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# **Including Mātauranga Māori in Environmental Flow Setting Decisions**

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**NIWA Client Report: HAM2010-030  
April 2010**

**NIWA Project: MFE10301**

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*Prepared for*

**The Ministry for the Environment**

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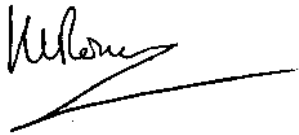
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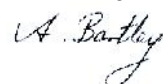
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## Executive Summary

In a New Zealand context, M ori and non-M ori both suffer from such potential water shortages. M ori cannot divorce themselves from this challenge as their culture and ways of life are closely tied to the lands and waters within their rohe (tribal territories). The modifications to rivers and streams in New Zealand over the last hundred years have shown that the waters of many catchments can also be managed primarily as an economic resource that can be dammed, stored, diverted and extracted. M ori have, for generations, voiced their concerns at the continual modification and manipulation of the waterways within their tribal territories (Waitangi Tribunal 1984, 1991, 1992, 1995, 1998).

Effective participation in water allocation processes is needed to ensure that the impacts experienced by tangata whenua in the past are not repeated. Of the many techniques developed to address flow related issues, many rely heavily on professional expertise and objective, scientific philosophies, which may fail to recognise cultural values and benefit from cultural knowledge. The analysis of case studies suggests that although M ori aspire to be equal participants in freshwater management, their level of participation (if any during the flow assessment process) has been limited to consultation, while their role in flow setting processes has been largely that of a submitter.

There is increased evidence of the contribution that indigenous knowledge can make to contemporary resource management. It, however, requires explicit recognition by resource management agencies and resource users of the benefits to be realised through the utilisation of indigenous knowledge. International studies analysing association of Indigenous societies to freshwater water are emerging. But it remains untested how these are used and applied to enable such associations to inform management.

Indigenous conceptualisations of well-being are influenced by the natural, social, spiritual and cultural worlds within which that indigenous community lives. Such conceptualisations that are now emerging in water management are consistent with conceptualisations of M ori and provide opportunities for both engagement with tangata whenua and incorporation of M tauranga M ori. The term “health and wellbeing” is now referred to in Treaty Settlements, most notably the Waikato-Tainui Deed of Settlement.

The cultural assessment framework in this report comprises a number of tools, methods, processes. These alongside the recommendations will enhance the effectiveness of tangata whenua participation, complement existing water management practices to the benefit of all sectors, and importantly accord protection to the health and wellbeing of freshwaters valued and used by tangata whenua.

**This report is written principally for Ministry for Environment (as the Client) but the intended audience includes whānau, hapū and iwi, statutory resource managers, and other interested agencies.**

**The focus of this report is one aspect of freshwater management – specifically flow setting processes.**

This report **does not** discuss issues relating to the ownership of, rights to, or governance of freshwater. It does not set out any positions in respect of these subjects. But the fact that rights, ownership or governance are not discussed in this statement should not be construed as meaning iwi accepts the current position or that the authors do not understand or realize the significance of these parallel processes. We simply believe that these fundamental issues – which are unresolved – are being discussed and debated in other more appropriate forums.

This work is, however, complementary to these wider discussions, because once these core issues are resolved, the question will still remain – how do we accommodate the values of tangata whenua in flow setting?

It is hoped that this report will help shape the work of Māori and resource management agencies over the coming years.

We believe that the recommendations in this report are conservative and realistic but also innovative and if implemented will benefit waterbodies, go part of the way to re-establishing relationships of whānau, hapū and iwi with valued waterways, and enhance the effectiveness of relationships between tangata whenua and resource management agencies.

## 1. Introduction

Globally, changes in the quantity and quality of freshwaters represent a strategic threat to humans, environmental sustainability and the “vitality of human cultures” (Ecological Society of America 1998). Indigenous communities are particularly sensitive to the use and development of freshwaters as they hold distinct perspectives on water which concern their identity, attachment to place, knowledge, and custodial obligations to manage tribal lands and waters (Sheehan 2001, Flanagan & Laituri 2004, Jackson et al. 2005).

New Zealand has some of the world’s highest quality fresh water, ranking in the top ten for both its abundance and its cleanliness (United Nations 2003). However, variability in the occurrence of water means that although New Zealand has abundant freshwater, we often have shortages because that water is in the wrong place and at the wrong time. In addition, the relationship between water use and water quality may mean that while there is an abundance of water as a whole, high demand for quality waters may result in scarcity for certain uses. Issues can arise when, for instance, commercial uses and recreational, environmental or aesthetic uses are in competition for the same water.

In a New Zealand context, Māori and non-Māori both suffer from such potential water shortages. Māori cannot divorce themselves from this challenge as their culture and ways of life are closely tied to the lands and waters within their rohe (tribal territories). The modifications to rivers and streams in New Zealand over the last hundred years have shown that the waters of many catchments can also be managed primarily as an economic resource that can be dammed, stored, diverted and extracted. This may conflict with Māori cultural values of those same waters.

Māori have, for generations, voiced their concerns at the continual modification and manipulation of the waterways within their tribal territories (Waitangi Tribunal 1984, 1991, 1992, 1995, 1998). Most whānau, hapū and iwi are able to point to their experiences that show that almost all their experiences with water developments have been negative. In particular:

- Wāhi tapu and wāhi taonga areas have been lost with a consequent loss of active associations and cultural relationships with the area.
- Previously valuable kai gathering areas have been similarly destroyed, and in instances access to existing resources has also been adversely affected.



- Fish movement within river systems has been disrupted; both of juveniles into the system and of mature adults attempting to leave the system. The success of recent attempts to mitigate these effects on fish passage is unknown.
- Newly created lake, canal and wetland systems are typically adopted enthusiastically by a range of users who then develop these areas as recreational fisheries and boating areas. This results in the further diminution of cultural interests and the erosion of rights in these areas.
- As with existing water allocation regimes in waters New Zealand, tangata whenua property interests in the ownership, management, usage and access to water resource never receives recognition let alone priority attention and are often subordinated to agricultural economic interests.
- The character of highly valued areas is irrevocably altered.
- The “minimum” flows are not considered adequate for the maintenance of a water body’s mauri.
- Infrastructure construction can have serious environmental implications and can damage fishery and other cultural interests, sometimes irrevocably.
- Infrastructure has interrupted the continuity of flow from the source to the sea which conflicts with the holistic conceptualisations.
- Infrastructure such as dams can trap sediment and coarser materials needed to replenish the eroding coastal environment.

In the last two decades M ori have become more vocal in seeking greater recognition of their cultural beliefs, values, and practices. If the needs of M ori are to be seriously considered and weighed alongside the needs of other populations, and if environmental flow assessments and allocative decision-making are to benefit from the knowledge of wh nau, hap and iwi, new techniques are needed to assess the appropriateness of flows in culturally sensitive ways. This report explores the nature and extent of iwi and hap participation in flow setting processes before recommending ways in which councils could effectively incorporate the knowledge held within wh nau, hap and iwi into decisions for setting environmental flows.

## 1.1 Project aims

Including tangata whenua in environmental flow decisions is a key to a fair and efficient system for water allocation and to achieving water quality, the Ministry for the Environment's and the Government's overarching objectives of the *New Start for Freshwater* strategy.

The purpose of this report is to gather information that will inform central government's development of tools to enable iwi and hapū to express their knowledge in ways that will allow councils to effectively incorporate this knowledge into decisions for setting environmental flows.

We were asked to:

- Develop an analytical framework for the project.
- Review published and unpublished information.
- Stock take the emerging tools for identifying tangata whenua knowledge.
- Develop a cultural health assessment framework for assessing the effectiveness of tools that enable Māori to be incorporated in environmental flow setting decisions.
- Provide a picture of the current level of knowledge, capacity, and legal and procedural settings in which Māori specific to river flows is conveyed.
- Analyse ten cases of flow setting that illustrate current limits or barriers to incorporating Māori in decisions.
- Test options for improving the incorporation of Māori in flow setting decisions.

## 1.2 Background – the national context

New Zealand is approaching some water resource limits, which can be seen in areas with deteriorating water quality, water demand outstripping supply, and constrained economic opportunities. Establishing a fairer and more efficient water management system is a priority for the Government. Water is central to New Zealand's

biologically based export economy and our competitive advantage; it is also of vital concern to M ori.

The *New Start for Fresh Water*, the Government's strategy includes the need to address the interests of M ori in New Zealand's fresh water. In 2007 the Government and iwi leaders<sup>1</sup> agreed to a relationship between Ministers and iwi leaders on freshwater management. A Joint Work Programme agreed by Ministers and Iwi Leaders contributes to the strategy by providing greater and more consistent M ori involvement to incorporate M ori perspectives at the national and regional levels. This report is part of the joint work programme.

### 1.3 Methodology

There were three distinct phases to this research. The first phase involved an interrogation of literature and other sources. The second phase examined the New Zealand resource (freshwater) management context, to determine the potential for M tauranga M ori to inform flow setting. The final phase of the research focused on completing the analysis of the catchment data collected and drafting the report. A summary of each phase is set out in Table 1 before being explained in the following paragraphs.

---

<sup>1</sup> Tumu te Heuhehu (chairman, Ng ti T wharetoa), Tukoroirangi Morgan (Tainui), Toby Curtis (Te Arawa), Archie Te Atawhai Taiaroa (Whanganui), Mark Solomon (Ng i Tahu) .

**Table 1:** Phases of this Research.

PHASE 1	PHASE 2	PHASE 3
Examine reference materials.	Continue to examine reference materials.	Continue files for selected catchments.
Start written files for selected resource management activities in case study catchments.	Continue files for selected catchments. Continue data analysis.	Continue data analysis. Modify theories.
Develop analytical framework.	Continue to refine theories.	Conduct checks on the data collected.
Start data analysis.	Interview groups represented in different flow setting processes.	Write the case studies.
Develop preliminary theories.	Participant observation in flow setting processes. Conduct checks on data collected.	Revise the analytical framework. Identify a process for incorporating tangata whenua values to complement BECA (2008). Identify feasible options to transition to an ideal system.

Phase 1: Existing Sources - For the purposes of data collection and analysis, literature was classified into four categories:

- international data relating to the integration of cultural perspectives into flow assessments and allocative decisions;
- data describing in general terms flow related issues from a cultural perspective;
- data relating to setting flow regimes within New Zealand's catchments; and
- other tools that have been developed to facilitate the articulation of cultural values.

An examination of literature was undertaken for two reasons: to gain an appreciation of the stated aspirations of Māori in respect of setting flow regimes and, secondly, to ascertain how decision makers have responded to these aspirations. Documents produced by Māori and resource management agencies were reviewed. A review of case law, legal opinions and Waitangi Tribunal reports demonstrates how the provisions of existing legislation are being interpreted and used. Initial analysis of the written material highlighted two areas of concern. Firstly few articles on environmental flows have been written by members of indigenous communities (and

in the context of New Zealand - iwi and hapū). This represents a potential limitation where the focus of this project is Māori informing the setting of environmental flows.

**Phase 2: Primary Research** - The main focus of the fieldwork was a series of case studies, in which the analytical framework was applied to specific spatial contexts. The case studies selected focused on 10 catchments across 5 regions. Each case study involved an examination of the flow setting process, and the outcomes from flow deliberations in the catchment. This also enabled the efficacy of the analytical framework to be examined. Case studies employed four methods of data collection: participation by a project team member in the flow setting process, interviews with key informants; interviews with scientists providing technical advice in the environmental flow assessment and allocative decision-making process; and on-going documentary research.

**Phase 3: Analysis** - The analysis involved identifying, sorting and grouping very detailed written material into the key themes underpinning this research. It must be acknowledged that implementation of the methods of data collection resulted in a considerable quantity of written material being gathered. Data from a variety of sources were brought together and systematically analysed. Data were read through thoroughly, broken into stand-alone pieces of information, which were then sorted into categories. Although categories emerged, merged, and disappeared as the research progressed, categorisation of the data enabled similar themes to be distilled. Some of the themes had been established a priori based on key issues that had emerged while undertaking preliminary discussions. Categorisation and the question of how to present the research findings were, at times, perplexing. Six principal categories were identified and these represent the major components of the analytical framework. It was also during this phase that we examined the proposed NES for ecological flows and water levels, the proposed NPS for freshwater management, and iwi submissions to these documents.

**Analytical framework** - Six components comprise the analytical framework - Māori values, other societal values, the Treaty of Waitangi, New Zealand's resource laws, the organisations responsible for water management, and the procedural environment – and are illustrated in

Figure 1. In brief -

- Tangata whenua believe that their values and knowledge should inform flow setting but they felt that there were inequities in how the interests of

stakeholders and M ori were addressed – hence starting with a consideration of values (in components 1 and 2).

- The Treaty is invariably seen to be the principle driver for tangata whenua participation, as is empowering legislation – (components 3 and 4).
- However tangata whenua repeatedly state that despite enabling provisions organisations don't engage effectively with tangata whenua. The final two components consider the organisational component and the procedural context that sets the scene for the engagement (components 5 & 6).

These components are interrelated in complex ways and each is in a state of intermittent redefinition or change. Each component therefore has to be proffered with the caveat that, although a number of the challenges have been teased out, not all of the complexities can be fully understood, measured or described without further empirical exploration. Furthermore, the framework that is proposed is specific to the development of responsive environmental flow assessments where M tauranga M ori informs and is recognised and provided for in allocative decision-making. When developing the analytical framework it has been necessary to consider the nature of each of the components; the order in which they are to appear in the framework; and the interrelationships between them.

**Separating the flow assessment from decision-making** - In the analytical framework and the analysis that follows we have deliberately separated the flow assessment process from the decision-making process.

1. One of the first tasks in setting a flow regime is the **flow assessment** that is undertaken, which usually results in a flow regime being recommended in a technical report that is made available to planners and policy staff (in the case of a Ministry or Council run processes) or to an applicant (if the flow setting process is being driven by a resource consent application). Subsequently it could be made available to M ori and stakeholders.
2. A **decision-making process** results in a recommended flow regime being set as a condition on a resource consent process, or via a planning process, an application for a Water Conservation Order, or by regulation.

Although M ori are focussing on initiatives that increase their role in decision-making, the decision maker is charged with making a decision based on the best information (usually presented as evidence) available to them. In the case of flow deliberations, if cultural interests are to be recognised and provided for pursuant to section 6(e) of the RMA then information specific to how cultural interests are dependent on certain flows or characteristics of a flow regime (low flow, fresh, floods) need to be conveyed to decision makers.

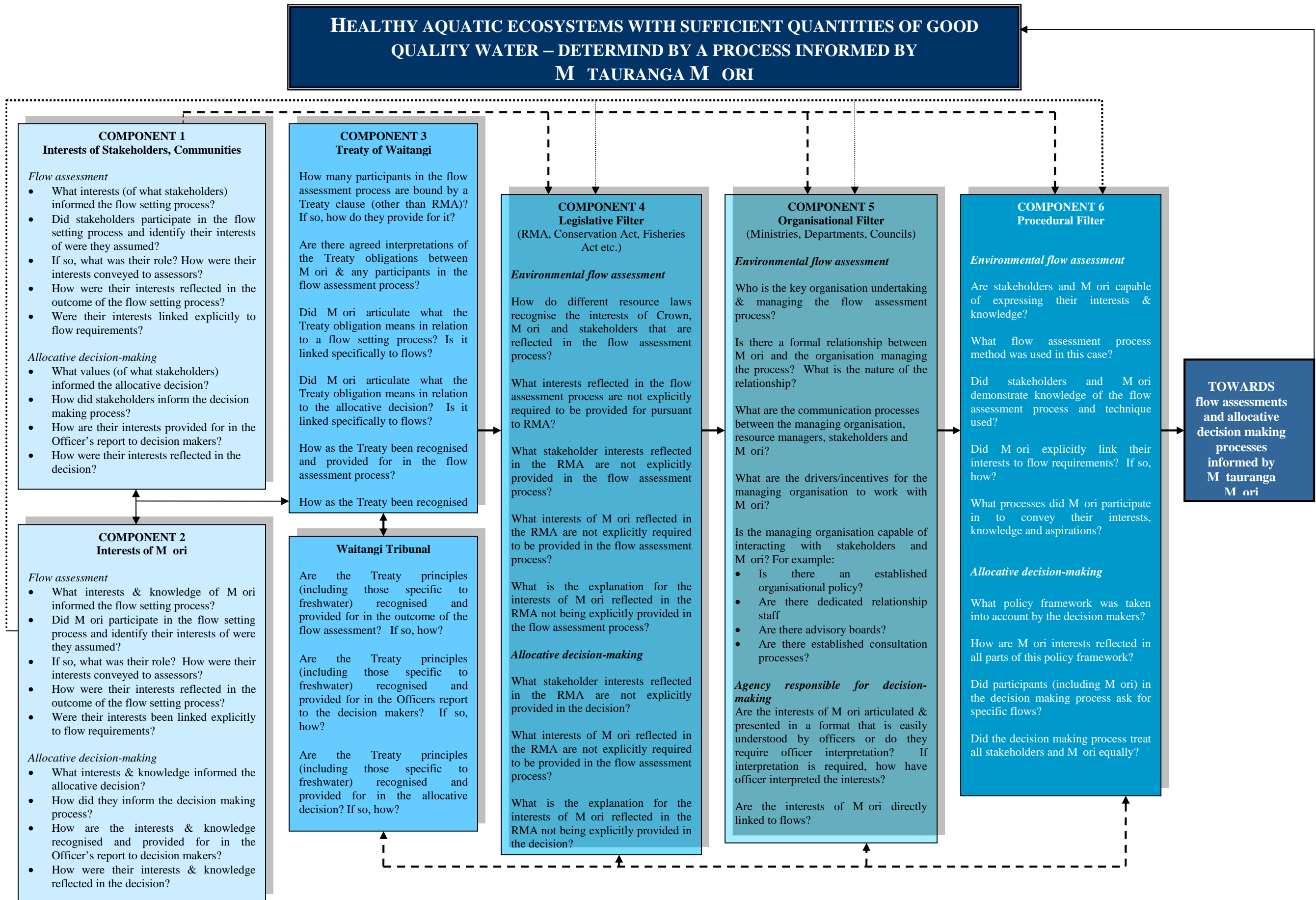
Even if every member of the decision-making authority was M ori, if the only information presented to decision makers related to the interests of stakeholders and communities and **not M ori**, the decision-making authority would need to base its decision on the limited evidence submitted to them. In other words without information to guide them, a M ori decision-making authority, although achieving the goal of increased participation, may due to the lack of evidence, fail to recognise and provide for the cultural interests of M ori. M ori therefore would not achieve the environmental and cultural outcomes they seek from increased participation.

Figure 1<sup>2</sup> shows how the six components are linked to produce the analytical framework. Each component can serve either to advance or inhibit the development of responsive environmental flow setting processes. The analysis of case studies explored the proposition that all six components of the analytical framework are significant and, collectively, will define an enabling / disabling environment. The results of this analysis are summarised Chapter 5 of the report.

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<sup>2</sup> This framework is a modification of that used by Tipa (2002).

Figure 1: Analytical framework





## 2. Terminology for environmental flow-setting

In this section four terms are defined:

- M tauranga M ori;
- environmental flow;
- environmental flow assessment; and
- ecological flow.

### 2.1 M tauranga M ori

Given the inherent difficulties of defining M tauranga M ori in absolute terms, the authors did not attempt to define “M tauranga M ori”. We do however include the following definitions:

*M tauranga M ori can be defined as ‘the knowledge, comprehension, or understanding of everything visible and invisible existing in the universe’, and is often used synonymously with wisdom. In the contemporary world, the definition is usually extended to include present-day, historic, local, and traditional knowledge; systems of knowledge transfer and storage; and the goals, aspirations and issues from an indigenous perspective<sup>3</sup>.*

While the above definitions are specific to the knowledge held by wh nau, hap and iwi, they are similar to the criteria used to define indigenous knowledge, which include the following –

1. Local: It is rooted to a particular place and set of experiences and is generated by the people living in those places.
2. Oral and Visual transmission: It is transmitted orally or through imitation and demonstration, and also may be acquired through personal observations and experience. The mode of transmission is usually informal, based on participation in a range of customary activities, closely tied to the cultural and ecological context(s) in which it occurs.

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<sup>3</sup> [http://www.landcareresearch.co.nz/sustainability/sustainability\\_details.asp?Sustainability\\_ID=7](http://www.landcareresearch.co.nz/sustainability/sustainability_details.asp?Sustainability_ID=7)

3. Practical: It is the consequence of practical engagement in everyday life and is adapted or reinforced by experience, trial and error, and experiment. The lessons learned from these experiences are often accumulated and passed along from one generation to the next.
4. Repetitive: This is a defining characteristic, aiding retention and reinforcing ideas.
5. Dynamic: It changes, being produced as well as transformed, discovered or lost. This represents its practical responsiveness and connection to other characteristics of the surrounding social and physical environment. When the environmental context changes, indigenous knowledge, like M tauranga M ori, will usually be impacted.
6. Shared: It is characteristically shared to a greater degree than other forms of knowledge even though its distribution within communities is uneven with some types of knowledge more widely disseminated than others.
7. Fragmentary: It is differentially distributed among community members.
8. Functional: It is organized and oriented toward the pragmatic fulfilment of identifiable goals, which specific to this project include health and well-being.
9. Holistic: It is integrated and situated within broader cultural traditions.

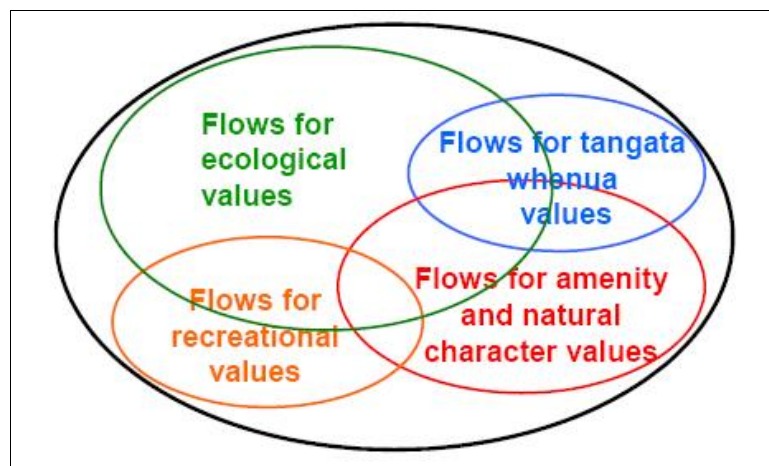
Environmental knowledge, or more specific to this project, knowledge of a river and the flows it needs to sustain its values, refers to the subset of M tauranga M ori that is specific to the river environs and the relationship of wh nau, hap and iwi to it. This is broadly conceived as encompassing knowledge of entities (sites, species, eco-regions), components (e.g., soils, waters, geology, astronomy, climate), the interrelationships among these, and the processes affecting them (including human-made impacts). Because such knowledge and is geared toward the practical engagement of it, it is often bound together with resource utilization behaviours. At the same time, vital aspects of it may be intimately associated with spiritual beliefs, notions of health and wellness, social behaviours, and symbolic expressions. Due to its multi-dimensional and interconnected nature, the demarcation of environmental knowledge from other kinds of M tauranga M ori can be somewhat ambiguous and arbitrary. It is therefore important to work with the complete data set rather than applying a filter in an attempt to isolate that which is deemed to be environmental knowledge.

The authors believe that it is for whānau and hapū who are working collaboratively with those undertaking flow assessments and setting flows, to define their relationship with rivers. When participants talked of their personal experiences of rivers, their interactions, and how this compared with their understandings of the river environment that earlier generations lived and interacted with, they in fact confirmed that Mātauranga Māori evolves through one generation's detailed observations and experiences which are then transferred to the next. In turn the following generation combines this received knowledge with their own observations of changes in environmental conditions. Mātauranga Māori is therefore place-based, dynamic, and responsive to ecosystem changes when and where they happen.

## 2.2 Environmental flow

In 2008, the Ministry for the Environment (MfE) published the *Proposed National Environmental Standard (NES) on Ecological Flows and Water Levels*. The proposed NES includes a useful discussion regarding the setting of environmental flows, and differentiates 'ecological' flows (the subject of the proposed NES discussion document) from the wider definition of 'environmental' flows (Figure 2).

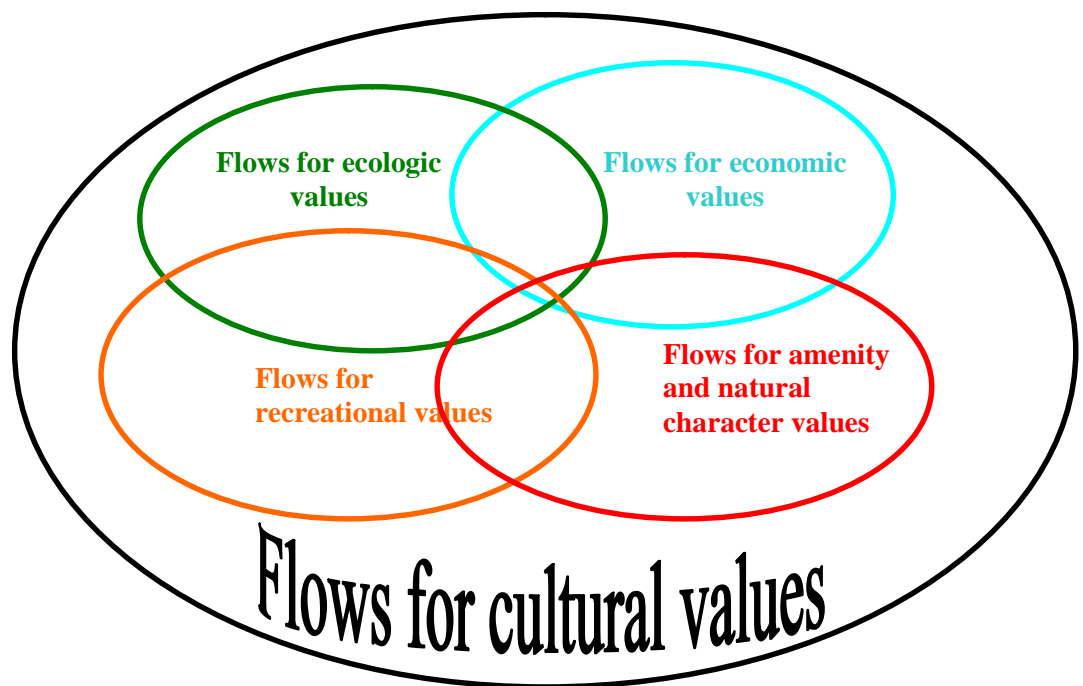
**Figure 2:** Proposed NES (MfE 2008) diagram to illustrate the four components required in environmental flow setting.



In that document, environmental flows are defined as:

*those required in a water body to provide for a given set of values which are established through a regional plan or other statutory process (MfE 2008).*

These environmental flows incorporate ecological flows that provide for the ecological integrity of the flora and fauna, and flow regimes established to sustain other values such as jet boating and angling. Figure 2 could be viewed as problematic. As currently structured it suggests that tangata whenua values are not recreational. Further, it suggests that some ecological values are not shared by tangata whenua. Similarly it implies that there are some amenity and natural character values that are not tangata whenua values. Given the multitude of statements from M ori about one undivided entity and the multi-dimensional nature of their relationship with water, we believe that Figure 3 may be a more accurate depiction of the way M ori are likely to view the relationship.



**Figure 3:** A revised diagram from (Figure 1) to illustrate the four components required in environmental flow setting.

### 2.3 Environmental flow assessments

Environmental flow assessments, which are defined by King et al. (1999, 3) as “an assessment of how much of the original flow regime of a river should continue to flow down it in order to maintain specified valued features of the river ecosystem”. Arthington et al. (2004) contends that this body of literature confirms the level of global concern at the increasing hydrological alteration of rivers and their resultant deterioration. Until the mid-nineteenth century water quality was at the forefront of issues arising from human manipulation of rivers (Tharme 1996), then a range of new

issues arose that were concerned with the reduced flow in rivers. Subsequently, as understanding of river changes resulting from flow manipulations increased (and been accompanied by worldwide awakening and concern with respect to the issues) a range of methods for calculating environmental flows has evolved.

In a New Zealand context, the framework for environmental flow setting is described by MfE in two documents; the proposed NES described above and in MfE's (1998 a and b) *Flow Guidelines for instream values* (in two volumes). The *Flow Guidelines* provide a consistent approach to setting minimum flows and other flow requirements in rivers (MfE 1998a). The *Flow Guidelines* do cover cultural values to some (limited) extent. Volume A covers the principles of hydrology and hydraulics, discusses various instream values, and sets out the process by which flow requirements are determined and given practical effect. Volume B provides technical and background information, including information on technical assessments for biological values, recreational values, landscape values and M ōri values.

The *Flow Guidelines* describe a process by which decision makers should:

- identify in-stream values that are to be sustained;
- determine the in-stream management objectives (the degree to which in-stream values are to be protected);
- identify the critical factors;
- apply technical assessment methods;
- determine and apply regime requirements; and
- monitor the effects of changed flows on the instream values and objectives.

This framework requires an understanding of values (identifying what is important) and determining the management objectives (to what degree each value should be protected). The values are called 'instream values' are defined in the *Flow Guidelines* as ecological values, landscape values, recreational values and M ōri values.

The *Flow Guidelines* also note that 'out-of-stream values' of water for uses such as water supply, irrigation, and power development should also be also taken into account in regional plans and water allocation decisions. The *Flow Guidelines* do not

offer help in suggesting how the balancing of instream and out-of-stream values should be carried out.

Whilst this framework may have remained relatively constant since the publication of the *Flow Guidelines*, the technical methods for undertaking environmental and ecological flow setting have been evolving. Different methods have been adopted by the various regional authorities for environmental flow setting. However, there is still a need for methods that enable cultural beliefs, values and practices to be explicitly accommodated within a framework that enables M ōri to assess what is a sustainable flow regime from a cultural perspective.

“Flow setting” processes or “flow assessment” processes or methods are generic terms to describe the technical assessments undertaken that result in a recommended flow regime. The New Zealand examples that we refer to in this report represent one aspect of a flow assessment process – an assessment of the ecological aspects. ‘Environmental flows’ are more than “ecological values”. We are aware of the distinction between the two terms and concerns arising from the use of “ecological flows” in contrast to “environmental flows” so for ease of the reader have chosen to use generic terms such as “flow setting” or “flow assessment”.

## 2.4 Ecological flows

The companion document to the proposed NES on ecological flows and levels (BECA 2008) provides a set of draft guidelines for the selection of scientific methods to determine ecological flows for rivers and water levels for groundwater, wetlands and lakes.

The proposed NES and the BECA Guidelines are consistent with a risk-based framework, where more complicated (and therefore expensive) methods are used in situations where highly significant instream values have been identified, and where significant changes to the flow regime are proposed in order to reduce uncertainty in decision making.

Of particular relevance to this paper, however, King et al. (1999) caution that ecological flows are only one component of environmental flows:

*“Historically, and still today in many instances, the focus of environmental flow assessment was entirely on the maintenance of economically important freshwater (and hence associated estuarine and/or marine) fisheries. This is particularly true of methodologies developed and applied in North America, where flows for the spawning, maintenance, rearing and passage of target fish species ...often represent the primary instream flow objective(s). The inherent assumption in such assessments is that flows that aim to protect target fish populations, habitats and activities will ultimately ensure maintenance of the overall riverine ecosystem”.*

The concept of ecological flows could be problematic for Māori if the values that they want to protect embrace more than ecological values. However, ecological values will represent a start in the process to accommodate tangata whenua values.

The current terminology gives rise to confusion – not just for Māori but to communities. The misperceptions that arise from use of terms could lead to rejection of flow assessment processes by communities, Māori, and managers. There is concern at the perceived narrow focus of the proposed NES on **ecological flows** and water levels rather than a consideration of **environmental flows**. While adopting new terms such as “social flows” or “environmental and community flows” is an option the reality is that the term “environmental flows” is so widely used it would be difficult to change and get acceptance and understanding of a new term. Retention of this terminology means that there is a need to stress a commitment to moving from ecological flows towards environmental flows which are intended to provide healthy river systems and that these bring benefits to many groups in society, including tangata whenua.

### 3. M tauranga M ori

For many indigenous communities their traditional knowledge constitutes a major “asset”. In this chapter we present examples of the types of knowledge that tangata whenua could use to inform freshwater management.

#### 3.1 Cultural concepts

Harmsworth and Tipa (2006) noted that it was important for methods specific to tangata whenua values to be grounded in the beliefs, values and practices of M ori. In this section we discuss (albeit briefly) how M ori see water, how they interact with water and how key cultural concepts relate to water flows.

M ori conceptualise water as an undivided entity and as part of a system of lakes, rivers, lagoon’s, swamps, their associated beds, and adjoining lands. This perspective has been systematically fragmented, principally by the Crown’s interpretation of the Treaty of Waitangi that they maintain sovereignty over M ori interests in water. Since the Treaty of Waitangi it appears that considerable effort, primarily through statutory intervention, has been made by the Crown to vest ownership of water resources in itself (Durette 2008a). Nevertheless we believe that an integrated and holistic approach to water allocation is necessary to give effect to the principle of water being an undivided entity.

We have previously stated that the engagement of M ori with waters (e.g., river catchments) is experiential. M ori living with a catchment experience a range of flow conditions – floods, freshes and periods when the river flow may be considered critically low. Monitoring and assessment of environmental condition and flow appropriateness is sensory, perceptual and is shaped by M tauranga M ori (Crengle, unpublished 1997). M ori interpret signs in the environment (such as indicator species or natural events). These signs are utilized to understand ecological conditions and/or change and they act as indicators of resource health and well-being (Crengle 2002). Conceptually, parallels can be drawn between the intent, design and application of flow setting methods we propose in section 8.5 to provide for tangata whenua values and the monitoring techniques of M ori with reference to river flows. This responds to the identified need that techniques are needed which are sensitive to the multi-dimensional and experiential relationship of M ori with catchments (Durette 2008a). However, we also recognise that there is a need to build on existing management techniques that evaluate the interactions and experiences of users. Aspects of the relationship between cultural concepts and flows are discussed in the paragraphs that follow:



**Te Ao M ori** - Holism in the context of freshwater ecosystems requires a consideration of the catchment. Each river has its own catchment area with tributaries that in turn have lesser tributaries and these again yet smaller ones. A catchment constitutes soils, water, flora, fauna and the relationships between them. Many physical, chemical and biological processes affect water character and movement. Each waterway contains elements, minerals, and salts that are specific to a place and catchment – each catchment has its own taste. In this sense, the mauri of one catchment may differ from the mauri of another. It is this holistic perspective that pervades M tauranga M ori – a knowledge based on relationships and connections over generations

**Whakapapa** – describes bonds, relationships, and connections. Water is the medium flowing through a catchment that makes connections. As previously stated rivers connect the entire landscape – ki uta ki tai – from the mountains to coastal environments. Manipulating flows, diverting waters, and dewatering river reaches, breaks connections and results in cultural impacts – even cultural loss.

**Wh naungtanga** – In Ng ti Hokopu v Whakatane DC (C168/02), the Environment Court stated that:

*Of all the values of tikanga M ori, wh naungatanga is the most pervasive. It denotes the fact that in the traditional M ori thinking relationships are everything – between people; between people and the physical world; and between people and the atua (spiritual entities).*

M ori Custom and Values in New Zealand Law NZ Law Commission, paragraph 130 citing an unpublished paper written for the Commission by Joseph Williams (“He Aha Te Tikanga M ori”).

Having flow assessment processes that provide for interrelationships is fundamental to M ori.

In Ng ti Rangi Trust v Manawatu-Wanganui Regional Council (A067/04), the Court observed:

*This genealogical relationship is one of the foundations upon which the M ori culture is based. It is known as “wh naungatanga”. Wh naungatanga in its broadest context could be defined as the interrelationship of M ori with their ancestors, their wh nau, hap and iwi as well as the natural resources within their [tribal] boundaries e.g., mountains, rivers, streams, forests, etc. [paragraph 104]*

**Mauri** – is about life in and around a river. Life is about movement, and is epitomized by a river being in motion. A river is not a river without sufficient amounts of

flowing water<sup>4</sup>. A healthy mauri is reflected in high water quality of sufficient quantities sustaining a range of aquatic and riparian habitats supporting diverse kaiora – and not simply fish species which is the focus of many flow assessment processes. Mauri also refers to the “working ability of a river” (Tau 1993), specifically its role in building floodplains, reshaping channels<sup>5</sup>, building river mouths<sup>6</sup>, sustaining biodiversity etc.

**Tikanga M ori**<sup>7</sup> also brings into play a range of other cultural concepts. In *Land Air Water Association & Ors v Waikato RC* (A110/01), the Environment Court, stated:

*In a general way section 8 requires the Court to take account of tikanga M ori whereas sections 6(e) and 7(a) refer to specific philosophical concepts that form part of tikanga M ori. Examples are “waahi tapu”, “other taonga” in section 6(e) and “kaitiakitanga” in section 7(a). Further the need to have regard to “tikanga M ori” by virtue of section 8 means that the Court may be required to have regard to a wide range of concepts such as “tangata whenua”, “manawhenua”, “wh naungatanga”, “mana”, “tapu”. “utu” and “mauri” to mention just a few. [paragraph 391]*

It is not explicit within flow setting processes how the current flow assessment methods would respond to the range of cultural concepts described above:

#### **Te Ao M ori, whakapapa, wh naungtanga**

- A catchment wide perspective is seldom undertaken. Typically the mainstem of a catchment is assessed, but not contributing tributaries. For example:
  - The Kakaunui River did not consider the Kauru River or Island Stream, which from the perspective of Ng i Tahu are important tributaries that are both now subject to dewatering.
  - The Lower Waitaki below Waitaki Dam has been subject to an IFIM but not a number of significant tributaries feeding into the Waitaki. Some tributaries have been assessed at different times (e.g., the Hakataramea River, the Upper Ohau River) but in an ad-hoc manner.
  - In contrast, in the TPD re-consenting process, a number of streams were assessed.

<sup>4</sup> Tipa (1999). Wh nau commented that the character of the river changed substantially at Outram Glen in the Lower Taieri when at 3 cumecs - it stopped flowing. From their perspective it was no longer a river.

<sup>5</sup> Reshaping braids was important in the Waitaki.

<sup>6</sup> River mouth dynamics was an issue raised in the Trotters and Kakaunui cases.

<sup>7</sup> This is found in section 6(e)

- Having commented that not all river / freshwater dependent species are considered as part of the flow assessment, it needs to be noted that **interrelationships** between species, and between mainstem waters and water dependent riparian and terrestrial habitats and species, also are unlikely to be accommodated.
- **Similarly interrelationships** between instream flows and coastal and marine ecosystems are seldom considered within a flow assessment process.

**Tapu / Noa** - Institutions such tapu and noa manage interaction and use of the natural environment and use of resources:

- For some waters, classed as wai tapu, M ori are likely to seek their absolute protection, and they are likely to seek the protection of the sufficient quantities of high quality water for wai taonga (Ministry for Environment 1997). In our case studies we did not find examples where stream flows have explicitly accommodated wai tapu and/or wai taonga.

### **Mauri**

- Mauri describes the life, energy and vitality of all things prized - both tangible and intangible.
- Headwaters, if viewed as the source of mauri<sup>8</sup>, should have their flows protected. However, focussing on a discrete part of the catchment – such as the headwaters – is not guaranteed within current flow assessment methods. In contrast the flow assessment method is likely to target the reaches that are to be impacted by the management decision.
- A healthy catchment system is dynamic and in a constant state of change: for example: rivers are meant to experience low flows, freshes and floods; and wetlands are meant to experience low levels and high levels. As has been noted, initially the focus of flow assessments was identifying minimum flows but more recently there has been a consideration of other components of a flow regime including freshes, floods etc.

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<sup>8</sup> Advised to Tipa by Maurice Gray – kaumatua in Christchurch.

### 3.2 Examples of M tauranga M ori with respect to hydrology / ecology / aquatic systems

#### (a) Hydrology

M ori can provide a historical background and describe cosmologies, mythologies, local everyday practices, and contextual regulations regarding cultural resource management. This will complement the existing knowledge of scientific river hydrology and transition to a more holistic understanding of the dynamics of the river system – including local understandings of climate changes: temperatures, evaporation, humidity and rainfall, along with local explanations of flows in the mainstream and its tributaries, local justification of floods and droughts, and local interpretations of catchment geography.

#### (b) Life cycle of species

Synexe & Nexus Associates (2009) refer to fishers' ecological knowledge (FEK) as a specialised body of traditional ecological knowledge (TEK) which is 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).*

Durette and Barcham in the Synexe report break TEK into three core constituents:

1. local observational knowledge of species and other environmental phenomena;
2. the practices people carry out their resource use activities; and further
3. the beliefs systems that describe how people relate to ecosystems” (Berkes, Colding & Folke, 2000, p. 1252).

FEK represented the knowledge held by local fishers and is likely to include not only information of species presence and abundance but also differences in the species behaviour that could be linked to hydrological variables e.g., inter-annual, seasonal, lunar, diet and food-related variations, and movements of fish.

This knowledge represents some of the earliest “scientific programmes” and provides a valuable longitudinal perspective (gathered over generations) that can inform the current state of fish and waterways (Lydon & Langley 2003). Indeed, fishers’ knowledge may often be the only source of site specific or species specific information on a local ecosystem (Haggan et al. 2007). As Durette & Barcham note however, the main challenge is to convert this knowledge into technical data so that it can inform resource management.

The Treaty of Waitangi (Fisheries Claims) Settlement Act 1992 not only saw M ori interests in commercial fisheries being accommodated, but M ori non-commercial rights were also recognised as was the right of M ori to participate in fisheries management, specifically the management of customary fisheries. Customary fisheries data is a valuable to resource that should be harnessed to advance the participation of M ori in flow setting.

### **(c) Hydrological alteration**

M ori, because of the experiential and interactive relationship with rivers and ecosystems are able to describe changes observed over time. For example they are usually able to identify how river management regimes have impacted:

- fishing sites and the species harvested from each;
- vegetation – the species and the location of these;
- swimming holes – that were safe for different age groups;
- dynamics of a river system -
  - floods, including the functioning of flood plains and any disconnections that have resulted from river engineering (e.g., stopbanks, floodgates etc.);
  - dewatering of river reaches;
  - river mouth characteristics; and
  - flow regime components – e.g., seasonality of low flows, droughts and freshes.

For example, the evidence submitted to the Waitangi Tribunal during the course of the claims is a valuable source of information about hydrological alteration (Waitangi Tribunal 1984, 1991, 1992, 1995, 1998).

### **3.3 Examples that Māori understand river flows<sup>9</sup>**

This section of the report seeks to give examples of some the knowledge demonstrating tangata whenua knowledge of flows.

#### **(a) Catchment perspectives**

A Māori worldview is holistic and stresses the interconnectedness and interdependence of the environment, resources, and people (Marsden 1992, Crengle 2002, Rochford 2003). While integrated management has become prominent in the last three decades, Māori, for generations have emphasised the necessity of considering a catchment in its entirety: from its source, the passage of its waters through a network of tributaries, onto lower floodplains, to its interface with the saltwater at estuaries along the coast. Holistic conceptualizations that emphasise integration, interdependencies and interrelationships are common to indigenous peoples rather than fragmenting and compartmentalizing the environment (Posey 1999).

#### **(b) Distinguishing between different water bodies**

Māori understand the subtle differences between streams and rivers within a catchment, as evidenced by traditional water classification systems (Douglas (1984, 1), Palmer and Goodall (1989) Rochford (2003), and Williams (2006). These classifications, typically denote saltwater and freshwater categories, distinguish other waters on the basis of physical character or levels of degradation, and identify specific cultural uses of different types of water. Rochford (2003, 45) explains the relationships between the different categorizations. “Each body of water has its own mauri. The mauri of any particular water then becomes diminished as the water travels through the world to the sea. These steps see this diminishment of mauri not only in a quantitative fashion but also once reaching a certain threshold changes in a qualitative manner”.

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<sup>9</sup> Some of these examples (b) – (f) have been extracted from Tipa (2008)  
Tipa, G. (2009). *Exploring Indigenous Understandings of River dynamics and River Flows: A Case from New Zealand*. Journal of Environmental Communication.

### (c) Environmental Indicators

Crengle (1997, 2002) explains that M ori utilise ecological indicators which are the manifestations of a robust mauri life force, including: aesthetic qualities e.g., clarity and wild character; capacity to provide for amenity and cultural use; abundance, depth, and velocity of flow supporting the character of the river; spiritual and physical character and presence; diversity of being (i.e., a range of moods and manifestations of the river including braids, pools, eddies, and shallows etc.); and productive capacity.

A project managed by Harmsworth (1999) resulted in the identification of indicators to be used by M ori to assess the cultural health of wetlands.

- No. of *taonga* species (flora and fauna) within wetland
- % area of *taonga* plants within total wetland.
- % area of exotic (introduced, foreign) plants covering total wetland.
- No. of cultural sites within or adjacent to wetland.
- Assessment of *te Mauri* (scale).

Another project initiated by Ng i Tahu in 1998 led to the identification of indicators that tribal members utilise to assess stream health (Tipa 1999). The thirty indicators identified represent the factors that Ng i Tahu believe are conducive to a healthy river, with a strong vibrant mauri<sup>10</sup>.

Some of the indicators are listed below:

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<sup>10</sup> Twenty tribal members were interviewed in 1997 as part of Stage 1 of the Taieri Project with a further eighteen interviewed in 2000 as part of Stage 2.

Place names

Greasiness of water

Smell

Unpleasant odours

Presence of riffles

Sound of birds being present

Flow in river visible

Riparian vegetation – overhang

Riparian vegetation in headwaters

Colour

Presence of absence of sediment on the  
riverbed

Unnatural growths

Foams, oils and other human pollution

Flood flows

Abundance and diversity of fish  
species

Abundance and diversity of birdlife

Changes to the rivermouth



Some of these indicators were then used to develop a Cultural Health Index (Tipa & Teirney 2003, 2006). In recent years other researchers and iwi have developed similar indicator based tools (Pauling 2006, Young et al. 2008) or are in the process of developing<sup>11</sup>.

#### **(d) Place names**

As previously stated, a M ori worldview does not separate spiritual and intangible aspects from the non-spiritual practices of resource management. Arguably, it is the intangible values ascribed to freshwater by M ori that are difficult for resource managers and scientists to accommodate within existing management regimes. Placenames were one of the medium by which M ori described and passed on both the nature of the resource and an assessment of its status (Crengle 2002, KTKO 2005). Specific to waterways, place names may describe the source of the waterway, its character, or discrete features within the catchment e.g., Waimate<sup>5</sup> is a name attributed to a stream that is dead, damaged, or polluted. Alternatively, Waiareka<sup>6</sup> is named for the stream's sweet water. Names also provide insights to the cultural uses the waterways sustain: an example Te Awa-Kai-Rai describes a stream supporting plentiful foods, while Te Awa Kauru is so named because of the presence of Ti Kouka – a tree from which kauru (a type of sweetener) was extracted. M ori may seek protection of the features or characteristics to which the name is ascribed. Conversely, the dislocation of place names and river characteristics may contribute to the loss of cultural association with sites within a catchment. Over time the traditional place names themselves may be lost which further compounds the sense of cultural loss.

#### **(e) Kai Gathering Practices**

Two examples of techniques used for gathering food were eel weirs and weirs that were constructed to help with harvesting lampreys. Each of these techniques represents an intimate understanding of river dynamics and the ecology of eels and lampreys.

Eels were harvested when migrating downstream, which dictated a particular design. In contrast lampreys were to be gathered when they were migrating upstream which required a different type of structure. At its simplest level, an assessment of river type was undertaken before weir construction began as such a technique could only be utilized in areas where water characteristics permitted such construction.

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<sup>11</sup> Waikato Tainui are developing a Cultural Health Index

Best (1986, p133) in his discussion of eel weirs explains that “Weirs are constructed at rapids, where the rushing waters glide from one calm reach to another; here the waters are shoal enough to allow for fences being erected”. The placement of the weirs within a catchment and the means of construction demonstrated knowledge of different river types - for example could the weir be constructed in a river comprising multiple channels or could it only be used in a single channel river or? In situations where there were multiple river channels, M ori selected the principal channel in the belief that this was the one down which eels were more likely to travel. A simple technique they employed was to toss pieces of driftwood into the river some distance above the riffles to identify the channel down which most of the floating driftwood passed. The weir would then be placed in this channel (Best 1986).

Lamprey weirs similarly demonstrated an intimate knowledge of streams and rivers. The design of the weir is however different to that utilized for gathering eels because M ori were cognizant of the movements of lamprey upstream along the river’s edge rather than in the midstream current. The challenge was to force lamprey that are moving upstream into nets facing in the same direction.

While there were regional variations in the design of the weirs, and the names accorded the different parts of the structures, they were widely utilized by M ori throughout the country. Historical records confirm that weirs were effective in enabling M ori to gather eels while still enabling quantities of eels to pass upstream. Other techniques utilised by M ori to gather fish species included excavating channels into which fish passed and moved downstream into a waiting net, thinking it was a channel of the river. Even the use of nets in a river channel required an understanding of the dynamics of in-stream flow, with the net and canoe being positioned in the gentler side of the river channel.

In contemporary society many M ori still gather resources from freshwaters. Underpinning their success is knowledge of when to gather (i.e., when the river conditions are conducive to gathering), where to gather (i.e., the places where the gathering effort is likely to be successful), what to gather (which also encompasses ecological knowledge of species) as well as how to gather (i.e., the techniques they are to employ given the characteristics of the rivers as well as the behaviour of target species). This project recognises that this information can inform and potentially benefit contemporary freshwater management.

### 3.4 Exploring the interface of M tauranga M ori and science in relation to environmental flows

Determining how M tauranga M ori can inform the framework for environmental flow decisions is the challenge this report is investigating.

Contemporary discussions of cultural values and M tauranga M ori may focus on the antiquity of knowledge and make reference to broad generalised value statements derived from oral histories. Internationally it is recognized that histories, stories, myths which are often highlighted as examples of ecological knowledge are in fact the cultural framework within which knowledge of the environment is transmitted (Menzies 2006). Such histories provide a clear cultural framework for indigenous ecological knowledge, but they are not however ecological knowledge in and of themselves. Ecological knowledge emerges through direct active use of the landscape. To understand ecological knowledge one must participate in the real life processes requiring interaction with local environments. For example, in a river context, such interactions could include:

- hunting, fishing, gathering and processing of kai;
- bathing, healing, ceremonial;
- Waka ama; or
- Waka taua.

These examples of interactions of tangata whenua with rivers results in the accumulation of a pragmatic knowledge that is dynamic and responsive to changes within the environment. They also describe the knowledge that wh nau, hap and iwi can bring to freshwater management. While in this report the values that are common to M oridom are outlined, prospective partners that tangata whenua will be engaging with when setting flows need to be cognisant of the differences between iwi, even the differences within hap and wh nau. A necessary prerequisite is to understand the tikanga and kawa that is appropriate for the particular wh nau, hap and iwi involved in a process.

## 4. Literature Review

In this review of literature we pull together a number of different threads that are relevant not only to how M tauranga M ori might inform flow setting (i.e., the **HOW**), but we also discuss emerging themes / theories that describe **WHAT** M ori are likely to want to see reflected in decisions. We have concluded each section with some summary points linking the theories to flow setting. This section summarises the literature related to:

- the international context; and
- the national context.

### 4.1 The International Context

#### 4.1.1 Promoting participation

Participation by individuals, particularly at the community level, is seen as being one of the central tenets for achieving sustainable development (Fenge 1996, WCED 1987). Participation is seen as a means of affording affected parties the opportunity to articulate their self-interest; enhancing the quality of information available to decision makers; enhancing the potential for support of decisions by enabling early and meaningful involvement; and affecting one's destiny as the opportunity to participate in decisions is a key element of self-empowerment and self-actualisation.

Participatory approaches to environmental management received further emphasis in the Brundtland report (WCED 1987) and in Agenda 21, at the 1992 'Earth Summit'. Perhaps the Summit's greatest significance lay in the acknowledgement that sustainable development would require new approaches to environmental management, and that effective environmental management would need to be differentially negotiated within individual states, even within individual communities. In effect, this meant that the range of cultural values and perspectives on environment applying in particular locations would need to be engaged in local processes of resource management.

Pretty and Pimbert (1997) contend that new partnerships and connectedness between different stakeholder interests is required in environmental management and argue that participatory processes must be locally grounded which will likely require different solutions for different places.

Despite the increase in participatory initiatives, Pretty and Pimbert (1997) also warn that the call for peoples' participation risks becoming a catch-cry and part of the conventional rhetoric without delivering meaningful outcomes for participants. This warning reinforced the desire of the authors to deliver a practical yet meaningful and effective process for application by M ori.

#### **4.1.2 Recognising the Value of Indigenous Knowledge**

The drive for greater participation has been paralleled by a concerted drive by indigenous communities to reassert their customary and Treaty rights to access and use land and resources, and greater recognition of the knowledge held within communities including indigenous communities (Western 1991, Pinkerton 1989, 1992, Notzke 1994, Berkes & Folke 1998). Although a range of terms are used, often interchangeably, Berkes (1999) defines indigenous knowledge as 'that knowledge held by indigenous peoples', and traditional ecological knowledge as a subset of that – 'a land-based practical knowledge of species and beliefs regarding human interaction with the ecosystem'. Menzies (2006) list the attributes of traditional ecological knowledge as cumulative (from long term intergenerational interaction), dynamic (informed by a customary lifestyle but not unchanging), providing a historical understanding of change, local, holistic (viewing all elements as interconnected), embedded (in a unique matrix of local, cultural, historical and traditional elements), moral and spiritual.

Sadly, indigenous communities, like M ori, have seen valued environments destroyed resulting in their alienation from the resource bases upon which their cultures and identities are constructed (Berkes 1991, 1994, 1999). This alienation and marginalisation could be compounded by the lack of familiarity of many indigenous communities with existing resource management systems. This could serve to limit their participation and the effectiveness of participation.

The growth of interest in the knowledge held by indigenous communities is related to the wider shift within resource management to an ecosystem based management approach (Menzies 2006) and recognises that indigenous communities understand the way animals and plants interrelate and how ecosystems work as a whole. It recognises that indigenous communities have a well developed understanding of the local environment and their own impacts on local ecosystems. Berkes (1999, page 33) also explains that the "use of traditional knowledge may benefit development by providing more realistic evaluations of local need, environmental constraints and natural resource production systems".

There is increased evidence of the contribution that indigenous knowledge can make to contemporary resource management. It, however, requires explicit recognition by resource management agencies of the benefits to be realised through the utilisation of indigenous knowledge.

#### 4.1.3 Recognising Indigenous Knowledge in freshwater management in Australia

Initiatives involving the incorporation and/or application of indigenous knowledge are emerging around the world as resource managers seek to engage with indigenous communities; one example being the National Water Initiative of Australia (NWI) which seeks to recognise the special character of indigenous interests in water. The NWI has as an over-riding objective recognition of indigenous needs and participation of indigenous communities through representation in water planning, incorporating indigenous objectives and strategies for achieving them, taking account of native title rights to water, and potentially allocating water to native title holders. While there are encouraging and potentially enabling provisions, MacFarlane (2004, cited in Jackson 2007) cautions that the provisions of the NWI are discretionary and therefore open to interpretation, while Connell et al. (2005 cited in Jackson 2007) explains that little guidance is given to water resource managers and regional bodies seeking to meet the obligations to indigenous communities (a challenge M ori confront in New Zealand). Despite these possible difficulties Jackson (2007) observes that a number of initiatives are emerging including the concept of a ‘cultural flow’<sup>12</sup>, indigenous participation in the Living Murray Initiative<sup>13</sup>, and the “cultural value” concept under the National Water Quality Management Strategy. Craig (2005, 2006) and Weir (2009) refer to the concept of a “cultural flow”.

Morgan, M, Strelein, L. Weir, J. (2004) describe the concept of a cultural flows:

*In order to enjoy rights such as fishing rights, or more general cultural and economic rights central to the maintenance of Indigenous Nations cultural traditions, it is first critical to have a healthy river system. The degradation of the river system has threatened these pendant rights.*

*The Indigenous Nations of the Murray have identified the interrelationship between these elements as the need to preserve the cultural economy through the identification of cultural flows. That is, sufficient environmental, social and economic water flows and volumes must be allocated to the River and to Indigenous Nations to sustain the cultural economy of each Nation in the River system.*

Weir (2009) describes the hydrological and ecological knowledge held within aboriginal communities that can inform processes, including information on flood

<sup>12</sup> A cultural flow is described as an allocation of water to provide for the indigenous cultural economy. See Craig (2005)

<sup>13</sup> See <http://thelivingmurray.mdbc.gov.au/>

levels, the incidence of floods and droughts, and species specific dependencies on flows and levels.

Within the environmental arena attention has been given to the incorporation of Indigenous values of water in catchment studies, for example the Murray Darling Basin (Morgan et al. 2004, Morgan et al. 2007) and the Daly River region of the Northern Territory (Jackson, 2005, Jackson, 2006, Jackson and Langton, 2006). A comprehensive examination of the means to recognise Aboriginal interests in NSW rivers, prepared for the Healthy Rivers Commission (Behrendt and Thompson 2004), provides one of the few studies of direct relevance to implementing the NWI but, for this project, does not explicitly enable the reader to see how indigenous knowledge inform flow setting. For example, in the Northern Territory a recent series of government hydrological surveys conducted on Aboriginal land (e.g., Haigh and Matsuyama 2003) has incorporated some Indigenous knowledge in the mapping of water resources. Langton (2006) has examined Cape York Indigenous hydrological knowledge and its part in the burning practices of various groups.

There are now a number of detailed studies analysing the ways in which Indigenous societies attribute meaning to water and the place of water in their systems of knowledge and social institutions (Langton 2002; 2006; Strang 2001a; 2001b; Toussaint, Sullivan and Yu 2005; Barber and Rumley 2003; Rose 2004; Jackson 2005). These are predominantly northern Australian studies and water is examined as a feature of the Indigenous cultural landscape with significant attention devoted to the symbolic dimension. This work follows that of Trigger (1985) which describes the symbolic and conceptual significance of water. These same studies also reveal the behavioural or material use of water according to Aboriginal custom.

Attention is also given to water's economic significance as a vital component of Indigenous interactions with aquatic life (see for example, Behrendt and Thompson 2004; Altman 2004; Strang 2001a). Indigenous manipulation of flows were used historically to improve rates of harvest of certain species, e.g., river flows were manipulated with the construction of fish traps, weirs and small dams etc. (Tan 1997).

Cultural affiliations to water are expressed in a many different ways: through social etiquette, place-based knowledge, narratives, beliefs and daily practices (Toussaint et al. 2001: 39, Yu 2000, Kolig 1996). The qualities of water that have a sense of the sacred, embody life and generate feelings of belonging and identity were identified as significant for Aboriginal groups from the Daly River region (Jackson 2004; 2005; 2006).

International studies analysing association of Indigenous societies to freshwater water are emerging. But it remains unclear how these will be used and applied to enable such associations to inform management.

## 4.2 The National Context

### 4.2.1 New Zealand's The Resource Management Act 1991: the legal requirement to respond to cultural interests

New Zealand has also experienced the drive for greater participation, including greater recognition of the beliefs, values and practices of M ori. In 1991, the Resource Management Act BECame the governing legislation for resource use in New Zealand (Davis & Threlfall 2006). Two sections are of particular relevance.

Section 6 requires that anyone exercising functions and powers under the Resource Management Act 1991 recognise and provide for matters of national importance including “the relationship of M ori and their cultures and traditions with their ancestral lands, water, sites, w hi tapu and other taonga” (section 6(e)). Arguably, section 6(e) represents one of the strongest drivers for the incorporation of M tauranga M ori in statutory planning processes. As Roberts (2002, p 217) observes:

*The inclusion of the wording “the relationship of M ori...” is significant. For the first time New Zealand’s environmental laws requires consent authorities to consider not only the tangible aspects of M ori culture, for example an unidentified pa, maunga (mountain) or river, but also the local wh nau, hap or iwi relationship with sites.*

Pursuant to section 7(a) decision-makers are required to have particular regard to kaitiakitanga. The Act presently defines kaitiakitanga as:

*The exercise of guardianship by the tangata whenua of an area in accordance with tikanga M ori in relation to natural and physical resources; and includes the ethic of stewardship based on the nature of the resource itself.*

The application of M tauranga M ori within resource management is one practical way of having regard to kaitiakitanga:

*Iwi and hap envision the environment through indigenous knowledge – m tauranga M ori. This way of seeing and experiencing the environment has given rise to the concept of kaitiakitanga, an emerging approach to environmental management arising from traditional principles, perspectives and worldviews. The concept has captured attention in a variety of quarters, including the Resource Management Act 1991, which makes provision for kaitiakitanga, which it defines as ‘the exercise of guardianship’. It is the combination of M ori communities and kaitiakitanga protection and enhancement that makes this ‘space’ distinctive (MORST, 2007)<sup>14</sup>*

<sup>14</sup> [http://www.morst.govt.nz/publications/a-z/v/vision-M\\_tauranga/2-research-themes](http://www.morst.govt.nz/publications/a-z/v/vision-M_tauranga/2-research-themes)



Roberts (2002, p217) observes that the reference to “tikanga M ori” reinforces the need to consider M ori worldviews. The responsibilities of Tangata tiaki are to protect the integrity of resources so that they are passed down in a healthy condition to future generations, this ensuring the continuity of cultural practice. This requires M ori, to focus on long term environmental results which are likely to include healthy ecosystems with robust mauri that are able to sustain cultural uses.

Section 8 of the Act requires that, anyone exercising functions and powers under the Resource Management Act 1991 ‘take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi)’, albeit that this can be weighed against other factors in reaching a decision (Crengle 2002). The principles that have been enunciated provide further confirmation of the imperative to recognise and provide for the cultural values and practices that M ori have promoted for decades, but which they may have struggled to have recognised by resource management agencies.

Part 2 of the Resource Management Act is enabling and supports the incorporation of M tauranga M ori into contemporary freshwater management. Another driver for incorporating M tauranga M ori is found in the Fourth Schedule of the Resource Management Act 1991, which advises applicants for resource consent to consult in the preparation of the Assessment of Environmental Effects when applying to use or develop natural and physical resources. As Zinsli (2002, p 234) explains, it is recognised as good practice that applicants engage with tangata whenua early in the process where proposals may affect matters in section 6(e) and 7(a)”.

The RMA is enabling because there are sections requiring M ori interests to be accommodated. In addition to these sections, however, M tauranga M ori can inform a number of the resource management processes prescribed in the RMA e.g., applications for consents to use and develop resources.

#### **4.3 Concepts Emerging In Water Management**

We discuss two concepts in this section, specifically 1) ecosystem health and 2) health and wellbeing. These concepts are gaining credence in water management and seen as being innovative. The descriptions that follow suggest that these concepts are akin to those that have been articulated by tangata whenua. They represent concepts that envisage and would benefit from the incorporation of M tauranga M ori.

#### 4.3.1 Ecosystem health

The evolution of flow setting methods coincides with the emergence of the concept of “ecosystem health” which provides an interdisciplinary framework for measuring change. An ecosystem approach is not new for tangata whenua who have promoted the principles of integration and holism for generations. A central proposition of this concept is:

*“extending the concept of health from its traditional domains of application at the individual and population levels to that of the whole ecosystem. This involves the development of methods of assessing the degree to which the functions of complex ecosystems are maintained or impaired by human activity. It also involves formulating new strategies that take account of societal values and biophysical realities so that ecosystem health is enhanced and not compromised further” (Rapport et al. 1998:83).*

Typical signs of an overstressed ecosystem could include loss of biodiversity, declines in primary productivity, and increases in pest/invasive species – all issues identified by M ori. The transition to a consideration of ecosystem health, however, requires analyses of how various socio-cultural dimensions interact with biophysical indicators, such as:

- human health / ecosystem health, e.g., bioaccumulation of toxins in species consumed, the habitats of these species that humans could come into contact with when gathering them, and consequently human tissue;
- cultural health / ecosystem health; and
- healthy governance / ecosystem health, e.g., the role of participatory politics and ecosystem-scale thinking in encouraging decision-making.

Of further relevance to the incorporation of M tauranga M ori, the concept of ecosystem health includes a link to cultural health. Cultural “health” might be said to result when the stress of cultural change does not overwhelm the resilience of a group, and the group is able to adapt to new circumstances while maintaining its core values, beliefs, knowledge, and practices.

Persistence of this core set does not mean unalterable, but rather that the core set maintains internal coherence as well as its significance for the particular cultural group during the process of change. M ori have held onto their beliefs, values and practices in the face of change which in and of itself is a sign of a culture's resilience and adaptive potential.

#### 4.3.2 Models of health and wellbeing - including studies with indigenous communities

We have introduced a discussion of wellbeing for two reasons:

1. Water resource assessment studies are increasingly engaging with Indigenous communities in their research activities and to varying degree are documenting customary knowledge, social arrangements and cultural practices amongst Indigenous land owners and water consumers. This literature tends to be written for health agencies or water utilities concerned with the availability, quality and sustainability of water supplies for domestic community consumption (Dodds et al. 2001; Willis et al. 2004; Yuen 2001).
2. The term “health and wellbeing” is now referred to in Treaty Settlements, most notably the Waikato-Tainui Deed of Settlement.

Cox (2003) explains how coastal waterways provide are an important indicator of the health of a coastal catchment. Cox (2003) sought to identify and quantify the health, social and economic impacts resulting from a change in the condition of coastal waterways. This allowed the development of a general framework for assessing impacts of changes in natural resource condition on human well-being that can be applied to the management of other natural resources, leading to improved human health and well-being.

Cox (2003) contends that the framework represents a significant addition to the decision-making tools currently available to managers as it purports to enable the well-being benefits that would flow from environmental improvements to be measured and synthesised within one management tool.

While the research of Cox moves to a more holistic approach to an assessment of wellbeing, its value to indigenous communities cannot be assumed. Culturally-specific conceptions of well-being, such as that proposed by Ingersoll-Dayton et al. (2004) which involved a Thai population and a study by Izquierdo (2005) with the Matsigenka culture in Peru, are of relevance to the integration of M tauranga M ori in flow setting because they open up rich, new terrain for well-being studies by acknowledging the value of culturally-specific notions of well-being beyond the dominant Anglo-American ones.

Izquierdo (2005) sought to identify the meanings and qualities attributed to well-being within the Matsigenka culture in Peru. Qualities identified, included “productivity, goodness, and maintaining harmony with their social, physical and spiritual environment” (Izquierdo 2005, p. 776). This study by Izquierdo also demonstrated that

well-being attributes could be adversely impacted despite improvements in bio-medical health status of the Matsigenka. This is a possible risk for communities intimately associated (and dependent) on the environment, such as the Matsigenka or in a New Zealand context, M ori. If the nature of the resources changes, (i.e., becomes depleted, polluted, or inaccessible), then the culture, health and well-being of the communities who have strong and extensive relationships with such resources may also be affected. Those interacting with river environments can identify these changes.

Within a New Zealand context, two conceptualisations are frequently referred to. Firstly, Durie (1994) and then Ministry of Health (2002) discuss Te Whare Tapa Whā - a four sided house - or the four cornerstones of health, which are: hinengaro (mental well-being), wairua (spiritual well-being), whānau (family well-being) and tinana (physical well-being). Durie (2004) proposed a second conceptualisation, Te Pae Mahutonga (the Southern Cross). The constellation itself comprises four central stars arranged as a cross with a further two stars pointing to the cross. Durie contends that the four stars represent fundamental components of health promotion.

- Mauriora is dependent on a secure cultural identity;
- Waiora relates to healthy air, land and water environments which requires a balance between use and development and protection;
- Toiora focuses on personal behaviours and responsibilities; and
- Te Oranga recognises that health promotion (in particular increasing well-being) requires increased participation by M ori in contemporary society.

Durie's work supports place-specific conceptualisations of well-being. As Panelli & Tipa (2007) explain, conceptualisations such as that by Durie may be crucial to researching (and enabling improvements in) the composite of human-environment conditions that characterize life in different places.

Another account of M ori well-being, conveyed by Pere (1997) describes reciprocity and interconnection between individual selves and wider social and other entities. Each experience of well-being would vary from place to place reflecting whenua (earth), turangawaewae (standplace), whānau (family), whānau (family), wairua (spirit), hinengaro (mind, heart), whatumanawa (feelings) and tinana (body). Again Pere's conception of well-being has implications for M ori participation in flow

setting and our need to understand connection between specific understandings of whenua and the social and cultural relations developed in particular places.

Panelli & Tipa (2007) describe how an appreciation of place is also becoming established in geographies of well-being (see Airey 2003; Gesler 1992; Williams 1999) and draw on the work of Gesler (1992) and Gesler & Kearns (2002), to identify the following “four dimensions of a place-focussed sense of well-being”:

- first, an analysis of personal and collective livelihoods as they are played out in different locations shows variation both within and between places;
- second, wellbeing requires an understanding of how place-particular social relations and structures affect a sense of well-being and are affected by wider social norms and infrastructure;
- third, the variations in particular cultural beliefs and practices that are embedded in contrasting locations are to be identified (Richmond et al. 2005); and
- finally, the significance of human-environment specificity – where particular relations with, and understandings of, environments affect people’s way of life and their sense of well-being needs to be understood (see the study by Crighton et al. 2003).

These dimensions are interdependent and collectively represent the lives and well-being of populations in various places. In the case of setting river flows the conceptualisations of Durie and Pere, plus the four dimensions by Panelli and Tipa provide a framework that enables the intersecting place-specific relations between M ori and valued river reaches within a catchment to be examined.

McGregor et al. (2003) who presented a five layer model to describe the well-being of people in Hawaii. The layers are - individual, family, community, nation and ‘Aina’, which is described as “a holistic concept of the natural system and resources that govern the life of the nation”. McGregor’s model reaffirms the importance of an attachment with a place and the significance of place and genealogy in well-being; again this mirrors the themes and cultural values that M ori convey in water management contexts including flow assessment processes.

Common threads are found in these studies, which reaffirm that indigenous conceptualisations of well-being are influenced by the natural, social, spiritual and cultural worlds within which that indigenous community lives. Such conceptualisations that are now emerging in water management are consistent with conceptualisations of M ori and provide opportunities for both engagement with tangata whenua and incorporation of M tauranga M ori.

#### 4.4 Environmental Flow Assessments

There are a number of methods for determining environmental flows. Four basic groups of methodology are widely recognised: hydrological index methodologies; hydraulic rating methodologies; habitat simulation methodologies and holistic methodologies (Arthington et al. 2004; Harding et al. 2004; Tharme 1996). These are summarised in Table 2.

**Table 2:** Summary of Environmental Flow Methodologies.

Methodology	Description
Hydrological index methodologies	These methodologies use primarily historical flow records for making flow recommendations, with only limited attention to ecological criteria. The remaining three types of methodology incorporate habitat-discharge relationships in various ways, and typically require some field data collection.
Hydraulic rating methodologies	These methodologies use the relationship between simple hydraulic variables and discharge to develop environmental flow recommendations. The hydraulic variables, such as wetted-perimeter or maximum depth, are usually measured along a single cross-section, across the target river section.
Habitat simulation methodologies	Habitat simulation, also known as habitat modelling or rating methodologies, provide more detailed analyses of the quantity and suitability of instream physical habitat available to target biota under different flow regimes, on the basis of integrated hydrological, hydraulic and biological data. IFIM is perhaps the best known EFA (Reiser et al. 1989(a) although it draws criticism (e.g., King & Tharme 1995). In most instances, hydraulic rating and habitat simulation methodologies have been designed for a specific activity, such as assessment of environmental flows for spawning, or for a suite of related activities like fish passage, spawning, flushing of spawning gravels and incubation.
Holistic methodologies	Holistic methodologies form a clearly separate group of methodologies geared towards addressing the flow requirements for an entire riverine ecosystem. They are considered amenable also to identifying the flows linked to issues of human use and interest, such as: maintenance of aesthetic quality, social dependence on the riverine ecosystem, economic costs and benefits of changing flow regimes, protection of features of cultural or scientific interest, and river-related recreation.

Many of the techniques described in the technical document (BECA 2008) appended to the NES fall within these four categories.

Each of these methodologies has inherent strengths, weaknesses and limitations which cannot be fully critiqued in this report. Furthermore, each to some degree is cognisant of and responsive to cultural values expressed by indigenous communities. As highlighted by Craig (2005) a common assumption has been that environmental flows are an acceptable surrogate for the protection of cultural values. But a factor common to all methodologies is their reliance on professional expertise for their implementation (King et al. 1999) and the predominance of objective, scientific philosophies and techniques which may serve to limit the engagement of indigenous peoples. The reliance on narrow technical / engineering based perspectives also appears contrary to the rich and diverse sources of information about the human perceptions, meanings and values ascribed to water, which range from ancient religious references through to modern studies (Burmil 1999).

Four methods that have attracted attention are Building Block Methodology – BBM (King & Louw 1998), the Holistic Approach (Arthington et al. 1992), EP Assessment Method (Swale & Harris 1995), Downstream Response to Imposed Flow – DRIFT (King, Brown, Sabet 2003). Two of these are briefly discussed below:

### **Building Block Methodology**

The BBM (King and Tharme 1994; King and Louw 1998; King et al. 2002) was the first structured approach to a holistic methodology. It was initiated as a bottom-up method. Other essentially bottom-up methodologies include ‘expert’ and ‘scientific panel’ methods developed and applied in Australia (Cottingham, Thoms and Quinn 2002).

This method is based on the concept that some flows within a hydrological regime of a river are more important than others for the maintenance of the river ecosystem and that these flows can be identified and described in terms of their size, duration, timing and frequency. The flows then constitute the environmental flow. A number of specialists work collaboratively using hydrological baseflow and flood data and information on the flow related needs of ecosystem components. These needs are the built into the modified flow regime.

The BBM has been applied in South Africa and has been applied once in Australia. However, the Holistic Approach, which was developed in parallel with the BBM

shares its basic tenets and assumptions. The Holistic Approach is described in Appendix 3.

The BBM changed the way in which scientists collected and analysed data, but it had two weaknesses. Firstly, it was very prescriptive. A river condition was identified as an “outcome” and the recommended river flow was to achieve that condition. Wider impacts arising from that flow not being met were not described. Secondly it did not assess the impacts on users (subsistence users) of the water.

### **Downstream Response to Imposed Flow Transformations**

This is a comprehensive assessment of several sites within representative and critical river reaches. It comprises 4 modules:

1. In the first module – the biophysical module – the character and functioning of river ecosystems are described and data on predicted flow-related changes collected.
2. The second module is the sociological module. The subsistence users of the river who are potentially affected by proposed changes to the flows and water levels are identified, their use of the river is quantified, and an understanding of how they will be affected by changes to the river is developed.
3. In the third module, scenarios for a range of possible flows and water levels are developed. For each flow scenario, the biophysical and socio-economic impacts are predicted.
4. In the fourth module, the costs of mitigating identified effects and/or compensating affected communities for impacts that cannot be resolved are assessed.

Scenario building using the information obtained from participatory processes to understand the perspective of those living with and using the river, is integrative and serves to accommodate differing worldviews, knowledge systems and differing values.

Holistic methods are likely to respond to more of the concerns of Māori but this does not negate the need for ecological flows as part of a holistic approach. However Tharme (2003) states that holistic methods are not undertaken in New Zealand.



## 4.5 Indigenous Participation in Flow Setting

From the range of literature described in preceding paragraphs what emerges is:

- development of new theories (e.g., ecosystem health, health and wellbeing);
- development of flow setting methods;
- increased recognition of the values of participation by indigenous communities;
- increased recognition of the knowledge held within indigenous communities;
- increased activity documenting indigenous conceptualisations of their association with water.

However this report is concerned with flow assessment processes. We support the proposition of Durette (2008b), that globally considerable work is needed in order to balance competing rights and interests. While water strategies purport to protect indigenous customary values (Jackson & Morrison 2007) what remains unclear is how the complexity of indigenous relationships to water is reflected.

For example, Armstrong, (2008) contends that Australia's indigenous people did not participate meaningfully in the negotiation of the National Water Initiative (NWI) and as a consequence it only has limited acknowledgement of indigenous interests in water.

The NWI does not specifically provide for cultural flows, but it does suggest that indigenous social, spiritual and customary objectives and strategies for achieving these objectives should be incorporated into water planning. As has been explained throughout this report, at issue is how this "incorporation" is to be realised.

While many look to New Zealand as a good example of how the RMA 1991 governs water allocation and requires decision makers to provide for M ori interests when managing water, how this is to be implemented remains at issue. Bennett (2007) contends that the courts in New Zealand are the primary source of guidance to further M ori interests under this Act but then observes that guidance provided from courts and legislation worldwide is minimal to non-existent with respect to determination of cultural water allocations. Having determinations made in the Courts, however, risks exposing M tauranga M ori to judicial review.

Synexe & Nexus Associates (2009) summarise a number of the initiatives that represent a mix of recent initiatives that could facilitate participation in M ori in environmental flow setting, including:

- indigenous representation in water planning (Armstrong 2008);
- the provision of means to participate in any **consultation** on water planning (Indigenous Peoples Kyoto Water Declaration);
- recognition of indigenous interests as water trading mechanisms emerge (Craig 2006);
- allowing for total decision making autonomy over a ‘cultural flow’ allocation for the indigenous community that receives the allocation (Craig 2006);
- further work on the development of tools to give practical effect to implementation of indigenous values in water planning and management (Bennett 2007); and
- Meaningful and effective joint partnerships between indigenous people and governments in the management of water and water resources.

These points are examined in the sections of the report that follow.

#### 4.6 Iwi Planning In New Zealand

*“Iwi management plans provide a ‘window of insight’ into the aims and aspirations of the iwi, and an opportunity to minimise confusion, uncertainty and ignorance at this interface.” (Matunga, H 1992)*

Iwi/hap Management Plans (IMP) are planning documents that consolidate iwi knowledge on resource management issues. Some IMPs address economic, social, political and cultural issues as well. IMPs’ provide a framework for the sustainable development of natural and physical resources by providing goals, and typically include a combination or all of the following: objectives, tasks, actions, indicators and measures. The Ministry for the Environment’s guide, Te Raranga a Mahi (BECA 2000), identifies several reasons why IMPs have been prepared. These include:

- to avoid reactive responses to resource management consent applications or issues and policies (including resource management plans) that affect iwi in a particular rohe;
- to clearly state iwi kaupapa on environmental issues;
- to enable whānau, hapū, iwi or Rūnanga to exercise their tino;
- Rangitiratanga over resources in their rohe;
- state how whānau, hapū, iwi or Rūnanga intend to participate in;
- resource management processes.

In relation to regional councils, section 66 of the Resource Management Act 1991 (RMA) states that when preparing or changing any regional plan, regional councils shall have regard to any relevant planning document recognised by an iwi authority affected by the regional plan. However, the scope of recognition is widened to apply in the processing of resource consents through policy provisions in many of the Regional Policy Statements. For example Policy 3.4.7(v) of the Auckland Regional Policy Statement which states:

*"In relation to resource consents, the ARC and TAs shall take into account where relevant any planning document recognized by an Iwi authority affected by a resource consent."*

Te Wai Māori (2007) describes another potential planning document a: freshwater iwi management plan (FWIMP) as a specific type of IMP that deals, as the name suggests, with an iwi's interests in freshwater. A freshwater management plan might be a stand alone document (like Ngāi Tahu's 1999 policy on freshwater use) or incorporated as a section within a broader IMP. Te Ohu explain that an iwi freshwater management plan will seek to influence the decisions on both regional and district plans (which will need to "take account of" the FWIMP). The FWIMP will also be useful when making submissions on individual resource consent applications, regional pest management strategies (prepared by regional councils), Long Term Council Community Plans (LTCCPs) (prepared by all local authorities), conservation management strategies and reserve management plans (for public conservation estate) and similar documents prepared by public authorities. Only the Ngāi Tahu FWIMP was available at the time this document was prepared, and the Ministry for the Environment and Ministry of Fisheries have no record of other such documents having been lodged either centrally

or in their regional constituencies. The only plan we were able to access that refers more generically to iwi and hapū water planning is the Kahungunu ki uta, Kahungunu ki tai: Marine and fresh water fisheries.

*This strategy aims to integrate management of fisheries, fresh water and coastal resources within the Kahungunu rohe and to develop management practices which are holistic and inclusive.*

Specific goals within this strategy include:

- Developing a strategy on maintaining, restoring and enhancing the mauri of inland and coastal waters and engage with local authorities on the basis of that strategy.
- Develop co-ordinated rohe moana/wai Māori management plans.

The list of Iwi Management Plans scrutinized for this project is found in Appendix 2. These plans generally illicit a series of values, goals, objectives, tasks, actions indicators and measures. Some are more detailed than others although a common feature is the lack of specificity with respect to the flows sought by tangata whenua.

**He Mahere Taiao The Maniapoto Iwi Environmental Management Plan (2007)**

This plan is consistent with the key information contained within Te Purongo - Maniapoto State of the Environment report 2002 and the Maniapoto response to the local government LTCCP process in 2006. The Maniapoto Trust Board's main mission is:

*"To preserve and protect the identity, integrity and interests of the Maniapoto Tribe".*

The document also describes intermediate goals for Wai including:

- Regeneration of native bush and healthy waterways with abundant freshwater and marine environments.
- To provide more consistent access and availability of kaimoana, eels, kaio etc.
- Adoption of policies that prevent the disposal or discharge of treated/untreated sewerage or wastewater into coastal and waterway environments.

The T wharetoa Environmental Iwi Management (2004) - The plan under its section: Te Waipuna Ariki has the following goals:

- Ng ti T wharetoa assert and exercise rang tiratanga and kaitiakitanga over waters within the T wharetoa rohe.
- Protect and enhance the mauri for future generations.
- Achieve statutory recognition of Ng ti T wharetoa Rang tiratanga over waterways through the Waitangi Tribunal claims process.

The issues identified included:

- The unnatural control of lake levels.
- Inadequate protection of puna.
- Confusion in roles, responsibilities and lack of partnership in the management of water.

T wharetoa considered some of following policies/baselines:

- Advocate the protection of mauri of water through effective policy and planning instruments.
- Support proposals that seek hap involvement to improve water quality and promote efficient use of water quantity.

T wharetoa considered some Methods of Implementation/Tools:

- Promote conditions on consents that provide for the involvement of Ng ti T wharetoa in the monitoring and review process of resource consents.
- Make submissions on resource consent applications that ensure the physical and spiritual relationship between tangata whenua and their taonga is recognised, protected and provided for.
- Oppose resource consent applications that will have an adverse effect on water quality and or quantity through the submissions and hearing process.

- Lobby for Ng ti T wharetoa to be appointed to the hearing committee on consent applications that impact Ng ti T wharetoa.

T wharetoa considered some other tools:

- Develop a suite of environmental performance indicators (tohu) by hap that may be used to monitor the mauri of Lake Taupo and tributaries.
- Lobby for a T wharetoa representative in the monitoring and review process of government policies, regional policy statement, regional and district plans.
- Make submissions to government policy, district and regional plans advocating for the protection of water.
- Ensure representation on behalf of Ng ti T wharetoa on the various stakeholder groups that utilise Lake Taupo and other resources e.g., Conservation Board, Lakes and Waterways Action Group, Taupo Lake Care, hydro power companies.
- Insist that hydro-power companies provide monitoring reports and expert advice to nga hap o Ng ti T wharetoa that relate to the use.

Nga Taonga Tuku Iho Ki Whakatu Management Plan (2004) - This plan which was prepared for Ng ti Rarua Iwi Trust, Te Ranga O Toa Rang tira, Te Atiawa Manawheuna Ki Te Tau Ihu Trust, Ng ti Koata No Rangitoto Ki Te Tonga Trust, Ng ti Tama Manawheuna Ki Te Tau Ihu Trust is less detailed document that is focused on Tangaroa in both the marine and freshwater realms. Tangaroa-the freshwater starts by describing the spiritual associations of Wai to these iwi:

*Wai is considered to be an essential element of life-an element that transcends life itself. Tangata whenua believe that the physical and spiritual survival of all things is dependant on the maintenance of the mauri (life force), wairua (spirit), mana (status) and tapu (sacred nature) of wai.*

A section listing the key issues is broken down into the following headings:

- Management approaches.
- Water Quality.

- Water Allocation.
- Damming, draining and diverting water.
- Riparian Management.
- In-stream Activities.
- Introduced species.

Water Allocation issues identified include the over allocation of water, reduced flows, and inability of water bodies to sustain the indigenous communities within them, all of which are of enormous concern for tangata whenua:

*In addition, where management of water has focused on the growing needs of the community, tangata whenua concerns relate to the potential for the mauri (life force) of the water to be diminished as a result.*

Key objectives and desired actions within the realm of Tangaroa that are extracted from the document are very high level including:

Water bodies are healthy and maintained to a level sufficient to:

- Preserve mauri (life force) of the water body.
- Provide for tangata whenua cultural and spiritual values and customs and traditions.

The policies underpinning these are also very high level and rely on improving engagement and increasing opportunity for iwi e.g.:

- For Nelson City Council to recognize and acknowledge tangata whenua custom as and traditions.
- To increase opportunities for tangata whenua to practice the customs and traditions with the uri of Tangaroa.

The resulting actions are all focused on capability building within local government and iwi e.g.:

- Record lessons learnt from the development of the Havens Holes management plan to assist future projects/initiatives.
- Map the old coastlines and waterways in the rohe.

There are many more examples of iwi planning documents that consider water quantity/allocation as an identified issue. However, when the plans consider actions or policies to reduce the risk around these issues it is clear that there is a general lack of understanding around the allocative mechanisms and decision-making processes which result in the policies and actions being weak.

A summary of issues is set out below. The intent is not to criticise existing plans – which we know are the result of considerable time, effort and resources. But we hope that the discussions below are of value to the next iteration of iwi plans or the preparation of iwi fresh water plans.

General comments on the existing iwi plans are as follows:

- The driver for the preparation of many iwi plans has been the enabling provisions of the RMA 1991 where resource managers are required to have regard to such plans.
- As a consequent of the RMA focus, the structure and content of many iwi plans follow the structure of statutory planning documents by setting out a vision, goals and policies.
- Preparing an iwi resource management plan is a major undertaking and whānau, hapū and iwi are justifiably proud of their endeavours and its output.
- Few plans provide specificity in the form of measurable targets, standards, rules – or in the context of flow setting - the flows in specific river reaches that are sought by Māori. This may make it difficult for planners, river users and developers to understand what tangata want in relation to a specific context, a specific location, or a specific resource use. Without a comprehensive knowledge of tangata whenua values, the risk for misinterpretation between the parties exists.
- The plans seek to control inappropriate resource use and development but it is often implied that these uses and developments will be by “others”. It is not always clear how the plans which describe the environmental outcomes



sought by tangata whenua accommodate or balance the social, economic and cultural aspirations of whānau, hapū and iwi when it is tangata whenua that is wanting to develop and use resources.

- As such the current iwi plans are focussing on achieving a limited range of outcomes for the environment. Although tangata whenua advocate for a holistic perspective, arguably the plans (prepared within the confines of RMA) do not reflect this by integrating social, cultural, economic and environmental aspirations of whānau.

There are already resources (e.g., Guidelines, Resource Kete etc.) available for preparing iwi management plans to serve a function under the RMA.

#### **4.7 Other initiatives of tangata whenua that enable Māori to inform resource management In New Zealand**

##### **4.7.1 Resource inventories**

Harmsworth (2002) describes inventories as a “stock take” of tribal resources”. The concept of resources encompasses “people, natural resources, and economic assets” or more specifically:

- **Human/Social:** understanding human resources, people resources, human capital, human capacity, human capability, he tangata he tangata.
- **Cultural:** understanding cultural resources, cultural vibrancy, cultural integrity, Māori values, tikanga Māori.
- **Physical:** understanding physical resources, natural resources, access to natural resources, physical state and condition, land and coastal characteristics, condition, and use, mana whenua, awa, moana, etc.
- **Economic:** understanding available economic resources, economic capital, investments, and economic potential.

Many whānau, hapū and iwi are in the process of preparing inventories. Some have progressed to the development of GIS (Geographic Information Systems) and computerised databases. Some inventories, although the project has been initiated by tangata whenua, attract external funding. There are other examples where an agency has sought to develop an inventory of resources significant to tangata whenua to

facilitate more effective communication e.g., some forestry companies, and Transit NZ.

#### 4.7.2 Customary fisheries assessments

Since the enactment of customary fishing regulations in the both the north and south islands, a range of initiatives are underway to record customary fisheries data. Catch records are available from Tangata Tiaki and MFish. M tauranga M ori is being recorded to support applications for mataitai and/or taiapure, or is being recorded to inform management strategies of fisheries managers, including Tangata Tiaki.

#### 4.7.3 Cultural mapping

Cultural mapping has been recognized by UNESCO as a crucial tool and technique in preserving the world's intangible and tangible cultural assets. It encompasses a wide range of techniques and activities from community-based participatory data collection and management to sophisticated mapping using GIS. There are examples of tangata whenua undertaking mapping. Many of the approaches being adopted are participatory and encourage tangata whenua to identify, record, and investigate cultural assets – both tangible or intangible and that form the foundations of the culture. These assets, like resource inventories, could be organisational, human, social, tribal, corporate, natural or built environments:

*Cultural mapping involves a community identifying and documenting local cultural resources. Through this research cultural elements are recorded – the tangibles ... as well as the intangibles like memories, personal histories, attitudes and values. After researching the elements that make a community unique, cultural mapping involves initiating a range of community activities or projects, to record, conserve and use these elements. ...the most fundamental goal of cultural mapping is to help communities recognize, celebrate, and support cultural diversity for economic, social and regional development.*

Keynote speech, Clark, Sutherland & Young 1995 Cultural Mapping Symposium and Workshop, Australia).

Poole (2003) describes his cultural mapping work, while guidebooks on participatory mapping techniques are found on the internet (e.g [http://www.ifad.org/pub/map/PM\\_web.pdf](http://www.ifad.org/pub/map/PM_web.pdf) ).

Data that is collected can be represented through a variety of formats like geographic maps, graphs, diagrams, aerial photographs, satellite-produced images, statistical databases, and others. But it is important for those working with tangata whenua that the formats they prefer are provided.

From this, a comprehensive view of cultural resources can be stored and the documented data will serve as invaluable information for the development of national strategies that engage in accurate and sensitive analysis of people, places, and environments. One of the contexts in which the outputs of cultural mapping can be of value is in flow assessments.

#### **4.7.4 Oral histories**

Oral histories are stories told by living people about the past. Generally, the stories are of their own life experiences and the lives of the people around them. Often an oral history includes details and stories that exist nowhere other than in the individual's mind. Therefore, preserving oral history and whānau stories should be a top priority for any Māori resource manager.

Kaumātua, parents, aunts and uncles, and other whānau members represent a valuable information resource. Some whānau, hapū and iwi members have received training in how to question individuals, and others have sought guidance on the best means of recording the discussions and preserving them for future reference.

#### **4.7.5 Cultural values reports**

Cultural values reports (CVR) are variations of CIAs. These can be used in assessing or providing background information as they can identify and describe values of tangata whenua pertaining to a particular area or resource.

They differ from CIAs in that they do not need to include a description of effects as they do not relate to a specific activity. However, if the author chooses and if sought by tangata whenua they may discuss high level impacts of a development occurring or anticipated in that area. Cultural values reports can provide direction as to the relevant issues and how these should best be addressed. They are useful for facilitating discussion.

The following webpage provides valuable information about Cultural values reports

<http://www.qp.org.nz/consents/cultural-impact-assessment.php>

#### 4.7.6 Cultural impact assessments (CIA)

*A CIA is a report documenting M ōri cultural values, interests and associations with an area or a resource, and the potential impacts of a proposed activity on these. CIAs are a tool to facilitate meaningful and effective participation of M ōri in impact assessment. A CIA should be regarded as technical advice, much like any other technical report such as ecological or hydrological assessments.*

(Extracted from the Quality Planning website <http://www.qp.org.nz/consents/cultural-impact-assessment.php>)

A CIA may:

- identify the effects of a proposed activity on M ōri (tangata whenua) cultural associations with the environment;
- identify or assist identification and formulation of methods to avoid, remedy or mitigate adverse effects on cultural values and associations;
- suggest what conditions of consent could be applied if consent is granted;
- provide iwi/hap ū with comprehensive information about and improved understanding of the proposed activity;
- assist both the applicant and the council in decision-making under the RMA.

The assessment of impacts on cultural values, interests and associations can form part of the AEE that accompanies applications under the RMA. The need for a CIA can emerge from:

- initial planning and consultation involved in the development of a proposal for a new activity that requires resource consent;
- a request from the council for information;
- referral of the application by the council to tangata whenua.

The content and structure of a CIA differs between iwi/hap ū groups and with the nature and scale of the proposed activity. Generally, a CIA will include:

- description of the consultative processes used in preparing the report (hikoi, hui, tangata whenua interviews, reviews of technical documents, drift for tangata whenua to comment and sign off for the final CIA);
- a description of the proposed activity – which may be provided by the applicant;
- recognition of the mana whenua within the area subject to the application and a description of who the report is being prepared on behalf of;
- a brief overview of the relevant statutory planning framework;
- a description of the cultural values of tangata whenua associated with the site or the resource that is subject to the application;
- identification of impacts and evaluation of effects of a proposed activity on the identified cultural values;

A CIA may also include:

- recommendations to avoid, remedy or mitigate any adverse effects on M ori cultural values;
- recommended conditions of consent should the application be granted;
- iwi/hap expectations for 'where to from here' - the process following the CIA.

However, some wh nau, hap and iwi may choose to discuss mitigation issues directly with the applicant rather than leave it for a contractor to initiate this discussion.

The following webpage provides valuable information about CIAs

<http://www.qp.org.nz/consents/cultural-impact-assessment.php>

#### **4.7.7 Archaeological assessments**

Specialist assessments such as an Archaeological Assessment or survey could be commissioned as part of a CIA or as a separate report that provides tangata whenua

with information needed to assess impacts on archaeological values from a cultural perspective.

#### **4.7.8 State of environment reports**

Within the New Zealand context, section 35 of the RMA 1991 requires the preparation of State of the Environment Reports at the national and sub-national levels. Recent examples are the Ministry for Environment's Report (1997, 2007) which provide a national overview, and regional and district government reports that present more detailed local perspectives. What is not always clear to the reader of such reports is how the monitoring methods employed by councils relate to the interests held by M ori and other sectors within the community. By working closely with M ori and stakeholders, resource management agencies could emphasise that the monitoring undertaken accurately assesses the quality and quantity characteristics for which the freshwater resource is valued by constituent groups. Increasingly cultural monitoring is sought by M ori.

A variation of the concept of State of the Environment Reports is Te Purongo - Maniapoto State of the Environment Report 2002 and State of the Takiwa that has been developed by Ng i Tahu. State of the Takiw is promoted as a culturally-based environmental monitoring and reporting system (see [www.ngaitahu.iwi.nz](http://www.ngaitahu.iwi.nz) ).

#### **4.7.9 Monitoring tools & processes**

Harmsworth explains that M ori have been formally developing indicator and monitoring tools mainly in response to the RMA and more latterly as part of the national 1998 MfE Environmental Indicator Programme, through reference groups, forums and related projects.

Some of the indicator programmes of tangata whenua include:

- Development of a cultural health index (Tipa & Teirney 2003, 2006).
- Adaption of the cultural health index by *Tiakina Te Taiao* for their own use and application in the Upper South Island.
- Development of cultural indicators for wetlands (Harmsworth 2002).
- Development of a coastal marine health index (underway).

- Development of cultural indicators for lakes (underway by Ng i Tahu).

There has also been development of a number of community based tools including:

- Estuarine Assessment Kit.
- SHMAK - the Stream Health Monitoring and Assessment Kit.
- Waicare.

#### **4.7.10 Research**

Research is funded by FRST, MORST, HRC and a number of other small agencies. All research proposals to the three main agencies are required to include a section detailing how their research is responsive to the needs and aspiration of M ori. Wh nau, hap and iwi are often identified as end-users.

The webpage for FRST (<http://myfrst.frst.govt.nz/Public/ResearchReports/reports09/index.cfm>) enables these who are interested to search to see what research is being undertaken in areas of interest to them.

#### **4.7.11 Training**

The effectiveness of participation of tangata whenua would benefit from targeted training in resource management, freshwater management, interviewing techniques etc. What may emerge however is the lack of time for tangata whenua to commit to long term education such as university degrees and the need for module or block courses. Another issue that may prevent the uptake by tangata whenua is the issue of “prior learning”.

Examples of initiatives that are underway include:

- Wananga – to up skill wh nau in resource management processes.
- Workshops – on taonga species e.g., tuna.
- Field days – how to use flow measuring devices.

#### **4.7.12 Accreditation**

Resource users may hold a form of environmental accreditation such as ISO or more specific to forestry certification from Forestry Stewardship Council (FSC), for example forest managers or owners who want to prove that their forest operation are socially beneficial and managed in an environmentally appropriate and economically viable manner can apply for forest management certification. Some accreditation systems include a social impact component as well as an indigenous component that in the New Zealand context could facilitate participation of tangata whenua.

#### **4.7.13 Cultural Audits**

Although not fully developed in the environmental sector, the opportunity exists for cultural audits to be undertaken by tangata whenua. For example in a South Island catchment, tangata whenua have negotiated an agreement with an irrigation company. All those drawing water from the Irrigation Scheme need to develop farm plans that detail environmental and cultural outcomes. Within the MOU there is provision for a cultural audit of the implementation of these plans. Throughout the country there are examples of tangata whenua working directly with resource users where these types of initiatives can be explored.

#### **4.7.14 Settlement mechanisms (Statutory Acknowledgements, protocols etc.)**

Each Treaty Settlement builds on those previously negotiated and as a result a number of mechanisms are found in Treaty Settlement Acts e.g statutory acknowledgements, protocols, implementation plans, the ability to make regulations, area management tools etc.

#### **4.7.15 Annual planning processes**

Although tangata whenua may participate in statutory planning processes, it is the annual planning processes that ultimately impact the degree to which statutory plans are implemented. Tangata whenua need to ensure that they have mechanisms in place to enable their priorities to be accommodated with annual plans (or their equivalent).

#### **4.7.16 Mitigation**

If tangata whenua believe that their interests cannot be adequately avoided, remedied or avoided, the negotiation of compensatory side agreements is an option.



#### **4.7.17 Review of resource consents**

Where tangata whenua believe that a decision has been made on the basis of uncertain information they may advocate for inclusion of a review clause in the conditions of a resource consent. Being able to initiate a review is dependent on having the information, which means that a review clause needs to be accompanied by many of the information gathering initiatives described above.

#### **4.7.18 University theses**

These represent a valuable information resource and many can now be accessed on line. Where the full text is not available, often an abstract is provided.

#### **4.7.19 Report cards**

Increasingly the concepts of report cards are being used to monitor the state of waterways. Reports currently in use (e.g., South Queensland, Tamaki estuary) typically monitor bio-physical parameters. There are opportunities for report cards to be developed that integrate western science and M tauranga M ori.

#### **4.7.20 Emerging theories**

This chapter introduced two theories that have emerged within water management – namely ecosystem health, and wellbeing. Other developments also have the potential to benefit tangata whenua e.g.:

- the move from ecological restoration to eco-cultural restoration;
- the transition from landscapes to cultural landscapes to aboriginal landscapes;
- widening the definition of bio-diversity to bio-cultural diversity.

All of these developments are likely to provide an incentive for professionals to engage more proactively with tangata whenua.

## 5. The case studies

Chapter 4 gave a brief insight to the knowledge, experience and expertise that tangata whenua could bring to flow assessment processes. In this chapter we summarise the extent to which such knowledge has informed contemporary processes. A range of rivers were selected as our case study catchments. Four rivers are found in the North Island and six are in the South Island.

The rivers chosen were:

1. Tongariro )
2. Moawhangao ) Part of TPD
3. Poutu )
4. Whanganui )
5. Waitaki
6. Kakaunui
7. Taieri
8. Trotters
9. Waianakarua
10. Oreti

River descriptions are contained in Appendix 1 of this report.

### 5.1 Discussion of the Interests of Stakeholders and Communities in flow assessment processes and allocative decision-making

This section is principally concerned with how stakeholders' interests are conveyed to water managers and subsequently represented in decisions when flow regimes are set<sup>15</sup>.

What emerges from the analysis of the case studies is the predominance of fisheries interests in determining the flows recommended. Of possible concern to Māori is the focus on a limited number of species, in particular salmonids, often with assumptions being made about native species. Salmonids may be seen as the most flow sensitive and if needs of the most sensitive species are met, by default other species needs will also be met. This clearly advantages those stakeholders whose interests align with the focus on fishes. It also reflects the history and evolution of flow assessment methods.

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<sup>15</sup> Tables providing a detailed analysis of each of the components of the analytical framework in Figure 3 in relation to the ten catchments is found in an internal working document prepared for MFE.

More recently, however, assessments have also considered the flow needs for other biota. Many assessments now consider the flow needs of riverine invertebrates (e.g., Kakaunui, Oreti, Tongariro, and Moawhangao) and birds (for example the Waitaki considered the needs of braided river birds, and the TPD considered who), aspects such as channel form (e.g., Waitaki), riparian habitats, floodplain wetlands, and sometimes ecosystem processes like primary production (Harding et al. 2004).

Information specific to other non-ecological interests - that relate to recreation, aesthetics, landscape and M ori - may be presented by other experts and / or submitters<sup>16</sup>. For some recreational activities such as jet-boating, (a value referred in some of the reports but not modelled in the flow assessment processes for our case studies), we note that it was modelled in the flow assessment process for the Hurunui (NIWA 2006). Rather than modelling recreational flow needs within a flow assessment process, the approach taken in the TPD was to schedule recreational flow releases. Similar approaches have been taken for the Upper Waitaki (namely Upper Tekapo River above Lake George Scott and the Pukaki River).

The Trotters Creek and Waianakarua flow assessment processes recognised that requirements of native fish (ORC, 2006):

*A flow of 0.035 m<sup>3</sup>/s is likely to ensure the sustainability of the diverse indigenous fish community in Trotters Creek during the high flow period from May to October inclusive. A flow of 0.02 m<sup>3</sup>/s is likely to ensure the sustainability of the diverse indigenous fish community in Trotters Creek during the lower flow period from November to April inclusive, and it is recommended that flows should not be allowed to drop below those outlined above due to consumptive use.*

***The low flow period flow of 0.02 m<sup>3</sup>/s is well below the point of inflection indicated by the IFIM survey for all fish species in Trotters Creek, with the exception of redfin bullies and Canterbury galaxiids .... Ecologically the point of inflection represents the flow below which there is serious risk of losing sufficient habitat to maintain a species of fish or size class.***

*The high flow period (May – October) flow of 0.035 m<sup>3</sup>/s represents the flow below which habitat declines sharply ...*

However, with respect to the low flow period in Trotters (as highlighted in the paragraph above), the decision of the Otago Regional Council was to set a low flow of 0.010 m<sup>3</sup>/s - a figure half what was the recommended low flow in the flow assessment process. In this example not only did the flow assessment recommend a flow below the point of inflection, but the decision makers went a step further to accommodate consumptive users that they stated are often restricted during the summer months.

<sup>16</sup> This is likely to be the case in the larger resource consent processes such as the TPD and the Waitaki.

Flow assessment processes concern both the minimum flow and flow variability. For example the Moawhangao flow regime incorporates 4 flushing flows during summer months to address concerns about periphyton and odour. More recently the Waitaki decision includes flushing flows plus provision for a higher “flood flow” if necessary.

Another consideration is **how** values are recognised. While a range of interests are recognised in the narrative of the flow assessment report, it is only the values that are modelled that are ultimately reflected in the recommended flow regime. For example, with the Tongariro case, angling, rainbow trout, the native fishery (3 species), rafting and canoeing are all recognised as interests. But only delectidum (a common mayfly), periphyton, feeding for adult rainbow trout and koaro were modelled within the flow assessment. It may not be clear to M ori how limiting modelling to these interests relates to specific M ori concerns.

The final consideration is the “weight” given to the recommendations in a flow assessment. The TPD hearings panel and the Environment Court made a number of observations with respect to the flow studies associated with the TPD and as the following statements confirm accepted the propositions of the experts:

*[200] ...Flow requirements were assessed for those fish species known to be present in the rivers, (i.e., longfin eel, rainbow trout, brown trout and Crans bully). ...*

*[208] Based on these conclusions, Mr Jowett could not agree with the statements of evidence, adduced by the Whanganui iwi and Ng ti Rangi, that stated that the reduction in the number of fish in the rivers had been caused by the TPD. He claimed that if the quality and quantity of suitable fish habitat reduces with a change in flow, then fish abundance is also expected to. However, flow changes and resulting water levels are not sufficiently large to effect fish habitat detrimentally. Indeed, he reiterated that the flow reduction has no negative effect on native fish, and in fact produces a slight benefit. Changes in fish population that have occurred, he states, have occurred for reasons not related to the operation of the TPD diversions, apart from potentially immediately below some intakes.*

Having stated that current flow assessment processes tend to perpetuate an ecological / bio-physical bias the allocative processes themselves are often accompanied by extensive consultation processes. Ng i Tahu has been involved in numerous processes discussing flows in the Lower Waitaki since 1988. The consultative process for renewal of the TPD resource consents was originally commenced by ECNZ in 1991, following the Planning Tribunal’s decision on the Whanganui minimum flow hearings in late October 1990. The setting of minimum flows in the Whanganui River had been a lengthy, very technical and highly adversarial and contentious process. All parties in the early 1990’s sought a more consultative approach for what was seen at the time as the more technically complex and potentially controversial process of seeking resource consents for the whole of the TPD.

The TPD included a number of monitoring requirements that were designed to assess achievement of objectives (relating to ecological health, aesthetics of the river etc.) set through the consent process. A summary of the water quality and ecological monitoring results to date have been described by NIWA (2006)<sup>8</sup> and quoted in Bowler (2008):

*“We suggest that implementation of the new flow regime has improved benthic communities in the Moawhango River below the dam, reflecting conditions expected in high-country lake-fed ecosystems. Flushing flows had a positive effect on controlling nuisance periphyton cover and silt downstream of the dam, however some changes in invertebrate community metrics such as increased dominance by chironomids were counter [to] expectations. The upcoming years monitoring may help explain if these were short term responses to the large changes in the flow regime, or whether they are reflective of the longer-term community response.”*

The feedback from the Moawhango community in relation to the state of their river has also been positive with comments about the reductions in periphyton; the elimination of offensive odours sourced from the river; the return of a gravel bottom river bed; and significant improvements in the trout fishery (Bowler 2008).

**Key points:**

- Flow setting processes are dominated by fisheries interests.
- Community values are identified but not necessarily in models to calculate flows.
- Some community values are being modelled e.g., jet boating and angling.
- In decision making a lot of weight is accorded the recommendations in the flow assessment report.
- Monitoring undertaken against agreed objectives is providing data that will inform review processes.

## 5.2 Discussion of the Interests of M ori in flow assessments and allocative decision-making

M ori are central figures in the water allocation debate. For hundreds of years rivers have been the lifeblood of M ori existence<sup>17</sup>. It is this long-term detailed, spatially specific, observation based and experiential knowledge that is potentially of value in contemporary water allocation forums. The case studies clearly show that the needs of native fish species are reflected in some of the flow assessment processes although not necessarily at the request of tangata whenua. Table 3 summarises the participation of tangata whenua.

<sup>17</sup> Descriptive passages are found in evidence to Waitangi Tribunal and in the reports from the Tribunal.

	Tangata whenua participants	Process	Tangata whenua engagement in the process	M tauranga M ori
TPD	<p><i>Eastern Diversion</i> – Ng ti T wharetoa, Ng ti Whitikaupēka, Ng ti Tamakopiri, Ng ti Hauiti, Ng ti Rangi, and Tamahaki inc. Soc.</p> <p><i>Western Diversion</i> - Whanganui M ori Trust Board, Ng ti Rangi, the Tamahaki inc. Soc. and individuals.</p> <p><i>Tongariro Section</i> – various iwi groups including T wharetoa Trust Board</p>	TPD consents sought by Genesis Ltd.	<p><b>Consultation</b></p> <p><b>Submissions</b> to the Council hearing, Ng ti T wharetoa Ng ti Whitikaupēka, Ng ti Tamakopiri, Ng ti Hauiti, Ng ti Rangi, Tamahaki inc. Soc ,</p> <p><b>Negotiations</b> - All but Ng ti Rangi and Tamahaki inc. Soc. Reached an agreement with Genesis Energy.</p> <p><b>Evidence</b> to hearings</p>	<p>Via two <b>Cultural Values Reports</b> and <b>submissions</b> the following values and outcomes were expressed -</p> <p>All diversions to cease (Whanganui Trust Board)</p> <p>Only return of natural flows to rivers could mitigate significant impacts on mauri, tapu, mana, mana kaitiaki, wairua (suggested in Cultural Values Report)</p> <p>Ng ti Rangi's concerns were diversion of water via the Wahianoa Aqueduct, the loss of opportunity to use the Whangaehu River (for bathing, human consumption, farming and cropping) has been lost, along with the loss of its natural character, and its native fishery. The reduced river is not a barrier to stock</p> <p>Ng ti Rangi also sought a consent term of 10 years. Relief specific to flows were:</p> <ul style="list-style-type: none"> <li>• Continuous flow of water from the Wahianoa Aqueduct into the Whangaehu</li> <li>• Provision of alternative sources of naturally flowing water with healing properties of the Whangaehu</li> </ul> <p>In stating the outcomes sought they did not want the decisions to pre-empt Treaty negotiations.</p>
Waitaki	<p>Ng i Tahu</p> <ul style="list-style-type: none"> <li>• Te R nanga o Arowhenua</li> <li>• Te R nanga o Waihao</li> <li>• Te R nanga o Moeraki</li> <li>• Te R nanga o Ng i Tahu</li> <li>• Te R nanga o Waitaha</li> </ul>	Development of the Waitaki Allocation Plan Meridian Energy Ltd sought consents for the North Bank Tunnel concept.	Since 1990 Ng i Tahu has had a <b>MOU</b> with Meridian Energy Ltd (and its predecessors) and has been engaged in 5 flow processes culminating in the resource consents for the North Bank Tunnel concept.	<p><b>CIA</b> (detailed site specific values, provided general description of the impacts on cultural values including site specific impacts. Impacts were not always specific to flow requirements. The discussion of flow dependencies was limited.</p> <p>The <b>submissions</b> to both the plan and the resource consents provided a generic discussion of cultural values and concerns with no flow requirements specified.</p> <p>Te R nanga o Ng i Tahu <b>submission</b> sought a cultural allocation as part of the Waitaki Allocation Plan.</p> <p><b>Evidence</b></p>

	<b>Tangata whenua participants</b>	<b>Process</b>	<b>Tangata whenua engagement in the process</b>	<b>M tauranga M ori</b>
Kakaunui	Te R nanga o Moeraki	Formulation of the Otago Regional Water Plan	Ng i Tahu were asked to formulate <b>a schedule of river values</b> (for all Otago rivers) to be included in the Regional Water Plan  <b>Submission</b> to regional plan	The cultural values associated with the Kakaunui were identified in <b>Schedule 1D</b> of the Regional Water Plan. But dependencies of values on flows are not discussed, nor are flow requirements  The <b>submission</b> provided a generic discussion of cultural values and concerns with no flow requirements specified.
Taieri	KTKO Ltd (on behalf of Te R nanga o Otakou)	A change to the Otago Regional Water Plan	Ng i Tahu were asked to formulate <b>a schedule of river values</b> (for all Otago rivers) to be included in the Regional Water Plan  A <b>submission</b> to the plan change.	The cultural values associated with the Taieri were identified in Schedule 1D of the Regional Water Plan. But dependencies of values on flows are not discussed, nor are flow requirements
Trotters	Te R nanga o Moeraki	A change to the Otago Regional Water Plan	Ng i Tahu were asked to formulate <b>a schedule of river values</b> (for all Otago rivers) to be included in the Regional Water Plan  <b>A hui</b> with Council staff and councillors  A <b>submission</b> to the plan change.	The cultural values associated with Trotters were identified in <b>Schedule 1D</b> of the Regional Water Plan. But dependencies of values on flows are not discussed, nor are flow requirements  The <b>submission</b> identified Te R nanga o Moeraki as manawhenua, values of Trotters, four issues (river mouth dynamics, mahinga kai, accumulation of gravel, loss of depth for swimming etc.), and sought a specific flow regime – i.e., flow levels were sought.
Waianakarua	Te R nanga o Moeraki	A change to the Otago Regional Water Plan	Ng i Tahu were asked to formulate <b>a schedule of river values</b> (for all Otago rivers) to be included in the Regional Water Plan  A <b>submission</b> to the plan change.	The cultural values associated with the Waianakarua were identified in <b>Schedule 1D</b> of the Regional Water Plan. But dependencies of values on flows are not discussed, nor are flow requirements  The <b>submission</b> identified values of Waianakarua, and two issues (mahinga kai, changing natural character due to gravel extraction), and sought a specific flow.
Oreti	Te Ao Marama on behalf of the 4 papatipu runanga of Murihiku.	Formulation of the Southland Regional Water Plan and an application for a WCO	<b>Working party</b> preparing the plan  <b>Submissions</b> to the plan  <b>Submission</b> to the WCO	The <b>submissions</b> discussed in general terms cultural values but described no dependencies of values on flows and sought detailed no specific flow requirements.

With respect to decision-making, the role of tangata whenua in the case study catchments has been limited to that of a submitter. However, as previously stated the decisions that set the flow regime must be based on the evidence that is submitted. This clearly imposes requirements on submitters to be explicit in stating what their flow needs are. What emerges from the case studies however, is the generic and descriptive nature of many of the submissions of M ori and the lack of specificity with respect to stating either the dependency of their cultural values on flows, or the flows necessary to protect their values. In the case of the TPD, some M ori stated that only the full return to natural flows would address their concerns.

The risk is that in the absence of M ori clarifying what their values require in terms of river flow, then by default, it becomes the role of the officers<sup>18</sup> and decision makers, who will have variable levels of understanding cultural associations, to interpret what they think is needed in terms of flow. In both the Trotters and Waianakarua cases, however representatives of the kaitiaki runanga – Te R nanga o Moeraki – sought specific flow regimes, which were also supported by the submissions of other submitters. Despite their submissions, the flows they sought were not recognised in the decision.

The need for specificity of flow requirements is also relevant to all submitters. However, M ori are likely to contend that some stakeholders (for example those with fishing interests or with economic interests (e.g., farming and hydro electricity) are inequitably advantaged over M ori and other stakeholders because their values are more easily translated into environmental flows.

The case of the Taieri River, specifically setting a minimum flow for Tiroiti, is interesting in that the recommended minimum flow of 1.15 cumecs was not set in response to identified values. This flow was determined in relation to the other minimum flows in the catchment. This approach is disempowering for Ng i Tahu and some stakeholders as it assumes that the minimum flows in the other parts of the Taieri catchment are acceptable, yet for Ng i Tahu they know that they are not satisfactory for sustaining their cultural values<sup>19,20</sup>. By instituting the minimum flow for the Tiroiti only Ng i Tahu did not get the opportunity to review the other minimum flows.

The Kakanui River is another interesting case as the Environment Court was the decision-maker. The regional council had set the minimum flow at 250l/s<sup>21</sup> in the

<sup>18</sup> Officer / staff reports usually are presented to decision makers as evidence in flow setting processes.

<sup>19</sup> The minimum flow at the Outram Glen is 2.5 cumecs. This is not supported by Ngai Tahu who consider it too low.

<sup>20</sup> Kai Tahu Ki Otago (2009) Cultural Impact Report on the Proposed Plan Changes.

<sup>21</sup> Schedule 2 of the ORC Regional Water Plan



Regional Water Plan although a number of submitters had sought a higher minimum (for example Department of Conservation sought a flow of 400l/s<sup>22</sup>). The decision of the Environment Court retained the 250l/s as the minimum at Mill Dam. However should this minimum flow be breached, all extractions have to cease until the flow is restored to 400l/s. In this example, arguably the Environment Court balanced more stakeholder interests by partially accommodating the interests of Department of Conservation.

Finally, an analysis of the involvement of M ōri in the TPD decision shows that M ōri participated at three distinct levels: the regional level, the Environment Court, and then the Court of Appeal. At council level, Genesis was granted all resource consents to maintain its Tongariro Power Development Scheme (TPD) operations for a 35-year term.

Representatives of iwi of the Whanganui River appealed the grant of regional consents on the basis that diverting water for the Scheme was culturally offensive and debilitating to M ōri. The Environment Court allowed the iwi appeal to the extent that the regional consents were reduced in term to 10 years. In reaching its decision, the Environment Court identified as factors: the substantial and detrimental effects on M ōri; the lack of evidence to quantify what level of minimum flows would address M ōri concerns; and the preference for a new application over a review provision in order to provide time for a ‘meeting of the minds’ between the two parties.

Another observation with respect to the recognition of tangata whenua values and M tauranga M ōri in flow assessment processes in general concerns the tangata whenua values that are not fully reflected in flow assessments. Having repeatedly stated that fishery interests predominate in flow assessment processes, this does not mean that the aspirations of wh nau with respect to the **activity of fishing** are accommodated. Fishing sites, like other cultural values and cultural interests may be place specific. For example, in the Waitaki, fishing from M ōri lands, M ōri reserves or fishery easements, which is an inherited right, cannot be relocated.

A final comment relates to the role Ng i Tahu in the formulation of the Regional Water plan for the Otago Region. Analysis of the Taieri, Kakaunui, Trotters and Waianakarua cases shows that Ng i Tahu formulated a Schedule of river values that was included in the Regional Plan. However the description of values in the Schedule is high level and does not state specific flow needs.

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<sup>22</sup> DOC 1998

**Key points:**

- Early engagement in the flow assessment itself would be advantageous to tangata whenua. It will also serve to develop the relationship with agencies and those undertaking the assessment.
- A flow assessment implies that some modification to the natural flow is envisaged. An openness to discuss values, impacts, flow dependencies and flow needs will aid communication between parties.
- Specificity by M ōri of flow dependencies of their values and flows needed to sustain these values is required.
- Greater specificity will enable linkages with other stakeholders to be explored. It will also aid the identification of flow assessment methods to ensure the impact on cultural values is assessed as part of the flow assessment.
- Tangata whenua engage at a range of levels – working groups, consultation processes etc. Tangata whenua also have the right to choose not to participate.
- A range of mechanisms are being used to convey values and M ōri e.g., cultural values reports, cultural impact assessments, submissions, evidence, schedules to plans etc.

### 5.3 Discussion of the Influence of the Treaty of Waitangi

This section considers the significance of the Treaty of Waitangi and the role of the Waitangi Tribunal to the processes for setting flow regimes. Firstly, the case studies confirm that although M ōri contend that the Treaty of Waitangi is central to any discussion of water allocation, the flow assessments are silent on Treaty obligations as are a number of the decisions. Where the Treaty is referred to in a decision it is usually descriptive narrative and not linked to recommended flow regimes e.g., Waitaki, TPD.

It should be noted tangata whenua sought to have the consents for the TPD reduced from 35 years to 10 years because of the expectation that co-management / co-governance could see them as a decision maker in 10 years time. The TPD decision clearly envisaged some changes resulting from the Treaty process as evidenced by the review conditions that were attached to consents:

*For the Whakapapa, Okupata, Taurewa, Tawhitikuri, Mangatepopo and Whanganui: The consent authority shall within 12 months of the Crown settling any Treaty of Waitangi claim by iwi in respect of the river dammed or diverted by this resource consent serve notice on the consent holder under section 128 of the Resource Management Act 1991 of its intention to review any or all the conditions of this consent for the purpose of making the consent consistent with all Resource Management Act 1991 matters contained in the said settlement.*

*For all other TPD resource consents: The consent authority shall within 12 months of the Crown settling any Treaty of Waitangi claim by iwi in respect of rivers or lakes*

*dammed or diverted by the TPD serve notice on the consent holder under section 128 of the Resource Management Act 1991 of its intention to review any or all the conditions of this consent for the purpose of making the consent consistent with all Resource Management Act 1991 matters contained in the said settlement. The consent holder may apply to the Council for a change or cancellation of any of the conditions of this consent by giving notice of its intention to do so pursuant to section 127a) of the Resource Management Act 1991 within 12 months of the Crown settling any Treaty of Waitangi Claim by iwi in respect of rivers or lakes dammed or diverted by the TPD.*

The role of the Waitangi Tribunal needs to be considered. The Waitangi Tribunal has deliberated on a range of flow related issues that different iwi have raised as part of claims before the Tribunal. As a result a series of Treaty principles specific to freshwater can be found in the decisions of the Tribunal (Crengle 1993, 2002); for example:

- The Waitangi Tribunal affirms that consultation with iwi is a significant aspect of the partnership duty under the Treaty (Ng i Tahu Report 1991). The effectiveness of the consultation process, however, must be questioned if cultural interests conveyed during consultation are not related to specific flows. It should be noted that in respect of the TPD hap , some hap said they were not consulted, some iwi claimed not to be consulted, and other iwi chose not to participate.
- The Waitangi Tribunal has stated that the spiritual and cultural significance of a freshwater resource to M ori can only be determined by the tangata whenua who have traditional rights over the river (Kaituna Report 1984). Yet our analysis of the case studies confirms that M ori are not fully involved in either the flow assessment or allocative decision-making.

Where resource management agencies have a statutory obligation with respect to the Treaty, they are obligated to ‘give effect to’ or ‘take account of’ those cultural values and practices that the Waitangi Tribunal and the Courts have confirmed by way of Treaty principle.

Enunciating resource specific Treaty principles, in theory, advance the case of M ori seeking greater participation in both flow assessment processes and allocative decision-making. But statements of principle, by themselves, do not identify the changes required to ensure the **practical application** of these principles. Instead of providing clear direction for freshwater managers, the Waitangi Tribunal has arguably imposed obligations without indicating how, in a practical sense, they are to meet these obligations while fulfilling their other statutory responsibilities. The next step, however, is to identify how the Treaty principles are to apply to specific management

functions that set flow regimes. The case studies show that Cultural Values Reports (in the case of the TPD), Cultural Impact Assessments (in the case of the Waitaki) and cultural monitoring (in the case of Trotters, Waitaki and Kakaunui) are tools that are used by tangata whenua to firstly articulate their values, and secondly identify impacts on those values.

Interestingly the TPD Hearings Panel concluded that “Genesis adhered to the Treaty principles even though it not obliged to do so, as it is not the Crown” (page 87). It also quoted the statement by Mr Buddy Mikaere appearing for Genesis that:

*“In terms of RMA no matter how much submitters might see a relevance in raising them unfortunately under the provisions of the RMA supported by past precedent, Treaty claim issues are not matters for resolution or consideration in this forum”.  
(page 87).*

As previously noted, conditions attached to the consents ensure that the TPD consent decision does not pre-empt Treaty Settlement Negotiations.

The Treaty principle which states that the spiritual and cultural significance of a freshwater resource to M ori can only be determined by the tāngata whenua who have traditional rights over the river clearly supports the participation of M ori in both the flow assessment and decision-making processes. At present, consultation with M ori often means they are given information to enable them to participate in the decision-making process. In other words, they are given the output of the flow assessment. However, as our case studies show, their participation in decision making is often via a submission process and does not involve them being an actual decision maker<sup>23</sup>. The obvious question that arises is why doesn’t the Treaty obligation of councils (who are commissioning or undertaking the flow assessment) require them to ensure that firstly, M ori understand the flow assessment process and secondly that the values of M ori and their M tauranga inform the assessment? When organisation, such as State Owned Enterprises or local authorities, commission a flow assessment, their Treaty obligations, arguably, also support the participation of M ori in the flow assessment itself.

In the case studies those representing the interests of tangata whenua included Trust Boards, hapū, Incorporated Societies, runanga collectives, M ori land owners, iwi authorities, runanga, Trusts, and collectives of customary fishers. In the case of the T wharetoa Trust Board submission to the TPD, their evidence identified them as the body mandated to speak on behalf of T wharetoa whanui for part of the TPD. Similarly Te Rōnanga o Ngāi Tahu submissions in respect of the Waitaki state that

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<sup>23</sup> We note that Peter Tapsell was Chair of the TPD hearing panel and Edward Ellison was on the Waitaki Allocation Board.

they are the mandated body to speak on behalf of Ng i Tahu whanui<sup>24</sup>. Flow setting processes need to accommodate this diversity.

Finally, outcomes being pursued by many wh nau, iwi and hap who are negotiating Treaty claim settlements with the Crown include new collaborative relationships where tangata whenua are participating in many if not all of the freshwater management functions. Settlement legislation could prescribe two requirements that our analysis suggests two factors could deliver more effective outcomes for tangata whenua.

1. Identification and communication of tangata whenua values:

- M ori have to identify values impacted by flows and preferably the flows necessary to protect these values. Having this information fed into the flow assessment is recommended.
- Freshwater managers – when discussing cultural values – have to ensure that they understand the relationships and dependencies between cultural values and flows so that they can discuss this with tangata whenua.

2. Requirements for “holistic” flow setting processes.

**Key points:**

- The range of entities representing tangata whenua in flow setting processes illustrates the diversity of tangata whenua participants who are seeking a greater say in protecting New Zealand's freshwaters.
- The analysis of case studies suggests that although M ori aspire to be equal participants in freshwater management, their level of participation (if any during the flow assessment process) has been limited to consultation, while their role in flow setting processes has been largely that of a submitter.
- For a Treaty position to be meaningful, parties will need to agree on how this understanding is to be translated into day to day practice. Having formal structures and processes for consultation and engaging early in the process will aid communication between parties.
- Participation in the process of planning and undertaking a flow assessment represents a means of early engagement that enables M ori to be involved in a number of management functions e.g., inventories, policy making, planning.
- Monitoring undertaken against agreed objectives is providing data that will inform review processes.

<sup>24</sup> Submission of Te R nanga o Ng i Tahu to the Waitaki Allocation Board.

- Review conditions / clauses provide an opportunity for tangata whenua still negotiating Treaty settlements to have a degree of surety that flow setting processes will not pre-empt their settlements.

## 5.4 Discussion of the legislative environment

This section examines whether the values of tangata whenua, which are supported by an enabling legislative environment, were recognised in the case studies. With respect to the RMA, Part 2 provides a summary of a range of interests / values (many aligned to those of stakeholders and M ori) that are to be considered. To determine whether flow assessment processes and decisions in our case study catchments have responded to these interests, we have examined how each case study reflects the subsections of sections 6 and 7 of Part of the RMA. This is shown in Table 4. The clauses that are shown in italics are found in section 6 and are matters of national importance that are to be **recognised and provided** for. The lower part of the Table lists section 7 matters that the decision maker is to **have regard to**.

**Table 4:** The sub-sections of section 6 and 7 of the RMA 1991 reflected in the case studies.

Section of RMA	Modelled in flow assessment	Recognised in the decision
the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development	?	?
the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development	N (Yes – braided features for the Waitaki River)	N (Yes for the Waitaki)
the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna	Yes (habitats)	Yes (habitats)
the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers	N	N
the relationship of M ori and their culture and traditions with their ancestral lands, water, sites, w hi tapu, and other taonga	N (? Possibly for native fish – a taonga species)	N (? Possibly for native fish – a taonga species)
the protection of historic heritage from inappropriate subdivision, use, and development	N	N
the protection of recognised customary activities	N	N
Kaitiakitanga	N	N
the ethic of stewardship	N	N
the efficient use and development of natural and physical resources / the efficiency of the end use of energy:	N	Yes
the maintenance and enhancement of amenity values	N	N
Intrinsic values of ecosystems:	N	Unknown
maintenance and enhancement of the quality of the environment	N	N
any finite characteristics of natural and physical resources	N	Unknown
the protection of the habitat of trout and salmon	Yes	Yes
the effects of climate change	N	N
the benefits to be derived from the use and development of renewable energy	N	Yes

With respect to the sub-sections that we believe are **modeled** within a flow assessment:

- Biophysical factors clearly drive the determination of flow regimes – thus recognising section 6:c. Those stakeholders with an interest that relies of biophysical characteristics are advantaged. However, there is evidence of trade off – usually to accommodate consumptive and economic interests – thus accommodating section 7: b.
- With respect to preservation of natural character (a requirement pursuant to section 6:a), the assessments for the Waitaki considered the braided character of the river, which is one of its distinctive features/characteristic. But in contrast, the TPD allowed for significant diversions of water and inter-catchment transfers. Tangata whenua clearly stated that only a return to natural flows would address their concerns<sup>25</sup>.
- Given the evolution of flow assessment processes (as described by Tharme 2003) it was to be expected that such processes and decision making had regard to the habitat needs of trout and salmon – thus having regard to section 7:h.
- In both the TPD decision and the Waitaki decisions the benefits derived from renewable energy resources are recognised pursuant to section 7:j.

There are a number of other provisions within the RMA that could be seen as enabling i.e., supporting the active engagement of tangata whenua and incorporation of M tauranga M ori in flow setting processes.

**Balancing competing interests** - The diversity of interests reflected in the above table highlights one of the challenges facing freshwater management agencies. M ori represent one of a number of groups with an interest in resource management. Early engagement to enable identification of values, and assessments by tangata whenua of how values are impacted by values is one means of identifying potential conflicts which is first step in possibly resolving them.

Negotiating “side agreements” - In both the TPD and the Waitaki side agreements were negotiated. These are generally confidential to the parties and so are not discussed. They are mentioned, however, because compensation and mitigation are

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<sup>25</sup> Stated in the first Cultural Values Report prepared for the TPD consent process.



options available to M ori if they believe their aspirations with respect to flows are not to be realised. Further as the Cultural Values Reports for the TPD, stated the preparation of the reports was complicated due to the number of confidential agreements that had been negotiated. The author of the Cultural Values Report therefore asked that the TPD Hearings Committee to investigate whether they believed the agreements were sufficient to mitigate cultural impacts.

**Sustainable management** - Section 5, of Part 2 of the RMA 1991, states its purpose is to “promote the sustainable management of natural and physical resources”. What is still to be determined is what the concept means in the context of New Zealand’s society. In the case of the TPD “cultural sustainability” was discussed. A wider discussion is still necessary as this could advance the position of M ori in resource management, including the water allocation debate.

**Tangible versus intangible** - A difficulty for M ori is that even where resource management agencies are prepared to recognise M tauranga M ori, the intangible or metaphysical aspects of M ori values make them difficult to provide for in practice. While resource management agencies may agree that collaborative governance and management would provide for the participation of M ori and the protection of their values, the fundamental question remains: what are the practical means by which cultural values, beliefs and practices – both tangible and intangible - can be recognised and provided for within a flow assessment process and allocative decision-making process? In the methods proposed in Chapter 8 a method for addressing the “intangibles” is presented.

**Key points:**

- A limited number of values, beliefs and practices that are recognised in Part 2 of the RMA are not recognised and provided for within existing flow assessments and within allocative decision-making.
- While some interests are explicitly modelled, others are addressed by default, while others are part of the tradeoffs agreed between parties.
- Asking for the assessment to identify the extent to which Part 2 matters are modelled in the flow assessment provides insights to how holistic the assessment was.
- Negotiating side agreements does not remove from the decision maker the obligation to determine whether Part 2 matters are adequately addressed.

## 5.5 Discussion of the Organisational Context

Organizational issues associated with flow setting that emerged from our analysis of the case studies are discussed below:

**Organisations managing and undertaking the flow assessments** - Some of the agencies initiating flow assessment processes could and perhaps should involve tangata whenua at an early stage given their statutory obligations (e.g., Councils, SOEs). We have deliberately referred to those initiating flow assessments because an agency / organization could commission one of the CRI's (such as NIWA in the case of the TPD, Lower Waitaki, Oreti and Kakaunui). But the obligation would rest on the agency that was the “client” that commissioned the flow assessment.

**The drivers/incentives for organisations to work with M ori** – In our case study catchments the drivers for organizations to work with tangata whenua were:

- Legislative provisions, most notably Part 2 of the RMA.
- Treaty obligations – which vary across organisations and it is the interpretation by staff that guide how an organization responds to these obligations.
- Best practice – as collaborative approaches are encouraged to identify and resolve issues rather than relying on confrontation processes: it makes sense to work with M ori and stakeholders as early in the allocative process as possible.
- Implementation of the provisions of relevant plans and policies.

**The capacity of organisations to interact with stakeholders and M ori** – There are a variety of mechanisms that are used to facilitate communication between organisations and M ori.

*A relationship between M ori and the organisation managing the flow assessment process / decision-making process* - Within most regions – not just those in our case study areas - M ori have developed formal relationships with regional council which is the freshwater management agency with which they have the greatest level of interaction<sup>26</sup>. But the present level of participation is often limited to consultation and for many cannot be described as collaborative. For example the relationship in Otago

<sup>26</sup> The nature of these relationships and the level of satisfaction of M ori with them are described in Synexe 2009.

(which has relevance to the Taieri, Kakaunui and Trotters case studies) is formalised by a “Memorandum of Understanding and Protocol between Otago Regional Council and Kai Tahu Ki Otago **for Effective Consultation and Liaison**”

But it cannot be assumed that in order to achieve the environmental and cultural outcomes tangata whenua seek that the relationship needs to be with the regional council. It cannot be stressed how important it is for M ori organizations and an applicant or developer to engage in building and maintaining relationships. For example the flow assessments in the Waitaki were driven by Meridian Energy Ltd’s (MEL)’s consent processes, which was aided by an effective relationship between MEL and Ng i Tahu. In relation to the TPD as part of the mitigation Genesis has established formal structures and processes. Agreements as part of consent process were negotiated with Ng ti Whitikaupeka and Ng ti Tamakopiri, Ng ti Hauiti and T wharetoa M ori Trust Board.

*Dedicated relationship staff:* The case studies highlight the need for effective communication:

- those undertaking the flow assessments need to know the values that flows are expected to sustain; and
- M ori need to be able to articulate their values and the dependency of their values on flows.

The importance of key individuals capable of facilitating dialogue between the partners is reflected in the appointment within some of the SOEs of dedicated relationship staff to manage consent processes and aid communication; for example dedicated staff were available in the Waitaki processes. Those charged with preparing Cultural Values Reports and Cultural Impact Assessments can facilitate dialogue between tangata whenua and relevant parties.

**Key points:**

- Early engagement in flow setting could include tangata participation in the flow assessment.
- Formal processes, structures and possibly dedicated staff aid communication.
- Moving beyond consultation (and process outcomes) to identifying and achieving environmental outcomes is important. This is a two way obligation. Organisations need to identify the outcomes sought. In return M ori need to specify the environmental outcomes they seek from engagement and from flow setting processes.

## 5.6 Discussion of the procedural environment

The paragraphs that follow discuss the procedural issues that emerged from our case studies.

**M ori expression of their interests & knowledge, and explicit links to flow requirements** - As has been repeatedly stated, M ori when submitting to a decision-making process often describe important cultural concepts and sites of cultural significance. But often they do not clearly articulate how these translate to flow requirements. Tools that enable this level of explicitness need to be implemented.

**Cultural Impact Assessments (CIAs), Cultural Values Reports** - Increasingly wh nau hap and iwi are preparing Cultural Values Reports (two were prepared for the TPD) or CIAs (in the case of the Waitaki). These typically describe the values of tangata whenua and (in the case of CIAs) the impacts that a water use or development could have on such values. However while a Cultural Values Report or a CIA may state that a particular flow regime is supported or opposed, they seldom progress to the specification of flow quantities for the flow components needed to protect their respective values.

In relation to the TPD, cultural values were discussed in two Cultural Issues Reports (October 2000, November 2000). The first report stated that the AEE was deficient because it did not specifically consider the effects of damming, diverting and discharging water in foreign catchments. The report did not accept that non-engagement with Whanganui Iwi was an excuse for the non assessment of impacts in the AEE. The report noted the significant impacts of the proposed activities on mauri, tapu, mana, mana kaitiaki, wairua. The applicant – Genesis - commissioned Mr Buddy Mikaere undertake an audit of the reports. There was disagreement between the Cultural Issues Report and the Audit by Mr Mikaere.

The approach in the CIA for the Waitaki was to describe the values associated with the Waitaki, identify the impacts of the proposed activity on these values, and identify the adverse effects that were to be avoided. But no flow requirements were specified. There was only one site in the catchment that Ng i Tahu was confident they knew the flow level that impacted their values e.g., at the Hakataramea Wetland they believed that flows below 120 cumecs risked dewatering the wetlands<sup>27</sup>. The proposed flow of 100-110 cumecs was therefore not supported.

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<sup>27</sup> This had been observed and photographed during the low flow trial organised by MEL.

We revisit the discussion of Cultural Values Reports and CIAs in the tools that we propose in Chapter 6.

**Relevant iwi plans** - Synexe & Nexus Associates (2009). argues that “One of the most common ways of communicating M ori values and interests to Council was through the use of iwi planning documents”. But we believe that relying on iwi plans alone is insufficient. The iwi plans that we reviewed provided general policies in relation to water allocation, but again, left it for others to interpret the specific flows needed to comply with the policies.

Thus, iwi plans do not always identify targets or measurable outcomes. Not only would targets and measurable outcomes better enable this document to be taken up by the regional council, but it would also provide real guidance and satisfaction when these clear targets were achieved. But Synexe & Nexus Associates did not explain the process by which measurable targets would be set and how these would be linked to specific flows and / or components of a flow regime. Some options are discussed in the next chapter.

**Policy framework taken into account by decision makers & M ori interests reflected in this framework** - What is evident from the case studies is that some councils continue to view their obligations to M ori as occurring within a consultative frame only. The other finding is that M ori participation is often limited to two management functions – plan formulation and processing resource consents. One exception from the case studies was the participation of Ng i Tahu in drafting a Schedule of river values for inclusion in the Otago Regional Water plan. However, analysis of the plan raised a fundamental issue - this schedule is not linked to the substantive management framework (objectives, policies, methods, and rules) in the plan. Therefore the Schedule is not proving to be an effective mechanism for having cultural values addressed in flow setting processes.

Decision makers base their decision on the evidence before them. Officer reports typically submit as evidence the relevant statutory planning provisions. Where there is alignment between cultural values, the flows necessary to sustain these values, iwi planning documents, and the substantive management framework of statutory planning documents, the decisions are likely to more effectively accommodate cultural interests. Where alignment and specificity are missing and don’t require the decision maker to take account of cultural interests, then participation is likely to be ineffective and M tauranga M ori will not inform flow setting. Decisions are unlikely to meet the aspirations of M ori.

**Difficulties with the annual prioritisation processes** - If M ori want the regional council or other Crown agencies to record M tauranga M ori and initiate participatory flow assessment processes they will likely need to an allocation of funding when the annual plans, annual business plans, or Statements of Intent are developed, pursuant to the Local Government Act 2002, Public Finance Act 1989 or Crown Entities Act 2004. This will need to be negotiated. In the cases within Otago Region (Trotters, Taieri, Kakaunui cases) the relationship agreement between Ng i Tahu and the Council provides for an annual meeting to have input to the regional council's annual plan. Projects to date have not focussed on flow setting processes although one project – development of region wide resource inventory was accommodated within the annual plan and starts the process of recording M tauranga M ori.

#### Key points

- The outcomes sought by M ori need to be able to be traced from the identification of their values, to policies, targets and measurable outcomes within their iwi planning document, to the substantive management framework found in statutory planning documents. Alignment is necessary to provide a solid foundation for the incorporation of M tauranga M ori and participation of M ori in subsequent statutory processes – as ideally both submitter and decision maker.
- The substantive policy framework within statutory plans that managers and decision makers are to have regard to, needs to require the identification and the incorporation of M tauranga M ori.

## 5.7 Summary

In concluding this section we want to explain that by examining the nature of M ori participation to date, our intention is not to undermine traditional management techniques or degrade the efforts of tangata whenua to date. Rather, it suggests that a range of initiatives are underway including developing relationships with agencies, formulating iwi plans, Cultural Values Reports and CIAs, and participating in statutory processes. However, our analysis identified a range of issues. Despite the range of initiatives underway, significant advances are still to be made by tangata whenua to achieve the environmental outcomes and cultural outcomes they seek. Sections 6-7 of this report proceed to set out a number of recommendations that respond to the issues identified during our examination of the case studies.

## 6. Tools for incorporating M tauranga M ori in flow setting

For M tauranga M ori to be incorporated into flow setting processes they should be grounded in the beliefs, values and practices of tangata whenua, and be simple for whānau, hapū and iwi to apply. Furthermore, M tauranga M ori should easily link with other flow assessment methods and not be seen as merely an ‘add-on’ or something separate from western science. This will enable linkages with other stakeholders to be identified and communicated, and the two ‘world views’ to be better integrated and brought together.

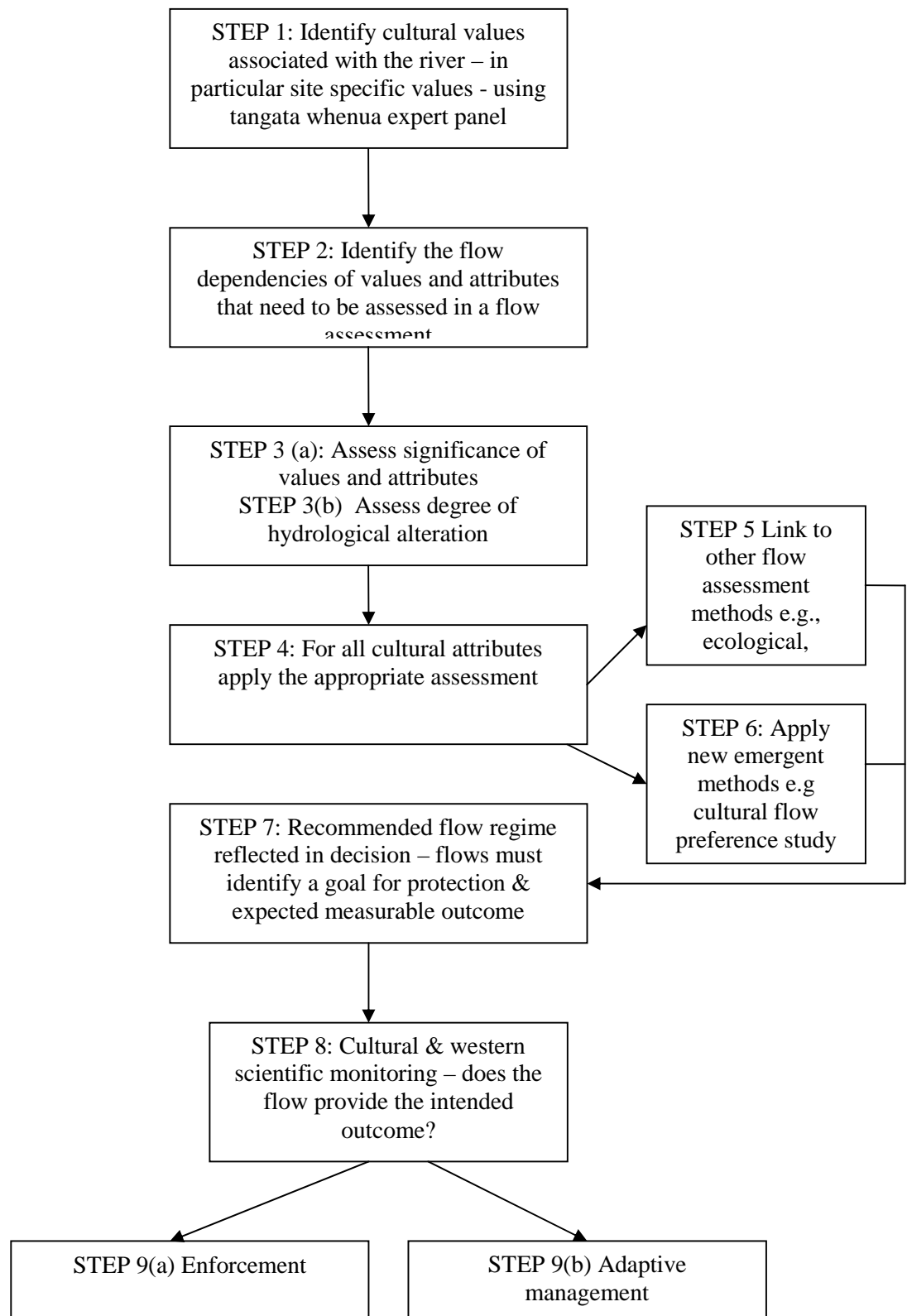
The previous chapter described, in relation to a number of case studies, the difficulties with incorporating M tauranga M ori in environmental flow setting processes. That chapter highlighted some of the practical, political and institutional impediments.

However, there has been some work undertaken within New Zealand that can assist in scoping a process that would improve the use of M tauranga M ori to inform flow assessment processes. This work involves:

- identifying cultural values;
- identifying which cultural values can be translated with conventional flow assessment methods;
- **methods / tools** that can be used by tangata whenua to participate in the concepts that not easily accommodated within existing flow assessment methods.

In this chapter, we describe this work by suggesting a process whereby M tauranga M ori could be incorporated into environmental flow setting processes through a step by step process that reflects that proposed by the National Environmental Standard for Ecological Flows (Figure 4). The emerging work is described within the context of each of the relevant steps in the process.

**Figure 4:** A process to incorporate M tauranga M ori in flow setting.





## 6.1 Step 1: Identify cultural values associated with a river – especially site specific values

Two aspects are discussed in this section:

STEP 1: Identify cultural values associated with the river – in particular site specific values - using tangata whenua expert panel

- Identifying values.
- Involve tangata whenua in the selection of sites for the rest of the flow assessment process.

Firstly cultural values, beliefs and practices are to be derived from tangata whenua. A discussion of each value should be followed by an in-depth investigation of the complex and interrelated dimensions of that value. The values set out in chapter three should inform this. Collectively the values are to describe the breadth of the relationship of tangata whenua with lands and waters within a catchment, and are likely to reflect an intimate knowledge of the interdependencies and interactions of resources / entities.

The process should be carefully facilitated to allow input from tangata whenua in a manner in which they are most comfortable with. Through such a process, qualitative data can be collected as tribal members are encouraged to talk about their experiences at each site and how their experiences have changed over time.

Secondly, spatial data needs to be mapped. This can involve mapping data obtained at different levels of specificity. Sites throughout a catchment need to be identified together with the values associated with each site – in other words, the reasons for determining the site to be of cultural significance.

Tangata whenua are already engaged in mapping cultural data (refer section 4.7). The data held in resource inventories, GIS systems and tribal archives can inform this step of the process.

Cultural Opportunity Mapping Tipa & Nelson (2008) requires three distinct tasks to be completed:

1. Preparation of a base map or aerial photograph upon which sites throughout a catchment are identified together with the values of each - in other words, the reasons for the site being of cultural significance are recorded.
2. Opportunities sought by tribal members (given the nature and extent of the values they mapped) are then recorded.
3. Finally, informants are to identify water related concerns they perceive to impact the provision of cultural opportunities at each site. These are represented as a concept map which is recognized as an effective tool to elicit the belief systems that are used to perceive and analyse situations (El Sawy & Pauchant 1998, Weick 1979, 1995).

Mapping opportunities enables tangata whenua to identify management actions conducive to their continued association with aquatic sites. Flow is one of the factors that can manipulated to provide or deny opportunities.

Cultural fishing knowledge can also be mapped (Synexe (2009b)). This maps a fisher's ecological knowledge. A cultural mapping exercise with tangata whenua *"would enable interview data to be plotted in a visual and concrete form that can later be used for planning purposes.... The outcomes of the cultural mapping exercise...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)"*

*Informing site selection* - Scientists undertaking ecological studies also need to identify sites for their assessments. However early engagement with tangata whenua and participatory processes would enable tangata whenua to help with this selection thus enabling them to link with other flow assessments being undertaken. Visits by tangata whenua and scientists could be made to all possible river reaches before confirming the choice of sites to be assessed as part of a flow assessment. Existing and easily acquired data can define zones that differ in terms of channel morphology, water quality parameters and biological zones for fish, invertebrates and riparian vegetation while tangata whenua can confirm sites or zones of cultural significance. Having M tauranga M ori – where feasible - reflected in the sites where flow assessment processes are undertaken is a step forward towards integration of western and M ori world views.

Tangata whenua participation in site selection is important because when they receive a copy of the flow assessment they will be better able to interpret the

recommendations in relation to sites and river reaches used and valued by them. This process would also enable those charged with investigating the functions and processes of a river to utilise M tauranga M ori and target their site assessments, where practicable, to address tangata whenua concerns.

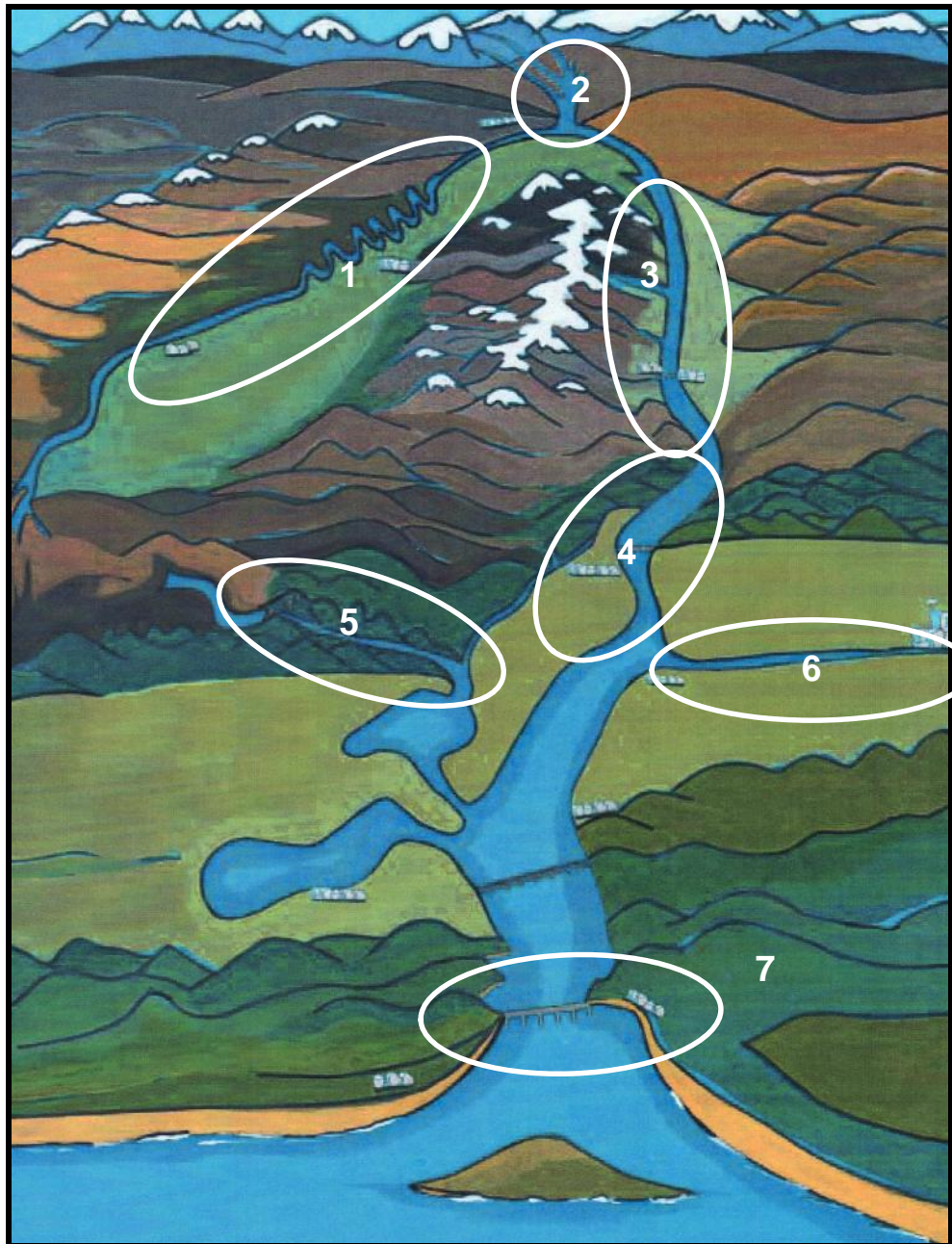
Figure 5 gives an example of the diversity of different zones within a catchment<sup>28</sup> that could be assessed. This illustrates the types of cultural values that could be identified through the mapping exercise from sites important for mahinga kai to those important for navigation:

- Zone 1 - is an area with upper wetlands. It is valued by Ng i Tahu as a large wetland providing source waters for the Taieri and sustaining a variety of taonga species. Historically it was a significant mahinga kai.
- Zone 2 - contains headwater streams sourced in the foothills. Historically there were many nohoanga in the area sustaining mahinga kai activities.
- Zone 3 - is a floodplain in the middle of the catchment. All small streams in this area were valued as mahinga kai. Trails converged in this plain. Today it provides numerous sites for fishing and recreational activities.
- Zone 4 - is a floodplain in the lower reaches of the catchment that is subject to intensive use by a range of stakeholders. It was the site where historically the river was forded. It was named Wai kirikiri for the beds of gravel that have always been present at this site. It marked the upper extent of navigation by waka.
- Zone 5 - contains an important tributary, the flows of which impact water retention times (and water quality) in the lakes. Historically these lakes were called “food baskets” because of the richness of kai provided and its availability. Kaika were found along the river bank and within the wetlands itself. Pa ringed the wetlands thus confirming its strategic importance. The lakes and wetlands still support many taonga species.
- Zone 6 - contains an important tributary on the lowland plain that is used for a number of recreational activities. It is important to Ng i Tahu because the taniwha Matamata moved throughout this tributary, causing depressions (now wetlands) before moving further downstream to the Taieri River.

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<sup>28</sup> This diagram of the Taieri catchment was produced by the Taieri Trust.

- Zone 7 - is the river mouth, which is important for fish migration, movement of sediment etc. There were kaika on both sides of the river and the area is still valued by Ng i Tahu for the range of kai it provides.



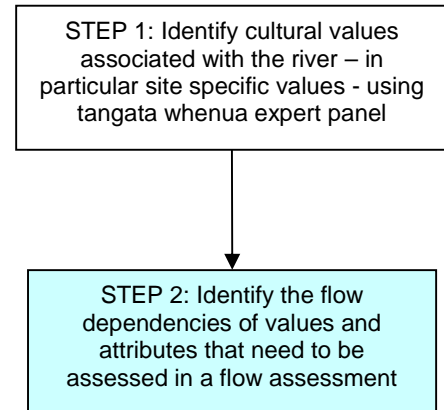
**Figure 5:** Example of zones within a catchment where flow assessment could be undertaken.

One aspect of site specificity to be discussed with tangata whenua concerns the availability of alternatives / alternative sites and the principle of substitution. For example, if river water is used for bathing, but groundwater pumps are available as an alternative source, a reduced river flow may have different level of impact than if river

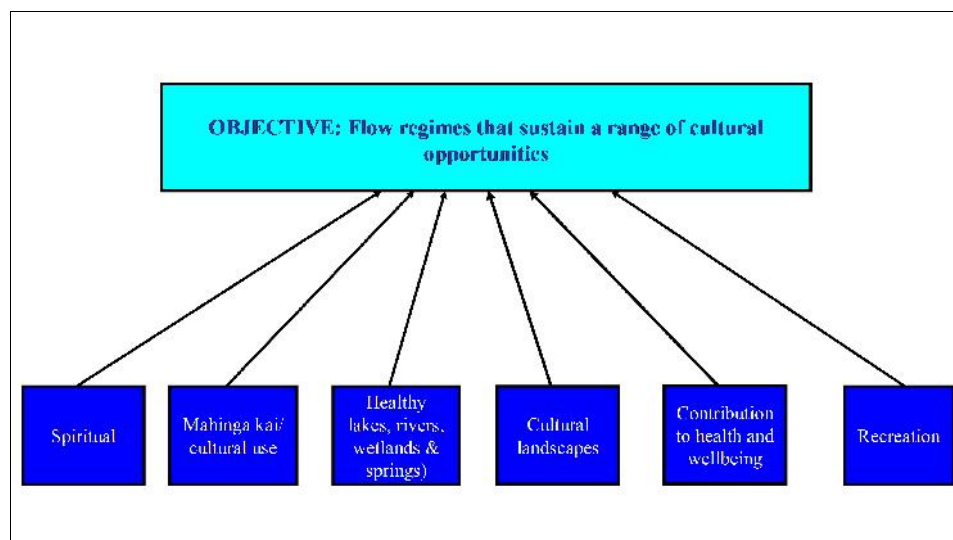
water was the only available fresh water source. If different sources are available, it is tangata whenua preferences that need to be understood. It is important to acknowledge that some site specific values to tangata whenua cannot be relocated.

## 6.2 Step 2: Identify flow dependent Cultural Values and Attributes

The next step in the process is for M ori to identify how their values, beliefs and practices of significance are either flow dependent or impacted by changing flows.



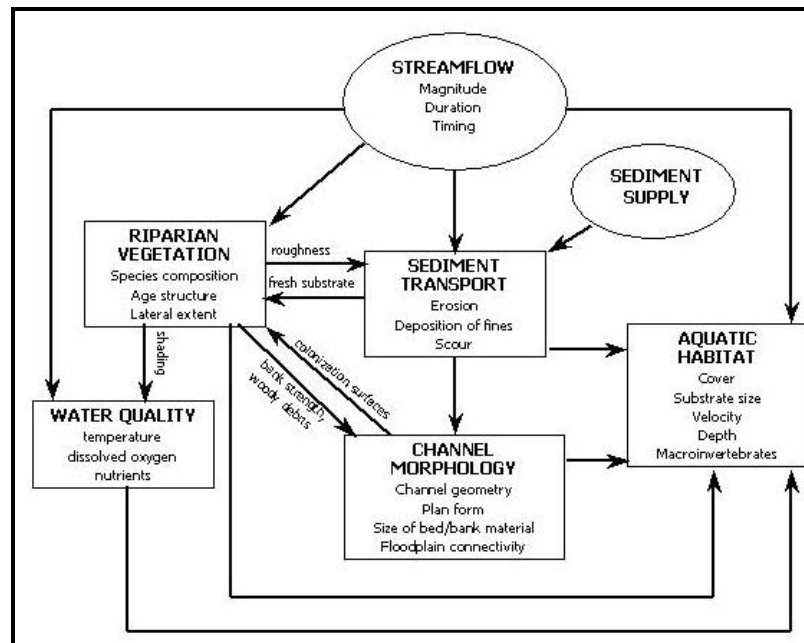
Drawing on the cultural concepts described in section 3.1, the M tauranga held by tangata whenua (as described in section 3.2) can then assist to identify the components that need to be assessed in order to identify the flow dependent tangata whenua values, i.e., leading to **WHAT** needs to then be assessed as part of the environmental flow setting process.



**Figure 6:** Attributes of a theoretical cultural assessment for flow setting.

Importantly, this step enables a critical identification of how flows impact the nature and extent of each value, belief and practice identified through the first step. In other words, specific indicators need to be identified that will be used to assess flow levels, and determine the opportunities afforded M ori given these flows.

If we accept the proposition of Tau (1993) that mauri encompasses the working ability of the river, a flow assessment will need to maintain the functions and processes essential to a “working river”.



**Figure 7:** Schematic illustration of major interactions among riverine resources and processes (Stamp, Olsen, Allred 2008).

This requires a consideration of the function and processes within a healthy system. The river ecosystem needs to be defined in a broad sense: the river ecosystem is seen as all components of the landscape that are directly linked to that river, including the source area, the channel from source to sea, riparian areas, the physical and chemical nature of water in the channel, associated groundwater, wetlands, floodplains, the estuary, and the near-shore marine ecosystem (King et al. 1999).

This approach - to consider the functions and processes of healthy river - could be seen to be continuing the bio-physical focus of flow assessments (Slootweg et al. 2001), but it does enable decision-making to be based on a more profound understanding of the role the biophysical environment plays for people and how each of the respective functions relate to the concerns of tangata whenua. It also describes the approach that may be undertaken for large consents (e.g., Waitaki, Mokohinui,

TPD) where experts may be engaged to examine each of these functions and processes.

Table 5 further illustrate flow dependent cultural values in order to illustrate how cultural values can be interpreted using western science methods, i.e., the two world views can be relatively easily brought together through the environmental flow assessment.

Table 5 provides a summary of how tangata whenua are dependent on function and processes within a healthy river. The list of functions and processes in the Table is illustrative only as it draws on a limited number of case studies. It is ultimately for tangata whenua to present their M tauranga and identify for those undertaking the flow assessment how the respective river functions and processes impact tangata whenua values.

**Table 5:** The relationship between river functions and processes & tangata whenua values.

River function and processes	How this relates to cultural values
<b>Navigation</b> — A major requirement for river navigation is, of course, sufficient water depth. But other factors, like high flow velocity, river features (such as waterfalls, rapids), and excessive growth of aquatic weeds can form important impediments for efficient and safe transport over water. These aspects of river function can be modelled using scientific flow assessment techniques.	Navigation is important for boating, waka ama, waka taua, mokihi. M ori are able to advise where navigation is problematic, describe the nature of the problem and the flows required to provide for navigation requirements.
<b>Riverbank occupation – historic and contemporary</b> - Many aspects of river flows affect communities living beside a river, such as movement of sediment (for forming beaches or swimming holes), level of low flow (affecting such matters as water quality during summer), flood flows etc.	Historically settlements (pa, kainga, nohoanga) were found alongside or on islands in rivers and on adjacent plains. Many wh nau still live alongside rivers. These sites can be impacted by both hydrological and morphological processes. It goes without saying that this greatly affects the livelihood of the wh nau and hap who comprise contemporary riverine communities.
<b>River fisheries</b> - Many rivers have fish faunas adapted to their hydrological and climatic regimes. Most river fish species require a particular flow regime to complete their life cycle in the most efficient way. Furthermore connectivity is also very important for many fish species and requires structural measures to be considered as well as a flow assessment (e.g., fish passes).	Synexe (2009b) describe the value of fishers ecological knowledge which they believe is akin to M tauranga M ori and propose tools for collecting data from tangata whenua.  An issue for M ori may be that the key species investigated may not align with the taonga species as defined and prioritised by tangata whenua.

<p><b>Coastline stabilisation and river mouth dynamics</b> - Long term coastal erosion and accretion is basically governed by two factors: sea level changes and availability of sediment. Rivers play a major role in the supply of sediment. Storage dams upstream are often seen as the cause of coastal erosion in many parts of New Zealand<sup>29</sup>. Although sediment transport is largely determined by water flow conditions, sediment availability is determined by other factors like land use and reservoir sinks.</p>	<p>Coastal environments remain of fundamental importance to Māori. Māori can identify sites along coastlines and rivers and historic patterns of erosion, accretion, and changes they attribute to changing flows.</p>
<p><b>Harvesting high flows</b> - In water short areas, and particularly where land use intensification is limited by rainfall, harvesting and storing higher flows is being promoted e.g., in Otago. Understanding the timing and duration of the higher flows and floods, and how they contribute to the overall health of the system is of importance.</p>	<p>Land use intensification (especially conversion to dairying) is a major concern, so Māori will be seeking certainty with respect to the impacts of harvesting on long-term river health.</p>
<p><b>Coastal fisheries</b> - Coastal lagoons / estuaries are transitional systems that are occupied by various fish species.</p>	<p>These sites are also highly valued by tangata whenua.</p>
<p><b>Estuarine and lagoon integrity</b> - Freshwater inflow influences the integrity of estuaries and lagoons in a number of ways. Apart from the salinity effect (which is described in a later paragraph), the volume of freshwater itself also has a hydraulic impact on the morphology. Some estuaries (e.g., lowland streams in Canterbury and Otago) may be temporarily closed during summer by a sand bar, which is pushed away during high flows in winter and spring.</p>	<p>Estuaries and lagoons are highly valued by tangata whenua for a number of values – fisheries, wahi tapu, whakapapa etc.</p>
<p><b>Ecosystem integrity</b> - The ecological value of river ecosystems is often encapsulated with the concept of ecosystem integrity, which consists of two parts: functional integrity and structural integrity (Westra, 1994). Many flow assessments are designed to assess what is necessary to maintain ecosystem integrity.</p>	<p>Māori have a holistic appreciation of ecosystem health and use other terms such as mauri, whakapapa, te ao Māori (chapter 3) to describe this concept.</p>
<p><b>Miscellaneous cultural materials</b> - Rivers and associated (vegetated) floodplains, wetlands and river mouths provide a multitude of resources such as plants (flax, raupo, kiekie), clays, dyes, gravels, sands and rongoa (medicinal species) etc. While the relationship between the health of these species and flow requirements is complex, as it involves many different species each with its own habitat requirement, specific aspects may be able to be modelled using scientific flow assessment methods.</p>	<p>Resources from rivers and other waterways are collected by Māori for personal use or semi-commercial uses.</p>
<p><b>Water quality</b> - Floodplains can remove nutrients through the uptake and vigorous growth of its vegetation. Furthermore, river waters dilute and wash out pollutants which are then carried downstream and enter the sea. The freshwater volume can also impact the water quality in waterbodies through a change in residence time of the water, especially in estuaries. It has been recorded for the Waipori catchment that reduced freshwater flows can increase water residence time which may cause accelerated water quality problems (Schallenburg 2001).</p>	<p>Māori believe that the source of contamination is an issue to be managed directly and do not support the strategy of using “dilution as the solution”.</p>
<p><b>Flood mitigation</b> - The buffer action of wetlands (floodplains, swamps etc.) in a river catchment serves to reduce fluctuations in river discharge.</p>	<p>In many forums tangata whenua identify the need for floods and freshes to “flush clean the river system”. River regimes which reflect flow variability are more likely to respect the mauri of the river.</p>

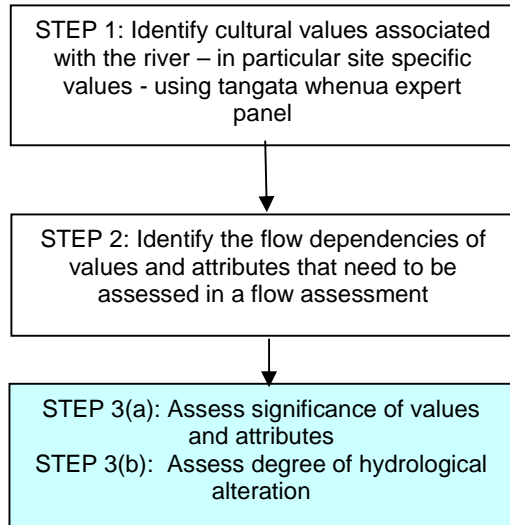
<sup>29</sup> This was a concern of tangata whenua in the case of the Waitaki, the Clutha, Trotters and the Taieri.



<p><b>Health</b> - There are generally health factors associated with river environments. Consideration of health impacts involves a interdisciplinary approach, in which not only water management plays a role, but also human behaviour and health services available.</p>	<p>The long-term interaction of M ori with catchments enables them to identify health concerns.</p>
<p><b>Wellbeing</b> - The livelihood concept is considered a useful approach to determine the dependence of people on the river for their well-being.</p> <p>Chapter 4.3.2, the concept of wellbeing and what it means to indigenous communities is attracting increasing attention.</p>	<p>River ecosystems continue to serve various functions for M ori living alongside and interacting with rivers, e.g., for drinking, baptism, washing, bathing, but also for fish and the collection of other food, of construction materials, or for recreation. Changes in the flow regime could have an impact on the lives of M ori.</p>
<p><b>Hydrological cycle</b> - Regulation of the hydrological cycle is formed by a combination of water retention (by wetlands), groundwater recharge and groundwater discharge.</p>	<p>M ori can identify what they believe are recharge zones, important wetlands, springs etc. and describe the interconnections. They can also advise of the impacts that they believe will result from modified flows.</p>
<p><b>Salinity and salt water intrusion</b> - Estuaries are highly dynamic systems and are under the influence of both river flow and tidal movements. Seasonal changes in river flow can temporarily change the 'normal' condition of an estuary. Preventing salt water intrusion into the river system and groundwater is a well-known function of freshwater flow in lower reaches of rivers. Salinities in lowland rivers may create problems for domestic, industrial and agricultural uses.</p>	<p>M ori have identified changes in lower reaches of rivers, e.g., the Taieri, brackish waters are being experienced further upstream, species composition is changing e.g., tidal mudflats &amp; crabs replacing vegetated riverbanks &amp; eels, salt intolerant plants are dying.</p>
<p><b>Sediment and suspended matter</b> - The presence of suspended solids and sediment in rivers is an important physical characteristic that can have both a direct effect at the aquatic life (e.g., fish) through damage to organisms and their habitat, and an indirect effect through its influence on turbidity and light penetration. Furthermore, the sediment budget is an important parameter for the morphological development of rivers. Flow regimes can to a certain extent be used to influence some of these processes, such as flushing of sediments.</p> <p>One aspect that is gaining importance is the use of flow assessments to preserve the long term river morphology by assuring high flows of relatively low frequency. For example the IFIM for the Waitaki considered sediment movement and maintenance of the braided character of the river resulting in a flow regime that incorporates a minimum flow with seasonal variation, flushing flows and a flood flow. In the contrast, the Opihi only has a minimum flow and is one of the most armoured riverbeds in the country. As the changes of river morphology are due to the erosion, transport and settling of sediment, the largest amounts of sediment are transported by the river during high-flows and not at average or low-flow conditions.</p>	<p>River regimes which reflect flow variability and take into account replicating the natural movement of sediment and suspended matter through the whole river system are more likely to respect the mauri of the river, and reflect the whole catchment approach recognised through Te Ao M ori (see chapter 3).</p>

### 6.3 Step 3(a): Assess Significance to Rivers and degree of hydrological alteration

The proposed NES on ecological flows and water levels uses significance as a criterion to help identify the methods to be applied in a particular context. We have adopted a similar approach in that we propose a process for according significance. However significance or the relative importance of a river to tangata whenua given its values and attributes can only be determined by tangata whenua. As the relative importance of values increases, the consequences of not meeting the goals and objectives of tangata whenua also increase.



We have chosen not to use the concept of national, regional and local significance as some river reaches are of significance to particular whānau, hapū and iwi. It is difficult and inappropriate to impose national regional or local significance based on non-cultural criteria. We propose according significance of a river on the basis of three criteria:

- presence or absence of attributes;
- level of modification; and
- ability for rehabilitation / restoration / reversibility.

In iwi management plans and or in resource inventories whānau, hapū and iwi identify their beliefs, values and uses of resources. They are likely to engage in planning processes to protect these values and the attributes that contribute to that value. The **presence of those attributes and values** will influence determinations of significance. In addition to the presence of attributes and values, their **condition (i.e., the level of modification)** will also influence the level of significance accorded as will the ability of whānau to **rehabilitate / restore or reverse** the impacts of an activity.

**Table 6:** Proposed instream values and scoring criteria for significance of rivers and river reaches based on a determination of cultural values and attributes.

<b>Values &amp; Attribute – tangata whenua decide whether</b> <ol style="list-style-type: none"> <li>1. No site specific values are present.</li> <li>2. Some site specific values are present.</li> <li>3. All site specific values are present.</li> </ol>	
<b>Degree of modification - tangata whenua decide whether</b> <ol style="list-style-type: none"> <li>1. No sign of site specific attributes – destroyed / lost.</li> <li>2. Some modification - some sign of site specific attributes.</li> <li>3. Totally natural – no modification.</li> </ol>	3, 4 low significance. 5-6 medium significance. 7-9 high significance.
<b>Ability to protect, restore, rehabilitate - tangata whenua decide whether</b> <ol style="list-style-type: none"> <li>1. No or very limited ability to restore or rehabilitate attributes.</li> <li>2. Ability to restore and rehabilitate.</li> <li>3. Realistic to protect all attributes.</li> </ol>	

Having provided a score each for the three criteria in Table 6 (e.g., 2 for “some site specific values present”, 2 for “some modification”, and 2 for “some ability to restore”) the three scores are summed. The combined score (of 6 in our example) represents a river that is medium significance.

Rating rivers is inherently challenging for M ori. However Table 6 is proposed as a possible means of according significance and is included to promote discussion. It is always the right of tangata whenua to determine significance and they may decide that all rivers are of high significance.

#### 6.4 Step 3(b): Degree of Hydrological Alteration

The proposed NES for Ecological Flows and Levels uses the degree of hydrological alteration to help in the selection of appropriate ecological flow assessment methods. In order to make the assessment process “accessible” to M ori we recommend distinguishing between low, medium and high hydrological alteration on the basis of

the nature of the activity and potential level of impact. BECA (2008) explain that water use can be divided into three categories of increasing hydrological alteration.

**Consumptive use or abstraction** - Water is taken from the river and used for activities such as water supply and irrigation, often with seasonally varying demand. BECA (2008, 10) contend that:

*abstraction of up to 10% of the mean annual low flow (MALF) is barely measurable and therefore unlikely to result in significant biological effects in any stream. Abstraction of up to 20% of MALF is unlikely to result in significant biological effects in lake- or spring-fed streams or in streams with frequent floods and freshes, such as those draining mountainous regions exposed to the prevailing westerly winds. When total abstraction exceeds these limits, the magnitude and duration of low flow may have significant effects on biota.*

**Diversion or large scale abstraction** - Water can diverted from rivers on a relatively large scale and may be returned to the river downstream or discharged into another catchment. A diversion or abstraction is considered large-scale when it is able to divert more than 90% of the MALF out of a river. With large-scale diversions or abstractions, the quality and amount of habitat at minimum flow will directly affect the biological communities because flows are at the minimum for substantial periods of time.

**Storage** - River flows are modified by storage with potential change to the seasonality of flows, minimum flows, and high flows. Storage regulation can be consumptive (water supply or irrigation) or non-consumptive (hydro-electricity). The potential degree of regulation will depend on the storage volume in the impoundment. Storage regulation can affect all biologically important components of the flow regime.

The proposed assessment criteria listed in Table 7 requires significant discussion with whānau, hapū and iwi before it could be finalised. However, it adopts a cautious approach based on the discussions presented in the BECA (2008) report and our interpretation of iwi submission to the proposed NES, but the levels may not address all the concerns of whānau, hapū and iwi given that some argue that any alteration is unacceptable culturally. Therefore Table 7 below must be considered as “illustrative” with the caveat that it needs to be the subject of further discussion with tangata whenua.

**Table 7:** Proposed assessment criteria for level of impact and hydrological alteration.

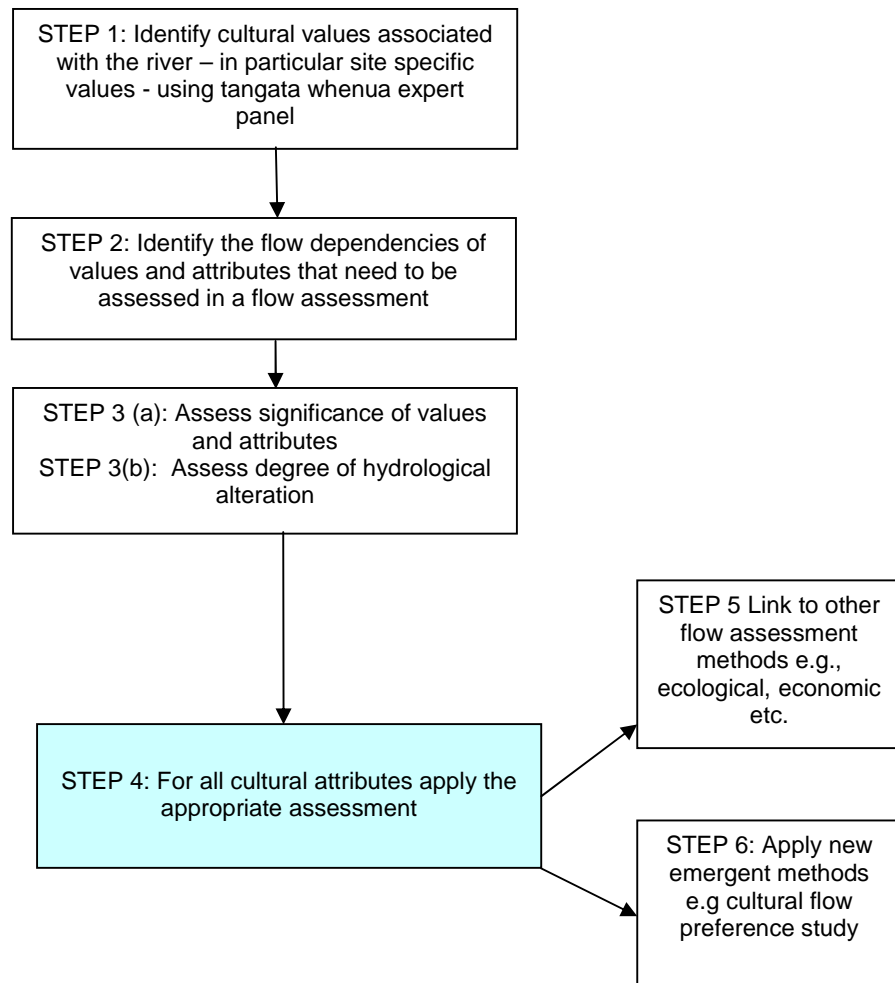
Level of impact	Degree of hydrological alteration
<p><b>Low impact activities:</b></p> <p>Extraction of less than 10% of MALF; or</p> <p>Diversion – in catchment - of less than 10% of MALF; or</p> <p><b>Out of river but in catchment storage that involves harvesting of higher flows; or</b></p> <p>Activities are completely reversible.</p>	Low
<p><b>Medium impact activities</b></p> <p>Extraction of less than 20% of MALF<sup>30</sup> but more than 10% of MALF; or</p> <p>Instream storage infrastructure on the tributary of the river system; or</p> <p>Diversion less than 20% of MALF<sup>31</sup> but more than 10% of MALF.</p> <p>Activities are partly reversible.</p>	Medium
<p><b>High impact activities</b></p> <p>Extraction more than 20% of MALF; or</p> <p>Storage infrastructure on the mainstem of any river; or</p> <p>Diversion of more than 20% of MALF; or</p> <p><b>Intercatchment transfers; or</b></p> <p>Activities are irreversible.</p>	High

To apply the criteria, tangata whenua are to identify the nature of the proposed activity and the level of impact for example intercatchment transfers (highlighted) would be classed as a high degree of hydrological alteration. In contrast a proposal that involved out of river but in catchment storage of high flows (highlighted) may be classed as a low degree of hydrological alteration. Once again, however, it is the right of tangata whenua to determine all activities to be of high hydrological alteration.

<sup>30</sup> The figure of 20% was taken from the Ngati Kahungunu submission to the NES discussion document.

<sup>31</sup> The figure of 20% was taken from the Ngati Kahungunu submission to the NES discussion document.

## 6.5 Step 4: Apply the appropriate assessment



Having identified the cultural values (step 1), identified cultural values that are flow dependent (step 2), assessed the degree of significance and level of hydrological alteration (step 3), the next step (following the approach presented in the proposed NES) is to select an appropriate level of investigation. We have drawn together the significance criteria and the degree of alteration to develop a matrix.

Table 8 is populated with suggested flow assessment methods with recommended tools / methods based on a cultural determination of both significance and hydrological alteration. For example where an activity that is likely to result in low hydrological alteration is to occur in a river reach considered to be of low significance, then it is recommended that a cultural values report be sought from tangata whenua. In contrast, for an activity likely to result in a high degree of hydrological alteration in a river reach considered to be of high significance, then it is recommended that the socio-economic module from DRIFT be undertaken, along with a Cultural Flow setting. These methods then complement assessments specific to ecological,

recreational or amenity values identified by tangata whenua, stakeholders and communities.

**Table 8:** Recommended cultural methods used in the assessment of flow requirements for degrees of hydrological alteration and significance of values.

Degree of hydrological alteration	Significance of river to tangata whenua		
	Low (1-3)	Medium (4-6)	High (7-9)
Low	<b>Cultural Values Report</b> <b>plus</b> other assessment methods to enable economic, ecological, aesthetic assessments	<b>Cultural Values Report</b> <b>plus</b> other assessment methods to enable economic, ecological, aesthetic assessments	<b>Cultural Impact Assessment</b> <b>plus</b> other assessment methods to enable economic, ecological, aesthetic assessments
Medium	<b>Cultural Values Report</b> <b>plus</b> other assessment methods to enable economic, ecological, aesthetic assessments	<b>Socio-economic module DRIFT</b> <b>Cultural Impact Assessment</b> <b>plus</b> other assessment methods to enable economic, ecological, aesthetic assessments	<b>Socio-economic module DRIFT</b> <b>Cultural flow assessment</b> <b>plus</b> other assessment methods to enable economic, ecological, aesthetic assessments
High	<b>Cultural Impact Assessment</b> <b>plus</b> other assessment methods to enable economic, ecological, aesthetic assessments	<b>Socio-economic module DRIFT</b> <b>Cultural flow assessment</b> <b>plus</b> other assessment methods to enable economic, ecological, aesthetic assessments	<b>Socio-economic module DRIFT</b> <b>Cultural flow assessment</b> <b>plus</b> other assessment methods to enable economic, ecological, aesthetic assessments

### Downstream Response to Imposed Flow Transformations

This is comprehensive assessment that comprises 4 modules (see section 4.4):

- The biophysical module.
- The second module is the sociological module. The subsistence users of the river who are potentially affected by proposed changes to the flows and water levels are identified, their use of the river is quantified, and an understanding of how they will be affected by changes to the river is developed.

- In the third module, modelling a number of scenarios for possible flows and water levels. For each flow scenario, the biophysical and socio-economic impacts are predicted.
- The fourth module, the costs of mitigating identified effects and/or compensating affected communities for impacts that cannot be resolved are assessed.

Scenario building using the information obtained from participatory processes to understand the perspective of those living with and using the river, is integrative and serves to accommodate differing worldviews, knowledge systems and differing values. King, Brown & Sabet (2003) explain:

*Two allied activities should occur in parallel to the DRIFT application...First an assessment of the wider consequences of each flow scenario should be done to illustrate related macro economics such as the loss or gain of irrigated agricultural land, the potential for industrial and urban development and the cost of water to offstream users. Second a public participation process (PPP) should be run parallel to DRIFT throughout its application. Initially the PPP provides input to DRIFT on river concerns that need to be described in each scenario, such as a recreational fishery, a conservation area, a riverside business or a flood hazard. Following this a continuing process of information exchange and education should allow interested parties to understand the scenarios developed in DRIFT and to indicate the degree of acceptability of each. All three activities thus produce independent but related information for the decision maker. (King et al. December 2004)*

*Like other holistic approaches DRIFT is essentially a data management tool allowing data and knowledge to be used to their best advantage in a structured process. Its central rationale is that different parts of the flow regime elicit different responses from the river ecosystem... the removal of one part of the flow regime will affect the ecosystem differently than removal of another part. Furthermore it is assumed that:*

- *It is possible to identify and isolate these different parts of the flow regime within a long term hydrological data set of daily flow.*
- *It is possible to describe in isolation the probable biophysical consequences of partial or whole removal of any one of these parts.*
- *The parts of the flow regime and their linked consequences can be recombined in various ways to describe the river condition of any flow regime of interest (the biophysical part of the scenario).*
- *The social impacts of each river condition can be described (the socio-economic part of the scenario).*

While it is beyond the scope of this research to delve into each of these modules and the DRIFT methodology in great detail, it is important to consider the methodology and the holistic approach that they represent (King, Brown & Sabet 2003). Their strength is that 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 with flow changes, and how this would impact overall environmental



condition and users. Scenario building is an integrative step. The public participation and transparent decision making processes are particularly relevant to our recommendations that follow in chapter 7. The trend in setting environmental flows is for these holistic methodologies to increasingly be run along with other hydrological based methods, and for more biodiverse, whole ecosystem approaches. The processes in section 6.3 and 6.4 that we propose complement but build on the “socio-economic” focus of both BBM and DRIFT by introducing a “Cultural assessment process for setting flows” that could stand alone or be considered as a “cultural module” to be included within a holistic methodology.

## **6.6 Step 5: Apply technical flow assessment methods where appropriate**

This step of the proposed assessment process recommends that linkages be made between cultural values and attributes, and a range of technical methods. This means that ‘western science’ techniques can be used to aid the understanding of the impact of flows on cultural values. Table 5 above describes how the functions and processes of healthy river systems are relevant to M ori while the table that flows shows how the flow dependent attributes of mahinga kai can link to technical methods.

**Table 9:** Mahinga kai - Places where food produced or procured. [Tipa in press].

Attributes	Flow indicator / Discriminator	Information Requirements
The bounty gathered river and wetlands i.e., abundance and diversity of species.	Absence / presence key species.	Identify species of significance to Māori usually sourced in catchment.
Needs of species at all stages of life cycle.  Habitat.  Food sources.  Migration.	Temperature, shade, breeding & rearing areas, quality edge habitat, inundated habitats (eel burrows), variety of instream habitats, flow variability to trigger life cycle stages, no strandings, food availability, competition between species.	Identify how changes in flow will alter habitat for species at all stages of the life cycle.
Accessing and using places and resources.	Legal and physical access, safe access	Identify where access is required.  Identify how flow alters access.
Ability to use river.	Condition of species.  Compatibility with other users.  Method of fishing.	Identify if preferred methods of fishing will be possible under different flow scenarios.

In the Table that follows we provide some other examples of values and knowledge that could link with other technical scientific flow assessments. Although the first reaction when reading Table 10 may be to dismiss these as intangible, examination of the dimensions of a value by tangata whenua can help identify opportunities to share information.

**Table 10:** Examples of values & knowledge that could link to scientific flow assessments.

Value	Dimensions	Flow Indicator	Information Requirements
Creation, life, energy and vitality of a river system	Creation		Record the creation story and analyse for descriptors of waterway or system.
	Inter-relationships – recognising that a catchment lands, river channel, river waters, riparian lands, and resources supported all contribute to the cultural and spiritual significance of the area and waterway.	<ul style="list-style-type: none"> <li>- Protects characteristics in river and within river reaches e.g., riffles, bends, braids, meanders, lagoons, fishing holes etc.</li> <li>- River channel full with vegetation on banks watered</li> </ul>	<ul style="list-style-type: none"> <li>- Identify valued water way characteristics with the creation story</li> <li>- Identify valued riverscapes in the catchment</li> </ul>
	Water / river / landscape	<ul style="list-style-type: none"> <li>- Protects connections between river, land – e.g.,</li> <li>- Springs, riparian wetlands, river, islands, riparian vegetation</li> <li>- No of channels and braids</li> </ul>	<ul style="list-style-type: none"> <li>- Identify valued cultural landscapes in catchment</li> </ul>
	Life supported by river	Flow requirements of taonga species at all stages of the life cycle	Identify life (key species) supported – in river, adjacent to river, key water dependent habitats
<p>Place names tell us the whakapapa of waterways</p> <p>Mauri is established with place names</p> <p>Place names may relate to a specific context e.g., the names of a waterway, reaches within the waterway, and sites in catchment may reflect their special attributes</p>	<p>Names for the waterway, reaches of waterways, and/or physical characteristics of waterway</p> <p>Names for flow dependent features within the catchment – wetlands, puna, rocks, cliffs,</p> <p>Names alongside the river</p>	<ul style="list-style-type: none"> <li>- Names that describe flow characteristics and size of flow</li> <li>- Consistency / inconsistency of names and flow attributes / river characteristics</li> </ul>	Identify names within a catchment

Value	Dimensions	Flow indicator	Information requirements
<b>Taniwha</b> are kaitiaki of water and land.	<p>Dwelling place of taniwha in and around waterway</p> <p>Role of taniwha to protect certain features of the river – e.g., shape (bends in river), rapids etc.</p> <p>May have a history of moving throughout the catchment</p> <p>May be protecting a w hi tapu</p>	<p>Dwelling place protected</p> <p>Flow dependent features protected</p>	Identify what is needed to protect w hi tapu
<b>Urupa</b> are perhaps the most readily known and accepted w hi tapu today. They are widespread across landscape but the precise location is not always known.	<p>Washing the bodies in preparation for burial</p> <p>Urupa along riverbanks / on islands in waterway</p> <p>Buried taonga</p>	<ul style="list-style-type: none"> <li>- Water availability from tapu source</li> <li>- Quality of water</li> </ul>	
<b>Water quality</b>	Direction of flow	<p>Flowing backwards</p> <p>Brackish water moving upstream</p> <p>Changing freshwater / tidal interface</p>	
	Purity	<p>Presence / absence of contaminants -</p> <p>Assimilative capacity</p> <p>Capacity to decompose pollutants</p> <p>Presence &amp; quantity of sediment / minerals / contaminants</p> <p>Food available to sustain species</p> <p>Sediment movement through system</p> <p>Infilling and build-up of sediment e.g., creating new bars, islands and or connections to mainland</p> <p>Cleanliness of riverbed</p>	

Value	Dimensions	Flow indicator	Information requirements
<b>Health and wellbeing</b>	<p>Healing waters, rongoa, bathing waters</p> <p>Drinking water</p> <p>Retention of M tauranga M ori – opportunity for kaumatua to teach practices and places of significance in and long the river to younger generation</p>	<p>Valued characteristics protected e.g., quality, temperature, currents, vortex, chemical composition etc.</p> <p>Sources and quality of drinking water from surface waters, puna, aquifers protected</p> <p>Aquatic conditions including flows need to sustain cultural uses and practices.</p>	

Rather than simply stopping at the identification of values (i.e., gathering the information in the left hand column), the objective of this stage through questioning and discussion, is to populate the right hand column so that we can link with the work of ecologists, hydrologists, engineers etc. to provide the information that is required by tangata whenua.

## 6.7 Step 6: Apply a cultural flow assessment

Of the range of methods developed over recent decades to address river flow and quantity related issues, few are cognisant of and responsive to the cultural values expressed by indigenous communities (Craig 2005). We have stated throughout this report that a challenge M ori (and possibly other indigenous communities) confront is conveying to decision-makers how water management decisions impact their cultural associations with rivers.

The previous step highlighted some flow dependent cultural values that could be feasibly modeled using scientific techniques. This next step involves a participatory process that assesses the river flows necessary to protect cultural interests and calculates cultural flow preferences (the Cultural Flow Preference Model (Tipa 2010, Tipa & Nelson forthcoming [a]<sup>32</sup>). This recognises that while some ecological flow assessment techniques can link with and address cultural attributes, some values and attributes can only be assessed within a cultural framework.

<sup>32</sup> Tipa, G ([a] in press) “Environmental flow assessments: a participatory process enabling Maori cultural values to inform flow regime setting” in Johnston, B. Hiwasaki, L. Klaver, I. Water, *A Cultural Diversity & Global Environmental Change: Emerging Trends, Sustainable Futures?* UNESCO International Hydrological Programme; Research Institute for Humanity and Nature (RIHN); UNU-IAS Traditional Knowledge Initiative; Center for Political Ecology.

The Cultural Flow Preference Model is designed to be applied by M ori. It is a method that is reliant on M ori “knowing” their streams and wanting to participate in a flow assessment process by undertaking the process themselves. The application of Cultural flow preference model results in identification of cultural flow preferences (i.e., the critical flow thresholds) and a set of management priorities which M ori believe will help realise the cultural opportunities (or outcomes) sought within a catchment.

The process for identifying the cultural interests of M ori is via an attention to cultural opportunities, which are defined as the combination of physical, biological, social, cultural and managerial conditions at a site that support cultural uses as they did in the past and as desired by M ori today and into the future (Tipa & Nelson 2008). Flow is one of the critical factors that can impact the quality and condition of a site. This, however, also assumes that most M ori are capable of describing the opportunities they seek. Diversity of belief, value and practice is found within M oridom as different iwi, hapū and whānau interact with sites in a variety of ways. Diversity is accommodated in this method as cultural opportunities sought are informed by traditional, historic and/or contemporary values, and may be akin to ecological, economic, recreational, aesthetic and social opportunities sought by others, while some are distinctly cultural.

A range of techniques for assessing opportunities have emerged in the last twenty years including a Recreation Opportunity Spectrum (Clarke, Stankey 1979), Water Recreation Opportunity Spectrum (Technical Service Center Economics and Resource Planning Group, date unknown), Tourism Opportunity Spectrum (Butler & Waldbrook, date unknown), and Forestry Opportunity Spectrum (Grove et al. 2005). Proposing an opportunity approach builds on this body of literature. The quality and condition of sites impacts the opportunities afforded M ori. Significantly, conditions – such as the flow regime - may be manipulated to provide cultural opportunities.

The six steps in the Cultural Flow Preference Model are: initiating the project, defining the association of M ori with the catchment, Cultural Opportunity Mapping, critically reviewing the data to focus the investigation on flows, undertaking assessments, analysis and calculating cultural flow preferences to inform decision-making.

### **6.7.1 Case study: The Kakaunui**

Flow has been a source of contention in the Kakaunui catchment for a number of years and the catchment has experienced a recent intensification of land use and the corresponding increase in demand for water. The runanga is increasingly concerned at

the deterioration of water quality in the catchment. The Kakaunui Cultural Preference Study was undertaken. The results of that study are described in the following paragraphs in relation to the steps proposed above (not all the steps proposed above were relevant in this study). Steps 1 through 6 are annotated.

#### Step 1 and 2: Identification of cultural values and values of specific sites

Hui and interviews with key informants identified by Te Rōhanga o Moeraki enabled a participatory mapping exercise to be completed where sites of cultural significance throughout a catchment together with the cultural opportunities sought were mapped. The final mapping task was formulation of a catchment wide concept map that visually depicted water management issues (including flow) perceived as impacting their experiences at the sites identified. The concept map was subject to a number of analyses<sup>i</sup>, which identified key issues warranting further investigation.

Cultural values & indicators quantifiable and place specific.

Some cultural values and cultural opportunities will be place specific, for example:

1. A bathing site be dependent upon the site's unique combination of geology, ease of access, privacy and flow. Even if a flow sufficient to afford bathing opportunities is provided in the catchment, the characteristics arising from the **combination** of factors may not be able to be replicated elsewhere.
2. Although not specific to the Kakanui, characteristics of sites affording food gathering opportunities may be place specific. For example gathering resources from lands awarded to Māori as reserves or fishery easements, which is an inherited right derived through *whakapapa*, cannot be relocated. Flows will need to afford opportunities to utilise existing easements and reserves.

What emerges from the above examples is the need for some place-based flow assessments as sites of significance to tangata whenua and the cultural values they sustain cannot be relocated to other locations in the catchment. Although flows sufficient to sustain opportunities somewhere in the catchment may be provided, relocation would only serve to dislocate and deprive them of their cultural context.

#### Step 4: Identify the appropriate assessment for the cultural values

To ensure a focused assessment and to link to other investigations, the issues were sorted to distinguish between firstly, those cultural values, cultural opportunities, and issues that could be evaluated as part of existing flow assessment method; secondly, those cultural values and opportunities, issues (and consequently flow attributes) that are place specific but could be addressed within an existing flow assessment if we aligned sites to be assessed as suggested in 6.3.1); and thirdly, those cultural values and cultural opportunities, issues and flow attributes that were unlikely to be adequately addressed via existing flow assessment methods and were more appropriately addressed through a cultural assessment undertaken by tangata whenua.

#### Step 5: Assessment of flow requirements using western scientific methods

Some of the dimensions that collectively encapsulate the cultural significance of food gathering may be incorporated within existing EFA methods, for example:

- the flows needed to sustain the habitats of valued aquatic species (such as eels) and flows needed to enable eel passage throughout the catchment;
- specific concerns relating to the character and shape of the river could also be addressed, for example: flows required to move sediment through the catchment, the impact of flows on the river mouth; and the potential impact of changing flows on marine ecosystems.

#### Step 6: Assessing flow requirements by calculating Cultural Flow Preferences

Assessments required field assessments were undertaken by tangata whenua. Assessments are premised on each site being assessed under different flow conditions using the attributes previously identified by M ori. In the case of the Kakaunui six sites (three on the mainstem Kakaunui River and three sites on the tributaries – two sites on the Kauru and one on Island Stream) - were assessed fortnightly from January to June and monthly from July to December. At each of the six sites they completed an assessment form on which all the attributes were listed. Because a catchment perspective is needed, the catchment as a whole was included as a site and in effect became the seventh “site”<sup>ii</sup>. In total, over the course of a year, 18 assessments were completed for each site. Assessors are asked to assess:



- (a) satisfaction – whether or not they were satisfied that the flow that they were observing sustains the attributes associated with the cultural values at that particular site; and
- (b) significance<sup>33</sup> – the significance of each attribute at that particular site. If the attributes most significant to M ōri could be improved, it would presumably result in an increase of overall satisfaction with specific sites.

An assessment form was completed by each team member at each site and their individual assessment recorded<sup>iii</sup>. Finally, assessors were asked to provide qualitative data in response to four questions. Firstly, they were required to identify site specific concerns. Secondly they were to provide an overall assessment as to whether or not they were satisfied that the flow at the site sustains cultural values and affords cultural opportunities. Next, they provided an overall assessment as their perception of the size of the flow being observed<sup>iv</sup>. Finally they were asked to identify the management actions they want to see prioritised at the site to ensure protection of cultural interests.

Three of the sites chosen correspond with sites monitored by the regional council, thus data from the flow recorders was available. Although the team of assessors did not know the flow they observed when they visited, by recording the time that they were at a site, we were able correlate their assessments to the actual flows that were observed.

A number of analyses were possible given the data collected.

*Identifying key attributes that impact the assessment of overall satisfaction with the flow* - Although not an analysis needed for the purpose of deriving cultural flows preferences, a Spearman's correlation analysis help us understand whether trends in any one particular attribute were correlated with the trends in the 'overall' site score. Having the ability to gather foods and cultural materials (MK1) was the most important attribute, with the availability of habitats (MK4) and maintenance of connections within hydrological systems (WM2) the next most important. All but two of the attributes, however, suggest a significant and positive correlation with overall aquatic condition. In other words, all but two of these attributes appear important in determining the overall satisfaction of M ōri with the flows observed.

*Examining significance of sites and attributes* - To meaningfully participate in setting flow regimes it is necessary for M ōri to identify what it is about the flow (i.e., the attributes of the observed level of flow at a specific site) that determines whether they

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<sup>33</sup> This links to Stage 3 of the proposed process Figure 6- significance was assigned for each attribute.

are satisfied or dissatisfied. Two types of analyses helped answer this question. Firstly, the inclusion of open-ended questions and qualitative data analyses elicited site specific concerns. Secondly, qualitative analyses were complemented by statistical analyses. Rating the significance of sites, the significance of each of the flow attributes at each site, and the level of satisfaction with the flow at each site enabled multi-variate analyses to be completed as part of the decision process.

*Identifying critical flow ranges* - A rating of 1-7 was given by M ori assessors for all flow attributes at each site. For each attribute the individual ratings (of the M ori observers) were averaged producing a single 1-7 score. Then the flow attributes within each theme were averaged - for example the nine attributes scores for the mahinga kai theme were averaged. This means that the output was a single score for each of the four themes (i.e., Wai M ori, Cultural Landscape, Mahinga kai / Cultural Use, Hauora). These averaged scores can then be directly compared with actual recorded flows for the day and time of assessment. Further it was possible, by examining the data for all nineteen attribute scores, to identify those attributes that contributed to the level of satisfaction/dissatisfaction at the flows observed.

The data collected, specifically the four theme ratings, suggest a threshold of 400 l/s as flows around this level or below were consistently perceived as unsatisfactory (scoring less than four on a 1-7 scale) by assessors. These initial analyses, although they only consider the ratings for satisfaction with the observed flow, suggest that the current minimum flow of 250 l/s could be considered too low by Te R nanga o Moeraki.

The four averaged scores for each of the theme ratings were then entered into a decision analysis software programme that considered both the level of satisfaction and the significance of the sites and the respective flow attributes. With respect to the Kakaunui River, the decision software confirmed that the critical flow threshold is 350-400l/s. A comparative analysis of the results of other flows assessment methods, the cultural flow preferences and the results of existing EFAs enabled differences to be identified, discussed and a flow regime negotiated. In the case of the Kakaunui, Department of Conservation had sought a flow of 400l/s to protect native fisheries.

*Presenting COMA results & linking with other environmental flow methods* - Two outputs were produced:

1. A catchment overview. On a map of the catchment a multi-part summary for each site that registered cultural values and cultural opportunities sought together with the cultural flow thresholds for that site. Cumulatively across a catchment summary matrices were mapped.

2. The catchment overview was supported by a series of individual site assessments. The data for each site included a description of the cultural values and cultural opportunities sought, and for each day when assessments were undertaken:

- the photographic record of the flow observed;
- the scores for each of the respective attributes and the cultural flow preferences;
- actual recorded flow that was observed;
- collated qualitative comments – including a list of priority actions; and
- recommended cultural flow thresholds to be negotiated with water managers.

In summary, the application of the Cultural Flow Preference Model results in identification of cultural flow preferences (i.e., the critical flow thresholds) and a set of management priorities which tangata whenua believe will help realise the cultural opportunities (or outcomes) sought within a catchment. It is for to decide how to use this information.

## **7. Options for improving incorporation of M tauranga M ori in environmental flow setting**

The previous chapters have reviewed international and national literature, examined a selection of case studies and outlined recommendations for a process to incorporate M tauranga M ori into environmental flow setting assessments and decisions. The incorporation of M tauranga M ori in flow setting processes is not as simple as stating that M ori need to participate. A range of initiatives need to be implemented ranging from system-wide recommendations to research needs. Recommendations for these initiatives are discussed in this chapter.

### **7.1 System-wide changes to support participatory initiatives.**

The challenge for water managers is to incorporate M tauranga M ori into flow setting assessments and decisions not as a ‘nice-to-do’ or as a separate add-on to other knowledge but as an integrated component of drawing together two world views. This section outlines some specific recommendations for achieving that:

1. Increased collaborative management of freshwater recognising that managers and M ori will confront, and need to overcome, a number of challenges.
2. Developing methods and processes for linking biophysical, social, economic and cultural impacts within a flow assessment framework and the subsequent decision making processes. This could involve for example, testing the process outlined in this report for incorporating M tauranga M ori in flow setting.
3. Promoting the development of common understanding across the water and environmental communities about the concepts, methods, and good practices related to environmental flows, including the need to incorporate flow assessment processes into statutory planning frameworks – at national and regional levels.
4. Increased communication between M ori and managers through the employment of specialists to facilitate a more effective communication between M ori and managers. This role is greater than that of liaison, but rather the bridge between two world views and between M ori and technical specialists. Good planning, science and communication skills would be required in order to assist the integration of scientific data and technical procedures with traditional knowledge and customary management practices.

5. Increased ability for resource management agencies to engage with M ori so they are able to recognise and meet more effectively the values of tangata whenua. This would be beyond ‘Treaty awareness’ and ‘cultural awareness’ programmes. To effect a change in resource management practice, M ori and resource management agencies need to progress beyond this superficial level of understanding to focus on practical management actions that are needed at the grassroots “river” level to enable resource management agencies to give practical effect to their statutory obligations.
6. Increased role for representatives of tangata whenua in decision making processes. M ori should be represented on decision making forums e.g., hearings for regional plans, hearings for consents, hearings for annual planning.
7. Participation in decision-making processes was highlighted by M ori as a key characteristic of a process to ensure that tangata whenua values inform flow setting. We accept that the role of M ori in decision making and governance is being discussed in other forums. However what remains unclear is the appropriate nature of such participation, for example:
  - What are there different levels of allocative decision making?
  - Does it mean decision making at the governance level, managerial level or both levels?
  - To what degree does ‘participation in decision making’ need to be negotiated and defined on a case by case basis?

## **7.2 M ori initiatives**

There is a need for M ori to undertake a number of initiatives so that they are better able to work with technicians, scientists and decision makers:

1. Working with kaumatua to ensure that Mātauranga Māori is recorded and passed on, using correct transference processes, is a priority.
2. The preparation of site specific resource inventories, detailing the values of water bodies and their dependencies on flows.

3. The trialling of flow assessment methods for M ori such as those described in this report.
4. Training of M ori to participate as decision makers.
5. Increased understanding of how the resource management and local government systems operate and the opportunities for engagement they present. While the consultation processes prescribed by the Resource Management Act 1991 and the Conservation Act 1987 are widely understood, less is known about the prioritisation and financial allocation processes under the Local Government Act 2002 and the Public Finance Act 1989. The system as a whole needs to be understood if M ori are to achieve the outcomes they seek.
6. Training in the use of different technology to measure flows – this becomes important if tangata whenua want to work in streams that are currently not being monitored and will equip M ori to have the discussions with the technical experts.
7. Training in the range of technical methods that are available and how the various methods could be applied to predicting flows required for flow-dependent cultural values.
8. Training and capacity building in the preparation of iwi water management plans, and how to seek alignment between iwi management plans and statutory plans.
9. Access, and ability to understand “better information” including data specific to the river attributes and characteristics important to them. This could involve tangata whenua seeking out specific technical information held by regional councils on their waterways.

### **7.3 Amendments to legislation, processes or institutions**

There are a number of possible amendments to legislation or central government policy instruments that could potentially improve the incorporation of M tauranga M ori in environmental flow setting processes:

1. A national policy statement on freshwater that requires the setting of environmental flows in a manner that incorporates M tauranga M ori, that

ensures sufficient flows to protect tangata whenua values and prioritises maintaining a healthy functioning aquatic system before the needs of consumptive water uses are met.

2. A national environmental standard, or similar, that sets out processes for the incorporation of M tauranga M ori in flow setting processes in order to recognise that environmental flows are broader than just ecological flows.
3. A national environmental standard, or similar, that recognises the importance of incorporate impacts on waterbodies other than rivers. Flow assessment techniques have been developed primarily to assess the effects of changes in river flows on bio-physical / ecosystem factors. Techniques need to be extended to ensure that assessments include impacts on estuaries and coastal systems – or as M ori would argue – to assess the impacts on the undivided entity.
4. Legislation changes to require the incorporation of M tauranga M ori in the preparation of AEEs, and the involvement of tangata whenua early on in the process. This could be as simple as requiring decision makers to use the ‘request for further information’ section of the RMA if the application is not explicit in terms of how the flow regimes provide for tangata whenua values.
5. In some cases water resources are fully allocated or over allocated to economic uses and water needs to be recovered or clawed back to allow more to be available to sustain instream values. This is always difficult. Various options for ‘clawing back’ water should be investigated<sup>34</sup>.

## 7.4 Information gaps

A number of research needs have already been identified in other forums such as the Research Sciences and Technology Strategy for Regional Council (2009). We note below the specific issues that were identified by tangata whenua.

1. The use of adaptive management in resource consent processes was raised as an issue by Ng i Tahu with respect to consents in the Waitaki<sup>35</sup>.

<sup>34</sup> Fish quota had to be clawed back to enable an allocation to M ori after the introduction of the Quota Management System and the Treaty of Waitangi (Sealords) Fisheries Deed of Settlement.

<sup>35</sup> <sup>35</sup> Paul Horgan (TRONT) evidence to Upper Waitaki irrigation consents. Its use was considered by Ngai Tahu in relation to the decision for North Bank Tunnel Concept – a proposed hydro development in the Waitaki.

2. Research into what is involved in extrapolating results from one system to another. This data was an issue raised in both the Trotters and Waianakarua case studies — deciding what is transferable and what needs to be known locally is critical.
3. Increased research into the impacts of climate change:
  - The impact of “flashier floods” and changing habitats<sup>36</sup> for whānau living alongside rivers (e.g., Taieri) and coastlines.
  - Climate change induced shifts in demand for water compared to changes in the location, quantity, and sources of water, and the implications for these changes in terms of the ability to manage environmental flow setting in a manner to meet the needs of tangata whenua and communities.
4. Detailed assessments of the water needs for specific ecosystems and/or species utilised by tangata whenua, e.g., flow regime requirements for kakahi, for tuna, for maintaining the river braids and river functioning, the freshwater flow needs for estuaries and coastal environments which are highly valued by tangata whenua, in part because of the customary fishing activities that they support etc.
5. More research into the long-term effects of water abstraction and/or environmental water allocation on cultural values.

### **Communication**

1. Prepare a communication resource that defines methodologies in a simple clear manner in order to bridge the gulf between Māori and western science perspectives of environmental flow setting in order to highlight the common ground between the two world views.
2. Include in communication material explanations that the concept of environmental flows is to include all affected downstream ecosystems including groundwater systems, lakes, estuaries and coastal regions.

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<sup>36</sup> Whānau have observed vegetated riparian margins used for eeling change to mud flats with an abundance of crabs but not eels.



## **7.5 Monitoring the effectiveness of participation in flow assessment processes**

Having identified processes that we believe could enable more effective participation by tangata whenua and result in consideration of tangata whenua values we propose a checklist for monitoring engagement. It can be used prior to engagement to identify opportunities in the process where tangata whenua could engage. Alternatively it could be used retrospectively after completion of a process.

It could also be of value to resource managers as it identifies opportunities that they could afford tangata whenua to engage.

The following checklist (Table 11) is simply an adaptation of the analytical framework.

**Table 11:** A checklist to analyse the effectiveness of tangata whenua participation in water planning.

	CRITERIA	YES / NO
<b>Interests of Stakeholders, Communities</b>	<ul style="list-style-type: none"> <li>Interests (of what stakeholders) informed the flow assessment process.</li> <li>Stakeholders participated in the flow assessment process and identified their interests.</li> <li>Their interests are reflected in the outcome of the flow assessment process.</li> <li>Their interests are linked explicitly to flow recommendations.</li> <li>Values of stakeholders informed the allocative decision.</li> </ul>	
<b>Interests of M ori</b>	<ul style="list-style-type: none"> <li>Interests of tangata whenua informed the flow assessment process.</li> <li>Tangata whenua participated in the flow assessment process.</li> <li>Their interests are linked explicitly to flow recommendations.</li> <li>Tangata whenua informed the decision making process.</li> </ul>	
<b>Treaty of Waitangi</b>	<ul style="list-style-type: none"> <li>Participants in the flow assessment process are bound by a Treaty clause &amp; provide for it in their operations.</li> <li>There are agreed interpretations of Treaty obligations between M ori &amp; participants in the flow assessment process.</li> <li>Tangata whenua have been asked to articulate what the Treaty obligation means in relation to a flow assessment process Treaty obligations are linked specifically to flows.</li> <li>The Treaty was recognised and provided for in the flow assessment process.</li> <li>The Treaty was recognised and provided for in the decision.</li> </ul>	
<b>Waitangi Tribunal</b>	<ul style="list-style-type: none"> <li>Treaty principles are recognised and provided for in the outcome of the flow assessment process.</li> <li>Treaty principles are recognised and provided for in the allocative decision.</li> </ul>	
<b>Legislative context</b>	<ul style="list-style-type: none"> <li>Resource laws recognising interests of Crown, M ori &amp; stakeholders are reflected in the flow assessment process.</li> <li>Resource laws recognising interests of Crown, M ori &amp; stakeholders are reflected in the decision.</li> </ul>	
<b>Organisational context</b>	<ul style="list-style-type: none"> <li>There is a formal relationship between M ori and the organisation managing the process.</li> <li>There are established communication processes between parties.</li> <li>The managing organisation is capable of interacting with stakeholders and M ori.</li> <li>The interests of M ori are presented in a format easily understood by officers &amp; these are linked to flows.</li> </ul>	

	CRITERIA	YES / NO
<b>Procedural context</b>	<ul style="list-style-type: none"> <li>Stakeholders and Māori are capable of expressing their interests &amp; knowledge.</li> <li>Stakeholders and Māori demonstrate a knowledge of the flow assessment technique used.</li> <li>Māori explicitly link their interests to flow requirements.</li> <li>Māori participated in appropriate processes to convey their interests, knowledge and aspirations.</li> <li>The policy framework that was taken into account by the decision makers has</li> <li>Māori interests reflected in all parts of this framework.</li> <li>Participants (including Māori) in the decision making process asked for specific flows.</li> <li>The decision making process treated all stakeholders and Māori equally.</li> </ul>	

## 8. Conclusions

Tangata whenua are particularly sensitive to the use and development of freshwaters as they hold distinct perspectives on water which concern their identity and their custodial obligations to manage tribal waters. Until about the mid-nineteenth century, water quality was at the forefront of issues concerning human manipulation of rivers. A range of new concerns then arose that seemed to be concerned with reduced river flows. Tangata whenua are of the clear view that the effects of the past water, use and developments have been negative to, and destructive of, tangata whenua cultural values.

More effective participation is needed to ensure that the impacts experienced by tangata whenua in the past are not repeated. Of the many techniques developed to address flow related issues, many rely heavily on professional expertise and objective, scientific philosophies, which may fail to recognise cultural values and benefit from cultural knowledge. This report presents (in Chapter 3) examples of the knowledge of streams and rivers held within M ori communities that could benefit contemporary resource management if it can be determined how traditional knowledge and practices and scientific approaches can be communicated and integrated.

We structured this report in order to systematically work through an evaluation of existing participatory process to assess the effect of tangata whenua participation in flow assessment processes (in Chapters 4-5). This followed the chapter that identified the range and depth of knowledge that M ori would bring to flow assessment processes and indeed wider water management functions. This then led us to propose in Chapter 6 a process by which tangata whenua could participate in flow assessment processes. We identified how it would be possible to link with complementary flow assessment methods (that are being undertaken by experts in a number of science disciplines) before proposing a cultural flow assessment method (proposed by Tipa 2010, and Tipa & Nelson forthcoming [a]).

Participating in the application of flow setting methods alone is unlikely to achieve the water management outcomes sought by tangata whenua so we proceeded to identify a number of areas in need of more work:

- We commented on a number of system-wide recommendations that are needed to support participatory initiatives.
- We commented on the need to further develop iwi planning processes to provide a greater level of specificity.

- We summarise a number of areas that require more education, targeted training, and clearer communication.
- We identified a number of research needs.

Throughout this report we have tried to reflect on the strengths and the limitations of allocative processes. With respect to the benefits or achievements from participating, tangata whenua are undertaking many diverse initiatives and are realising some of the cultural outcomes they seek. But these outcomes may require a significant departure from the previous management regime and the changes may not have unanimous support. However, increasingly scientists, resource managers and stakeholders can see the benefits of reorienting water management in order for it to be more responsive to cultural beliefs, values and uses while complementing other initiatives in the area. Scientists also see opportunities for collaborating with tangata whenua in the future.

The knowledge that Māori bring to water management and flow deliberations is rooted in and informed by a traditional or customary lifestyle but the recommendations in the report allows for its adaptation to incorporate contemporary information and technology thus explicitly recognising that new information is continually generated as the environment is transformed. Although there are discussions at an international level about the loss or erosion of knowledge as indigenous communities become more integrated into regional or national economies, it is necessary to differentiate between situations where knowledge is adapting to new environments and economic conditions and those circumstances where knowledge is being lost due to a disruption of its transmission. The planning processes that we discuss in Chapters 4, 5 represent the evolving reality of tangata whenua needs, capacities and aspirations.

We were tasked at the beginning of this project to identify an assessment framework. Our cultural assessment framework comprises a number of tools, methods, processes. It includes:

- a process that enables tangata whenua to identify the flows needed to sustain their values;
- a flow assessment process that enables tangata whenua values and Māori to inform flow setting (Figure 4);
- a means for tangata whenua to assign significance to different waterbodies (Table 6);
- a means for tangata whenua to determine the degree of hydrological alteration likely to result from a water use or development (Table 7);
- a table of recommended flow assessment methods based on cultural determinations of significance and hydrological alteration (Table 8);
- a method that could be classed as cultural flow assessment for assessing flows (see section 6.7);
- a checklist that can be used to evaluate effectiveness of tangata whenua participation in flow assessment processes (Table 11);

- a list of areas where tangata whenua (and probably stakeholders) would benefit from information that is communicated more effectively, further research that is undertaken and training of whānau, hapū and iwi.

Tangata whenua, like other Indigenous communities, are actively pursuing the re-establishment of their customary and Treaty rights to natural resources including water. Although we started this report by qualifying its scope and stated that we were not discussing rights or the issue of co-governance, we have focused on one component that constitutes recognition of such rights – that is participation in water management and water allocation processes.

The nature of collaboration, in particular the **level** of participation by Māori and the **extent** of their knowledge that is shared, will need to be negotiated in each case and will be determined by the ability of the partners to develop a trusting relationship, agree on a vision for freshwaters within a region and the direction that needs to be taken to realise that vision. Refinement of cultural methods – like scientific methods – needs to continue.

However, we believe that many of the recommendations set out in Chapters 7 will enhance the effectiveness of tangata whenua participation, complement existing water management practices for the betterment of all sectors of the community, and importantly accord protection to the health and wellbeing of freshwaters valued and used by tangata whenua.

## 9. References

- Airey, L. (2003). 'Nae as nice a scheme as it used to be: lay accounts of neighbourhood incivilities and well-being'. *Health and Place* 9: 129-137.
- Altman, J. (2004). Indigenous interests and water property rights. *Dialogue* 23: 29-43.
- Arthington, A.H.; King, J.M.; O'Keefe, J.H.; Bunn, S.E.; Day, J.A.; Pusey, B.J.; Bluhdorn, D.R. & Tharme, R. (1992). Development of an holistic approach for assessing environmental flow requirements of riverine ecosystems. *In*: J.J. Pigram & B.P. Hooper eds. Proceedings of an International Seminar and Workshop on Water Allocation for the Environment. Armidale, USA, Centre for Water Policy Research, University of New England. Pp. 69-76.
- Arthington, A.H.; Tharme, R.; Brizga, S.; Pusey, B.; Kennard, M. (2004). Environmental Flow Assessments with Emphasis on Holistic Methodologies. *In*: Proceedings of the Second International Symposium on the Management of Large Rivers for Fisheries Volume II. Welcomme R. and T. Petr, Eds., FAO Regional Office for Asia and the Pacific. Bangkok, Thailand. RAP Publication 2004/17.
- Armstrong, R. (2008). An overview of Indigenous rights in water resource management, Onshore and offshore water rights discussion booklets, Lingiari Foundation - [http://www.nailsma.org.au/publications/indigenous\\_water\\_rights.html](http://www.nailsma.org.au/publications/indigenous_water_rights.html)
- Barber, K. & Rumley, H. (2003). A Study and Report Prepared for the Water and Rivers Commission, available at [http://portal.water.wa.gov.au/portal/page/portal/WaterManagement/Groundwater/Ord/Content/ABORIGIN VALUES.pdf](http://portal.water.wa.gov.au/portal/page/portal/WaterManagement/Groundwater/Ord/Content/ABORIGIN%20VALUES.pdf).
- BECA (2000). Te Raranga a Mahi: Developing Environmental Management Plans for Whānau, Hapū and Iwi, Ministry for Environment, Ref. ME619
- BECA (2008). Draft Guidelines for the Selection of Methods to Determine Ecological Flows and Water Levels. Report prepared by BECA Infrastructure Ltd for MfE. Wellington: Ministry for the Environment. PO Box 10 362, Wellington, New Zealand ISBN: 978-0-478-30219-6 (print) 978-0-478-30220-2 (electronic). This document is available on the Ministry for the Environment's website: [www.mfe.govt.nz](http://www.mfe.govt.nz)

- Behrendt, J. & Thompson, P. (2004). The recognition and protection of Aboriginal interests in NSW rivers. *Journal of Indigenous Policy* 3: 37–140.
- Bennett, A.L. (2007). Recognizing and providing for Maori values in water allocation. Research paper presented for Resource and Environment Planning, Massey University.
- Berkes, F. (1999). *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. Philadelphia and London: Taylor & Francis.
- Berkes, F. & Folke, C. eds. (1998). *Linking Social and Ecological Systems. Management Practices and Social Mechanisms for Building Resilience* Cambridge University Press, Cambridge.
- Berkes, F.; Colding, J. & Folke, C. (2000). Rediscovery of Traditional Ecological Knowledge as Adaptive Management. *Ecological Applications* 10, No. 5: 1251-62.
- Best, E. (1986). *Fishing Methods and Devices of the Maori*. National Museum Wellington, Dominion Museum Bulletin No. 12 Reprinted 1986 Bowler (2008).
- Bowler, J. (1 July 2008). In the matter of the Resource Management Act 1991 and in the matter of the submissions by Genesis Power Limited on the Horizons Regional Plan One Plan Statement Of Evidence of Jarrod Bowler.
- Burmil, S.; Daniel, T. & Hetherington, J. (1999). Human Values and Perception of Water in Arid Landscapes *Urban Planning* 44: 99-109.
- Butler, R.W.; Waldbrook, L.A. A New Planning Tool: The Tourism Opportunity Spectrum  
[http://www.jcu.edu.au/business/idc/groups/public/documents/journal\\_article/jcudev\\_012854.pdf](http://www.jcu.edu.au/business/idc/groups/public/documents/journal_article/jcudev_012854.pdf)
- Cottingham, P.; Thoms, M.C. & Quinn, G.P. (2002). Scientific panels and their use in environmental flow assessment in Australia. *Australian Journal of Water Resources* 5: 103-111.
- Cox, M.E.; Johnstone, R.J. & Robinson, J. (2003). A conceptual model of impacts of environmental change on human well-being. In: Albrecht, G. (Ed.) *Airs, Waters, Places: A transdisciplinary conference on ecosystem health in Australia*. Pp Curtis, S. (2004). *Health and Inequality: Geographic Perspectives*, London: Sage.



- Craig, D. (2005). Indigenous Property Rights to Water: Environmental Flows, Cultural Values and Tradeable Property Rights. Accessed from [www.law.mq.edu.au/MUCEL/craig/](http://www.law.mq.edu.au/MUCEL/craig/)
- Craig, D. (2006). Indigenous property rights to water: environmental flows, cultural values and tradeable property rights. In: Smajgl, A. and Larson, S. (eds). *Adapting rules for sustainable resource use*. CSIRO Sustainable Ecosystems, Townsville: 153-172.
- Crengle, D. (1993). Taking into account the principles of the Treaty of Waitangi: Ideas for the implementation of Section 8 Resource Management Act 1991. Wellington: Ministry for the Environment.
- Crengle, D. (1997). Notes on Environmental Performance Indicators, unpublished.
- Crengle, H. (2002). The Legal Basis for a Consideration of Cultural Values of Kai Tahu. In: Tipa, G.; Crengle, H.; Davis, K.; Allingham, B.; Symon, A. (2002). *Cultural Impact Assessment – Project Aqua*. Meridian Energy Ltd, New Zealand.
- Crichton, E.J.; Elliott, S.J.; van der Meer, J.; Small, I. & Upshur, R. (2003). Impacts of an environmental disaster on psychosocial health and well-being in Karakalpakstan. *Social Science & Medicine* 56: 551-567.
- Davis, M.D. & Threlfall, J. (2006). Integrated water resource management in New Zealand: Legislative framework and implementation. *Journal of Contemporary Water Research and Education* 135: 86-99.
- Dodds, A.; Hostetler, S. & Jacobson, G. (2001). Community water supplies in the Anungu Pitjantjatjara Lands, South Australia: sustainability of groundwater resources. Bureau of Rural Sciences, Canberra.
- Douglas, E.M.K. (ed). (1984). *Waiora, Waimaori, Waikino, Waimate, Waitai: Maori Perceptions of Water and the Environment*. Hamilton: University of Waikato.
- Durette, M. (2008a). Discussion on Freshwater: A wai Maori perspective.
- <http://waimaori.maori.nz/innern/publications/resources/Discussion%20on%20Freshwater%20-%20A%20Wai%20Maori%20Perspective.pdf>

- Durette, M. (2008b). Indigenous legal rights to freshwater: Australia in the international context, Working CAEPR Paper 42 / 2008.
- Durie, M. (1994). *Whaiora: M ori Health Development*, Auckland: Oxford University Press.
- Durie, M. (2004). Te Pae Mohutonga, Implementation Planning Guide, <http://www.maorihealth.govt.nz/moh.nsf/pagesma/196> (accessed 16 March 2007).
- Ecological Society of America (1998). Integrating Cultural, Economic and Environmental Requirements for Freshwater. *Ecological Applications* Volume 8, No. 3.
- El Sawy, O. & Pauchant, T. (1988). Triggers, templates, and twitches in the tracking of emerging strategic issues. *Strategic Management Journal* 9(5): 445–473.
- Flanagan, C. & Laituri, M. (2004). Local Cultural Knowledge and Water Resource Management: The Wind River Indian Reservation *Environmental Management* Volume 33, Number 2: 262 – 270.
- Fenge (1996). Towards Sustainable Development in the Circumpolar North. In: Report of the Second Conference of Parliamentarians of the Arctic Region, pp 21–41. Minister of Public Works and Government Services, Ottawa.
- Gesler, W. (1992). Therapeutic landscapes: medical geographic research in the light of the new cultural geography. *Social Science and Medicine* 34: 735-746.
- Gesler, W. & Kearns, R.A. (2002). *Culture/Place/Health*, London: Routledge.
- Grove, J.M.; Cumming, A.B.; Galvin, M.F.; Hager, G.W.; O'Neil-Dunne, J.P.M.; Troy, A.R.; Rodgers, F.; Spero, F.; Svendsen, E. & Draddy A.E. (2005). Integrating urban forestry research and applications: A forest opportunity spectrum framework and its application to Baltimore, Maryland, Annual Report. [http://www.beslter.org/frame2-page\\_8\\_2004-2005.pdf](http://www.beslter.org/frame2-page_8_2004-2005.pdf)
- Haggan, N.; Neis, B. & Baird, I. (eds.) (2007). Fishers' knowledge in fisheries science and management. *Coastal Management Sourcebooks 4*. Paris: UNESCO.

- Haigh, T. & Matsuyama, A. (2003). Water resources of Wadeye (Port Keats) and Nauyiu (Daly River) Region. NT Department of Infrastructure Planning and Environment.
- Harding, J.; Moseley, P.; Pearson, C.; Sorrell, B. (2004). Freshwaters of New Zealand. New Zealand Hydrological Society, New Zealand Limnological Society.
- Harmsworth, G.R. (1999). Coordinated Monitoring of New Zealand Wetlands: Building Iwi Partnerships. Landcare Research Contract Report LC9899/085. April 1999. Prepared for UNEP/GRID Christchurch and Ministry for the Environment, Wellington. MfE SMF Funded project. 50 pp.
- Harmsworth, G.R. (2002). Indigenous concepts, values and knowledge for sustainable development: New Zealand case studies.  
[http://www.landcareresearch.co.nz/research/sustainablesoc/social/indigenous\\_index.asp](http://www.landcareresearch.co.nz/research/sustainablesoc/social/indigenous_index.asp)
- Harmsworth, G.R. & Tipa, G. (2006). M ori environmental monitoring in New Zealand: progress, concepts and future direction [Electronic Version] from [http://icm.landcareresearch.co.nz/knowledgebase/publications/public/2006\\_M\\_ornvmonitoring\\_harmsworth\\_tipa.pdf](http://icm.landcareresearch.co.nz/knowledgebase/publications/public/2006_M_ornvmonitoring_harmsworth_tipa.pdf).
- He Mahere Taiao. (2007). The Maniapoto Iwi Environmental Management Plan (2007).  
[http://www.ifad.org/pub/map/PM\\_web.pdf](http://www.ifad.org/pub/map/PM_web.pdf)  
<http://www.qp.org.nz/consents/cultural-impact-assessment.php>  
<http://myfirst.first.govt.nz/Public/ResearchReports/reports09/index.cfm>
- Ingersoll-Dayton, B.; Saengtienchai, C.; Kespichayawattana, J.; Aungsuroch, Y. (2004). Measuring Psychological Well-Being: Insights From Thai Elders, *Gerontologist* 44: 596-604.
- Izquierdo, C. (2005). When 'health' is not enough: societal, individual and biomedical assessments of well-being among the Matsigenka of the Peruvian Amazon. *Social Science and Medicine* 61: 767–783.

- Jackson, S.; Storrs, M.; Morrison, J. (August 2005). Recognition of Aboriginal Rights, Interests and Values in River Research and Management: Perspectives from Northern Australia. *Ecological Management and Restoration* Volume 6, Issue 2.
- Jackson, S. (2005). Indigenous values and water resource management: a case study from the Northern Territory. *Australasian Journal of Environmental Management*, 12: 136–46.
- Jackson, S. (2006). Compartmentalising culture: the articulation and consideration of Indigenous values in water resource management. *Australian Geographer* 37: 19–31.
- Jackson, S. & Langton, M. (2006). Indigenous cultural values and water resource management: workshop overview and introduction. In: Jackson, S. (ed.). Recognising and protecting Indigenous values in water resource management: a report from a workshop held in Darwin, 5–6 April 2006. Darwin, CSIRO.
- Jackson, S. (2007). Indigenous Interests and the National Water Initiative – water management, reform and implementation. Background Paper and Literature Review, North Australian Indigenous Land and Sea Management Alliance ISBN 978-0-9775886-1-9. Accessed from [http://www.nailsma.org.au/nailsma/projects/downloads/NAISMA\\_NWI\\_Review\\_UPDATEDec07.pdf](http://www.nailsma.org.au/nailsma/projects/downloads/NAISMA_NWI_Review_UPDATEDec07.pdf)
- 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. (Jackson & Morrison 2007).
- King, J.M. & Louw, D. (1998). Instream flow assessments for regulated rivers in South Africa using the building block methodology. *Aquatic Ecosystem Health and Restoration* 1: 109–124.
- 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.
- King, J.M. & Tharme, R.E. (1994). Assessment of the Instream Flow Incremental Methodology (IFIM) and initial development of alternative instream flow

methodologies for South Africa. Water Research Commission, Report No. 295/1/94. Pretoria, SA. 590 pp.

King, J.; Tharme, R.; Brown, C. (1999). Definition and Implementation of Instream Flows. Contributing Paper to the World Commission on Dams see <http://www.dams.org>

King, J.M.; Tharme, R.E. & de Villiers, M.S. eds. (2000). Environmental flow assessments for rivers: Manual for the building block methodology. Water Research Commission Technology Transfer Report No. TT131/00. Pretoria, SA, Water Research Commission. 340 pp.

King, J.M.; Tharme, R.E. & de Villiers M.S. (eds.) (2002). Environmental flow assessments for rivers: Manual for the building block methodology. Water Research Commission Technology Transfer Report No. TT131/00. Pretoria, SA, Water Research Commission. 340 pp.

King, J.M.; Brown, C.; Paxton, B.R. & February, R.J. (December 2004). Development of Drift, a Scenario-Based Methodology for Environmental Flow Assessments Report No 1159/1/04  
[http://www.google.co.nz/search?hl=en&as\\_q=&as\\_epq=Development+of+Drift%2C+a+Scenario-Based+Methodology+for+Environmental+Flow+Assessments&as\\_oq=&as\\_eq=&num=10&lr=&as\\_filetype=&ft=i&as\\_sitesearch=&as\\_qdr=all&as\\_rights=&as\\_occt=any&cr=&as\\_nlo=&as\\_nhi=&safe=images](http://www.google.co.nz/search?hl=en&as_q=&as_epq=Development+of+Drift%2C+a+Scenario-Based+Methodology+for+Environmental+Flow+Assessments&as_oq=&as_eq=&num=10&lr=&as_filetype=&ft=i&as_sitesearch=&as_qdr=all&as_rights=&as_occt=any&cr=&as_nlo=&as_nhi=&safe=images)

KTKO (2005). Natural Resource Management Plan  
<http://www.ktkoltd.co.nz/documents/natural-resource-management-plans/natural-resource-management-plan-2005.html>

Langton, M. (2002). Freshwater. In: Lingiari Foundation (ed.). *Background briefing papers: Indigenous rights to waters*. Lingiari Foundation, Broome: 43–64.

Langton, M. (2006). Earth, wind, fire and water: the social and spiritual construction of water in Aboriginal societies. In: Bowmen, D.; Barker, B. & McNiven, I. (eds.) *The Social Archaeology of Australian Indigenous Landscapes*. Aboriginal Studies Press, Canberra: 139-160.

Lydon, G. & 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.)  
<[http://www.fisheries.ubc.ca/publications/reports/report11\\_1.php](http://www.fisheries.ubc.ca/publications/reports/report11_1.php)>.

McGregor, D.P.; Morelli, T.P.; Matuoka, J.K.; Minerbi, L. (2003). An ecological model of wellbeing. *In: Becker, H.A. & Vanclay, F. (Eds). The International Handbook of Social Impact Assessment: Conceptual and Methodological Advances.* Edward Elgar: Cheltenham.

Matunga, H. (1992). Benefits for Both Parties. *Planning Quarterly*, December 1992.

Menzies, C. (2006). Local knowledge and contemporary resource management: historicizing indigenous knowledge. *In: Menzies, C. Traditional Ecological Knowledge and Natural Resource Management.* Board of Regents of the University of Nebraska.

Ministry of Health (2002). He Korowai Oranga – M ori Health Strategy, Wellington: Ministry of Health.

Ministry of Environment (1997). Environmental Performance Indicators: Proposals for Air, Freshwater and Land. Ministry for the Environment, Wellington.

Ministry of Environment (1998 a and b). Flow Guidelines for Instream Values. Ministry for the Environment, Wellington.

Ministry of Environment (2007). Environment New Zealand. Ministry for the Environment, Wellington.

Ministry of Environment (2008). NES. Ministry for the Environment, Wellington.

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 (2009). Proposed National Environmental Standard on Ecological Flows and Water Levels: Summary of Submissions. Wellington: Ministry for the Environment. Published in February 2009 by the Ministry for the Environment Manat M Te Taiao PO Box 10362, Wellington 6143, New Zealand ISBN: 978-0-478-33141-7 (print) 978-0-478-33142-4 (electronic) Publication number:

- Morgan, M.; Strelein, L. & Weir, J. (2004). Indigenous water rights within the Murray Darling Basin. *Indigenous Law Bulletin* 5: 17-20.
- Morgan, M.; Strelein, L. & Weir, J. (2007). Authority, knowledge and values: Indigenous nations engagement in the management of natural resources in the Murray–Darling Basin. *In*: Langton, M.; Mazel, O.; Palmer, L.; Shain, K. & Tehan, M. (eds.). *Settling with Indigenous peoples*. Federation Press, Annandale.
- NIWA (2006). Flow Report for the Hurunui, submitted to the Board of Inquiry hearing the application for a WCO.
- Office of the Minister, Office of the Minister of Agriculture (8 June 2009). New Start for Fresh Water. This paper can be obtained from <http://www.mfe.govt.nz/issues/water/freshwater/new-start-for-fresh-water-paper.html>
- Ng ti Maniapoto (2007). The Maniapoto Iwi Environmental Management Plan.
- Nga Taonga Tuku Iho Ki Whakatu Management Plan (2004).
- Notzke, C. (1994). Aboriginal Peoples and Natural resources in Canada. Captus University Publications: Canada.
- Otago Regional Council Regional Water Plan.
- Otago Regional Council (2008). Management Flows for aquatic ecosystems in the Taieri River.
- Otago Regional Council (2006). Management Flows for aquatic ecosystems in Trotters Creek.
- Otago Regional Council (2006). Management Flows for aquatic ecosystems in Waianakarua.
- Panelli, R.; Tipa, G. (2007). Placing well-being: a Maori case study of cultural and environmental specificity. *EcoHealth* 4: 445-460.
- Pauling, C. (2006). People of the Land...and City: Tangata Whenua Attitudes to Greater Christchurch Urban Development. Quantcon 2006, Lincoln University.

- Pere, R. (1997). *Te Wheke: A Celebration of Infinite Wisdom*, 2nd ed. Gisborne: Ao Ako Global Learning New Zealand.
- Pimbert, M.; Pretty, J. (1997). Diversity and sustainability in community based conservation. Paper presented at the UNESCO-IIPA regional workshop on community based conservation, India.
- Pinkerton, E.W. (1989). *Cooperative Management of Local Fisheries: New Directions for improved management and Community Development*, Vancouver: University of British Columbia Press.
- Pinkerton, E.W. (1992). Translating legal rights into management practice: overcoming barriers to the exercise of co-management. *Human Organization* Volume 52: No. 4 Winter.
- Posey, D. (1999). *Cultural and Spiritual Values of Biodiversity*. UNEP.
- Rapport, D.; Gaudet, C.; Karr, J.; Baron, J.; Bohlen, C.; Jackson, W.; Jones, B.; Naiman, R.; Norton, B.; Pollock, M. (1998). Evaluating Landscape Health: Integrating Societal Goals and Biophysical Processes. *Journal of Environmental Management* 53: 1 -15.
- Regional Councils (2009). *A Research, Science & Technology. Strategy for Regional Councils*  
<http://www.envirolink.govt.nz/PageFiles/29/researchfortheenvironmentmar09.pdf>
- Richmond, C.; Elliott, S.J.; Matthews, R.; Elliott, B. (2005). The political ecology of health: perceptions of environment, economy, health and well-being among 'Namgis First Nation. *Health and Place* 11:349-365.
- Roberts, N. (2002). Planning and Tangata Whenua Issues: A Proactive Approach. In: Kawharu, M. *Whenua: managing our resources*, Reed Publishing.
- Rochford, T. (2003). *Te Kōrero Wai: Maori and Pakeha views on water despoliation and health*. A Thesis for the completion of a Masters in Public Health, University of Otago.
- Rose, D. (2004). Fresh Water Rights and Biophilia: Indigenous Australian Perspectives. *Dialogue*, Vol. 23: No. 3: pp. 35-43, available at



<<http://www.assa.edu.au/Publications/Dial.asp?id=73&s=1>>.

Sheehan, J. (2001). Indigenous Property Rights and River Management. *Water Science and Technology* 43(9): 235-42.

Strang, V. (2001a) Evaluating Water; Cultural Beliefs and Values about Water Quality, Use and Conservation. *Water UK*, Ipswich.

Strang, V. (2001). Negotiating the river: cultural tributaries in far north Queensland, in B. Bender and M. Winer (eds). *Contested landscapes: movement, exile and place*. Oxford berg, pp. 69-86.

Swale, S. & Harris, J.H. (1995). The Expert Panel Assessment Method EPAM: a new tool for determining environmental flows in regulated rivers. In: D.M. Harper & A.J.D. Ferguson (eds.). *The Ecological Basis for River Management*. Chichester, UK, John Wile & Sons. pp. 125- 134.

Synexe & Nexus Associates (2009). Maori Perspectives on Water Allocation Report prepared for Ministry for Environment. This report also appears as a reference for Durette, M.; Nesus, C.; Nesus, G. & Barcham, M.

Synexe (2009). An integrative model for cultural flows: Using values in fisheries to determine water allocations.

Tan, Poh-Ling (1997). In: Bryan Horrigan and Simon Young (eds). *Commercial Implications of Native Title*. The Federation Press: Sydney, pp. 157-99.

Tau, R.T.M. (2003). *Nga pikituroa o Ng i Tahu: The oral traditions of Ng i Tahu* University of Otago Press.

Tau, H.R. (1993). Summary of cultural values of freshwater, presented to the Christchurch City Council, unpublished.

Tau, T.; Goodall, A.; Palmer, D. & Tau, R. (1990). *Te Whakatau Kaupapa: Ng i Tahu resource management strategy for the Canterbury region*. Wellington, New Zealand: Aoraki Press.

Te R nanga o Ng i Tahu (1999). *Freshwater Policy*, Te R nanga o Ng i Tahu, PO Box 13046 Christchurch, New Zealand.

Te Wai Maori (2007). A guide to the preparation of Freshwater Iwi Management Plans

<http://waimaori.maori.nz/publications/Iwi%20Management%20Plan%20final%20April%202007.pdf>

Tharme, R.E. (1996). Review of international methodologies for the quantification of the instream flow requirements of rivers. Water law review final report for policy development. For the Department of Water Affairs and Forestry, Pretoria. Freshwater Research Unit, University of Cape Town. 116 pp.

Tharme, R.E. (2003). A global perspective on environmental flow assessment: Emerging trends in the development and application of environmental flow methodologies for rivers. *River Research and Applications* 19: 397-442.

Tipa, G. (October 1999). Taieri River Case Study Technical Paper No. 58. Ministry for Environment.

Tipa, G.; Teirney, L. (2003). A Cultural Health Index for Steams and Waterways: Indicators for Recognising and Expressing Cultural Values. Ministry for Environment Technical Paper 75. ME number 475.

Tipa, G.; Teirney, L. (2006). Using the Cultural Health Index: How the assess the Health of Streams and Waterways. Ministry for Environment Reference ME711.

Tipa, G. (2009). Exploring Indigenous Understandings of River Dynamics and River Flows: A Case from New Zealand. *Journal of Environmental Communication*.

Tipa, G.; Nelson, K. (2008). Introducing Cultural Opportunities: A Framework for Incorporating Cultural Perspectives in Contemporary Resource Management. *Journal of Environmental Policy & Planning*.

Tipa, G. ([a] in press). Environmental flow assessments: a participatory process enabling Maori cultural values to inform flow regime setting. In: Johnston, B. Hiwasaki, L. Klaver, I. *Water, A Cultural Diversity & Global Environmental Change: Emerging Trends, Sustainable Futures?* UNESCO International Hydrological Programme; Research Institute for Humanity and Nature (RIHN); UNU-IAS Traditional Knowledge Initiative; Center for Political Ecology.

- Tipa, G. ([b] in press). Cultural Opportunity Assessments: Introducing a Framework for Assessing the Suitability of Stream Flow from a Cultural Perspective. *In: Mulholland, M. Wai Maori.*
- Tipa, G. & Nelson, K. ([a] forthcoming). A Guide to designing and implementing a Cultural Flow Preference Study.
- Toussaint, S.; Sullivan, P. & Yu, S. (2005). Water ways in Aboriginal Australia: an interconnected analysis. *Anthropological Forum* 15: 61-74.
- Trigger, D. (1985). The social meaning of water for Aboriginal people in Australia's Gulf country. Paper delivered at School of Environmental Studies. Griffith University. (Tan 1997).
- The T wharetoa Environmental Iwi Management (2004).
- United Nations (2003). 1st UN World Water Development Report.
- Waitaki Allocation Plan – can be accessed from <http://www.mfe.govt.nz/publications/water/waitaki-regional-plan-jul06/index.html>
- Waitangi Tribunal (1984). Kaituna Report Brooker & Friend, Wellington.
- Waitangi Tribunal (1991). Ng i Tahu Report. Brooker & Friend, Wellington.
- Waitangi Tribunal (1992). Mohaka River Report. Brooker & Friend, Wellington.
- Waitangi Tribunal (1995). Te Whanganui a Orotu Report. Brooker & Friend, Wellington.
- Waitangi Tribunal (1998). Te Ika Whenua River Report. Brooker & Friend Wellington.
- Weick, K. (1979). Cognitive processes in organizations. *Research in Organizational Behaviour* 1(1): (1979) 41–74.
- Weick, K. (1995). Sensemaking in Organizations, Sage, Thousand Oaks, CA, 1995.

- Weir, J. (2009). Murray River Country: An ecological dialogue with traditional owners. Aboriginal Studies Press.
- Western, D.; Wright, R.; Strum, S. (1994). Natural Connections: Perspectives in Community based Conservation. Island Press, USA.
- Williams, J. (2003). E pakihi hakinga a kai: An examination of pre-contact resource management practice in Southern Te Wai Pounamu. PhD thesis, University of Otago.
- Willis, E.; Pearce, M.; Jenkin, T.; Wurst, S. & McCarthy, C. (2004). Water Supply and use. In: *Aboriginal communities in South Australia: Report to South Australian Department of Aboriginal Affairs and Reconciliation*. Adelaide, Flinders University.
- World Commission of Environment and Development (1987). Report on World Commission of Environment and Development.
- Young, R.; Harmsworth, G.; Walker, D.; James, T. (2008). Linkages between cultural and scientific indicators of river and stream health. Motueka Integrated Catchment Management (Motueka ICM) Programme Report.
- Yuen, E.; Anda, M.; Mathew, K. & Ho, G. (2001). Water harvesting techniques for small communities in arid areas. *Water Science and Technology* 44: 189-194 Yu 2000.
- Zinsli, C. (2002). Consultation with Maori in Kawharu, M. *Whenua: managing our resources*. Reed Publishing.

## 10. Appendix 1: Case study catchments

We chose the Tongariro Power Development as a case study because:

- It covers two regions.
- The rivers comprising the TPD have been subject to a range of modifications e.g., weirs, diversions, canals, dewaterings, augmentations, etc.
- Flows were set via a consent process.
- The consent process involved an extensive consultation process.
- Multiple tangata whenua groups participated in the consultation process. Others chose not to engage.

The rivers chosen from within the TPD included the following:

### **Moawhangao**

The Moawhango River rises in the Kaimanawa Mountains in the central North Island and flows southwards into the Rangitikei River at Mangaweka. Its upper reaches are in native forest from where it flows through tussock grasslands and finally into agricultural landscapes. A special feature of the river is the Moawhango Dam from which water is diverted to the Tongariro Power scheme. There are now controlled flows downstream of Moawhango Dam. Prior to the renewal of consents there was no flow downstream of the dam. The mean flow of the Moawhango at Mangaweka is 61.8 m<sup>3</sup>/s.

### **Poutu**

The Poutu Stream is located in the central North Island on the eastern side of Mt Tongariro. It is one of the rivers impacted by the Tongariro Power Development. The stream was the natural outflow from Lake Rotoaira whose levels are now controlled by the Tongariro Power Scheme and the stream flows are thus now modified. The minimum flow is set at 0.6 m<sup>3</sup>/s to protect trout spawning habitat.

### **Tongariro**

The Tongariro River originates in the Central Plateau of the North Island where it is fed by numerous Tributaries (including the Whitikau, Poutu, and Mangamawhitiwhiti streams) that flow off the surrounding hill ranges and mountains such as Mount Ruapehu. It winds north, through the township of Turangi before entering Lake Taupo

via a number of river mouths. At its mid-reaches the Tongariro is dammed at Rangipo where water is diverted to the Rangipo Power station. At this point the river also receives water from the Moawhango diversion (see Moawhango River above). The river is further dammed at the Poutu Intake Dam. The minimum volume of water flowing down the lower Tongariro River ranges from approximately 16 m<sup>3</sup>/s (recorded at the upper rivers Poutu Intake) to 21 m<sup>3</sup>/s (recorded at the lower rivers Major Jones Pool). This volume can substantially increase due to catchment of rainfall by the surrounding mountains and hill ranges.

### **Whanganui**

The Whanganui, at 290km, is the country's third-longest river. And has a mean flow at the mouth of 220 m<sup>3</sup>/s. Much of the land to either side of the river's upper reaches is part of the Whanganui National Park, though the river itself is not part of the park. The river flows from the northern slopes of Mount Tongariro and flows to the north-west before turning south-west at Taumarunui. From there it runs through rough, bush-clad hill country before turning south-east. It reaches the coast at Whanganui. It is the country's longest navigable river. The upper reaches at Te Maire are subject to a minimum flow setting of 29 m<sup>3</sup>/s. Now there are minimum flow on the Upper Whanganui, some tributaries and the Whakapapa which is a major tributary of the Whanganui.

### **Kakaunui**

The Kakanui River is a river of North Otago in the South Island and is one of a number of rivers that drain the coastal hills of the Otago region. It rises in high country and passes through predominantly dry lowlands. The catchment is subject to low flows, particularly the six month period between November - April. Schedule 23 of Ng i Tahu Claims Settlement Act 1998, acknowledge the significance of the Kakaunui River to Ng i Tahu. The mean flow of the Kakaunui River in its lower reaches is ca. 5 m<sup>3</sup>/s.

### **Oreti**

The Oreti River is one of the main rivers of Southland, being some 170 kilometres in length. It has a mean flow in its lower reaches of 42 m<sup>3</sup>/s. The Oreti has its headwaters close to the Mavora Lakes between Lake Te Anau and Lake Wakatipu, and flows south across the Southland Plains to its outflow into Foveaux Strait at the southeastern end of Oreti Beach. The Oreti River is subject to a Water Conservation Order.

### **Taieri**

The Taieri River, 200 km long, is the fourth-longest river in New Zealand with a mean flow in its lower reaches of 35 m<sup>3</sup>/s. It is located in Otago in the South Island. It is sourced from Lammerlaw ranges and initially flows north, then east around the Rock and Pillar range before turning southeast, reaching the sea 30 km south of Dunedin. The upper reaches meander in a series of convoluted loops across a floodplain near Paerau before running through two small hydroelectric power stations before Patearoa in the Maniototo. The Taieri then arcs through almost 180 degrees, entering a broad glacial valley the Strath-Taieri, surrounded by rugged hill ranges. Immediately downstream the river has cut a steep-sided declivity — the Taieri Gorge. In the Taieri's lower reaches there is a broad floodplain (the Taieri Plains) containing much of Otago's most fertile farmland. The river then flows through the lower Taieri Gorge to the Pacific Ocean at Taieri Mouth. The last 20 km of the river are navigable.

### **Trotters**

Trotters Creek is a small east coast stream located in North Otago. With a catchment of approximately 32 km<sup>2</sup> which drains the Horse Range, the river runs for approximately 12 km and joins the Pacific Ocean at Katiki Beach, south of Moeraki. Upper Trotters Creek travels through the limestone Trotters Gorge, well known for its spectacular cliffs and outcrops, and flanked with native bush. The lower Trotters Creek flows through relatively flat, predominantly pastoral, land. The river runs with slow, deep pools combined with shallow riffles.

### **Waianakarua**

The Waianakarua River is a river in North Otago, flowing through farmed landscapes into the Pacific Ocean. It has a mean flow of 2 m<sup>3</sup>/s. There are three main tributaries, the North, Middle and South Branches. The North and South Branches of the river are subject to gravel extraction and the river had been further modified by channel realignment and willow planting to minimise bank erosion where this has impacted on adjacent land.

### **Waitaki**

The Waitaki River is a large braided river in the South Island. The mean flow of the Waitaki River at Kurow is 376 m<sup>3</sup>/s. Waters are sourced from Aoraki and the southern Alps and feed into three large glacial lakes, Pukaki, Tekapo, and Ohau all found in the upper catchment (known as the Mackenzie Basin). The mid catchment is characterised by three artificial lakes - Lake Benmore, Lake Aviemore and Lake Waitaki – all created when the Waitaki River was dammed. The Waitaki has several tributaries, notably the Ahuriri River and the Hakataramea River. It enters the Pacific Ocean between Timaru and Oamaru on the east coast of the South Island.

## 11. Appendix 2: Informants & Iwi Plans Reviewed

### **Iwi/hap /R nanga**

Ng ti Kahungunu.

Ng ti T wharetoa M ori Trust Board.

Ng ti Rarua.

Te Roroa.

Ng ti Hine.

Whanganui M ori Trust Board.

Te R nanga o Ng i Tahu (1 staff member, 2 Board members).

Te R nanga o Moeraki Stream Tipa – re Trotters / Waianakarua (Nelson, McCallum, Tipa, Whaiti, Tipa, Williams, Williams, Coy).

Waitaki Hikoi members - re Waitaki (McCallum, Home, Whaiti, Davis, Nelson, Tipa, Tipa, Tipa).

KTKO Ltd - re Trotters, Taieri, Waianakarua.

### **Individuals**

Re Kakaunui - Davis, Cook, Higgins, Williams; McCallum.

Re Taieri - Ellison; Broad; Tipa; Thomas; Thomas; Todd, Ellison, Langsbury, Wesley.



### **Local Government**

Taupo District Council.

Environment Waikato.

Horizons MW.

Hawkes Bay Regional Council.

Environment Canterbury (2 staff members).

Otago Regional Council (2 staff members).

### **Iwi Plans reviewed**

KTKO Iwi Natural Resource Management Plan.

Te Rōnanga o Arowhenua Iwi Management Plan.

Te Whakatau Kaupapa.

Te Tangi a Tauria - The Cry of the People: Ngā i Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008.

### **Consents applications reviewed**

- Meridian Energy - Reports for Project Aqua.
- Meridian Energy - Reports for NBTC.

### **Decisions Reviewed**

Otago Regional Council Plan change decision – Trotters, Waianakarua.

TPD decision, AEE, Officers Report.

NBTC decision.

### **Other Planning documents Reviewed**

Gisborne LTCCP.

Hawkes Bay LTCCP.

Horizons LTCCP.

EW LTCCP.

Canterbury LTCCP.

Southland LTCCP.pdf

## 12. Appendix 3: A summary by Arthington et al. of existing holistic methodologies (adapted from Tharme 2003)

Methodology	Features, strengths and limitations
<b>Holistic Approach:</b> (Arthington et al. 1992; Davies et al. 1996; Arthington 1998; Petit et al. 2001).	Conceptual and theoretical approach for bottom-up construction of EF regime for whole riverine ecosystem from headwaters to floodplains, including groundwater and estuary or coastal waters; describes systematic construction of a modified flow regime, on a month-by-month (or shorter time scale) flow element-by-element basis and based on best available scientific data, to achieve predetermined objectives for future river condition of rivers; principally represents a flexible conceptual framework, elements of which have been adapted in a variety of ways into several Australian holistic methodologies and for individual studies; basic tenets and assumptions as per BBM, which was derived from it; incorporates more detailed assessment of flow variability than early BBM studies; includes method for generating trade-off curves for examining alternative water use scenarios; some risk of inadvertent omission of critical flow events (common to all holistic methodologies); applicable to regulated or unregulated rivers and for flow restoration; high potential for application to other aquatic ecosystems; recommends a monitoring programme as a crucial component of holistic flow assessments; lack of structured set of procedures and clear identity for EFM hinders rigorous routine application (but routinely used in customized format in Western Australia).
<b>Building Block Methodology (BBM):</b> (King and Louw 1998; King et al. 2000).	Rigorous and extensively documented (manual and case studies available); prescriptive bottom-up approach with interactive scenario development; moderate to highly resource intensive; shared conceptual basis with Holistic Approach; developed to differing extents for both intermediate-level (2 months) or comprehensive (1-2 years) EFAs, within South Africa's Reserve framework; based on a number of sites within representative and/or critical river reaches; includes a well established social component (dependent livelihoods); functions in data poor or rich situations; comprises 3-phase approach: (1) preparation for workshop, including stakeholder consultation, desktop and field studies for site selection, geomorphological reach analysis, river habitat integrity and social surveys, objectives setting for future river condition, assessment of river importance and ecological condition, hydrological and hydraulic analyses, (2) multidisciplinary workshop-based construction of modified flow regime through identification of ecologically essential flow features on a month-by-month (or shorter time scale), flow element-by-flow element basis, for maintenance and drought years, based on best available scientific data, (3) linking of EFR with water resource development engineering phase, through scenario modelling and hydrological yield analysis; EFM exhibits limited potential for examination of alternative scenarios relative to DRIFT, as BBM EF regime is designed to achieve a specific predefined river condition; incorporates a monitoring programme and additional research on important issues, as crucial components of EF implementation; some risk of inadvertent omission of critical flow events (common to all holistic methodologies), high potential for application to other aquatic ecosystems; links to external stakeholder and public participation processes; flexible and amenable to simplification for more rapid assessments; less time, cost and resource intensive than DRIFT; applicable to regulated or unregulated rivers and in flow restoration context; now incorporates Flow Stressor-Response Method facilitating top-down, scenario-based assessments of alternative flow regimes, each with expression of the potential risk of change in river ecological condition.
<b>Expert Panel Assessment Method (EPAM):</b> (Swales and Harris 1995).	Bottom-up, reconnaissance-level approach for initial assessment of proposed WRDs with many conceptual features and methodological procedures in common with the Holistic Approach and BBM; rapid and inexpensive, with limited field data collection; site-specific focus; applicable primarily for sites where dam releases are possible; relies on field-based ecological interpretation, by a panel of experts, of different multiple trial flow releases (ranked in terms of scored ecological suitability) from dams, at one or a few sites, to determine EFR (typically expressed as flow percentiles); low resource intensity; limited resolution of EF output; aims to address river ecosystem health (using fish communities

	as indicators), rather than to assess multiple ecosystem components; strongly reliant on professional judgement; limited subset of expertise represented by panel (e.g., fish, invertebrates, geomorphology); simplistic in terms of the range of ecological criteria and components assessed (but scope for inclusion of additional ones) and the focus on fish; no explicit guidelines for application; poor congruence in opinion of different panel members (e.g., due to subjective scoring approach, individual bias); requires further validation; led to development of more advanced, but similar SPAM, Snowy Inquiry Methodology and other expert panel approaches.
<b>Scientific Panel Assessment Method (SPAM):</b> (Thoms et al. 1996; Cottingham et al. 2002).	Bottom-up field (multiple sites) and desktop approach appropriate for provision of interim or intermediate level EFAs with many conceptual features and methodological procedures in common with the Holistic Approach and BBM; evolved from EPAM as more sophisticated and transparent expert-panel approach; aims to determine a modified flow regime that will maintain ecosystem health; differs from EPAM in that key features of the ecosystem and hydrological regime and their interactions at multiple sites are used as basis for EFA; EFR process includes: (1) identification of management performance criteria by panel of experts for 5 main ecosystem components: fish, trees, macrophytes, invertebrates and geomorphology, (2) application of the criteria for three elements (and associated descriptors) identified as exerting an influence on the ecosystem components (viz. flow regime, hydrograph and physical structure at 3 spatial scales), (3) workshop-based cross-tabulation approach to identify and document generalised responses and/or impacts for each ecosystem components to each specific descriptor (for each element), so as to relate flow regime attributes to ecosystem responses and EFRs; incorporates system hydrological variability and elements of ecosystem functioning; includes stakeholder-panel member workshop for EFR refinement; well defined EFA objectives; some potential for inclusion of other ecosystem components; led to the evolution of other expert-panel approaches; limited use of field data; poor definition of output format for EFR; moderately rapid, flexible and resource-intensive; simpler, less quantitative supporting evidence and less rigorous than Flow Restoration Methodology, BBM and DRIFT; recent applications and limitations reviewed, need for a Best Practice Framework identified.
<b>Habitat Analysis Method:</b> (Walter et al. 1994; Burgess and Vanderbyl 1996; Arthington 1998).	Relatively rapid, inexpensive, basin-wide reconnaissance method for determining preliminary EFRs at multiple points in catchment (rather than at a few critical sites); superior to simple hydrological EFMs, but inadequate for comprehensive EFAs; field data limited or absent; bottom-up process of 4 stages using TAP: (1) identification of generic aquatic habitat types existing within the catchment, (2) determination of flow-related ecological requirements of each habitat (as surrogate for EFRs for aquatic biota), using small group of key flow statistics, plus select 'biological trigger' flows and floods for maintenance of ecological and geomorphological processes, (3) development of bypass flow strategies to meet EFRs, (4) development of EFR monitoring strategy; EFM represents an extension of expert panel approaches (EPAM, SPAM), with conceptual basis and assumptions adapted from Holistic Approach; little consideration of specific flow needs of individual ecological components; requires standardisation of process, refinement of flow bands linked to habitats and addition of flow events related to needs of biota; represents a simplified version of the Holistic Approach; largely superseded by Benchmarking Methodology.
<b>Benchmarking Methodology:</b> (Brizga et al. 2001, 2002).	Rigorous and comprehensive, scenario-based, top-down approach for application at basin scale; using field and desktop data for multiple river sites; same conceptual basis as BBM and Holistic Approach, EFM has 4 main stages: (1) establishment: formation of multidisciplinary expert panel (TAP) and development of hydrological model for catchment, (2) ecological condition and trend assessment: development of spatial reference framework (multiple river sites within representative and critical river reaches), assessment of ecological condition for suite of ecosystem components (using 3-point rating of degree of change from reference condition and appropriate methods for assessing each component), development of generic models (conceptual, empirical) defining links between flow regime components and ecological processes, selection of key flow indicators and statistics with relevance to these relationships, modelling-based assessment of hydrological impacts, (3) development of risk assessment framework to

	<p>guide evaluation of potential impacts of future water resource development and management scenarios: benchmark models are developed for all or some key flow indicators showing levels of risk of geomorphological and ecological impacts associated with different degrees of flow regime change, risk levels are defined by association with benchmark sites which have undergone different degrees of flow-related change in condition, link models are used to show how the modelled flow indicators affect ecological condition, (4) evaluation of future WRD scenarios, using risk assessment and link models, ecological implications of scenarios and associated levels of risk readily expressed in graphical form; EFM is particularly suited to data poor situations; potential for use in developing countries and for application to other aquatic ecosystems (e.g., wetlands, estuaries); utilises a wide range of specialist expertise; presents a comprehensive benchmarking process and transparent reporting system; provides several ways of developing risk assessment models, guidance on key criteria for assessing condition and key hydrological and performance indicators; a recent approach built on several preceding EFA initiatives; no explicit consideration of social component, but with scope for inclusion of socio-economic assessments (note that socio-economic issues are evaluated separately by DNR and considered when the final EF recommendations are being decided); requires evaluation of several aspects (e.g., applicability or sensitivity of key flow statistics, degree to which benchmarks from other basins or sites within basins are valid considering differences in river hydrology and biota); recommends a monitoring programme and additional research on important issues, as crucial components of EF implementation; requires documentation of generic procedure for wider application.</p>
<p><b>Environmental Flow Management Plan Method (FMP):</b> (Muller 1997; DWAF 1999).</p>	<p>Simplified bottom-up approach, applicable in highly regulated and managed systems with considerable operational limitations; considered for use within South Africa Reserve determination process only where BBM or equivalent approach cannot be followed; workshop-based, multidisciplinary assessment including ecologists and system operators; 3-step process: (1) definition of operable reaches for study river and site selection, establishment of current operating rules, (2) determination of current ecological status and desired future state, (3) identification of EFRs using similar procedures to BBM; EFM has limited scope for application; structure and procedures for application are not formalised or well documented; poorly established post-workshop scenario phase; no evaluation undertaken; considerably more limited approach than Flow Restoration Methodology.</p>
<p><b>River Babingley (Wissey) Method:</b> (Petts et al. 1999).</p>	<p>Bottom-up field and desktop approach; EAFR (the EF regime) defined in 4 stages: (1) ecological assessment of river and specification of an ecological objective comprising specific targets (for river components and biota), (2) determination of 4 general and 2 flood benchmark flows to meet the specified targets, (3) use of flows to construct 'ecologically acceptable hydrographs', which may include provision for wet years and drought conditions, (4) assignment of acceptable flow frequencies and durations to the hydrographs and their synthesis into a flow duration curve, the EAFR; EFM uses hydro-ecological models, habitat and hydrological simulation tools to assist in identification of benchmark flows and overall EAFR; allows for flexible examination of alternative EF scenarios; loosely structured approach, with limited explanation of procedures for integration of multidisciplinary input; risk of omission of critical flow events from EAFR; specific to baseflow-dominated rivers and requires further research for use in flashy catchments; requires documentation of generic procedure for wider application.</p>
<p><b>Downstream Response to Imposed Flow Transformations (DRIFT):</b> (King et al. 2003 and 2004; Arthington et al. 2003a).</p>	<p>Rigorous and well-documented top-down, scenario-based process with interactive scenario development; same conceptual basis as BBM and Holistic Approach; appropriate for comprehensive EFAs (1-3 years) based on several sites within representative and critical river reaches; comprised of 4 modules: (1) biophysical module: used to describe present ecosystem condition, to predict how it will change under a range of different flow alterations, uses generic lists of links to flow and relevance for each specialist component, each prediction and the direction and severity of change are recorded in a database, to quantify each flow-related impact, (2) sociological module: used to identify subsistence users at risk from flow alterations and to quantify their links with the river in terms of natural resource use and health profiles, (3) scenario development module: links first 2 modules through querying of database, to extract</p>

	<p>predicted consequences of altered flows (with potential for presentation at several levels of resolution); this process is used to create flow scenarios (typically 4 or 5), (4) economic module: generates description of costs of mitigation and compensation for each scenario; well developed ability to address socio-economic links to ecosystem; considerable scope for comparative evaluation of alternative modified flow regimes; high potential for application to other aquatic ecosystems; resource intensive but amenable to simplification for more rapid assessments; uses many successful features of other holistic EFMs; exhibits parallels with Benchmarking Methodology; output is more suitable for negotiation of tradeoffs than in BBM or other bottom-up approaches, as implications of not meeting the EFR are readily accessible; links to external public participation process and macro-economic assessment; generic lists provide clear parameters for inclusion in a monitoring programme; applicable to regulated or unregulated rivers and for flow restoration; EFM modules require refinement; approach provides limited consideration of synergistic interactions among different flow events and ecosystem components; limited inclusion of flow indices describing system variability; recommends a monitoring programme and additional research on important issues, as crucial components of EF implementation; requires documentation of generic procedure for wider application.</p>
<p><b>Adapted BBM-DRIFT Methodology:</b> (Steward et al. 2002).</p>	<p>Simplified top-down, multidisciplinary team approach, for use in highly resource-limited (including data limited) situations and with direct dependencies by rural people on riverine ecosystems; combines pre-workshop data collection phase of BBM with DRIFT's scenario-based workshop process; comprises 3 phases: (1) preparation for workshop as per BBM and DRIFT, but excluding certain components (e.g., habitat integrity and geomorphological reach analyses) and with limited field data collection, (2) workshop, with simplified DRIFT process linking the main geomorphological, ecological and social impacts with elements of the flow regime (based on assessments of impact and severity for component-specific generic lists), used to construct a matrix, (3) use of matrix in evaluating development options, where the matrix indicates ecosystem aspects that are especially vulnerable or important to rural livelihoods, socially and ecologically critical elements of the flow regime and EF recommendations for mitigation; EFM incorporates more limited ecological and geomorphological assessments than BBM and DRIFT; limited coverage of key specialist disciplines; no link to system for defining target river condition; limited capability for scenario development; especially appropriate in developing countries context; requires further development and validation; would benefit from inclusion of economic data.</p>
<p><b>Flow Restoration Methodology (FLOWRESM):</b> (Arthington et al. 1999; Arthington et al. 2000).</p>	<p>Primarily bottom-up, field and desktop approach appropriate for comprehensive (or intermediate) EFAs; EFM represents hybrid of Holistic Approach and BBM; designed for use in intensively regulated rivers with emphasis on identification of the essential features that need to be built back into the hydrological regime to shift the regulated river system towards the pre-regulation state; EFM uses an 11-step process in 2 stages, in which the following are achieved: (1) review of changes to the river hydrological regime (focusing on unregulated, present day and future demand scenarios, using hydrological simulation model), (2) series of 8 steps within scenario-based workshop, using extensive multidisciplinary specialist input from field work, literature and expert judgement: determination of flow-related environmental effects for low and high flow months, rationale and potential for restoration of various flow components so as to restore ecological components and functions and establishment of EFRS based on identification of critical flow thresholds or flow bands that meet specified ecological or other objectives, (3) develops series of EF scenarios (quantity, timing, duration of flows) and assesses implications of multiple scenarios for system yield, (4) outlines remedial actions not related to flow regulation, alternatives to flow restoration (e.g., physical habitat restoration, fish passage facilities) are evaluated when some elements of pre-regulation flow regime cannot be restored fully for practical or legal reasons, (5) outlines monitoring strategy to assess benefits of EFRs; particular relevance to rivers regulated by large dams, but applicable to any river system regulated by infrastructure or surface and/or groundwater abstraction; includes well-developed hydrological and ecological modelling tools; more rigorous than expert-panel methods; includes flexible top-down process for assessing ecological implications of alternative modified flow regimes and impacts of not restoring particular flows; potential for adoption of full benchmarking process to rank outcomes of not restoring critical flows; some risk of inadvertent omission of critical flow events</p>

	(common to all holistic approaches); requires documentation of generic procedure for wider application.
<b>Flow Events Method (FEM):</b> (Stewardson and Cottingham 2002).	Top-down method for regulated rivers; considers the maximum change in river hydrology from natural or key ecologically relevant flow events, based on empirical data or expert judgement; considered a method of integrating existing analytical techniques and expert opinion to identify important aspects of the flow regime; EFM comprises 4 steps: (1) identification of ecological processes (hydraulic, geomorphic and ecological) affected by flow variations at range of spatial and temporal scales, (2) characterisation of flow events (e.g., duration, magnitude) using hydraulic and hydrological analyses, (3) description of the sequence of flow events for particular processes, using a frequency analysis to derive event recurrence intervals for a range of event magnitudes, (4) setting of EF targets, by minimising changes in event recurrence intervals from natural or reference or to satisfy some constraint (e.g., maximum percent permissible change in recurrence interval for any given event magnitude); EFM's singular development appears to be analysis of changes in event recurrence intervals with altered flow regimes; draws greatly on established procedures of other complex EFMs (e.g., BBM, FLOWRESM and DRIFT); may be used to: (1) assess the ecological impact of changes in flow regimes, (2) specify EF management rules and/or targets, (3) optimise flow management rules to maximise ecological benefits within constraints of existing WRD schemes; possibly places undue emphasis on frequency compared with other event characteristic independent of an associated expert panel method, but could be embedded into one as routine procedure.

Further information on the strengths and deficiencies of individual holistic methodologies is provided in Tharme (1996); Arthington (1998); Cottingham et al. (2002); Arthington et al. (2003a); King et al. (2003); Tharme (2003). Abbreviations: DNR - Queensland Department of Natural Resources; DWAF - South African Department of Water Affairs and Forestry; EAFR - ecologically acceptable flow regime; EF - environmental flow; FLOW ASSESSMENT PROCESS - EF assessment; EFR(s) - EF requirement(s); EFM - EF methodology; TAP - technical advisory panel; WAMP - water allocation and management planning; WRD(s) - water resource development(s); abbreviations for methodology names are given in the first table column.

Additional holistic methodologies developed and applied elsewhere include the River Babingley Method (Petts et al. 1999) developed in England and the Adapted BBM-DRIFT methodology developed in Zimbabwe (Steward, Madamombe and Topping 2002).

<sup>i</sup> The software used for the development of concept maps is Decision Explorer (by Banxia). [www.banxia.com](http://www.banxia.com). The different types of analyses are described in the User Manual.

<sup>ii</sup> This was recommended by Andy Hicks who undertook an analysis of the early Kakaunui data.

<sup>iii</sup> This parallels similar practices of cultural stream monitoring such as the application of a Cultural Health Index for assessing overall stream health (Tipa & Teirney 2006).

<sup>iv</sup> They are classed as being very high, high, average, low or very low.