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An integrative model for cultural flows: Using values in fisheries to determine water allocations

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1. INTRODUCTION

As the earth increasingly faces problems of water scarcity, governments worldwide are beginning to undergo a re-evaluation of water resources as part of their national agenda. One of the greatest challenges for most governments in this period of re-evaluation is how to define "environmental flows", or the amount of water required to meet the environmental or ecological needs within an ecological system (Brandes et al., 2005), and balance this need with other competing interests in water. These interests include those of Indigenous people who worldwide are increasingly engaging in water policy debates and calling on their governments to address their interests. For example, the Garma International Indigenous Water Declaration presented at the fifth World Water Forum in Turkey in March 2009 calls for water to be treated as a spirit or ecological entity with its own inherent right to exist and reaffirms the responsibilities of Indigenous people to ensure the sustainability of the environment as a whole. Alongside this movement is a growing paradigm shift in government agencies globally towards more holistic and integrated approaches to water management that seek to find a sustainable balance among the competing demands on water systems. These holistic and integrated approaches seek to find ways to incorporate Indigenous knowledge, values, and interests in water management.

The shift towards integrated water management, including the incorporation of Indigenous perspectives in water management, is seen in recent policy in both New Zealand and Australia. For example, the recent Proposed National Policy Statement on Freshwater Management from New Zealand recognises that water is central to the social, economic and cultural well-being of many aspects of New Zealand's society and that water has "deep cultural meaning" for all New Zealanders. Similarly, a key element of the recent National Water Initiative in Australia is integrated management of water. This includes management water not only for environmental purposes, but for other public benefits as well, including cultural benefits.

However, despite these emerging policies, the trend towards integrated water management has been slow, and to date Indigenous values, and the water flows related to them, are rarely accounted for in a category of their own in water plans (Craig, 2006). Similarly, considerable uncertainty exists around how to achieve the incorporation of Indigenous knowledge into mainstream approaches to water management (Durette et al., 2009). It has been argued that sustainable solutions to the world's water problems will only be reached if decisions made are based on "a deep understanding of how culture affects, and is affected by, the myriad interactions between people and water" (UNESCO-IHP, 2008, p. 3). Yet to date, the spiritual and cultural connections that Indigenous people have to water has been largely overlooked within these water allocation systems globally (Jackson, 2005).

One of the major challenges to accounting for Indigenous values in water is the qualitative nature of them; that is, they tend to be expressed a way that is descriptive and subject to the opinions and experiences of the person or people speaking about them.[1] While qualitative descriptions of values provide a rich account of the relationships of people with the waterways that are important to them, they do not readily lend themselves to being expressed in a numerical form. For this reason, water planners who rely mainly on quantifiable data in their work are less able to account for these more qualititive values in water plans.

Thus, rather than accounting for these values in a category of their own in water plans, the assumption often made is that by allocating flows for the environment, Indigenous values are also protected (Jackson, 2005). Yet, some would argue that the connections held by Indigenous people to water that have been part of their existence for thousands of years are not always reflected in environmental flow allocations (Craig, 2006). Jackson (2005) similarly argues that although the concepts of environmental and cultural flows may overlap in their content or

[1] In this paper, the term "values", in most instances, includes "knowledge" and "interests" of Indigenous people. In some cases, knowledge will be discussed separately from values when the reference made is to knowledge specifically.

definition, there may be cultural values that are not encompassed by a minimum flow determined on a limited set of ecological values. Therefore, flows for the environment and for cultural purposes are not one and the same.

Craig and Shearing (2004) argue that rather than being synonymous with environmental flows, water flow levels required to protect cultural values should be seen as overlapping with environmental flows, but that environmental flow requirements should be kept distinct from the cultural requirements in the water. From this line of reasoning, the concept of "cultural flow" requirements is slowing emerging in the water planning discourse. Cultural flows encompass the provision of water to a specific Indigenous group for cultural purposes in order to ensure that cultural obligations relating to the health of the water body can be better met (Craig & Shearing, 2004).

The challenge of recognising and providing for cultural flows and the qualitative values they represent in water allocation processes is not unique to New Zealand. Literature from Australia, South Africa, and North America (Flanagan & Laituri, 2004; Jackson, 2008; Pollard & Simanowitz, 1997) provides evidence that other countries are tackling the same issue. One of the main reasons for the difficulty of accounting for these values lies in their qualitative nature, as discussed above, and that there are no methods internationally that allow for the quantification of Indigenous values in relation to water flows.[2] The lack of an ability to convert cultural values information into a form that can be used to set water flows and levels thus remains a considerable challenge to integrated water management approaches.

In an attempt to bridge this gap in methodologies that account for Indigenous values, this research looked at how cultural flows may be quantified at least in part through their inherent relationship to cultural values in fisheries. In particular this research focused on identifying the processes and methods that might be employed by groups that have limited capacity to engage on water allocation. These processes and methods were identified both through a literature review and through a case study method.

This article first set outs the policy and legislative context in New Zealand. It then describes the local context in which our case study was undertaken.[3] The following sections discuss the methods used in the case study and methods that might be employed by groups that would assist them to integrate their values and knowledge into technical data that can be taken up by water planners and policy makers. Lessons learned from the case study are then incorporated into an integrative model that will inform other groups as they begin their own journeys in water planning and management. The model demonstrates how values in customary fisheries, and the knowledge of them held by Indigenous people, may provide a useful starting point in the quantification of Indigenous values for water planning.

[2] However, work is underway in New Zealand to develop a tool that will allow for the incorporation of a wide spectrum of Maori values for fresh water in water allocation (Tipa, forthcoming).

[3] The case study was originally funded by Te Wai Maori as part of their freshwater research round in 2008/2009.

2. POLICY AND LEGISLATIVE CONTEXT IN NEW ZEALAND

Accounting for Indigenous values in water is a timely topic in New Zealand given the current policy and legislative context. In response to growing concern about the future sustainability of water and the need for greater consistency in decision making on water management, the New Zealand Government has developed the Sustainable Water Programme of Action (SWPoA) under which three key outcomes are sought for water: strengthening partnerships with stakeholders to improve water quality and quantity; managing the undesirable effects of land use on water quality; and managing increasing demands for water and encouraging efficient water use (Ministry for the Environment and Ministry of Agriculture and Forestry, 2006). A critical aspect of the third outcome is promoting consistency in decision making to ensure there is sufficient water flowing in water bodies (Mallard, 2008).

The responsibility for decision making in relation to flows in water bodies in New Zealand vests in regional councils under the *Resource Management Act 1991* (RMA). Section 30 of the RMA provides for regional councils to regulate the use of, and quantity of water in, water bodies. As part of this function, they can set minimum or maximum flows. Regional councils carry out these functions through regional plans and regional policy statements. A regional plan must state the objectives for the region, policies to implement the objectives, and rules (if any) to implement the policies.[4] The setting of environmental flows or water levels requires a judgment to be made by a regional council on how it will provide for the values attributed to a water body. This judgment is made in accordance with the priorities set in Part II of the RMA, national and regional policy, regional policy and regional plans. It is additionally informed by technical and subjective assessment of the likely consequences of changes to water flows or water levels to the values related to the water body (Ministry for the Environment, 2008).

As part of the SWPoA, the previous Government developed a proposed National Environmental Standard (NES) on Ecological Flows and Water to guide the work of regional councils. While the NES does not provide guidance as to how to incorporate cultural values into water allocation decisions, it does offer clarification on the relationship of cultural flows to other values in a water system. The NES focuses on ecological flows which are defined as "the flows and water levels required in a water body to provide for the ecological function of the flora and fauna present within that water body and its margins" (Ministry for the Environment, 2008, p. 8). In drafting the NES, it was recognised that flows for ecological values and cultural values are separate but overlapping components of an environmental flow[5] in any given area (see Fig. 1). Following this approach, cultural flows in New Zealand could therefore be defined as the flows and water levels required in a water body to provide for the values of tangata whenua.[6] While the NES does not provide guidance as to how to weight values – including cultural values – it contextualises them within New Zealand's broader policy framework and importantly for Māori, acknowledges that accounting for ecological flows only will not necessarily reflect Māori values in water.

[4] s. 67(1)
[5] Environmental flows is a broader concept that refers to "the flows and water levels required in a water body to provide for a given set of values which are established through a regional plan or other statutory process" (Ministry for the Environment, 2008, p. 7).
[6] Tangata whenua can be translated as the Māori group that has chiefly authority over a particular area.

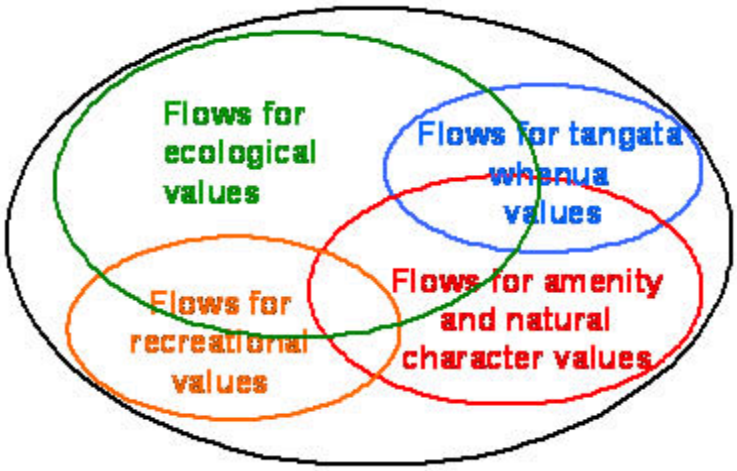

Fig. 1: Components of an environmental flow or water level
(Ministry for the Environment, 2008, p. 8)

One of the most widely employed means by which New Zealand regional councils manage water levels is to set minimum flows, based on instream values, beyond which the river or stream should not drop as a result of continuing abstraction (HBRC, 2006a). While instream values encompass a range of ecological, social, cultural and economic values (Ministry for the Environment, 2008), not all of these specific values are recognised in the methods that councils use to assess the flow that a water body needs. This is in part due to the need for water planners to have quantitative data about the values for a water body. Therefore, in reality, the process of defining minimum flows is an often unclear and uncertain process, and adding qualitative values to the process would create further complications (HBRC, 2006a). However, there is an acknowledged need both amongst Māori and regional council staff for methods to assist in identifying and assessing cultural values (Durette et al., 2009).

A recent study looking at Māori perspectives on water allocation set out the methods employed by Māori to engage on water allocation issues in their rohe and offers insight as to the relationship between fisheries and water flows (Durette et al., 2009). Participants of this study were asked to identify the methods they used to monitor the health of their water and to engage with local government on water allocation. The methods cited included local observation and various water monitoring techniques, such as the Cultural Health Index and the Stream Health Monitoring and Assessment Kit. One of the most common methods reported was through the monitoring of customary fisheries. Given the relationship between healthy fish and water flows, many groups reported monitoring customary fisheries as a way of engaging on water issues in their rohe. Ways of monitoring included electric fishing methods and recording catch. The knowledge held by fishers based on years of experience was also identified as useful feedback to inform groups in their water planning. Thus, given that there are many widely accepted methods that can be employed by Māori to monitor the health of their fisheries, and the relationship between healthy fish and water flows, it is possible that groups who are seeking to engage on water allocations in their regions could look to customary fisheries for quantifiable data that might inform water allocation decision making. The process by which this might happen was the focus of the case study.

3. NGATI HORI AND THE KARAMU STREAM

Recent research identifies that the uncertainty of Māori values within current water allocation systems is a major issue of concern to Māori New Zealand-wide and that the current system to date is not reflective of the relationship that Māori have to water or the Treaty partnership (Durette et al., 2009). In order to regain control of their water resources, Māori are increasingly taking steps to engage in water allocation processes and planning in their regions of the country. One of these groups is Ngāti Hori - a hapū (clan) of Ngāti Kahungunu ki Heretaunga. Members of the hapū have long expressed concerns about the degradation of their ancestral waterway, the Karamu Stream, and the decline of important customary fisheries in the stream. The hapū also attribute the decline in these fisheries to a reduced flow and water levels in the Karamu Stream, along with a number of other factors. Therefore, Ngāti Hori's situation provided a useful case study for research exploring the connections between water flow and customary fisheries.

Ngāti Hori presents an example of a smaller pre-Treaty settlement group with minimal resources in the early stages of engaging on water allocation and were therefore an appropriate group to work with in the development of the model. One of the major challenges for Māori in their engagement on water allocation is a lack of capacity often associated with being smaller, pre-Treaty settlement, and removed from central government (Durette et al., 2009). These groups are often taken up with other issues and have minimal resources in terms of time, people, and funding to devote to water issues within their rohe. As a result, it is difficult for them to engage with both regional and central governments. Similarly, it is difficult for regional councils to engage with these groups on water allocation (Durette at al., 2009). This case study, therefore, will demonstrate how a group with limited capacity can organise themselves with minimal resources to engage on water allocation as well as manage water more generally in their region.

Ngāti Hori are kaitiaki (guardians) of the lower Karamu Stream and have a close historic and traditional relationship with the Karamu and the former Ngaruroro River.[7] The Karamu Stream is a low gradient waterway that drains a catchment area of 490 km^2. It flows through Havelock North and the small townships of Whakatu and Clive in the Hawkes Bay region before entering an estuarine river mouth that it shares with the Tutaekuri and Ngaruroro rivers. The current Karamu Stream was once a former course of the Ngaruroro River, until 1867 when a large flood changed the course of the river. Flooding of the productive, southern area of the Heretaunga Plains has been an issue since the time of settlement, and in 1969, as part of the Heretaunga Plains Flood Protection scheme, the Ngaruroro River was diverted to the north, leaving the Karamu and Raupare streams to feed the lower Karamu Stream or, as it also known, the Clive River (HBRC, 2004).

The Karamu Stream has historically been subject to some of the greatest threats to the sustainability of a freshwater ecosystem, including extensive river diversion, pollutants such as runoff from vineyards and deliberate dumping of industrial waste, and loss of wetlands (Kusbabs, 2008). Drainage and flood control has developed in an ad-hoc manner in the area, and is the reason for the current low levels of flow in the Karamu Stream (HBRC, 2004). Most banks are covered with weeds, grass or flood tolerant trees such as willow and poplar, where they once would have been covered in native ferns, tall grasses, shrubs, flaxes and native trees (HBRC, 2004). Arguably, one of the most significant impacts of the Ngaruroro River diversion is the excessive growth of aquatic weeds in the lower Karamu Stream. The absence of flushing flows, sediment deposition, and increased nutrient levels have provided ideal conditions for nuisance growths of these plants. These processes and new ecosystems have resulted in a significant loss of habitat and fisheries diversity. For example, species, such as patiki and matamata, which once thrived in the area have been mostly lost.

The importance of the Ngaruroro River to Ngāti Hori is reflected in the location of Kohupatiki Marae, one of the Ngāti Hori marae, which is situated on the true left bank of the lower Karamu Stream (Kusabs, 2008). In the past, the Ngaruroro, was very much part of daily life for Ngāti Hori

[7] This description of the Karamu Stream is sourced mainly from Kusabs (2008).

ki Kohupatiki and was a major mahinga kai.[8] Today, however, the area is now highly modified and indigenous biodiversity is scarce. The hapū is concerned about the continued deterioration of the Karamu River and in particular a decline in their customary fisheries, especially the patiki which are a key aspect to the identity of Kohupatiki as a marae.[9] Ngāti Hori has indicated that their cultural values in the Karamu Stream, especially in customary fisheries, are dependent on the restoration of minimal flow levels that have largely been destroyed due to the extensive historic river diversion. Flow levels in the Karamu Stream are thus of primary importance to Ngāti Hori's role as kaitiaki of the area and the species once well supported by the stream system.

However, the futures of both the Karamu Stream and the values it provides for are uncertain. The Hawkes Bay Regional Council oversees management of the Karamu Stream. The Regional Resource Management Plan sets out the objectives, policies and methods for managing water quantity in surface water bodies in the region, including the setting of minimum flows. Māori cultural and spiritual values are identified in the Regional Resource Management Plan as one of the criteria that should be considered in the setting minimum flows. However, at present, the Hawkes Bay Regional Council does not have any method to assist them in accounting for these values. This is an acknowledged gap in their processes that they would like to address in the near future (Johnson, 2009). Ngāti Hori have expressed concern because the Karamu Stream continues to be viewed and treated as a flood channel and there are plans to increase protection against floods through the widening of the Karamu Stream where it passes by Kohupatiki marae. As this will potentially result in even lower water flows and greatly alter the riverbank even further, these plans directly conflict with Ngāti Hori's aspirations for the long-term management of the Karamu Stream and the species it supports.

At the time of this research project, the Hawkes Bay Regional Council was in the early implementation stages of a Karamu Stream Enhancement Project (the "Karamu Project"). The Karamu Project is a comprehensive enhancement programme for the Karamu catchment that aims to eventually improve water quality and fisheries values in the lower Karamu Stream. This programme includes riparian planting, restricted stock access to the riparian margins, enhanced public access, screening of industry and development of wetlands for stormwater treatment and enhancement of mahinga kai species (such as plantings for inanga spawning). The Karamu Project provided additional opportunities for the recognition and take up of Ngāti Hori's values in the Karamu Stream and for dialogue with the Hawkes Bay Regional Council throughout the research project.

[8] Mahinga kai refers to wild food resources such as fish, waterfowl and plants and the area they are sourced.
[9] "Patiki" is a reference to the vigorous manner in which the flounder forages for food, and is a historical reference to the strengths of Ngāti Hori ki Kohupatiki at foraging for food and providing for manuhiri.

4. RESEARCH METHODOLOGIES

Māori research methodologies are informed by a Māori worldview and values. The development of Māori research methodologies, therefore, represents the pursuit of tino rangātiratanga (self-determination) in the field of research and the belief that research involving Māori people should enrich the lives of Māori and use research approaches that reflect Māori culture, knowledge, and ways of living (Durie, 1996). Rather than a single Māori research methodology, Cunningham (1998) describes a continuum of approaches to research with Māori and by Māori. These range from research involving Māori at one end of the spectrum, to Kaupapa Māori research conducted by Māori at the other. Māori centred research may be considered to lie somewhere in between.

A Māori centred research methodology provides guidance on the purpose, approach and process of research (Durie, 1996). It comprises three principles: whakapiki tangata (enablement, enhancement, empowerment), whakaurunga (integration) and mana Māori (Māori control). The principle of whakapiki tangata requires the research to benefit Māori. The second principle, whakaurunga, recognises that research occurs within a wider context. The researcher must take into account the influences beyond those captured in the research objective that impact on the research. These include interactions between stakeholders, the effects of the past on the present, interactions between individuals and the collective they are part of, the nature of relationships between people and the environment, political dynamics within the group and between the group and outsiders, and socio-economic conditions and issues. Mana Māori refers to Māori having control over research that involves them as participants. It stems from the concept of tino rangātiratanga and promotes research that benefits Māori, uses Māori methods to collect data and disseminate research findings, develops and applies Māori theoretical frameworks to analyse data, and provides safeguards to prevent exploitation of Māori knowledge and people.

In keeping with a Māori centred research methodology this research aimed to benefit Ngāti Hori, which in light of their aspirations, meant that the research needed to enable the participants to actively take part in processes that lead to improvements in their customary fisheries. This research employed cultural mapping and a fisheries assessment as two of the primary methods for engaging and working with Ngāti Hori. In using these methods, the principles of the Māori centred research methodology were incorporated into our approach.

Cultural mapping

Cultural mapping is commonly used by Indigenous groups to gather together baseline data for long term community planning and resource management. Other reasons for undertaking a mapping exercise include articulating values; increasing connection to land and resources; generating enthusiasm, satisfaction and vision; and mobilising and empowering a community. In this case, cultural mapping provided an initial method to gather baseline data on fisheries and water flows.

There are a range of methods that may be employed when undertaking a mapping exercise, and the method chosen will depend on the purpose for undertaking a mapping project as well as the resources available. In this case study, the purpose of the mapping exercise was to gather basic baseline data for planning purposes. Minimal resources were available and the hapū did not have the technical capability to undertake a larger mapping project (for example, involving geographical information systems and the creation of data bases for information storage). In this case, a smaller mapping exercise was designed to collect three sets of data about the past subsistence regime and resource patterns; the present situation; and aspirations for the future.

The three sets of data were collected in separate phases of the mapping project on three separate sets of five aerial photographs that were generated from the Hawkes Bay Regional Council databases. The mapping exercise involved a group interview of community members and fishers with knowledge of the area and its resources. An interview questionnaire was prepared. The questions were designed to gather data about three general phases of time – past, present and future. Questions about the past focused on fish species collected, the

condition of the Karamu Stream and its margins, and flow and water levels in the stream. Similar questions were asked about participants' present experience and perspectives of the stream to gauge change over time. A further set of questions focused on the participants' aspirations for the stream in the future. A set of symbols was developed for the participants to record responses on the maps, and a spreadsheet was also used for recording responses.

The mapping exercise assisted Ngāti Hori to gather in a consolidated manner their community's knowledge about customary fisheries and water flows together in a series of maps that could be used for planning purposes. The maps generated discussion as to how water flows could be addressed (for example, by the opening of flood gates at certain times of the years) and were later used by the group in the creation of their management plan. The maps were also used to identify areas for the subsequent fishing survey as well as future planting projects. Most importantly, as a preliminary exercise in this research, the mapping exercise served to generate considerable enthusiasm and support among the community members for this work. This demonstrates that a mapping exercise of smaller scale is useful for many purposes and such an exercise need not be dismissed owing to lack of resources.

Fishing survey

In addition to collecting qualitative data about the fish species in the Karamu Stream, quantitative data was also collected using a fish survey and guided by a fisheries biologist (Kusabs, 2008). There were three objectives for the fishing survey. First, the fishing survey would determine the fish species present, including their abundance and general condition, in the Karamu Stream with particular emphasis near Kohupatiki marae. Second, as part of the fisheries survey, the effects of flood protection work, landuse and other stressors on fisheries values in the lower Karamu Stream be discussed with the community. The third objective would be to consolidate the information collected from the survey and make recommendations for appropriate measures to monitor and enhance customary fisheries in the Karamu Stream.

The survey was carried out using a search of existing fisheries records and a combination of field methods, such as trapping and night time observations. During the day, the group visited various sites to collect data and to set nets and traps to catch fish in order to assess their abundance and condition the following morning. As well, some freshwater mussels were collected by a hapū member and sent away for heavy metal testing. The consolidated data was delivered into report form to Ngāti Hori and used everyday language in order to provide the group with material that could be further used in their planning and management of customary fisheries and the Karamu Stream.

5. INTEGRATING QUALITATIVE DATA INTO RESOURCE MANAGEMENT

Although there is increasing recognition of the role that Indigenous and/or fishers' knowledge can play in filling the gaps of scientific knowledge used in management of resources and the environment, in practice the integration of these two types of knowledge remains difficult (Baelde, 2003). Similarly, while governments are starting to recognize the need to account for Indigenous values in water planning, there is an absence of methods to assist water planners in accounting for them. A recent study in New Zealand demonstrated that the qualitative nature of Māori knowledge and values affects the ability of Māori to engage on freshwater issues, such as allocations and management (Durette et al, 2009). Indeed, Baelde (2003) writes that one of the greatest impediments is found in the different nature of Indigenous and/or fishers' knowledge which tends to be holistic and expressed qualitatively.

Even though fish are only one component of the ecosystem, owing to their sensitivity to flow conditions, this research aimed to demonstrate how customary fisheries can provide a useful indicator in the setting of flows and, in New Zealand, help to bridge the gap in the realisation of these values at the regional level. Māori, especially those who are fishers, will hold considerable knowledge about the relationship between flows and fish and fish habitat in their rohe. This is especially relevant where there are older fishers in the area who have witnessed historical changes in the water body and species that it supports (Johannes, 2000). Moreover, there are methods of monitoring fish that provide measurable indicators and would allow Māori to set quantifiable targets, for example in relation to species abundance and size.

Ngāti Hori have been witness to the effects of changing flow levels on the fish in the stream over the many generations that they have fished the Karamu. Although not formalised, Ngāti Hori fishers have their own stream health indicators, in terms of past and present take levels of species such as patiki, water quality, and changes in vegetation. These fishers then are uniquely positioned to inform water allocation in the region. Since one of the areas of future work identified by Hawkes Bay Regional Council under the Karamu Stream Enhancement Project is developing baseline information on the fish and aquatic life in the system to better inform the setting of minimal flow levels (HBRC, 2004), an opening is created for the data collected by Ngāti Hori to inform the setting of flows in their area.

The remainder of this section discusses three groups of methods that might be employed by groups that would assist them to integrate their values and knowledge into technical data that can be taken up by water planners and policy makers. First, this section considers a group of methods that can be used to incorporate fishers' ecological knowledge and community knowledge into resource management. Next, methods that have been developed specifically to convert Indigenous knowledge around water and land management into technical data are discussed. The final set of methods involves international approaches to incorporating social values into environmental flows. Our focus is on methods that do not necessarily require a large input of resources and technical skill. The methods discussed in this section inform the development of an integrative model that can provide assistance to groups seeking water flows within their regions that reflect their values in customary fisheries.

5.1 Methods that incorporate fishers' ecological knowledge and community knowledge into resource management

Fishers' ecological knowledge (FEK) is a specialised body of traditional ecological knowledge (TEK). TEK can be defined as "a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes, Colding, & Folke, 2000, p. 1252). It can be considered to comprise three core constituents: "a component of local observational knowledge of species and other environmental phenomena, a component of practice in the way people carry out their resource use activities, and further, a component of belief regarding how people fit into or relate to ecosystems" (Berkes, Colding, & Folke, 2000, p. 1252). As a specialized body of TEK, FEK is knowledge held

by local fishers concerning, among other things, inter-annual, seasonal, lunar, diet and food-related variations in the behavior and movements of fish, and it is passed through the generations of fishers (Johannes, Freeman & Hamilton, 2000, p. 265). This is knowledge that has been developed long before scientific programmes were in place, and as such provides a valuable historical perspective that can inform the current state of fish and waterways (Lydon & Langley, 2003). In some cases, fishers' knowledge may be the only source of information on the historical changes in and current state of a local ecosystem that provides sufficient detail to enable resource managers to design appropriate methods for protecting both fish and their habitat (Haggan et al., 2007). The main challenge for the recognition of this type of knowledge in resource management planning is to find ways to convert it into technical data. Two methods that might be used are cultural mapping and fisheries assessments.

Cultural mapping

Cultural mapping is one of the methods that might be used to convert FEK, and TEK more generally, into technical data and often provides a useful starting point for engagement on resource management. Cultural mapping involves the collection of data, often through interviews, about traditional use of resources and occupancy of land by indigenous people, and the presentation of those data in map form (Tobias, 2000).[10] The utility of cultural mapping lies in its flexible nature such that a mapping exercise can be tailored to any situation. For example, even smaller groups with limited capability can undertake a mapping exercise though this may not be on the same scale as those groups who have access to considerable resources and technologies, such as geographical information systems and databases for information storage. The range of mapping methods varies from basic sketch maps or ephemeral maps, made on the ground with natural materials, which last only as long as the discussion, to more geographically accurate maps including geographical information systems technologies as they increasingly become available and affordable (Poole, 2003). As mentioned above, the scale of the mapping project will reflect the resources of the group, and may focus on specific sites and resources within a catchment area or it may involve looking at a larger region as a whole. As awareness and skill levels increase regarding technology, Indigenous communities are increasingly generating high-quality maps to be used in the negotiation of land and resource rights (Poole, 2003). While access to such technology greatly improves the quality and validity of maps, even maps generated by hand can be useful to Indigenous communities as they can show information from an Indigenous perspective that is not necessarily captured by conventional maps.

Johannes (2000) points to the fact that effective environmental management can only proceed if enough knowledge of natural history is available to provide sufficient information to construct sound hypotheses, yet this type of knowledge is often lacking. As recognised by Tobias (2000), one of the key reasons for undertaking a mapping project is "[p]roviding baseline data for long term community planning and resource management" (Tobias, 2000, p. vii). Other reasons include articulating values; increasing connection to land and resources; generating enthusiasm, satisfaction and vision; and mobilising and empowering a community (Durette, 2009). Since the knowledge that informs this type of mapping is anecdotal, there may be resistance to the use of this type of knowledge among scientists. However, its potential as a tool for bridging the gap between traditional and scientific knowledge should not be overlooked.

In such a mapping exercise the following provides a list of the type of information that might be recorded:

- spawning/breeding grounds
- fishing sites
- access sites
- patterns of vegetation and habitat
- levels of water flow

[10] We have chosen the term "cultural mapping" which has also been referred to as "land use and occupancy mapping" (Tobias, 2000), "tenure mapping" and "participatory mapping" (Chapin, 2005). These terms are all just variances of the same concept, with the distinction resting in the methods employed and the use to which the maps are put (Poole, 2003).

- withdrawals and discharges
- areas of blockage
- farming and industrial activities
- sites of cultural and spiritual significance
- habitation sites including settlements and burial grounds
- travel and trade routes
- Indigenous place names, stories and legend

Mapping may be of current patterns of use and occupancy, as well as historical mapping. Where two such sets of maps are made, this can provide a useful basis for comparison for future planning purposes.

A mapping exercise can therefore provide useful data that can be employed both for planning purposes and for engagement with councils on water allocations and flows. From a mapping exercise, patterns may emerge that assist the group in their planning. For example, a historical and current comparison may reveal areas to target for revegetation in order to recreate conditions that were once favourable to fish habitat. A comparison of past and current flow levels in such an exercise would be a first step in planning and provide some basis for engaging with councils on water allocations and flow levels. Concrete target actions, such as clearing areas of blockage or fencing certain areas, may also be identified for planning and engaging with councils. Where these maps are shared with council staff members, an increased understanding of the group's relationship to water resources in that region is possible. Regardless of the specific form or scope of a water mapping exercise, such an undertaking will always serve to mobilise Indigenous knowledge and capacity around water issues, as well as generate enthusiasm for the work ahead. As will be demonstrated by our case study, such maps provide a useful starting point for the articulation of a group's values that might be affected by water flows. These values may then later be incorporated into the group's water management planning.

Fisheries assessments

Another preliminary step that might be undertaken by a group in its planning stages is an assessment of its customary fisheries. In a recent study of Māori involvement in water allocation processes in their regions, many groups reported assessing and monitoring of customary fisheries as a way of engaging on water issues in their area (Durette et al., 2009). There are many methods that might be employed in order to undertake an assessment of fisheries, including recording catch, trapping, night spotlighting, habitat surveys and electronic fishing surveys. In the above-mentioned study, one group reported using the simple method of liaising with fishers in order to obtain updates informed by years of experience on the state of fisheries. Interviews with fishers can provide large amounts of information pertaining to both past and present fish species that can be useful when making fisheries assessments (Haggan et al., 2007). The comparison of data over the years provided useful feedback to inform itself in water planning. Data gathered in fisheries assessments could also be correlated with water flows in order to better understand how fish are affected by flows.

While some of these methods can be implemented by groups themselves with minimal external assistance; in the case of methods such as habitat surveys, night spotlighting, and electronic fishing surveys it might be useful to work in partnership with external experts. These exercises will be more useful and satisfying to a group where the external person is familiar with Indigenous relationships to water and resources. In New Zealand, it is essential that this person employs a Māori centred research methodology and operates in alignment with the principle of whakapiki tangata (enablement, enhancement, empowerment) (Durie, 1996) which would see the group participating in the research. This means that the external person would work closely with fishers and the community to identify sites as well as to collect data.

An example of how community data can be used to determine the flow requirements of a system comes from Australia in northern Queensland, where the Department of Primary Industries and Fisheries is currently investigating how freshwater flows into estuaries affect the productivity of estuarine fisheries. Although the project is led by scientists who work in partnership with

community fishers, this work provides an example of how data can be collected and correlated with water flows. This work involved scientists gathering information related to age and numbers of fish caught from commercial, recreational and community fishers in the area. The scientists took specimens from the catch of these fishers and analysed the age structure of barramundi, king threadfin and summer whiting catches to see if recruitment (the number of fish surviving the first year of life) correlated with freshwater flow (Haliday & Robins, 2007). Both commercial and recreational catches of various species were found to vary from year to year in relation to the size of river flows into the estuary. (Haliday & Robins, 2007). The goal of this project was to enable researchers to predict how changes in rivers flows might affect the productivity of fish that live in the estuaries at the end of tropical river systems.

5.2 Methods that have been used to convert indigenous knowledge about water and land management into technical data

The value of Indigenous knowledge lies in the fact that it has been passed down through generations and is about the relationship of living beings with one another and their environment. When used alongside scientific methods, it contributes to a more holistic approach to water management. In recognition of the importance of incorporating this knowledge into contemporary water management, some methods that convert indigenous knowledge into technical data have been developed both in New Zealand and internationally. Within New Zealand, one of the most well-known methods is the Cultural Health Index that was developed to enable Māori to assess and monitor the health of their water. Similarly, the State of the Takiwa is an environmental monitoring approach that will assist Māori to manage their environment into the future. The development of indicators is also another useful methods that allows a community to monitor changes in the environment. Finally, overseas, the Canadian Forest Model Program, though it deals with forestry rather than water, provides insight into how cultural knowledge might be incorporated into resource management planning and practice.

Cultural Health Index

The Cultural Health Index is a tool that Māori can use to assess and manage the waterways in their area (Tipa & Teirney, 2006). The index is based on Māori values of, and perspectives about, waterways and uses Māori indicators to evaluate the health of waterways. It was developed to meet two objectives: first, to provide a way for Māori to take an active role in managing freshwater resources and second, to give resource management agencies, such as regional councils, an option for discussing and incorporating Māori views and values for stream health in management decisions (Tipa & Teirney, 2006).

The Cultural Health Index has three components – site status, mahinga kai,[11] and cultural health. The first component is concerned with whether a site is of traditional significance and whether tangata whenua[12] would return to a site and use it. The second component involves tangata whenua assessing the mahinga kai values of a site: namely, identifying what species are present, comparing these species with what was known to be traditionally sourced from the site, assessing access to the site, and determining whether they would return to the site to source food or materials. The final component is stream health. The Cultural Health Index uses eight indicators to assess the health of a waterway. These indicators are: catchment land use, riparian vegetation, use of riparian margins, riverbed condition/sediment, channel modification, flow and habitat variety, water clarity and water quality. Scores are assigned to the sub-components in component one, the mahinga kai values in component two, and the indicators in component three. These scores are combined and used to assess the health of a waterway from a tangata whenua perspective.

In the landscape of tools for enabling Māori to participate in fresh water planning, the Cultural Health Index is unique. It enables qualitative information about people and streams to be

[11] See footnote 6 for definition.
[12] Tangata whenua is the term used by Tipa and Teirney (2006) in the Cultural Health Index, see footnote 5 for definition.

translated into quantitative data. In a quantitative form, the information may be more acceptable to, and readily used by, regional councils to inform decisions about how fresh water is managed.

Māori environmental indicators

An environmental indicator is something that is measured regularly to show trends or sudden changes in the state of a system, population or individual (Ministry for the Environment, 1998). Indicators enable the community to determine and monitor fluctuations in the health of the environment. Amongst other things, they should be relevant to the values the community wishes to achieve (Huser & Donaldson, 2004). Māori environmental indicators have been defined as "tohu [indicators] created and configured by Māori to gauge, measure, or indicate change in an environmental locality" (Ministry for the Environment, 1998). Traditionally Māori used environmental indicators to monitor the environment and moderated their practices accordingly. For example, early flowering of certain plants signified a long summer and drought ahead that tribes would need to prepare for (Meylan, 2005).

In the last decade, various organisations and individuals have developed Māori environmental indicators for contemporary use. Harmsworth and Tipa (2006) have grouped these indicators into five main categories:

- presence and abundance of culturally significant flora and fauna species, referred to also as taonga species;
- presence and abundance of plant and animal pests;
- a measure or assessment of the mauri of a place;
- indicators associated with water quality; and
- an assessment of cultural heritage, such as marae and waahi tapu.

According to these same authors for Māori environmental indicators to be effective they must be:

- based on tikanga;
- based on information that is still available;
- meaningful to tangata whenua;
- able to be measured and interpreted by local and wider Māori groups;
- cost-effective;
- repeatable and consistent;
- able to show environmental change;
- useful in a wide range of environments; and
- practical and tangible.

There are many reasons that a group may undertake to monitor their environment, including internal drivers (to monitor for themselves and to safeguard resources for future generations), to respond to issues (for example long term monitoring of water quality or fish stocks), and external drivers (for example in response to government initiatives or in relation to legislation such as the RMA).

Canadian Model Forest Program

The Canadian Model Forest Program (CMFP) involves processes that recognise and promote the incorporation of cultural knowledge into forest management practices and as such is a useful model to inform this research. The work of the CMFP has led to many successful collaborations between First Nations and non-First Nations partners in Canada, many of which involve the identification of cultural values and their incorporation into forestry management. As part of this, one of the focuses of these partnerships is to identify the community's relationship to the forest, and how its members perceive, identify and define a healthy forest.

The first step in any project under the CMFP will involve the collection of comprehensive baseline data on cultural values in the area (Higgins, 2007). The CMFP experience suggests that one of the keys for success is that Indigenous communities are supported, both in terms of

financial and technical assistance, to ensure that they are able to gather comprehensive base-line data within their territories (Higgins, 2007). Without this comprehensive information, the next step of developing measurable indicators and targets will continue to be a challenge (Higgins, 2007). The indicators are developed to suit local and regional conditions and provide the framework for monitoring on-the-ground changes and assessing their influence on the many components of forestry management. It is important that the community is involved in the development of indicators and targets that will allow them to measure whether or not their cultural values are being incorporated into planning and management practices. The CMFP recognises that while the development of indicators will be unique to each situation, there are some standard indicators that generally arise, such as the need to protect hunting and fishing grounds and key species (Higgins, 2007). Finally, there must be Indigenous involvement in the monitoring and reporting processes that are put in place based on these indicators.

At a national level this process is facilitated by an Aboriginal Strategic Initiative (ASI) that builds awareness of Model Forests in Indigenous communities and works to develop tools, publications and promote cross-cultural learning opportunities nationally.

5.3 International approaches to incorporating social values into environmental flows

While there is not yet a specific methodology for the conversion of cultural knowledge into technical data, international approaches to incorporating social values into decisions about flow and water levels may be relevant, and could usefully inform the development of the integrative model. One of the most well-known of these holistic environmental flow methodologies is the Downstream Response to Imposed Flow Transformations (DRIFT) methodology that was developed in South Africa. A similar earlier methodolgoy is the Building Block Methodology (BBM) also developed in South Africa. Both of these methods will be discussed in this section and later incorporated into the integrative model.

Holistic environmental flow methodologies

While early approaches to setting environmental flows tended to focus on single species or components of an ecosystem, in the 1990s a new more holistic approach to setting flows emerged from South Africa. The first of these methodologies, known as the Building Block Methodology (BBM), required all components of the river ecosystem, including people, to be considered when decisions are being made about environmental flows. The idea behind holistic approaches, such as the BBM, is to draw together a variety of disciplines to inform the setting of water flows. Each specialist on the multi-disciplinary team uses methods of their own choice to develop an understanding of the relationship between flows and ecosystems, and then works with the other team members to reach consensus on environmental flows. (King, Brown & Sabet, 2003). The information from this process is then used to guide decisions about the instream flow requirements for that river.

An important component of the BBM is the assessment of instream flow requirements from a social perspective. The aim of the social assessment is to determine the use of the riverine resources by rural communities living along a river, and to provide from this a qualitative assessment of their dependence on a healthy river system (Pollard & Simanowitz, 1997). In practice this assessment involves “detailing, with communities, the importance of, and reliance on, run-of-river flow, use of riparian species for food, thatching, medicinal and other purposes, as well as the use of floodplains and pools” (Pollard & Simanowitz, 1997, p. 397). In developing a method for assessing social instream flow requirements, Pollard and Simanowitz (1997) carried out research with people from two villages on the Sabie River in South Africa. The researchers used qualitative methods, such as key informant interviews, to gather data from the villagers. In questioning the villagers, they sought to understand a number of issues, such as the resources that were used, where these were located, the extent of resources, who used resources, the relative importance of different resources, and when resources were used. The purpose of the research was to establish a link between resource use and flow to indicate the components of the flow regime, such as low flows and medium flows, that the community considered important for maintaining the resources that they used.

While the BBM had its limitations,[13] it set the stage for the evolution of several alternative holistic environmental flow methodologies, most notably the Downstream Response to Imposed Flow Transformations (DRIFT) methodology. The DRIFT methodology is an interactive, scenario-based approach, designed for use in negotiations, and contains a strong socio-economic component, important when quantifying subsistence use of river resources by riparian peoples. Like the BBM it involves a multi-disciplinary research team from the biophysical and social sciences. Each contributes their expertise to predict the consequences of different flow scenarios for the river ecosystem and the communities who are likely to be affected. The strength of DRIFT as a methodology is that it offers a structured process for predicting the biophysical, social and economic consequences of altering the flow regime of a river (King, Brown & Sabet, 2003).

There are four modules in the DRIFT methodology (King, Brown & Sabet, 2003). In the first module – the biophysical module – the nature and functioning of the river ecosystem is described and a database of predicted flow-related changes is created. The second module is referred to as the sociological module. This involves identifying the subsistence users of the river who are potentially affected by proposed changes to the flows and water levels. Their use of the river is quantified, and an understanding of how changes to the river might affect them is developed.[14] In the third module, scenarios for a range of future flows and water levels are developed. For each flow scenario, the associated biophysical and socio-economic impacts are predicted. In the fourth module, the costs of mitigating adverse effects and providing compensation to the affected communities for impacts that cannot be resolved are assessed.

While it is beyond the scope of this research to delve into each of these methodologies in great detail, it is important to consider the holistic approach that they represent (King, Brown & Sabet, 2003). They provide decision makers with information that usually remains unconsidered in water-resource developments, especially on potential human and ecosystem costs. The scenarios provide a number of future options on how the river could change as flow changes, and how this would impact overall environmental condition and subsistence users. The trend in setting environmental flows is for these holistic methodologies to increasingly be run along with other hydrological based methods, towards whole ecosystem approaches. As such, these methodologies provide insight into processes, and in particular public participation and transparent decision making processes, that can inform the development of the integrative model.

[13] According to King et al. (2003) the Building Block Methodology has changed the way water specialists collected and analysed data about rivers in South Africa. However, it had two major shortcomings. First, it was essentially prescriptive. A river condition is specified, and then the recommended flow regime to achieve it [is] described. The outputs do not lend themselves to negotiation, because effort is mostly directed to justifying a single flow regime, and information on the implications of not meeting it is not easily accessed. Second, it did not adequately address the impacts of changing rivers on subsistence users. These social impacts are part of the costs of water resource developments in many developing countries, but are still rarely described (King et al., 2003, p. 621).

[14] The sociological module involves quantifying the affected communities' use of the river in economic terms. Two implications are apparent here. First, some economic valuation of the river resources is required. Second, community values that cannot be quantified in monetary terms, such as a customary relationship with the river, are not able to be included in the module.

6. INTEGRATIVE MODEL

Informing the development and implementation of our model are both the Māori centred research methodologies that were employed in our case study and the three other groups of methods set out in the previous section. In the development of the model, we also considered the growing global shift towards more integrated water management approaches (Pahl-Wostl et al., 2008). We argue that contemporary approaches to water management do not adequately address the needs of the entire ecosystem or spectrum of water users. Integrated water management approaches, in contrast, look at the system as a whole and recognise the inter-dependency of all users within a system. Therefore, these approaches to water management should lead to more resilient outcomes including healthier water and waterways for current and future generations. Since these integrated approaches to water management tend to account for all values – social, economic, and cultural – a space is created with their implementation for a dialogue around, and the realisation of, Indigenous values in water.

As discussed in previous sections, one of the major challenges to integrating Indigenous values into water management is the qualitative nature of these values. That is, Indigenous values do not lend themselves to being easily expressed in a form that can be readily incorporated into water planning and policy at the regional level. However, there are existing methods, both within New Zealand and internationally that, in part, address this gap by providing means to enable the conversion of these qualitative values into a form that is more quantifiable and is able to be taken up by water planners and policy makers. In the previous section we discussed three different types of these methods: methods that incorporate fishers' ecological knowledge and community knowledge into resource management; methods that have been developed to convert indigenous knowledge around water and land management into technical data; and international approaches to incorporating social values into environmental flows.

There are commonalities within each of these groups of methods in their approach to providing for qualitative values and knowledge. This model builds on these commonalities to create an integrative model for the conversion of Indigenous values regarding their customary fisheries into technical information about flow levels in river bodies. Through this comparison of the approaches taken in the various methods described above, we have identified five key stages that would form the basis of the integrative model. These five stages are set out below (see. Fig. 2). This model provides direction on the data gathering and assessment stages of the process of engaging on water flows. It then considers the tools that can be utilised to carry the work forward – including management plans and appropriate governance structures. The model also highlights the importance of relationship building as an essential aspect of achieving the group's aspirations for customary fisheries and water flows. The outcome is an approach that can be taken, and the identification of tools that can be used at various stages of this process, to convert the data into a more quantifiable form that can then inform planning and policy on water allocation. In following this process and applying these tools, the ultimate outcome sought is water flows that reflect Indigenous customary values in fisheries.

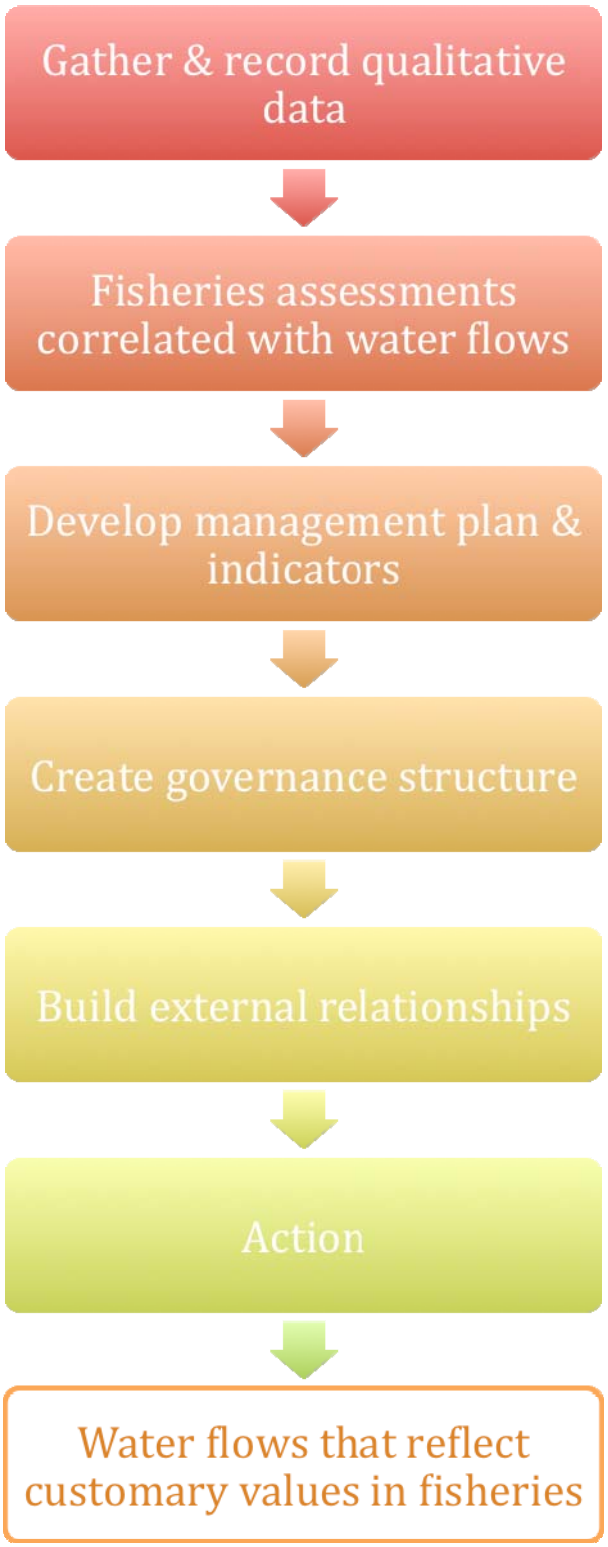

Fig 2: Integrative Model

1. Gather and record baseline qualitative data

One of the first actions required by a group seeking to engage on water flows is to gather baseline qualitative data from the community. Most of the methods discussed above identify collection of qualitative data as a preliminary step, and the most commonly employed method for gathering this data is through interviews. For example, fisheries assessments typically start with

interviews of fishers to gain an understanding of the species present and to identify the appropriate scientific methods that should be employed to collect data as well as where data should be collected. Similarly, the Cultural Health Index, BBM and DRIFT all use interviews as a preliminary data collection method. Methods such as the BBM, DRIFT and CFMP further suggest that these interviews would seek to detail, with communities, the importance of, and reliance on, water flows and the species they support. Interviewees should include elders, those who have lived near the river for a long period, those who are responsible for or active in carrying for the environment, and those who rely on the water body as a source of traditional species, including local fishers (Tipa & Tierney, 2006).

One of the means of recording data from interviews might be to hold them in conjunction with a cultural mapping exercise. According to Tipa and Tierney (2006) the purpose interviews is threefold: to identify sites of traditional significance; to identify why sites were valued in the past and how they have been used by tangata whenua; and to identify how sites and the uses of them have changed over time. A cultural mapping exercise would enable this data to be plotted in a visual and concrete form that can later be used for planning purposes. Our case study demonstrates how such an exercise might be designed for a smaller group with minimal resources. The outcomes of the cultural mapping exercise in our case study were three sets of comparative maps (past, present and future); spreadsheet of data (including site identification, past and current use, changes in use and patterns over time); a rich dialogue describing the waterway from the perspective of Ngāti Hori that was recorded; initial contacts within Hawkes Bay Regional Council; and enthusiasm and vision amongst participants.

Where data is recorded it is most appropriate that the community has overall responsibility for all aspects of data management throughout the study (Tipa & Teirney, 2006). In cases involving external researchers, multidisciplinary teams and government funded studies this may not always be easy to reconcile. However, it is essential that the issue of data storage is addressed from the outset of any project to ensure the commitment and full involvements of all project participants. For example, in Australia where intellectual property mainly rests with the government agency funding the study, Indigenous groups remain hesitant to participate in any study that involves the articulation of their values, even those studies undertaken for environmental management purposes. In the guide to the Cultural Health Index, Tipa and Teirney (2006) offer some insights into issues around data security and storage. Additionally, in most countries various forms of software for the storage of such data is available. Where groups do not have access to software and other computer databases, any data collected, for example, in the form of recordings, maps, and notes, can be assigned to one person from the group who agrees to act as guardian of that information. Clear agreement is also required as to who will have access to that data.

2. Assessments of fisheries in relation to water flows

The next step is to undertake assessments of customary fisheries and correlate the state of these fisheries with water flows to provide quantifiable data that can work alongside the qualitative data collected in the interview stage. This assessment will ideally employ both mainstream science and traditional assessment methods. Established methods with a scientific basis are available and accessible for fisheries assessments, including recording catch, trapping, night spotlighting, habitat surveys and electronic fishing surveys. These methods lead to quantifiable data on fisheries but related to water that can be used by water planners and policy makers. Other methods include discussions with fishers as to long term changes and patterns, as well as visual assessments. The methods chosen will depend on the access of the group to technical skill and resources. In our case study, Ngāti Hori was able to work closely with a fisheries biologist who then provided them with a report assessing their customary fisheries and recommending ways forwards.

When this data is recorded over time or compared with historic databases, such as the New Zealand Freshwater Fish database or any other databases kept by regional councils or the Department of Conservation, it can lead to quantifiable targets around the impacts of flows on fisheries values that can be incorporated into the group's plans. For example, the long term collection of this data would lead to conclusions about the dependency of certain species on

levels of water flows if indicators such as species distribution, abundance and size are correlated with water flows.

3. Developing management plans and indicators

The next step is to link both the qualitative and quantitative data into the group's long term planning. In order to assist the take up of this data by water planners and policymakers, the group must first incorporate the data into their own planning. In New Zealand, iwi and hapū planning documents provide groups with one way to organize their data into a long term plan with concrete targets and actions. These concrete plans then provide a basis for dialogue with local authorities. In our case study, Ngāti Hori was able to use comparisons between the past and present state of the Karamu Stream based on the cultural mapping exercise and the fisheries report completed by the fisheries biologist to develop a hapū management plan. Another possibility is for the group to develop their own environmental indicators and to incorporate these into their plan as a way of achieving and monitoring change in their environment.

The development of these plans will either require assistance from a facilitator or for the group to undertake some research of their own on how to develop a management plan. Our approach was to develop the management plan over a period of approximately ten months with meetings at intervals of six weeks. At the first meeting, the incorporation of data into the plan was facilitated mainly by the researchers. After time, the community coordinator, appointed at the outset of the project, was able to facilitate the exercise as the researchers worked to transfer the skills needed for developing the plans to the coordinator and other community members.[15]

One of the main challenges to the development of an effective management plan is that these documents tend to lack the depth of detail at the quantifiable level necessary to be taken up by scientists and planners within the regional councils (Durette et al., 2009). Instead, these documents often work at the more general level and higher concepts. For example, in New Zealand the focus is often on concepts such as mauri[16] and Māori relationships to water (Durette et al., 2009). Thus, the focus of our management plan was to provide targeted or measurable outcomes while taking into account Māori relationships to water. Not only would this approach better enable this document to be taken up by the regional council, but it also provided real guidance to the group and satisfaction when these clear targets were achieved.

In order to be manageable the management plan developed by Ngāti Hori sets out four priority areas that were identified from the data collection stage of the research. These priority areas include water flow, water quality, protection and restoration of fish and fish habitat and protection and restoration of traditional riparian vegetation. These priority areas are then each broken down into two to three specific issues, each of which is further broken down into a desired outcome, method for achieving the outcome and concrete actions (see Fig. 3 below).

[15] The plan is expected to be completed and lodged with the Hawkes Bay Regional Council and the Maori Standing Committee of the Hawkes Bay Regional Council early 2010.
[16] Mauri might be defined as an essential life force inherent in all things.

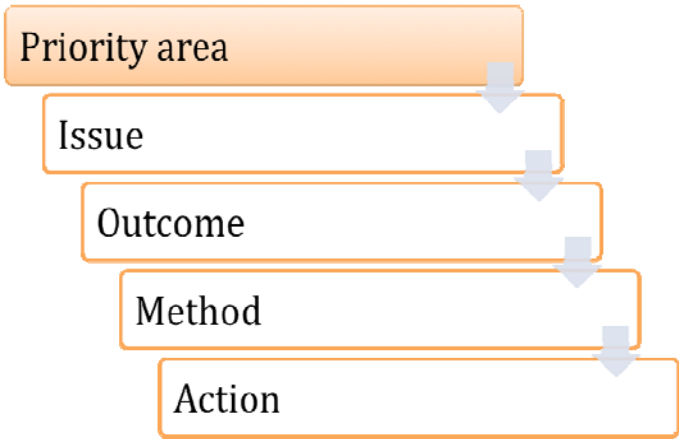

Fig. 3: Breakdown of a priority area of management plan

The management plan is supported by an operational plan that assigns a person and a timeline to each action. The final task in the creation of the management plan and associated operational plan is the development of indicators. These will be used to identify and monitor outcomes in relation to customary fisheries and water flows. For example, the presence and abundance of a certain fish species may be an indicator of the water flows required to support that species.

When concrete issues and outcomes are included, these management plans provide a tool for Māori to articulate their values in such a way that they are more likely to be recognized and responded to by planners and policy makers. Under the Resource Management Act, regional councils are obliged to take into account any such planning document lodged with that council in the case of preparing or changing a regional policy statement[17] and preparing or changing a regional plan.[18] It should be noted that the lodgment of these plans with councils does not necessarily ensure that regional councils will take action that reflect the values in them (Durette et al., 2009). While it is more likely that regional councils will act where there are clear outcomes identified within the plans, in all cases the lodgment of these plans by a group will still require considerable persistence on the part of the group lodging the plan to ensure that regional councils follow through with them (Durette et al., 2009).

4. Creation of a governance structure

There is no specific point at which a governance structure must be set up; however, it is necessary at some point to choose a structure to carry the work forward. There is a wide range of governance structures that might be implemented by a group. Where the group has a long term source of resources, a resource management unit might be created that would sit within a larger organization or a trust board may take on the work. However, where the group is smaller and has minimal resources, both management committees and forums might be more appropriate and sustainable organisational forms to use. In a recent study of Māori engagement on water allocation, committees and forums were identified as two of the most common structures chosen by Māori to engage on water allocation (Durette et al., 2009). These committees may be made up of only Māori, or they may be made be up of Māori along with the wider community and stakeholders. The forums provide a space for Māori to come together themselves or with council and stakeholders to discuss issues around either water specifically or environmental issues generally (Durette et al., 2009).

In our case study, the group elected to start gathering data as an informal structure led by an appointed person who would act as a coordinator to organize the group's meetings and liaise with Hawkes Bay Regional Council. Approximately six months into the project, the group met

[17] s. 61(2A)
[18] s. 66 (2)(c)

with the purpose of choosing a structure to carry on with the work. An advertisement was put out to the wider community inviting both Ngāti Hori and other interested parties to attend the hui. A working committee was constituted and a hapū management plan was chosen at the tool to carry the work forward. The committee elected to meet every six weeks until the plan was finished. The working committee is led by the Ngāti Hori community coordinator and includes members of the wider community and local fishers. The community coordinator has established a relationship with the Hawkes Bay Regional Staff member responsible for overseeing the Karamu Stream Enhancement Project. This staff member has also attended some of these meetings as well as assisting the committee to put together a funding submission.

5. Building relationships with external groups and regional councils

A group can strengthen its resources through building its networks. These networks can include local government staff members, other community organisations and stakeholders, interest groups, farmers and industry, as well as other Indigenous groups. These networks not only increase the availability of various types of support, but also raise awareness of Indigenous values more generally. Finally, the viability and sustainability of a group might be strengthened if the it eventually seeks to become part of a larger body, for instance, the Aboriginal Strategic Initiative that supports the CFMP at the national level in Canada. In New Zealand, iwi organisations may provide the additional assistance required by a smaller group for their engagement on water flows.

The table below demonstrates the types of relationship built and the types of support received by Ngāti Hori during the course of our research:

Relationship built	**Type of support**
Hawkes Bay Regional Council	Generation and donation of maps for cultural mapping exercise; Scientific advice; Training in council databases; Access to council reports; Assistance submitting funding applications; Discussion of possible future partnerships.
Local fishers	Additional input in data collection stage
Ngāti Hori members living away	Facilitation of set up of governance structure and development of hapū management plan
Periodic Detention groups	Volunteer staff for planting and maintenance
Neighboring marae and other groups with similar issues	Opportunities for mutual learning
Local growers	Donation of plants
Local school	Creation of a long term source of plants through creation of a school nursery
Chadwick Trust	Creation of a long term source of plants
Māori Standing Committee of the Hawkes Bay Regional Council	Agreement to support the hapū management plan upon its lodgement with council

6. Taking action on customary fisheries and water flows

Considerable energy and effort will be required on the part of group members to carry through with the work they set out for themselves. In New Zealand, the lodging of a management plan with a regional council will require follow up actions on the part of the group to ensure that council staff members understand the values and worldview behind the plan, and that these are reflected in regional plans and policies. The take up of such a management plan might be strengthened if the group accompanies its lodgment with training or education for council staff members on how to account for Māori values in water planning and policy (Durette et al., 2009). However, the high turnover of regional council staff means that these initiatives may only serve their purpose for a limited time, which can be frustrating and taxing on the group who is left to start at the beginning with new staff members.

It will also be important for the group to implement its own monitoring processes in relation to customary fisheries. In our case study, it was recommended through the work with the fisheries biologist, that Ngāti Hori implement a fisheries monitoring program, based on traditional fishing methods, to monitor fisheries resources in the lower Karamu Stream. This would enable Ngāti Hori to establish baseline fisheries data and to monitor any future changes in their fisheries. In addition to monitoring their own resources, some groups may undertake to monitor their regional council's implementation of their obligations under the Resource Management Act to provide for their management plans.

7. CONTRIBUTIONS OF THE MODEL

This research focused on how to convert Indigenous values regarding customary fisheries into technical information about flow levels in river bodies which can then inform policy on water allocation. This research is of extreme importance as governments world-wide are currently faced with this new and emerging notion of “cultural water flows” and dealing with the larger question of how to incorporate cultural values into resource management planning. Increasingly Indigenous people are challenging mainstream approaches to water management, calling for more holistic approaches that incorporate Indigenous knowledge and reflect a broader spectrum of values. The assumption that environmental flows provide for the entire relationship that Indigenous people have with their water and the resources that it supports is no longer sufficient. However, determining how much water should be allocated to cultural values and translating this into practice is a major challenge for both Indigenous and governments world-wide.

In New Zealand, a recent engagement of Māori country-wide revealed that their expectations in relation to freshwater, and water allocation specifically, are not being met (Durette et al., 2009). In that study, Māori called on the central government to provide clear direction to regional councils as to how to provide for Māori values in freshwater. However, many of those same participants expressed skepticism as to the political will of central government to take the steps necessary to change the current approaches to water management to better take into account Māori values. In this way then, even when groups have access to the appropriate tools and methods, and are able to engage on water allocation, they face a considerable challenge in seeing their values reflected in regional plans, policies and practices. We propose that our model provides a starting point for meaningful dialogue around specific volumes that might provide for the customary values of Māori and Indigenous groups in other countries – at least in relation to fisheries.

8. REFERENCES

Baelde, P. (2003). Using fishers' knowledge goes beyond filling gaps in scientific knowledge – Analysis of Australian experiences. In Haggan, N., Brignall, C. & Wood, L. (eds) *Putting Fishers' Knowledge to Work*, *Fisheries Centre Research Reports, 11*(1): 78.

Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications, 10*(5), 1251-1262.

Bishop, R. (1993). *Collaborative research stories: whakawhanaungatanga*. Palmerston North: The Dunmore Press.

Chaffey, H., Montevecchi, W. & Neis, B. (2003). Integrating scientific and local ecological knowledge (LEK) in studies of common elders in Southern Labrador, Canada. In Haggan, N., Brignall, C. & Wood, L. (eds) *PuttingFishers' Knowledge to Work*, *Fisheries Centre Research Reports, 11*(1): 78.

Chapin, M., Lamb, Z. & Threlkeld, B. (2005). Mapping indigenous lands. *Annual Review of Anthropology, 34*: 619-38.

Cooper, D. & Jackson, S. (2008). Preliminary study on indigenous water values and interests in the Katherine region of the Northern Territory. Report for NAILSMA's Indigenous Water Policy Group. Darwin: CSIRO Sustainable Ecosystems & NAILSMA.

Craig, D. & Shearing, S. (2004). *Best Practice Models and Approaches for Indigenous Engagement in the Murray Darling Basin*. Research Report Prepared for Murray Darling Basin Commission for the Development of the Indigenous Action Network. Sydney: Macquarie Centre for Environmental Law.

Durie, M. (1996). *Characteristics of Māori Health Research.* Paper given at Hui Whakapiripiriri: A Hui to Discuss Strategic Directions for Maori Health Research. Wellington: Te Roopu Rangahau Hauora a Eru Pomare, Wellington School of Medicine.

Durette, M., Nesus, C., Nesus, G. & Barcham, M. (2009). *Māori perspectives on water allocation*. Wellington: Ministry for the Environment.

Durette, M. (2009). *Community-driven mapping for resource and environmental management*. Synexe Knowledge Note 2009/05.

Flanagan, C., & Laituri, M. (2004). Environmental assessment: local cultural knowledge and water resource management: The Wind River Indian Reservation. *Environmental Management, 33*(2), 262-270.

Garcia-Allut, A., Freire, J., Barreiro, A. & Losada, D. (2003). Methodology for integration of fishers' ecological knowledge in fisheries biology and management using knowledge representation (artificial intelligence). In Haggan, N., Brignall, C. & Wood, L. (eds) *Putting Fishers' Knowledge to Work*, *Fisheries Centre Research Reports, 11*(1): 78.

Haggan, N., Neis, B. & Baird, I. (eds.). (2007). *Fishers' knowledge in fisheries science and management*. Coastal Management Sourcebooks 4. Paris: UNESCO Publishing.

Haliday, I. & Robins, J. Environmental flows for sub-tropical estuaries: understanding the freshwater needs of estuaries for sustainable fisheries production and assessing the impacts of water regulation. Final Report

Harmsworth, G. R., & Tipa, G. (2006). Māori environmental monitoring in New Zealand: progress, concepts and future direction [Electronic Version] from <http://icm.landcareresearch.co.nz/knowledgebase/publications/public/2006_Māorienvmonitoring_harmsworth_tipa.pdf>.

Hawkes Bay Regional Council (HBRC). (2004). *Te Karamu catchment review and options for enhancement.* HBRC: Asset Management Group.

Hawkes Bay Regional Council. (2006a). Water management review. Environmental Management Group Technical Report. EMT 06/11 HBRC Plan No. 3886.

Hawkes Bay Regional Council. (2006b). *Regional Resource Management Plan*. Available at <http://www.hbrc.govt.nz/ReadAboutIt/PlansandStrategies/tabid/245/Default.aspx>.

Hudson, H. Bryom, A. & Cadderton, W. (2003). A critique of IFIM - instream habitat simulation in the New Zealand context. *Science for Conservation*, 231. Wellington: Department of Conservation.

Huser, B., & Donaldson, C. (2004). *Proposed indicators and performance standards for the 2020 Community Action Plan*. Hamilton: Environment Waikato.

Jackson, S. (2008). Recognition of indigenous interests in Australian water resource management, with particular reference to environmental flow assessment. *Geography Compass, 2/3*, 874-898.

Jackson, S. & Morrison, J. (2007). Indigenous perspectives in water management, reforms and implementation. In Hussey, K. & Dovers, S. (Eds.), *Managing water for Australia: The social and institutional challenges*. Canberra: CSIRO Publishing.

Johannes, R., Freeman, M. & Hamilton, R. (2000). Ignore fishers' knowledge and miss the boat. *Fish and Fisheries, 1,* 257-71.

Johnson, K. (2009). Personal Communication. Hawkes Bay Regional Council.

King, J., Brown, C., & Sabet, H. (2003). A scenario-based holistic approach to environmental flow assessments for rivers. *River research and applications, 19*, 619-639.

Kliskey, A. D. (1993). A comparative analysis of approaches to Wilderness Perception Mapping. *Journal of Environmental Management, 41*(199-236).

Kusabs, I. (2008). *An assessment of fisheries values and comments on the impact of river diversion and potential for future restoration*. Report prepared for Ngati Hori. Rotorua, New Zealand.

Lydon, G., and Langley, A.D. 2003. How local fishers' knowledge improves the management of fisheries in New Zealand — a seafood industry perspective. In *Putting fishers' knowledge to work*. (Eds. Haggan, N., Brignall, C. & Wood, L). Available at <http://www.fisheries.ubc.ca/publications/reports/report11_1.php>.

Mackinson, S. (2001). Integrating local and scientific knowledge: an example in fisheries science. *Environmental Management 27*(4), 533-545.

Mackinson, S., & Nottestad, L. (1998). Points of view: combining local and scientific knowledge. *Reviews in Fish Biology and Fisheries, 8*, 481-490.

Mallard, T. (2008). *Ensuring healthy water - national environmental standard*. Available at <http://www.beehive.govt.nz/release/ensuring+healthy+water+–+national+environmental+standard>.

Meylan, G. (2005). Climate scientist looks to iwi tradition. *Sunday Star Times*.

Ministry for the Environment. (1998). *Maori Environmental Monitoring*. Written by Te Ahukaramu Charles Royal. Technical paper No. 26 - Maori, July 1998.

Ministry for the Environment. (2008). *Draft guidelines for the selection of methods to determine ecological flows and water levels*. Wellington: Ministry for the Environment.

Ministry for the Environment and Ministry of Agriculture and Forestry. (2006). *Freshwater for the future*. Wellington: Ministry for the Environment and Ministry of Agriculture and Forestry,.

NAILSMA. (2009). Indigenous perspectives at World Water Forum. North Australian Indigenous Land and Sea Management Alliance Media Release, 10 March 2009.

Pahl-Wostl, C. , Tàbarab, D., Bouwenc, R. , Crapsc, M., Dewulf, A. , Mostert, E., Ridder, D., and Taillieuc , T. (2008).The importance of social learning and culture for sustainable water management. *Ecological Economics*, 64 *(3)*: 484-495.

Pollard, S., & Simanowitz, A. (1997). *Environmental flow requirements: a social dimension*. Paper presented at the 23rd WEDC Conference: Water and sanitation for all: partnerships and innovations.

Poole, P. (2003). Cultural mapping and indigenous peoples. A report for UNESCO. UNESCO Doc. FS82/WF.32 (1982).

Tipa, G. (forthcoming).

Tipa, G. (2007). *Negotiating values: providing for cultural opportunities when setting river flows*. Paper presented at the River Symposium. Available at <http://www.riversymposium.com/2007_Presentations/C2G_Tipa.pdf>.

Tipa, G. & Teirney, L. (2006). *Using the Cultural Health Index: How to assess the health of streams and waterways*. *Te whakamahi i te Kuputohu Hauora Ahurea: Me pëhea te arotake i te hauora o ngä pükaki me ngä awa wai*. Wellington: Ministry for the Environment.

Tobias, T. (2000). *Chief Kerry's moose: A guidebook to land use and occupancy mapping*. Vancouver: Union of B.C. Chiefs.