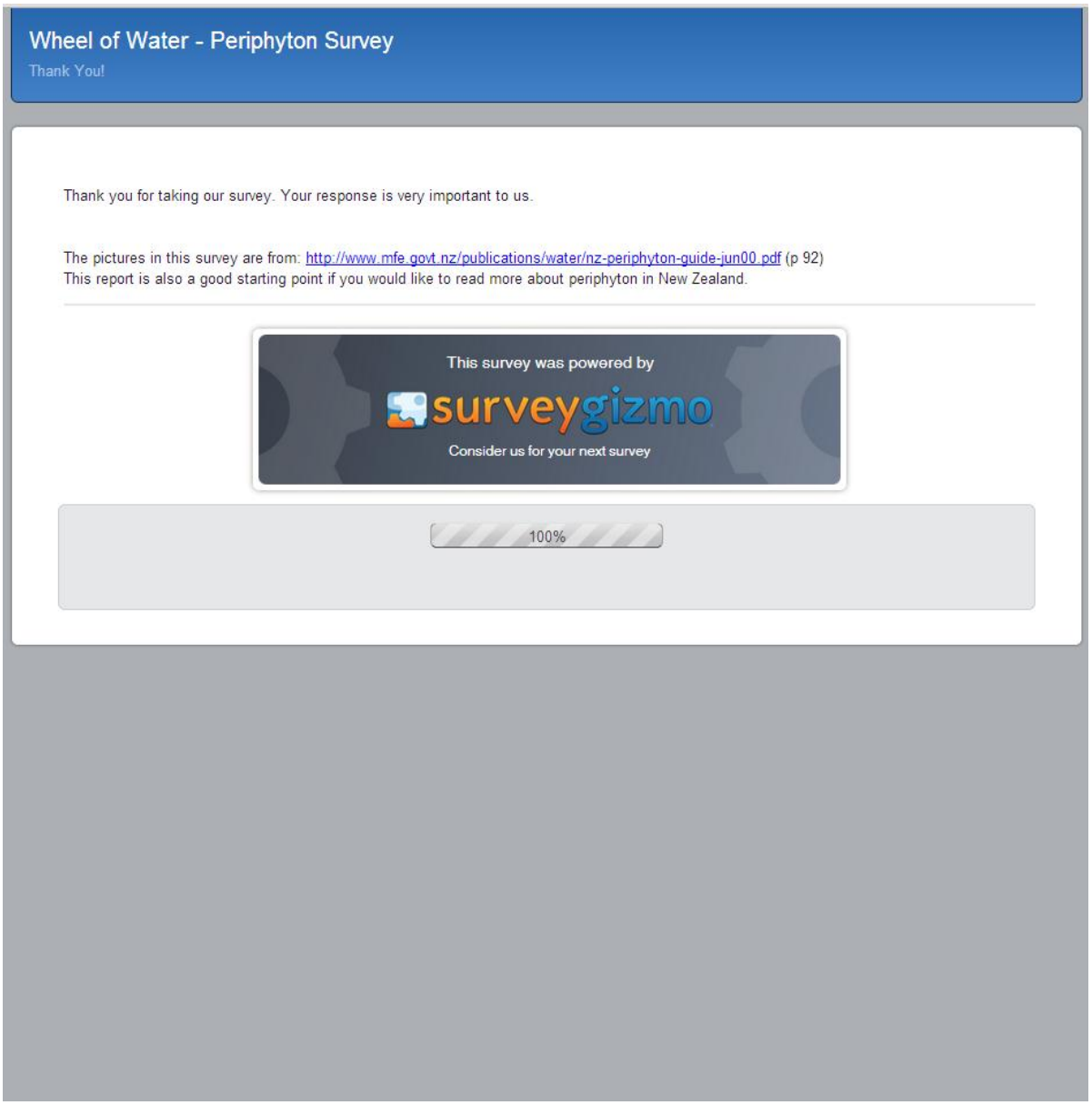
Wheel of Water - Periphyton Survey
Thank You!
Thank you for taking our survey. Your response is very important to us.
The pictures in this survey are from: http://www.mfe.govt.nz/publications/water/nz-periphyton-guide-jun00.pdf (p 92)
This report is also a good starting point if you would like to read more about periphyton in New Zealand.
This survey was powered by
surveygizmo
Consider us for your next survey
100%

APPENDIX 6 DIVERSITY OF USES SURVEY

Purpose: To come up with thresholds and current state (baseline) for the indicator "diversity of uses in the Mangatarere catchment"

Background: In workshop 2, the diversity of land uses, water uses and people in the Mangatarere catchment was picked by the group as an indicator of "diversity of uses in the Mangatarere catchment".

We would like you to establish a baseline for this indicator based on current diversity of land uses, water uses and people in the Mangatarere.

We would also like to identify thresholds for Excellent, Good, Fair and Poor "diversity of uses in the Mangatarere catchment".

Examples of **land uses** could be people's homes, life style blocks, dairy farming, sheep farming, industrial (or commercial) businesses, crops, orchards, and bee hives.

Examples of **water uses** could be people swimming or wading, fishing, walking, picnicking, irrigating paddocks or crops, and water for stock.

Examples of **different people** could be different ages (children, teenagers, adults, elderly) and different ethnicities (European NZer, Asian, Maori, Pacifica, Australian, European, North American, African).

Instructions

1. Go to three points on waterways in the Mangatarere Catchment and at each point
2. Turn around completely and count the following that you see while turning around
    a. Number of land uses
    b. Number of water uses
    c. Number of different people (number of different ages, ethnicities)

3. Note these numbers in the separate sheet for each of the three points. Please count only the land uses, water uses and people that are different. For example, only count dairying once, even if you see it at all three points
4. Add the scores for each of these three points to give a total score.

Points on Mangatarere Stream	Time of visit:	Day of week of visit:	Date of visit:	Land uses (number)	Water uses (number)	People (Number of different kinds e.g. age, ethnicity	Total Score
Total Score	-	-	-				

Help us to figure out the thresholds

Instructions

1. Close your eyes and imagine you are in the Mangatarere catchment on a fine summer's day. What would be an Excellent "diversity of use in the Mangatarere catchment" for each of the following:
    a. Number of land uses
    b. Number of water uses
    c. Number of different types of people (age, ethnicity)
2. Fill in the first row of the table below.
3. Now do the same for Good, Fair and Poor "diversity of use in the Mangatarere catchment" for each of:
    a. Number of land uses
    b. Number of water uses
    c. Number of different types of people (age, ethnicity)
4. Fill in the rest of the table below.

	Land uses (number)	Water uses (number)	People (Number of different kinds of people e.g. age, ethnicity	Total Score
Excellent				
Good				
Fair				
Poor				

5. What score range (for the total scores combining land use, water use and people) would you consider to be Excellent; Good; Fair; and Poor?, e.g. 0-3 = Poor

	Excellent	Good	Fair	Poor
Total Score Range				

Note: We anticipate the final indicator for "Diversity" as it is understood here, will also include some type of indicator and threshold for ecological diversity.