# A Cultural Health Index for Streams and Waterways: A tool for nationwide use

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A Cultural Health Index for Streams and Waterways: Indicators for recognising and expressing Māori values. June 2003.

Using the Cultural Health Index: How to assess the health of streams and waterways. February 2006.

# Contents

# List of Tables



# List of Figures

# 1 Introduction

Water is fundamentally important for its life-giving essence and spiritual values. Māori philosophy takes a holistic, ki uta ki tai (mountains to the sea) approach to looking after water resources. These principles, and the management practices associated with them, are quite different to current water resource management practices which are based on a purely technical approach. For this reason, iwi need a means to evaluate the health of streams and rivers within their rohe that expresses and accommodates their values and beliefs while at the same time enabling effective communication and working relationships with water managers.

The Cultural Health Index (CHI) offers this. Initially developed on the Taieri and Kakaunui Rivers from stream health evaluations of Otakou and Moeraki Rūnanga stream assessment teams, the index was improved and refined on the Hakatere (Ashburton) and Tukituki Rivers from Arowhenua Rūnanga and the Kahungunu team evaluations respectively. This provided data from a variety of river types (single-channel, rain-fed and braided shingle, snow and rain-fed) and sizes. Three Ngāi Tahu rūnanga in the South Island and Ngāti Kahungunu in the North Island participated.

There was a high level of agreement in the CHI scores relating to stream site status, mahinga kai and stream health provided by four rūnanga/iwi teams for four river catchments. Together with further analysis of combined stream health data, a generic CHI was created. This generic CHI can be used confidently by any iwi at sites on streams of any size or river type. This is an index which allows iwi/hapū to assess the cultural and biological health of a stream or catchment of their choosing.

This report details the development of the CHI. It compares the results of studies involving testing on the different rivers, carries out further analysis of all data sets combined and describes a generic CHI that. we believe, can be applied by any iwi to any river in New Zealand. The report concludes with a discussion of how the CHI responds to the values, beliefs and aspirations of Māori, as well as outlining how its application could assist resource managers, not only to enhance contemporary resource management practice but also to fulfil their obligations stemming from the Treaty of Waitangi and New Zealand's resource management laws.

## 1.1 Structure of the Cultural Health Index

The CHI score is made up of three components:

- Part 1 – Site status

  Identifies whether or not the site is of traditional significance to tangata whenua and can be determined when the sites are first selected. The second part of the status grade indicates whether tangata whenua would return to the site in future.

- Part 2 – Mahinga kai

  Assesses the mahinga kai values of a site. Examining the health of mahinga kai recognises that mauri is tangibly represented by the physical characteristics of a freshwater resource, including the indigenous flora and fauna, the fitness for cultural usage and its productive capacity.

The mahinga kai measure has four elements, each of which is scored on a 1–5 basis (1 is poor health, 5 is very healthy):

1. Identification of mahinga kai species present at the site. A score is given depending on the number of species present. The productive capacity of a site is reflected in the ability of the freshwater resource to yield mahinga kai.
2. Comparison between the species present today and those sourced traditionally from the site. A score is given based on the number of species of traditional significance that are still present. Maintaining cultural practices, such as the gathering of mahinga kai, is an important way of ensuring the transfer of cultural values through the generations.
3. Access to the site. Do tangata whenua have physical and legal access to the resources they want to gather?
4. Assessment of whether tangata whenua would return to the site in the future as they did in the past.

The four mahinga kai elements are then averaged to produce a single score between 1 and 5.

- Part 3 – Cultural stream health

  The cultural stream health measure is the average of 1–5 scores awarded to each of eight individual indicators:

  1. water quality
  2. water clarity
  3. flow and habitat variety
  4. catchment land use
  5. riparian vegetation
  6. riverbed condition/sediment
  7. use of riparian margin
  8. channel modification.

  These eight indicators were selected from the combined results of the four catchment studies and are the most objective and accurate reflections of tangata whenua evaluations of overall stream health.

## Cultural Health Index

The three components are brought together in an overall Cultural Health Index score.

When the CHI is calculated for a specific site, a score expressed as A-1/3.25/4.87 is generated. This combines the three components as follows.

| Component 1: Site status | Component 2: Mahinga kai measure | Component 3: Cultural stream health measure |
|---|---|---|
| A – 1 | 3.25 | 4.87 |

This particular CHI score is for Sharplin Falls (Hakatere), a site of traditional significance that Māori will return to, that supports above average mahinga kai values and exceptional cultural stream health values.

## Applying the Cultural Health Index

Guidelines have been prepared[1] that outline how to identify areas that may need evaluating, how to organise a programme and how to collect and analyse data to determine the CHI. To apply the CHI, members of the iwi/hapū/rūnanga assessment team visit selected sites in a stream catchment and look over a stream reach from a vantage point. The team also walks along the river bank and views the river upstream and downstream, visually assessing the health of the site. At the same time they record their observations by filling in the assessment forms. After the forms have been completed, the information is analysed and a CHI score produced. Creating a CHI score or series of scores is a relatively straightforward process which does not require a major commitment of time on the part of the team members.

The CHI can be used by iwi/hapū/rūnanga for a variety of purposes such as identifying and prioritising stream health problems, evaluating remedial actions aimed at restoring or enhancing stream health, and monitoring stream health of a site or the whole catchment. Use of the CHI in discussions with water managers and others involved in rivers and streams also provides a way of better understanding Māori perspectives and concerns about streams and rivers of value and incorporating these into management decisions.

[1] *Using the Cultural Health Index: How to assess the health of streams and waterways* is available on the MfE website at www.mfe.govt.nz/publications/water/

# 2 Development of the Cultural Health Index

The Cultural Health Index (CHI) for rivers and streams is a tool that involves iwi in resource management processes. Funded by the Ministry for the Environment as part of its Environmental Performance Indicator (EPI) Programme, this work arose in an attempt to recognise and incorporate Māori values in river management. In addition to this, the index provides a diagnostic tool which identifies issues of concern to iwi. Remedial actions can then be prioritized using data gathered from field assessments. Monitoring aspects of the freshwater resource can also be undertaken.

### Stage 1

The first stage of the CHI work documented the association of Ngāi Tahu with the Taieri River catchment and identified a sizeable set of indicators that Ngāi Tahu use to assess the health of freshwater resources (Tipa 1999).

### Stage 2

In Stage 2 the indicators of cultural health and mahinga kai were refined to develop a tool and a process that could be used by kaitiaki to assess the condition of freshwater resources. This work focused on the Taieri and Kakaunui catchments (single-channel, rain-fed rivers) and involved Te Rūnanga o Moeraki and Te Rūnanga Otakou. The stream CHI was thus devised and first used in 2002 (Tipa and Teirney 2003). It has three components:

1. site status, specifically the significance of the site to Māori
2. a mahinga kai measure
3. a stream health measure.

### Stage 3

Recognising the need to validate the CHI to determine whether the tool could be implemented more widely, a further stage was carried out. Stage 3 involved the application of the process to another river type in the rohe of Ngāi Tahu (the braided Hakatere [Ashburton] River) (Tipa and Teirney 2005). A major question was whether different river types might each need their own modified version of the CHI. Stage 3 also involved a river similar to the Taieri and Kakaunui (the Tukituki) but in the rohe of another iwi (Ngāti Kahungunu) (Tipa and Teirney 2005; see these reports for details of the rivers and analyses). The question here was whether different iwi might incorporate different values, perhaps requiring fewer or more than the three components of the CHI, or perhaps needing to incorporate different indicators in the assessment of the third CHI component (stream health).

## 2.1 Engaging Māori perspectives on freshwater

If the project to develop the Cultural Health Index is to be promoted as an example of the successful incorporation of a Māori perspective in freshwater management, the key question to be answered is – how does the index reflect the beliefs, values and practices of Māori? In this section we provide a brief overview of:

- the significance of freshwater to Māori
- indicators that Māori use to assess stream health.

## 2.2 The significance of freshwater to Māori

Water is the life-giving essence. Freshwater resources represent the connection that Māori believe humans enjoy with the spiritual forces operating in the environment (Ministry for the Environment 1997). Protecting the integrity of valued freshwater resources, therefore, is an important aspect of the responsibilities of those Māori who are mandated as kaitiaki.

> *Water may be considered tapu or sacred because of its properties: in relation to other water, tapu places, or objects, or because of its close association with the gods. Other water bodies may be accorded taonga value because of uses of the waterway, which unlike wai tapu, are not prohibited by tapu.* (D Crengle in Ministry for the Environment 1997)

Values (both tangible and intangible) associated with specific freshwater resources include: the role of particular freshwater resources in creation stories; the role of those freshwater resources in historical accounts; the proximity of settlements and/or historical sites in, or adjacent to, specific freshwater resources; the value of freshwater resources as a source of tribal identity as well as mahinga kai; the use of freshwater resources as access routes or transport courses; and the continued capacity to be accessed, used and treasured by future generations (Ministry for the Environment 1997).

The Māori 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 Māori that are difficult for resource managers and scientists to accommodate within existing management regimes where objective, scientific philosophies and techniques predominate.

## 2.3 Indicators used by Māori to assess stream health

From a Māori perspective the Ministry for the Environment's approach to the development of Environmental Performance Indicators could not provide an independent, holistic measure of ecosystem health. Freshwater environmental performance indicators developed by the Ministry were restricted to the waterway itself and the riparian zone – macroinvertebrate community index, temperature, riparian condition, clarity, periphyton, occurrence of native fish, dissolved oxygen (percent saturation), and ammonia (mg/l).

This limited approach concerned Ngāi Tahu. It also represented an opportunity, as Ngāi Tahu were invited to suggest their own indicators through the Taieri River Project. The indicators identified by Ngāi Tahu whanui during Stage 1 (Table 1) and the Cultural Health Index (described in the next section) that resulted from Stage 2 represent the assessment of a mix of physical attributes of waterways and catchments and other values that Māori ascribe to freshwater.

The indicators listed in Table 1 reflect Māori concerns for health throughout a catchment, *ki uta ki tai – from the mountains to the sea*, and express a holistic approach to that health. All of the indicators identified represent the factors that kaumātua and Ngāi Tahu resource managers believe are conducive to a healthy river with a strong vibrant mauri. A waterbody with a healthy mauri will sustain healthy ecosystems, support cultural uses (including mahinga kai) and be a source of pride and identity to the people.

The perspectives Māori bring to resource management differ from those of non-Māori. A comparison of the indicators identified by kaumātua with western science-based indicators identified by the Ministry for the Environment's Freshwater Working Group reveal the extent of these differences (Table 1).

**Table 1: Indicators of stream and river health as identified by kaumātua and MfE**

| Indicators identified by kaumātua only | Indicators identified by both kaumātua and MfE | Indicators identified by MfE only |
|---|---|---|
| Place names (3) | Temperature (3) | Dissolved oxygen (% saturation) |
| Unpleasant odours (4) | Riparian condition (8) | Ammonia (mg/l) |
| Greasiness of water (3) | Occurrence of native fish (14) | Periphyton |
| Presence of riffles/white water (9) | Clarity (10) | Macroinvertebrate index |
| Sound of winds in riparian vegetation (2) | | |
| Sound of birds present (2) | | |
| Sound of current of waterway (4) | | |
| Sound of flood flows (1) | | |
| Flow in river visible (11) | | |
| Smell (8) | | |
| Presence or absence of activities in the headwaters (2) | | |
| Sediment on/not on the riverbed (8) | | |
| Continuity of vegetation (4) | | |
| Unnatural growths (1) | | |
| Foams, oils and other human pollution (8) | | |
| Flood flows (2) | | |
| Willow infestation (1) | | |
| Abundance and diversity of birdlife (14) | | |
| Presence or absence of stock in the riparian margin and waterway (7) | | |
| Changes to the river mouth (2) | | |
| Unnatural sedimentation in channels (2) | | |
| Loss of aquatic vegetation in the marine environment (1) | | |
| The health of fish found in the waterway (3) | | |
| The stomp test (1) | | |

| | | |
|---|---|---|
| Changes to the extent of the tidal influence (4) | | |

There are similarities but some fundamental differences between Māori and non-Māori perspectives. One example that highlights the difference is the notion of water pollution. Māori spiritual values conflict with scientific measures. For example, from a western science perspective drinkable water may carry contaminants but at a level that is not toxic to humans. In contrast, Māori require drinking water to be protected from spiritual pollution which means certain discharge activities, regardless of the level of physical contamination, are prohibited (Ministry for the Environment 1997).

# 3 Evolution of the Cultural Health Index for Streams and Rivers

The Cultural Health Index is made up of three components:

1. site status, specifically the significance of the site to Māori
2. a mahinga kai measure
3. a stream health measure.

In this section we provide:

- an overview of the overall structure of the index
- a description of each of the components of the index and how they evolved as the index was applied to a new river and a new iwi.

## 3.1 Overall structure of the Cultural Health Index (CHI)

### Component 1 – site status

This component of the CHI explores the significance of the site to Māori and distinguishes between traditional and contemporary sites.

There are two questions to establish this component:

The first question requires a site to be classified as either:

A – indicates a *traditional* site of significance to Māori or

B – indicating the site is not traditional but has been included because of other aspects (eg the site may be one monitored by the regional council).

The second question asks whether Māori would return to the site in the future. If the rūnanga would return, the site is awarded a 1 and, if not, a 0. When the answers to the two questions are collated there are four possible combinations:

| A-1 | A-0 | B-1 | B-0 |
|---|---|---|---|
| This is a traditional site that Māori would return to and use as they did in the past. | This is a traditional site that Māori would not return to. | This is a site that is not of traditional significance to Māori. However they would go to the site in the future. | This is a site that is not of traditional significance to Māori. Further they would not go to the site in the future. |

### Component 2 – Mahinga kai measure

The second component of the CHI addresses the mahinga kai values of a site. This component, in addition to encapsulating the many intangible qualities associated with the mauri of a waterway, is tangibly represented by some of the physical characteristics of a freshwater resource including: indigenous flora and fauna, water clarity, water quantity, and the mahinga kai it yields (Ministry for the Environment 1997).

There are four parts to the 'mahinga kai measure' of the Cultural Health Index.

1. The first part (a) **identifies mahinga kai species present** at the site. A list of plant, bird and fish species is prepared. A score (1–5) is then assigned, depending on the number of species present.

2. The second part (b) **compares the species present today and the traditional mahinga kai** sourced from the site. This was deliberately factored into the design of the Cultural Health Index to recognise that maintaining cultural practices, such as the gathering of mahinga kai, is an important means of ensuring the transference of cultural values through the generations. Cultural continuity means that greater value is likely to be assigned to sites of traditional significance that continue to support the mahinga kai species sourced in the past. A single score (1–5) is assigned, based on the number of species of traditional significance that are still present:
   - non-traditional site scores 1
   - none of the species sourced in the past is present at the site scores 1
   - at least 50percent of the species sourced in the past are still present at the site scores 3
   - all species sourced in the past are still present at the site scores 5.

3. Mahinga kai gathering assumes Māori have physical and legal access to the resources that they want to gather. The third part of the mahinga kai measure (c) assesses each site based on **access to the site**. (No access scores 1 and unimpeded legal and physical access scores 5.)

4. The fourth part in the mahinga kai measure (d) assesses whether Māori would **return to the site** in the future and use it: No scores 1, Yes scores 5.

The four mahinga kai elements are then averaged to produce a single score (1–5).

### Component 3 – Cultural Stream Health Measure

The third and final component of the CHI is the Cultural Stream Health Measure (CSHM). Indicators of stream health identified in Part 1 of the study have been tested and refined by different iwi assessment teams on the four rivers studied. This has resulted in a set of indicators that best reflects iwi participants' assessment of overall stream health and that can be defined objectively. Each of these eight indicators receives a score (1–5) from each rūnanga member involved in the assessment. The scores for each indicator are then averaged. The average of all indicator scores is calculated as the CSHM (1–5).

**Figure 1: Example of an assessment site: Kakaunui Catchment**

Application of the Cultural Health Index results in a score of A-0/ 2.56/ 1.06 (representing each of the three components).

The site at Island Stream was traditionally used by the Tipa whānau who travelled there each autumn to harvest eels during the downstream migration. Because of this traditional use, the site is classed as an 'A'. However, its degraded condition means the whānau would not return to use the site, hence component 1 scores A-0. The mahinga kai measure score is in the middle of the range (2.56 out of 5) because while two of the factors included in the measure score highly, the other two receive a low score. The stream health measure (1.06 out of 5) confirms the poor health of this site.

## 3.2 The evolution of Component 1 of the CHI: site status

Oral records from rūnanga members reinforced the relevance and usefulness of the overall structure of the CHI (components 1–3). There was no call for addition or deletion of any component, however, refinements of a generally minor nature were made as the research progressed.

Each of the river studies (Taieri/Kakaunui, Hakatere, and Tukituki) confirmed that the structure of Component 1 (site status) accommodated the values and concerns of Māori in different iwi (Ngāi Tahu and Ngāti Kahungunu). However, a minor refinement was made as the study progressed, eg the original definition for the Taieri/Kakaunui study, *recognising culturally significant sites and ability to sustain future mahinga kai use*, was refined *to recognising culturally significant sites and ability to sustain future cultural use* in the Hakatere study. This broader definition to cultural use was maintained in the Tukituki study.

For some sites, members of the assessment team were not unanimous about whether they would return to the site. However, the assessment of the majority was always clear and able to be used as the final determinant of the score for that dimension.

This component of the CHI enables Māori and resource managers to make comparisons between different catchments. Table 2, for example, shows how rivers vary in the proportion of sites recorded as traditional and to which rūnanga would return or not. While only 25 percent of Taieri sites would be revisited, Māori would return to more than 70 percent of sites on the rivers of the other three catchments.

**Table 2: Number of traditional sites being accorded A-1 and A-0 status**

| Catchment | Number of traditional sites scoring A-1 (Traditional sites that Māori would return to and use in the future) | Number of traditional sites scoring A-0 (Traditional sites that Māori would not return to in the future) |
|---|---|---|
| Taieri | 4 of 16 sites (25.0%) | 12 of 16 sites (75.0%) |
| Kakaunui | 8 of 11 sites (72.7%) | 3 of 11 sites (27.3%) |
| Hakatere | 17 of 19 sites (89.5%) | 2 of 19 sites (10.5%) |
| Tukituki | 14 of 19 sites (73.0%) | 5 of 19 sites (26.0%) |

Table 3 reveals the percentage of all sites, traditional and non-traditional combined, that tangata whenua would return to in future. This ranges from 23.3 percent (Taieri) to 73 percent (Tukituki).

**Table 3: Number and percentage of all sites, traditional and non-traditional combined, to which Māori would return (A1 or B1 status)**

| Catchment | |
|---|---|
| Taieri | 7 of the 30 sites (23.3%) would be visited and used by Māori in the future |
| Kakaunui | 10 of the 16 sites (62.5% would be visited and used by Māori in the future |
| Hakatere | 21 of the 31 sites (67.7%) would be visited and used by Māori in the future |
| Tukituki | 22 of the 30 sites (73%) would be visited and used by Māori in the future |

In the future, a 'traffic light' system could be used to graphically display overall catchment scores – for example:

- red: all traditional sites are unable to sustain cultural use – ie would not be visited by Māori in the future
- orange: most sites (the majority) are unable to sustain cultural use – ie would not be visited by Māori in the future
- yellow: most sites (the majority) are able to sustain cultural use – ie would be visited by Māori in the future
- green: all traditional sites are able to sustain cultural use – ie would be visited by Māori in the future.

## 3.3 The evolution of Component 2 of the CHI: Mahinga kai

This component of the Index recognises that mauri is tangibly represented, in part, by some of the physical characteristics of a freshwater resource including the mahinga kai it yields (Ministry for the Environment 1997).

In the Taieri/Kakaunui study, Component 2 focused entirely on mahinga kai values. However, rūnanga members on the Hakatere study identified the need to recognise cultural uses other than mahinga kai, and this was confirmed in the Tukituki study where it was observed that while mahinga kai is important for many sites, Component 2 needs to recognise sites that maintain other cultural uses. Thus, of the four parts making up Component 2 (refer to Section 3.1) the only refinement was to the fourth part, changing the focus from *whether Māori would return and gather mahinga kai in the future* to *whether Māori would return and **use** the site in future.*

In relation to assigned scores for the number of species present, concerns were raised at each stage about expressing the 1–5 score in relation to the maximum number of species at any site on the river in question. The problem was threefold. First, it may be inappropriate for a degraded site to score highly simply because it was the 'best of the worst'. Second, unlike other measures, this scoring system does not allow for comparisons between catchments. Third, such an approach to deriving a catchment-specific score may involve complex calculations. Despite these concerns, it was not considered appropriate to apply a generic 1–5 rating for a set number of species. Thus, to assign a score for the number of species present at a site, the steps are:

- collate the list of plant, fish and bird species present
- for all sites assessed, determine the maximum number present
- based on the maximum number of species present at any one site, use the table (Appendix 1) to assign a score of 1–5 based on how many species there are compared to this maximum figure.

## 3.4 The evolution of Component 3 of the CHI: Cultural stream health measure

The cultural stream health measure (CSHM) was first developed for the Taieri and Kakaunui Rivers (that were combined because of their similar nature). To determine whether a different CSHM must be developed for every river or, alternatively, whether a generic CSHM can be used, the study was extended to the Hakatere River (a different river type) and the Tukituki River (a different iwi). In this section of the report, the CSHMs for the four rivers are compared and then the data from all four rivers are combined to derive and test a combined CSHM. Finally, a new generic CSHM is described. The development of a CSHM for each of the four rivers is documented in Tipa and Teirney (2003c [Taieri/Kakaunui], 2005a [Hakatere] and 2005b [Tukituki]).

The CSHM is calculated by averaging scores for a number of separate cultural indicators of stream health. The original 30 indicators identified during Stage 1 (Section 2.2, Table 1) were reduced to 19 after further interviews with kaumātua and others from within the Ngāi Tahu rohe. Some indicators were considered to be too subjective or unable to be clearly defined or readily measurable. Thus, only a subset was used. For the Taieri/Kakaunui and Hakatere catchments, the same recording form was used for all site assessments (Appendix 2). However, as a result of rūnanga interviews in the Tukituki study a slightly modified recording form was used (Appendix 3). The indicators included in the different studies are shown in Table 4.

**Table 4: Indicators used in the different studies**

| Taieri / Kakaunui Hakatere | Tukituki |
|---|---|
| Catchment land use | Catchment land use – indicator description modified |
| Riverbank condition | Riverbank condition |
| Riparian vegetation | Riparian vegetation |
| Indigenous species | Indigenous species |
| Use of the riparian margin | Use of the riparian margin |
| Riverbed condition | Riverbed condition – indicator description modified |
| Use of the river channel | Use of the river channel – indicator description modified |
| Use of the river (takes/discharges) | Use of the river (takes/discharges) |
| River flow (see) | River flow (see) |
| River flow (hear) | River flow (hear) |
| Water quality (odours) | Water quality (odours) |
| Water quality (appears polluted) | Water quality (appears polluted) – indicator description modified |
| Water clarity | Water clarity |
| Sediment | Sediment |
| Would you eat fish | Variety of habitats present |
| Would you taste the water | Would you taste the water |
| Would you fish | Would you fish |
| | Would you eat fish |
| | Would you swim |

Note: Some indicator descriptions were modified slightly in the Tukituki study (compare Appendices 2 and 3) and two indicators were added.

Rūnanga interviews revealed the similarity in the majority of indicators used by Māori to assess stream health and the emphasis on resource use, in particular mahinga kai. This similarity gave confidence that a CHI with a common set of indicators might be applied across the country.

### 3.4.1 The process

The process of deriving a CSHM for each river involved:

- identification of cultural stream health indicators by tangata whenua
- rating the importance of each indicator (on a 1–5 basis) by the tangata whenua team for selected sites along the river
- rating the overall stream health, a holistic subjective measure, of each stream site by the tangata whenua team
- identifying the relationships between each indicator and overall stream health using correlation coefficients
- setting aside indicators that are so highly correlated with overall stream health that they actually represent alternative measures of stream health rather than contributing factors
- for the remaining indicators, using multiple regression to identify those that best account for overall stream health (scores for this subset of indicators are then averaged to give the CSHM for each site)

- assessing the performance of the CSHM by comparing values for each site in relation to:
  - stream size (to ensure applicability of the measure across a range of stream sizes)
  - western stream health measures (MCI – Macroinvertebrate Community Index, SQMCI – Semi-Quantitative Macroinvertebrate Community Index)
  - land use (percentage of developed land in the catchment area of a stream site).

The process of deriving a combined CSHM involved:

- following the same steps as for individual rivers except that data from all 106 stream sites were first combined (Taieri/Kakaunui 35, Hakatere 30, and Tukituki 31)
- identifying indicators to be included in the combined CSHM using multiple regression on the combined data set
- applying the combined CSHM to each site on each river and assessing performance of the combined CSHM for individual rivers in relation to:
  - stream size
  - western stream health measures (MCI, SQMCI)
  - land use (percentage of developed land in the catchment area of a stream site).

### 3.4.2 Identification of alternative indicators of stream health

The indicators "would you eat fish", "would you go fishing" and "would you taste the water" were very highly correlated with overall stream health in all four rivers and for all data combined (Table 5). The consistency of responses across contrasting rivers by different rūnanga and iwi emphasises the fundamental importance of mahinga kai to a cultural evaluation of stream health by tangata whenua. The presence of food resources that would indicate stream health was highlighted by Ngāti Kahungunu, as was swimming, an important activity associated with the Tukituki River that is unlikely to be the case for colder South Island rivers.

**Table 5: Correlations between the overall stream health measure and selected stream health indicators for individual rivers and all data combined**

| Alternative indicator | Taieri/Kakaunui | Hakatere | Tukituki | Combined data |
|---|---|---|---|---|
| Would you eat fish | 0.91 | 0.97 | 0.92 | 0.93 |
| Would you go fishing | 0.83 | 0.95 | 0.83 | 0.78 |
| Would you taste the water | 0.84 | 0.94 | 0.86 | 0.89 |
| Would you swim | – | – | 0.80 | N/A |
| Necessary food resources | – | – | 0.76 | N/A |

Note: The relationship between two variables can range from being perfectly correlated, correlation coefficient of 1.0, to not correlated, correlation coefficient of 0.0. For instance, a correlation of 0.97 between "would you eat fish" and the overall stream health measure for the Hakatere is exceptionally strong. The correlations between the indicators listed in table 5 and overall stream health are all highly significant.

Note: N/A – not applicable.

### 3.4.3 Identification of indicators that contribute to overall stream health

Two statistical methods were used to identify the indicators that contribute the most to cultural stream health, correlations and regressions. Both methods provide important insights into the make up of a generic cultural health stream measure.

#### Indicators evaluated by correlation coefficients

The indicators that are significantly correlated with the rūnanga assessments of overall stream health show remarkable consistency across the different rivers (Table 6). Water quality was always the most significant indicator of overall stream health, whilst water clarity, flow, riverbed condition/sediment and use of the riparian margin were also strongly correlated with overall stream health in each river. Other indicators showed some variation between rivers but even these were all positively and quite strongly related to overall stream health. These results indicate that a single set of stream health indicators may be appropriate to use in all rivers by different rūnanga and iwi. Given the consistency in pattern, it is not surprising that the combined data set also shows good levels of correlation between the indicators and overall stream health. An exception is river flow because of different patterns of flow in the contrasting rivers.

**Table 6: Correlations between the overall stream health measure and stream health indicators for individual rivers and all data combined**

| Contributing indicator | Taieri/Kakaunui | Hakatere | Tukituki | Combined data |
|---|---|---|---|---|
| Water quality (appears polluted) | 0.75 | 0.86 | 0.90 | 0.73 |
| Water clarity | 0.61 | 0.83 | 0.70 | 0.59 |
| Use of the river (takes/discharge) | 0.39 | 0.76 | 0.47 | 0.50 |
| River flow (visible) | 0.58 | 0.75 | 0.85 | 0.38 |
| Catchment land use | 0.64 | 0.70 | 0.49 | 0.65 |
| Riparian vegetation | 0.54 | 0.70 | 0.33 | 0.65 |
| Riverbed condition/sediment | 0.60 | 0.69 | 0.83 | 0.62 |
| Riverbank condition | 0.36 | 0.57 | 0.33 | 0.35 |
| Use of the riparian margin | 0.65 | 0.55 | 0.50 | 0.64 |
| Channel modification | 0.66 | 0.47 | 0.25 | 0.49 |
| Indigenous species | 0.45 | 0.43 | 0.57 | 0.54 |
| Variety of habitats present | – | – | 0.75 | N/A |

### Indicators evaluated by multiple regression

Multiple regression analysis determines the indicators that account best for variation in overall stream health. The total amounts of variation explained in the different rivers was 92.6 percent, 88.6 percent and 76.0 percent, and for all rivers combined 71.8 percent (Table 7). All these values are remarkably high and give confidence that, in each case, a set of indicators can effectively encapsulate what rūnanga members assess to be overall stream health. Not unexpectedly, water quality is of key importance in all river data sets. Flow, catchment land use and channel modification contribute to the results for two rivers whereas condition/sediment, water clarity and use of the riparian margin feature only once. River bank condition, use of the river (takes and discharges), indigenous species and riparian vegetation did not feature in the multiple regressions. In the combined data set, water quality, riparian vegetation, flow and bed condition/sediment were the factors of importance. Thus, these are the indicators whose scores will be averaged to produce the combined CSHM to be discussed in Sections 3.4.5 and 3.4.6

**Table 7: Regressions to identify the indicators that account best for variation in overall stream health of separate rivers and for all rivers combined**

| Taieri/Kakaunui Rivers | | Hakatere | | Tukituki River | | Combined data | |
|---|---|---|---|---|---|---|---|
| **Indicator** | **% var** | **Indicator** | **% var** | **Indicator** | **% var** | **Indicator** | **% var** |
| Water quality | 56% | Water quality | 73.5% | Water quality | 80.6% | Water quality | 53.3% |
| Use riparian margin | 10.8% | Catchment land use | 7.1% | Flow | 8% | Riparian vegetation | 15.6% |
| Channel modification | 5.5% | Water clarity | 5.4% | | | Flow | 1.7% |
| Flow | 4.4% | Bed condition/ sediment | 3.7% | | | Bed condition/ sediment | 1.2% |
| Catchment land use | ns | Channel modification | 2.9% | | | | |
| Total | 76.0% | Total | 92.6% | Total | 86.6% | Total | 71.8% |

Note: Although catchment land use did not contribute significantly [ns] to the CSHM for the Taieri/Kakaunui Rivers it was included in the original calculation. This indicator was a significant component of the CSHM for the Hakatere.

## 3.4.4 Comparing CSHMs for individual rivers with other stream health measures

In our previous reports, the CSHMs calculated for each site were compared with two existing measures of stream health, the macroinvertebrate community index (MCI) and its semi quantitative variant (SQMCI), both used extensively by researchers and water managers in New Zealand.

We also compared the CSHMs for each site with the percentage of developed land in the catchment area of the site. There were always significant positive correlations between CSHM and the invertebrate stream health measures (pollution sensitive invertebrates being less common where the CSHM was low) (see bold values in Table 8). Moreover, there was always a negative relationship between CSHM and percentage of developed land (where more of the catchment area of a site is developed, the CSHM was low).

These results are noteworthy in that they indicate the CSHM, like the other stream health measures, successfully captures aspects of stream health. Furthermore, the relationship is particularly noteworthy given MCI and SQMCI are based on measures of stream invertebrates whereas the CSHM evaluates stream health from a Māori perspective, based on a combination of catchment, river margin and in-stream characteristics.

### 3.4.5 Are the CSHMs from individual rivers interchangeable?

To compare the CSHMs of individual rivers, an independent measure is needed to which they all relate. As indicated in Section 3.3, MCI, SQMCI and percentage of developed land within the catchment have been shown to be significantly related to individual CSHMs (values in bold in Table 8). The other cells in Table 8 show what happens when the set of indicators used to calculate the CSHM in one river (eg Hakatere) are applied to the dataset from another case (eg the Taieri/Kakaunui – column 2 of row 1). In this case, even using the Hakatere CSHM indicator set, the new CSHMs for sites on the Taieri/Kakaunui are still very strongly correlated with MCI, SQMCI and percentage of developed land in the catchment. The same pattern is seen in every case (although relationships with percentage of developed land are less obvious when Tukituki data are involved).

The general conclusion is obvious and important: the precise set of indicators used in the CSHM is not critical to the assessment of river health. Indeed, when the combined CSHM is used to recalculate health in all sites in each river, there remain highly significant correlations with MCI (0.54***), SQMCI (0.54***) and percentage of developed land –0.44***). Accordingly, cultural stream health can be assessed using a generic group of indicators rather than different sets of indicators for individual rivers.

**Table 8: Correlations of CSHMS with MCI, SQMCI and percentage of developed land, in all possible combinations of river data sets**

| | **Regression CSHMs from ...** Taieri/Kakaunui Rivers | Hakatere River (= Ashburton R.) | Tukituki River |
|---|---|---|---|
| **Data from ...** Taieri/Kakaunui Rivers | **MCI: 0.58*****<br>**SQMCI: 0.50****<br>**% developed land: -0.42**** | MCI: 0.54***<br>SQMCI: 0.51***<br>% developed land: -0.35* | MCI: 0.53***<br>SQMCI: 0.49**<br>% developed land: -0.45** |
| Hakatere River (= Ashburton R.) | MCI: 0.40*<br>SQMCI: 0.44*<br>% developed land: -0.45* | **MCI: 0.40***<br>**SQMCI: 0.49****<br>**% developed land: -0.53**** | MCI: 0.40*<br>SQMCI: 0.46**<br>% developed land: -0.45* |
| Tukituki River | MCI: 0.66***<br>SQMCI: 0.60**<br>% developed land: -0.37* | MCI: 0.68***<br>SQMCI: 0.58**<br>% developed land: -0.29 (not significant) | **MCI: 0.66*****<br>**SQMCI: 0.73*****<br>**% developed land: -0.59**** |

*** < 0.001 p value – very highly significant

** < 0.01 p value – highly significant

* <0.05 p value – significant

### Features of the analysis using all river data sets combined

- The combined data sets show strong correlations between overall stream health and mahinga kai cultural activities, further reinforcing the interpretation that these indicators are functionally equivalent to overall stream health (Table 5).
- Correlations between overall stream health and influential indicators reinforce the conclusion of a consistently important set of contributors to overall stream health revealed for each river (Table 6). The final choice of indicators must also take into account whether each can be assessed consistently.
- The multiple regression analysis further highlights water quality, riparian vegetation, flow and riverbed condition/sediment as major contributors to stream health (Table 7).
- Correlations between the combined CSHM and MCI, SQMCI and percentage of developed land in the catchment are all highly significant. This is an important result given the cultural stream health measure is based on cultural perceptions of aspects of the entire catchment whereas the established indicators are based on the macroinvertebrates inhabiting a stream site – very different measures.

## 3.4.6 A generic cultural stream health measure

We have considered using the combined CSHM, calculated according to the results of multiple regression analysis, as a generic CSHM for use in any river by any rūnanga or iwi. However, given the consistency in patterns among indicators that correlate with overall stream health, we recognised there is considerable leeway in defining a generic CSHM. Accordingly, we decided not to restrict our generic CSHM to only the four indicators from the combined analysis in Table 7. Instead, we selected eight of the indicators shown in Table 6. Three were not included for the following reasons:

- 'riverbank condition' was not sufficiently highly correlated with overall stream health to be included
- 'indigenous plant species' was highly correlated with riparian vegetation and the latter indicator was more highly correlated with overall stream health
- 'use of the river (takes and discharges)' was not included because of difficulties experienced by rūnanga members when evaluating the indicator. Whereas the indicator referred to takes and discharges that could be seen, local knowledge could influence the rating.

As different rivers were added in the course of the study, the definition of flow was refined but never satisfactorily reflected the aspect of stream health being sought. Variation in flow was a way of describing variability in stream habitats (slow to fast water, still to white water, pools, runs and rapids). Finally, in the Tukituki study, 'variety of habitats present' was added as a more satisfactory indicator and demonstrated a correlation of 0.75 with overall stream health. Accordingly, flow (visible) is replaced by variety of habitats in the generic CSHM.

With these adjustments, the generic CSHM is made up of the indicators listed in Table 9. The generic CSHM thus combines evaluations of eight indicators that cover catchment, riparian and in-stream factors. That a measure of cultural stream health is made up of indicators from the top of the catchment down to and into the river reflects the holistic ki uta ki tai (mountains to the sea) philosophy that is fundamental to tangata whenua kaitiakitanga.

**Table 9: Indicators selected for the generic CSHM**

| Contributing indicators | Correlations |
|---|---|
| Water quality | 0.73 |
| Variety of habitats | 0.73 |
| Catchment land use | 0.65 |
| Riparian vegetation | 0.65 |
| Use of the riparian margin | 0.64 |
| Riverbed condition/sediment | 0.62 |
| Water clarity | 0.59 |
| Channel modification | 0.49 |

Note: Correlations with overall stream health in the combined datasets are indicated.

# 4 Engagement with Māori Values

## 4.1 Responsiveness to Māori values

Throughout the study, our intention was to develop an evaluative tool that was grounded in the beliefs and values of Māori. Before concluding this report it is necessary to reflect, firstly, upon how the index recognises and provides for Māori values described in Section 2 and the indicators identified during Stage 1. Each of the Māori values from Section 2 is listed below, and the extent to which the design of the Cultural Health Index and/or the process by which tangata whenua apply the Cultural Health Index in their takiwa recognises and responds to that particular value, is explained.[2]

**Whakapapa:** the Cultural Health Index uses traditional knowledge (without disclosing it) and recognises interactions between, and the significance of, different parts of an ecosystem (e.g. relationship between physical characteristics and the mahinga kai species present, or between individual physical characteristics of a waterbody such as water flow, water quality catchment and riparian condition).

**Mauri:** the three components of the Cultural Health Index collectively represent a means by which Māori will measure the present health of the river in a holistic manner, thus enabling them to assess the extent to which contemporary resource management protects the mauri of the resource.

**Wahi tapu and wahi taonga:** sites that are assessed will be chosen by those individuals mandated as kaitiaki because the sites are significant due to their tapu or taonga status.

**Rangatiratanga:** application of the Cultural Health Index by tangata whenua and use of the data collected formally recognises the rights of iwi to land, water and other natural resources within their tribal areas – including rights to access, use and manage resources.

**Mahinga kai:** the mahinga kai measure reflects the need to protect the diversity and abundance of species necessary for the cultural well-being of tangata whenua as well as the need to safeguard the ability of tangata whenua to gather and use these resources, thus enabling the transference of cultural values and practices between generations.

**Taonga**: the three components of the Cultural Health Index collectively recognise the intrinsic and the amenity values of resources and the fundamental management principle – protection of the mauri of taonga.

**Kaitiaki:** when applying the Cultural Health Index, Māori will be fulfilling their intergenerational responsibilities to protect taonga for future generations.

**Tikanga Māori:** the three components of the Cultural Health Index comprise indicators that Māori have confirmed are those used by Māori to monitor the state of freshwater resources.

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[2] This is based on the framework presented by Crengle which appears in Tipa, Crengle, Davis, Allingham and Symon (2002) *Cultural Impact Assessment – Project Aqua.*

## 4.2 Responsiveness of the CHI to indicators from stage 1

**Table 10: Description of how the indicators are addressed in the final CHI**

| Indicators from Stage 1 | Response |
|---|---|
| **Place names*** | This is addressed during design of the CHI study – traditional sites with place names of significance can be chosen |
| Greasiness of water | Dropped as difficult to replicate |
| Temperature of water | Temperature is not measured as part of the CHI |
| Smell | Dropped as difficult to replicate |
| Unpleasant odours | Dropped as difficult to replicate |
| **Presence of riffles** | |
| Sound of winds in riparian vegetation | Dropped as difficult to replicate |
| Sound of birds being present | Dropped as difficult to replicate |
| Sound of current of waterway | Dropped as difficult to replicate |
| Sound of flood flows | Dropped as difficult to replicate |
| **Flow in river visible** | Is addressed by one of the eight indicators in component 3 |
| **Riparian vegetation – overhang** | Is addressed:<br>• by one of the eight indicators in component 3 (riparian vegetation)<br>• by identifying any mahinga kai plant species present as part of component 2 |
| **Riparian vegetation in headwaters** | Is addressed:<br>• during site selection by choosing sites in the headwaters to assess<br>• by one of the eight indicators in component 3<br>• by identifying any mahinga kai plant species present as part of component 2 |
| **Presence or absence of activities in the headwaters** | Is addressed:<br>• during site selection by choosing sites in the headwaters to assess<br>• by one of the eight indicators in component 3 |
| **Colour** | Is addressed by two of the eight indicators in component 3 |
| **Presence or absence of sediment on the riverbed** | Is addressed by one of the eight indicators in component 3 |
| **Continuity of vegetation – from land, through riparian zone, to the waterway** | Is addressed by one of the eight indicators in component 3 |
| **Unnatural growths** | Is addressed by one of the eight indicators in component 3 |
| **Foams, oils and other human pollution** | Is addressed by one of the eight indicators in component 3 |
| **Flood flows** | Is addressed by one of the eight indicators in component 3 |
| **Willow infestation** | Is addressed by one of the eight indicators in component 3 |
| **Abundance and diversity of fish species** | Is addressed by inclusion of component 2* |
| **Abundance and diversity of birdlife** | Is addressed by inclusion of component 2 |

| Indicators from Stage 1 | Response |
|---|---|
| **Presence or absence of stock in the riparian margin and waterway** | Is addressed by one of the eight indicators in component 3 |
| **Changes to the river mouth** | This is addressed during design of the CHI study – sites at the river mouth can be chosen |
| **Unnatural sedimentation in channels** | Is addressed by one of the eight indicators in component 3 |
| Loss of aquatic vegetation in the marine environment | Not measured as part of the CHI |
| **The health of fish found in the waterway** | Is addressed by components 1 and 2 |
| The stomp test | Dropped as difficult to replicate |
| Changes to the extent of the tidal influence | This is not measured as part of the CHI however the mahinga kai species present will give an indication of whether the waters are saline, brackish or fresh. |

* Indicators from Stage 1 that are incorporated in the CHI are marked in bold.

Issues that are still to be resolved include: whether these values are formally or informally acknowledged in the Cultural Health Index; whether resource management agencies will recognise these Māori values; and, if adopted, will resource management agencies fully appreciate their relevance and give them appropriate weighting along with 'scientific' values?

A further issue concerns how a Māori perspective in freshwater management is to be acknowledged. Collaborative management is seen by Māori as a means of recognising *different* perspectives and benefiting from the *complementarity* of different value systems. Collaborative management is not about merging values systems (Davis, personal communication). While Stage 1 of the Taieri River Environmental Performance Indicator (EPI) project was initiated and managed by Ngāi Tahu, Stage 2 saw two perspectives, 'indigenous – cultural' and 'western science', working together to develop an index, using the indicators that Māori had identified. In effect, the Cultural Health Index provides an opportunity to extend the relationship between Māori and resource management agencies beyond the confined processes of New Zealand's resource laws.

Another significant consideration relating to the values of prospective partners concerns the value of knowledge. The Ministry's EPI programme was based on the premise that it is important to establish an environmental baseline so that changes and trends can be monitored over time. The intergenerational knowledge of Māori is a taonga (treasure) and its value to resource management has not been fully realised. The design of the CHI has found a way to use traditional information while protecting its sensitivity thus potentially enabling a 'baseline' that uses data from earlier periods, even as far back as the nineteenth century, to be established.

And finally there is the issue of environmental outcomes. Māori are likely to commit to a collaborative process if they are assured that collaboration will achieve the outcomes they seek. Because the project is only at the stage where a 'tool' to assist assessment and data collection has been developed, the process has not progressed to the point where it is possible to provide resource management agencies with hard evidence that the use of the Cultural Health Index will result in positive environmental outcomes.

## 4.3 Facilitating increased responsiveness by resource managers

Within contemporary New Zealand society, the Treaty is viewed as the cornerstone, having the potential to be enabling (Broad, personal communication). In advocating an increased level of participation and support for initiatives such as the Cultural Health Index, Ngāi Tahu would inevitably use the Treaty of Waitangi and the principles of the Treaty to support its argument.

The role of the Waitangi Tribunal is the second aspect that needs to be analysed when considering the future of the Cultural Health Index. The Waitangi Tribunal has considered a range of issues that different iwi, including Ngāi Tahu, have raised as part of claims before it. These relate to changes that have affected both the health of freshwater resources within tribal territories and tribal associations with these resources. As a result, a series of Treaty principles specific to freshwater can be found in the decisions of the Tribunal.[3] For example:

- The Waitangi Tribunal has stated that the discharge of effluent or human waste is an affront to traditional Māori concepts and it is irrelevant to argue that it has been treated to a high, scientifically-defined standard before it has been discharged into rivers. Non-Māori, in particular those who share the use of freshwater and those who are charged with its protection, need to be aware of the mental and spiritual values held by Māori in relation to water and the resources it supports (Motunui-Waitara Report 1989).
- The Waitangi Tribunal also affirms that environmental consultation with iwi is a significant aspect of the partnership duty under the Treaty (Ngāi Tahu Report 1991).
- The Waitangi Tribunal has determined that the Māori concept of waterways is holistic and the rights that stem from the exercise of rangatiratanga over such resources will reflect this holistic perspective. The taonga value of freshwater encompasses the water itself, the resources within the waterbody and its supporting environs. Rangatiratanga with respect to water may include developmental interests (Te Ika Whenua Report 1998).
- The Waitangi Tribunal has stated that the spiritual and cultural significance of a freshwater resource to Māori can only be determined by the tangata whenua who have traditional rights over the river (Kaituna Report 1984).

These principles recognise cultural values and practices that Māori have promoted for decades and which they have struggled to have recognised by resource management agencies. 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.

[3] See Crengle (1993), Crengle in Ministry for the Environment (1997) and Tipa, Crengle, Davis, Allingham, Symon (2002).

Enunciating resource-specific Treaty principles, in theory, advances the case of Māori seeking either participation as a partner in a collaborative management system or at least the incorporation of their perspective in resource management. The identification of indicators and the development of the Cultural Health Index were necessary because statements of principle, by themselves, do not identify the changes in resource management practice that are required to ensure the practical application of these principles. Instead of providing clear direction for resource management agencies, the Waitangi Tribunal has imposed obligations without indicating how in a practical sense these obligations are to be met. The next step, to identify how the Treaty principles apply to specific resource management functions and activities, creates an immediate need for tools such as the Cultural Health Index and the formulation of appropriate processes to engage Māori.

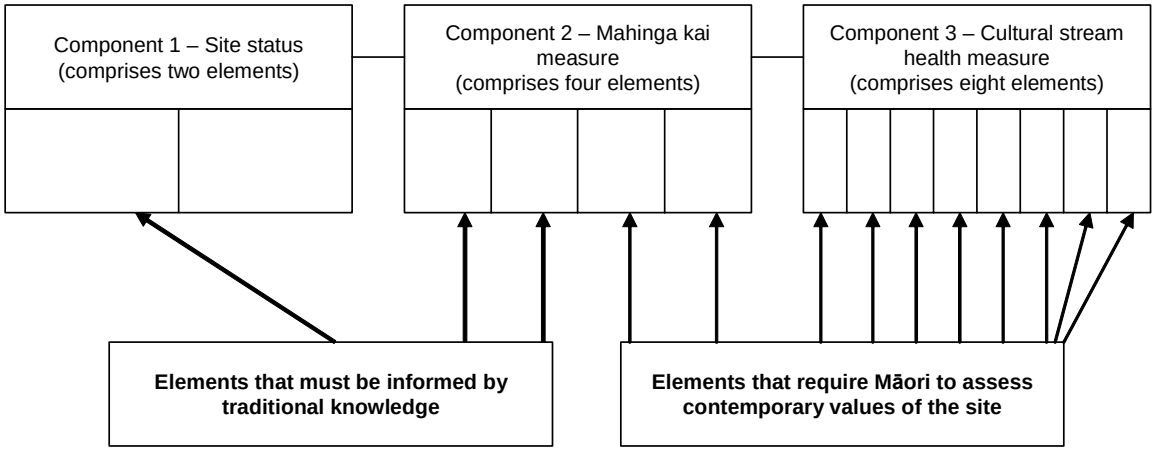
With respect to freshwater management, a Treaty principle states that the spiritual and cultural significance of a freshwater resource can only be determined by the tangata whenua who have traditional rights over the river (Waitangi Tribunal, Kaituna Report). This principle clearly supports the participation of Māori and the application of tools such as the Cultural Health Index, a mechanism that enables Māori to assess the health of sites of significance using an evaluative tool grounded in the beliefs and values of Māori [and affirmed by scientific measurements].

## 4.4 Customary interests in freshwater

If the Cultural Health Index is to fully accommodate cultural values, it should also be cognisant of customary and Treaty rights. A rights-based approach is likely to be fundamental to tangata whenua interests in using the Cultural Health Index in working relationships with resource management agencies. From discussions with key informants, the property interests that Ngāi Tahu want to protect are the rights to manage, access and use resources of significance to them.

With respect to the right to manage, the Cultural Health Index project recognises the need for tools that enable Māori to exercise their right to manage natural resources significant to them. When designing the Cultural Health Index, a conscious decision to incorporate traditional knowledge was made. As a consequence, Māori, as kaitiaki, must apply the index and use their traditional knowledge to inform future assessments. If the support of resource management agencies is obtained, the Cultural Health Index is applied by Māori, and the resultant data used to inform decision-making, the project team will have achieved, in part, its goal of enabling Māori to exercise their right to manage.

**Figure 2: Recognising the right to manage: elements of the Cultural Health Index that must be assessed by Māori**




The ability of Māori to access and use resources is recognised in the design of the Cultural Health Index and, as a result, data are collected about access and use rights. Step 1 of the Cultural Stream Health Index requires Māori to respond to the question: *would you visit and use this site in the future?* This, together with questions relating to mahinga kai, enables an immediate assessment of the ability of the site to sustain cultural usage.

Finally, through the application of the Cultural Health Index, resource management agencies will be able to collect data that can facilitate Māori exercise of those rights. However, the fragmentation of property interests poses practical difficulties. As Davis (personal communication) points outs, "Where do we run the argument?". In other words, which organisation should Māori be targeting as a prospective partner and thus advocating the use of the Cultural Health Index? Davis also expressed concern that there is a reluctance by resource management agencies to recognise rights or even use that terminology because of their perception that rights only means ownership rights (Davis, personal communication). The failure of agencies to recognise that rights encompass not just the right to own but also to manage, access and use resources is seen as a potential barrier to effective collaboration with Māori and more effective resource management practice.

It is acknowledged that local authorities face a challenge in meaningfully including Māori values, satisfying expectations and meeting their obligations under the Resource Management Act in the absence of knowledge, tools and processes that provide them with access to a Māori perspective. Without these, resource managers will have trouble incorporating Māori values in the planning and application of environmental management and working in partnership with the iwi and hapū who share a responsibility for the areas in question. The Cultural Health Index is a tool that supports the meaningful inclusion of Māori values in the management of freshwater stream health. Ideally, the index will thus support both tangata whenua and council management of the streams and waterways in their areas.

# 5 Conclusion

The Cultural Health Index (CHI) for rivers and streams is a tool that has been developed to facilitate the participation of iwi in resource management processes, specifically the management of streams and rivers. It was funded by the Ministry for the Environment as part of its Environmental Performance Indicator (EPI) Programme – a programme that has since ended. This developmental work arose in recognition by both Ngāi Tahu and the Ministry for the Environment that limited attention had been paid to the incorporation of Māori values in river management. In addition to incorporating Māori values in river management, the index provides a potentially powerful diagnostic tool which can assist in the prioritisation of remedial actions once issues of concern to iwi are identified. The data gathered from field assessments as the CHI is applied will be used to identify areas of possible concern.

Three stages were completed in the development of the CHI:

- the first stage of the work documented the association of Ngāi Tahu with the Taieri River catchment and identified a sizeable set of indicators that Ngāi Tahu use to assess the health of freshwater resources (Tipa 1999)
- in Stage 2 the indicators of cultural health and mahinga kai were refined to develop a tool and a process that could be used by kaitiaki to assess the condition of freshwater resources. This work focused on the Taieri and Kakaunui catchments (single-channel, rain-fed rivers) and involved Te Rūnanga o Moeraki and Te Rūnanga Otakou. The stream CHI was thus devised and first used in 2002 (Tipa and Teirney 2003). It has three components:
  - site status, specifically the significance of the site to Māori
  - a mahinga kai measure
  - a stream health measure.
- Stage 3 recognised the need to validate the CHI to determine whether the tool could be implemented more widely. This involved the application of the process to another river type in the rohe of Ngāi Tahu (the braided Hakatere [Ashburton] River) and also involved a river similar to the Taieri and Kakaunui (the Tukituki) but in the rohe of another iwi (Ngāti Kahungunu).

In total, four catchment studies were completed on the Taieri, Kakaunui, Hakatere (Ashburton) and Tukituki Rivers. From the data collected, a Cultural Health Index was developed that is generic in the sense that it can be used confidently by any iwi at sites in streams of any size or river type.

The index allows whānau/hapū/iwi to monitor the health of a stream or catchment of their choosing. Guidelines have been prepared that outline how to identify which areas need monitoring, how to set the programme up and how to collect data and analyse it so that changes are identified and remedial actions can be taken to restore or enhance the site. The CHI can also be used to monitor changes after restorative work has been carried out on a site.

# Glossary

| | |
|---|---|
| hapū | sub-tribe, extended whānau |
| iwi | tribe |
| iwi authority | the authority that represents an iwi and which is recognised by that iwi as having authority to do so |
| kaitiakitanga | the exercise of guardianship |
| kaumātua | a respected elder within the tribe |
| ki uta ki tai | from the mountains to the sea |
| mahinga kai | food and other resources and the areas from which they are sourced |
| manawhenua | those who hold rangatiratanga for a particular area or district |
| mauri | the essential life force or principle; a metaphysical quality inherent in all things, both animate and inanimate |
| Ngāi Tahu | South Island tribe |
| Ngāti Kahungunu | North Island east coast tribe |
| papatipu rūnanga | traditional rūnanga (the First Schedule of Te Rūnanga o Ngāi Tahu Act 1996 lists the 18 Papatipu Rūnanga of Ngāi Tahu Whānui and their respective takiwā) |
| rangatiratanga | chiefly authority |
| rohe | area |
| rūnanga | local representative groups or community system of organisation |
| takiwā | area, region, district |
| tangata whenua | the iwi or hapū that holds manawhenua in a particular area |
| taonga | all things highly prized including treasures, property, a resource or resources or even a person |
| tapu | sacred |
| waahi tapu | sacred places |
| whānau | family |

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### Some of the individuals interviewed

| | | |
|---|---|---|
| K Davis | J Ellison | T Broad |
| DJ Tipa | I Williams | G Thomas |
| D Thomas | W Loper | R McCallum |

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Professor Colin Townsend
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Chris Arbuckle
Christoph Matthaei

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Jenny Mauger undertook interviews with whānau living in the Tukituki catchment and whānau who whakapapa to the Tukituki. Jenny also coordinated the fieldwork.

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Te Rūnanga Otakou
Te Rūnanga o Moeraki
Te Rūnanga o Arowhenua
Members from Ngāti Kahungunu

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# Appendix 1: Recording Form Used to Assess Sites in the Taieri, Kakaunui and Hakatere Catchments

**CULTURAL STREAM HEALTH ASSESSMENT – SITE NO: DATE:**

| INDICATORS | UNHEALTHY | | | | HEALTHY |
|---|---|---|---|---|---|
| 1 Catchment land use | 1. Land heavily modified | 2 | 3 | 4 | 5. Appears unmodified |
| 2. Riverbank condition | 1. Banks eroding | 2 | 3 | 4 | 5. Banks appear stable |
| 3. Vegetation – banks & margins (100m either side) | 1. Little or no vegetation | 2 | 3 | 4 | 5. Complete cover of vegetation |
| 4. Indigenous (native) species - margins & adjacent land | 1. All exotic (no natives) | 2 | 3 | 4 | 5. All indigenous (native) |
| 5. Use of the river banks + margins (100m either side) | 1. Margins heavily modified | 2 | 3 | 4 | 5. Margins unmodified |
| 6. Riverbed condition (sediment) | 1. Covered by mud/sand | 2 | 3 | 4 | 5. Clear of mud/sand |
| 7. Changes to river channel | 1. Evidence of modification eg stopbanks, straightening, gravel removal, vegetation in river channel | 2 | 3 | 4 | 5. Appears unmodified |
| 8. River flow | 1. Cannot see movement | 2 | 3 | 4 | 5. Broken/white water |
| 9. Water quality eg foams, oils etc | 1. Appears polluted | 2 | 3 | 4 | 5. No pollution evident |

| | | | | | |
|---|---|---|---|---|---|
| 10. Water Clarity | 1. Water badly discoloured | 2 | 3 | 4 | 5. Water is clear |
| 11. Use of the river | 1. Major takes/discharges | 2 | 3 | 4 | 5. No takes or discharges |

12. What other indicators do you use to assess the health of a braided river that are not listed above?_____

_____

**How safe would you feel tasting the water at this site?**

| | | | | |
|---|---|---|---|---|
| 1. Completely unsafe | 2 | 3 | 4. | 5. Completely safe |

**Would you gather mahinga kai at this site?**

| | | | | |
|---|---|---|---|---|
| 1. No, gathering at this site | 2. | 3. | 4. | 5. Yes, definitely gather kai |

**How safe would you feel eating fish caught at this site?**

| | | | | |
|---|---|---|---|---|
| 1. Completely unsafe | 2 | 3 | 4. | 5. Completely safe |

**How would you describe the overall health of the river at this site?**

| | | | | |
|---|---|---|---|---|
| 1. Very unhealthy | 2 | 3 | 4. | 5. Very healthy |

Please explain your answer_____

_____

_____

**BIRDS**

**Please list the mahinga kai bird species that you can see at this site**

1._____ 2._____ 3._____

4._____ 5._____ 6._____

7._____ 8._____ 9._____

**PLANTS**

**Please list the mahinga kai plant species that you can see at this site.**

1._____ 2._____ 3._____

4._____ 5._____ 6._____

7._____ 8._____ 9._____

**ACCESS**

**Do you consider access to this site is sufficient to harvest mahinga kai?**

1. Not able to harvest at this site 2. 3. 4. 5. Able to harvest - no restrictions

Please explain your answer_____

_____

**Would you return to this site in the future?**

1. YES 5. NO.

**FINAL COMMENTS**

**What characteristics of this site should be protected?**_____

_____

**What characteristics of this site should be enhanced?**_____

_____

# Appendix 2: Recording Form Used to Assess Sites in the Tukituki Catchment

**CULTURAL HEALTH OF STREAMS ASSESSMENT – Site No: Date: Observer No:**

| INDICATORS | UNHEALTHY | | | | HEALTHY |
|---|---|---|---|---|---|
| 1 Catchment land use | 1. Land heavily modified Wetlands, marshes lost | 2 | 3 | 4 | 5. Appears unmodified |
| 2. Riverbank condition | 1. Banks eroding | 2 | 3 | 4 | 5. Banks appear stable |
| 3. Vegetation – banks & margins (100m either side) | 1. Little or no vegetation | 2 | 3 | 4 | 5. Complete cover of Vegetation |
| 4. Indigenous (native) species – margins & upstream catchment | 1. Only exotic species visible (no natives) | 2 | 3 | 4 | 5. All indigenous (native) species visible |
| 5. Use of the river banks + margins (100m either side) | 1. Margins heavily modified | 2 | 3 | 4 | 5. Margins unmodified |
| 6. Riverbed condition (sediment) | 1. Covered by mud/sand slime, weed | 2 | 3 | 4 | 5. Clear of mud/sand/sediment/weed |
| 7. Changes to river channel | 1. Evidence of modification eg stopbanks, straightening, gravel removal, shingle build up | 2 | 3 | 4 | 5. Appears unmodified |
| 8. River flow | 1. Cannot see movement | 2 | 3 | 4 | 5. Broken / white water |
| 9. Water quality | 1. Appears polluted eg foams, oils slime, weeds etc | 2 | 3 | 4 | 5. No pollution evident |
| 10. Water Clarity | 1. Water badly discoloured | 2 | 3 | 4 | 5. Water is clear |

| | | | | | |
|---|---|---|---|---|---|
| 11. Use of the river | 1. Major takes/discharges | 2 | 3 | 4 | 5. No takes or discharges |
| 12. A variety of habitats | 1. No variety in habitat flow and habitat uniform | 2 | 3 | 4 | 5. A range of habitats present - channel winding, flows from smooth to broken white water. |

**13. How safe would you feel tasting the water at this site?**

1. Completely unsafe 2 3 4. 5. Completely safe

**14. How safe would you feel swimming at this site?**

1. Completely unsafe 2 3 4. 5. Completely safe

Please explain your answer _____

15. **How would you feel about fishing at this site?**

1. I would not fish here 2 3 4. 5. This is a great place to fish

Please explain your answer _____

**16. How safe would you feel eating fish caught at this site?**

1. Completely unsafe 2 3 4. 5. Completely safe

**17. When you look at this site, do you see the necessary food sources to support the life in and around the river?**

1. No food sources present 2 3 4. 5. Abundant food source

Please explain your answer _____

**18. How would you describe the overall health of the river at this site?**

1. Very unhealthy 2 3 4. 5. Very healthy

Please explain your answer_____

_____

_____

**BIRDS**

Please list the mahinga kai bird species that you can see at this site.

1._____ 2._____ 3._____

4._____ 5._____ 6._____

7._____ 8._____ 9._____

**PLANTS**

Please list the mahinga kai plant species that you can see at this site.

1._____ 2._____ 3._____

4._____ 5._____ 6._____

7._____ 8._____ 9._____

**ACCESS**

**Do you consider access to this site is sufficient to harvest mahinga kai?**

1. Not able to gather at this site 2. 3. 4. 5. Able to gather – no restrictions

Please explain your answer_____

_____

**Would you return to this site in the future?**

1. YES 5. NO.

**FINAL COMMENTS**

**What other indicators do you use to assess the health of the Tukituki that are not listed above?**_____

_____

**What characteristics of this site should be protected?**_____

_____

**What characteristics of this site should be enhanced**?_____

_____

# Appendix 3: Table Used to Assign the 1–5 Scores for the Number of Species Present at a Site

**Table 1: Calculating the 1-5 Scores of the number of Mahinga Kai Species Present**

| Maximum 1 | Maximum 2 | Maximum 3 | Maximum 4 | Maximum 5 |
|---|---|---|---|---|
| 1 species scores 1 | 1 species scores 1<br>2 species scores 5 | 1 species scores 1<br>2 species scores 3<br>3 + species scores 5 | 1 species scores 1<br>2-3 species scores 3<br>4 + species scores 5 | 1 species scores 1<br>2 species scores 2<br>3 species scores 3<br>4 species scores 4<br>5 + species scores 5 |

| Maximum 6 | Maximum 7 | Maximum 8 | Maximum 9 | Maximum 10 |
|---|---|---|---|---|
| 1-2 species scores 1<br>3 species scores 2<br>4 species scores 3<br>5 species scores 4<br>6 species + scores 5 | 1-3 species scores 1<br>4 species scores 2<br>5 species scores 3<br>6 species scores 4<br>7+ species scores 5 | 1 species scores 1<br>2-3 species scores 2<br>4-5 species scores 3<br>6-7 species scores 4<br>8+ species scores 5 | 1-2 species scores 1<br>3-4 species scores 2<br>5-6 species scores 3<br>7-8 species scores 4<br>9+ species scores 5 | 1-2 species scores 1<br>3-4 species scores 2<br>5-6 species scores 3<br>7-8 species scores 4<br>9-10+ species scores 5 |

| Maximum 11 | Maximum 12 | Maximum 13 | Maximum 14 | Maximum 15 |
|---|---|---|---|---|
| 1-3 species scores 1<br>4-5 species scores 2<br>6-8 species scores 3<br>9-10 species scores 4<br>11+ species scores 5 | 1-4 species scores 1<br>5-7 species scores 2<br>8-9 species scores 3<br>10-11 species scores 4<br>12 species scores 5 | 1-2 species scores 1<br>3-4 species scores 2<br>5-8 species scores 3<br>9-11 species scores 4<br>12,13+ species scores 5 | 1-3 species scores 1<br>4-5 species scores 2<br>6-8 species scores 3<br>9-12 species scores 4<br>13,14+ species scores 5 | 1-3 species scores 1<br>4-7 species scores 2<br>8-10 species scores 3<br>11-14 species scores 4<br>15+ species scores 5 |
| **Maximum 16** | **Maximum 17** | **Maximum 18** | **Maximum 19** | **Maximum 20** |
| 1-4 species scores 1<br>5-7 species scores 2<br>8-10 species scores 3<br>11-15 species scores 4<br>16+ species scores 5 | 1 -5 species scores 1<br>6-8 species scores 2<br>9-11 species scores 3<br>12-15 species scores 4<br>16,17+ species scores 5 | 1-4 species scores 1<br>5-8 species scores 2<br>9-2 species scores 3<br>13-16 species scores 4<br>17,18+ species scores 5 | 1- 4 species scores 1<br>5-7 species scores 2<br>8-11 species scores 3<br>12-17 species scores 4<br>18,19+ species scores 5 | 1-5 species scores 1<br>6-10 species scores 2<br>11-15 species scores 3<br>16-19 species scores 4<br>20+ species scores 5 |

# Appendix 4: Final Recording Form Used to Assess Sites in any Catchment

| CULTURAL STREAM HEALTH ASSESSMENT | Date: | Site no: | | | |
|---|---|---|---|---|---|
| **INDICATORS** | **UNHEALTHY** | | | | **HEALTHY** |
| 1 Catchment land use | 1. Land heavily modified Wetlands, marshes lost | 2 | 3 | 4 | 5. Appears unmodified |
| 2 Vegetation – banks & margins (100m either side) | 1. Little or no vegetation -– neither exotic or indigenous | 2 | 3 | 4 | 5. Complete cover of vegetation – mostly indigenous |
| 3. Use of the river banks + margins (100m either side) | 1. Margins heavily modified | 2 | 3 | 4 | 5. Margins unmodified |
| 4. Riverbed condition (sediment) | 1. Covered by mud/sand slime, weed | 2 | 3 | 4 | 5. Clear of mud/sand/sediment/weed |
| 5. Changes to river channel | 1. Evidence of modification eg stopbanks, straightening, gravel removal, shingle build up | 2 | 3 | 4 | 5. Appears unmodified |
| 6. Water quality slime, weeds etc | 1. Appears polluted eg foams, oils | 2 | 3 | 4 | 5. No pollution evident |

| | | | | | |
|---|---|---|---|---|---|
| 7. Water Clarity | 1. Water badly discoloured | 2 | 3 | 4 | 5. Water is clear |
| 8. A variety of habitats | 1. Little or no current, Uniform depth and limited Variety of flow-related habitats . | 2 | 3 | 4 | 5 Current and depth varies creating a variety of different flow-related habitats |

**9. How would you describe the overall health of the river at this site?**

1. Very unhealthy 2 3 4. 5. Very healthy

Please explain your answer_____

_____

_____

**BIRDS: Please list the mahinga kai bird species that you can see at this site**

1._____2._____3._____ 4._____

5._____6._____7._____8._____

**PLANTS: Please list the mahinga kai plant species that you can see at this site**

1._____2._____3._____4._____

5._____6._____7._____8._____

**10. ACCESS: Do you consider access to this site is sufficient to harvest mahinga kai?**

1. Not able to gather at this site 2. 3. 4. 5. Able to gather – no restrictions

Please explain your answer _____

_____

**11. Would you return to this site in the future?**

1. YES 5. NO.

**12. At the beginning of this trip, how did you feel?**

Very unhappy/discont.d Fairly unhappy/discont.d Neutral Fairly happy/cont.d Very happy/contented

**13. How do you feel at this particular site, now?**

Very unhappy/discont.d Fairly unhappy/discont.d Neutral Fairly happy/cont.d Very happy/contented

**14. Have you ever visited this site before**? Yes/No

If yes, how long ago _____

If yes, what did you do here _____

_____

**15. Have you heard of this site/area before today?** Yes/No

If yes, what have you heard about _____

_____

**If yes, from what sources:**

| | | |
|---|---|---|
| whanau | manuscripts/archives | recent Ngai Tahu publications |
| other written sources | other hikoi | other sources (please name) |

**5. How important/significant do you think this site is for:**

| | | | | | |
|---|---|---|---|---|---|
| Self | None | Little | Some | Very | No opinion |
| Whanau | None | Little | Some | Very | No opinion |
| Hapu | None | Little | Some | Very | No opinion |

**Why have you rated the site this way (write brief comments)**

**6. Would you bring whānau here again** **Yes/No**

Why or why not? (write brief comments)

---

---

---

**7. Is there anything about this site that limits or stops you enjoying this site?** Yes/No

Please explain your comment (write brief comments)

---

---

---

Are there any of these questions you think we shouldn't ask people? Are there any other questions you think we should ask?

Are there any other changes you suggest we make?

# Appendix 5: Examples of Site Assessments Completed in the Four Catchment Studies

## Taieri Catchment

### Site 1 – McRaes Creek (B-1 / 2.69 / 4.87)

The assessment confirmed that:

- This is not a traditional site
- Despite this, rūnanga members would return to the site.
- Its mahinga kai values are only average:
  - It receives an average score for access. It is accessible, although it involves a significant walk.
  - There is a reasonable range of mahinga kai species present, especially plants. However, this is a small tributary and there are not many fish species present.
  - This is not a traditional site and therefore species sourced traditionally cannot be compared with those present today. Accordingly, a 1 was assigned to this part of the mahinga kai component.
  - It scores highly because rūnanga members would return to the site.
- It scores very highly for component 3 stream health, in fact McRaes Creek received the highest ratings of all 46 sites:
  - Catchment 4.6
  - Modification 4.75
  - Riparian 5
  - Flow visible 5
  - Water quality 5

  The slightly lower score for "catchment" reflects the presence of some exotic species within a native catchment. The score for modification reflects the presence of a track through the watercourse that is used by mountain bikes and motorbikes.

### Site 6 – Barbours Stream (B-0/ 1.3/ 3.02)

The assessment confirmed that:

- This is not a traditional site.
- Because of the degraded condition of the site, rūnanga members would not return to the site.
- Its mahinga kai values are poor:
  - It scores poorly for access. It was be difficult for rūnanga members to find this site without assistance.
  - Mahinga kai species were absent.
  - This is not a traditional site and therefore species sourced traditionally cannot be compared with those present today. Accordingly, a 1 was assigned to this part of the mahinga kai component.
  - It only scores 1 because rūnanga members would not return to the site.

- It received an average score for stream health:
  - Catchment 2.5
  - Modification 2.6
  - Riparian 1
  - Flow visible 5
  - Water quality 4

  The low scores for "catchment, modification and riparian" were due to this site being heavily modified by stock. In particular, the riparian was considered to be in poor condition. Despite this, a flow is visible in the river and the water quality appears to be high possibly because of the tussock in the catchment.

**Site 11 – Owhiro Creek (A-0/ 1.75/ 1.65)**

The assessment confirmed that:

- This is a traditional site.
- Rūnanga members would not return to the site.
- Its mahinga kai values are low:
  - It receives a high score for access.
  - Because the site is so modified, there is an absence of mahinga kai species, aside from eel.
  - It scores highly because it is traditionally a significant site for eels and these are still present.
  - It scores poorly because rūnanga members would not return to the site.
- It scores poorly for stream health, in fact it was one of the two poorest scoring sites for this component:
  - Catchment 1
  - Modification 1
  - Riparian 1
  - Flow visible 4
  - Water quality 1.25

  All scores apart from a visible flow are very low.

## Kakaunui Catchment

**Site 38 – Island Stream – Maheno (A-0/ 2.56/ 1.06)**

The assessment confirmed that:

- This is a traditional site.
- Rūnanga members would not return to the site.
- Its mahinga kai values are only average:
  - It receives a high score for access. It is easily accessible.
  - There is a limited range of mahinga kai species present.

  - It scores highly because it was a significant eel fishery and has the highest density of eels within either of the two catchments.
  - It scores poorly because rūnanga members would not return to the site.
- It scores highly for stream health:
  - Catchment 1
  - Modification 1.3
  - Riparian 1
  - Flow visible 1
  - Water quality 1

  The consistently low scores for each of the indicators confirm the poor health of this site, the worst of the 46 study sites.

## Hakatere Catchment

### Site 1 – Gentleman Smith – A-1 / 4.25 / 3.80

The assessment confirmed that:

- This is a traditional site.
- Because of the healthy condition of the site, rūnanga members would return to the site.
- Its mahinga kai values are very good:
  - It scores highly for access. It was be easy for rūnanga members to access this site without assistance.
  - A reasonable range of mahinga kai species were present.
  - This is a traditional site and all the species sourced traditionally are present today. Accordingly, a 5 was assigned to this part of the mahinga kai component.
  - It scores 5 because rūnanga members would not return to the site in the future.
- It received an average score for stream health:
  - Catchment 2.33
  - Modification 3.33
  - Clarity 4.66
  - Bed condition 4.5
  - Water quality 4.16

  Of the 30 sites assessed in the Hakatere, this site scored the highest for component 2 – mahinga kai values.

### Site 3 – Lambies Stream – B-0/ 2.0/ 3.13

The assessment confirmed that:

- This is not a traditional site.
- Rūnanga members would not return to the site.
- Its mahinga kai values are only average:
  - It receives an average score for access.
  - There is a limited range of mahinga kai species present.

  - This is not a traditional site and therefore species sourced traditionally cannot be compared with those present today. Accordingly, a 1 was assigned to this part of the mahinga kai component.
  - It scores poorly because the majority of rūnanga members would not return to the site.
- It receives average scores for stream health:
  - Catchment 2.3
  - Modification 3.66
  - Clarity 3.16
  - Bed condition 3.33
  - Water quality 3.16

**Site 9 – Bowers Stream (Sharplin Falls) – A-1/ 3.25/4.87**

The assessment confirmed that:

- This is a traditional site.
- Rūnanga members would return to the site.
- Its mahinga kai values are average:
  - It receives a high score for access.
  - Because the site is unmodified, there is a good range of mahinga kai species present.
  - It scores poorly because it was traditionally a significant site for eels and these are no eels present today.
  - It scores highly because rūnanga members would return to the site.
- It scores poorly for stream health, in fact it was one of the two poorest scoring sites for this component:
  - Catchment 4.5
  - Modification 5
  - Clarity 5
  - Bed condition 4.83
  - Water quality 5

  All scores are very high. Of the 30 sites assessed this received the highest score for component 3 – stream health.

## Tukituki Catchment

**Site 2 – Mangaomate Stream – B-1/2.72/3.75**

The assessment confirmed that:

- This is not a traditional site.
- Because of the healthy condition of the site, iwi members would return to the site.
- Its mahinga kai values are average:
  - It scores average for access. It would be easy for iwi members to access this site without assistance.
  - A reasonable range of mahinga kai species were present.

  - This is not traditional site and therefore scores 1 for the traditional species indicator in the mahinga kai component.
  - It scores 5 because iwi members would return to the site in the future.
- It received an above average score for stream health:
  - Flow 3.7
  - Water quality 3.8

**Site 4 – Unnamed tributary – Totora Hills stream – B-0/1.42/2.3**

The assessment confirmed that:

- This is not a traditional site.
- Because of the unhealthy condition of the site, iwi members would return to the site.
- Its mahinga kai values are below average:
  - It scores average for access. It was relatively easy for iwi members to access this site without assistance.
  - A limited range of mahinga kai species were present.
  - This is not traditional site and therefore scores 1 for the traditional species indicator in the mahinga kai component.
  - It scores 1 because iwi members would not return to the site in the future.
- It received an above average score for stream health:
  - Flow 2.4
  - Water quality 2.2

**Site 5 – Mangaoho Stream – B-1/2.62/4.0**

The assessment confirmed that:

- This is not a traditional site.
- Because of the healthy condition of the site, iwi members would return to the site.
- Its mahinga kai values are average:
  - It receives an average score for access.
  - A reasonable range of mahinga kai species were present.
  - This is not traditional site and therefore scores 1 for the traditional species indicator in the mahinga kai component.
  - It scores above average because iwi members would return to the site in the future.
- It received an above average score for stream health:
  - Flow 4.1
  - Water quality 3.9

# Appendix 6: Ministry for the Environment's Environmental Performance Indicator Programme

This appendix provides important information about the Ministry for the Environment's Environmental Performance Indicator programme and its relationship with Stage 1 of the CHI project.

A brief overview of the following topics is provided:

- the relationship of the CHI project to the Ministry for the Environment's Environmental Performance Indicator Programme
- the concerns of Māori with respect to the EPI Programme
- the concerns of Ngāi Tahu that led to the initiation of a freshwater indicators project in 1997/98.

## 1. Background to the EPI programme

The *Environment 2010* strategy detailed a set of national environmental goals that were adopted by the Government in 1994. Goals and proposed actions for nine priority issues represent the environmental outcomes sought from the implementation of the Resource Management Act 1991. The purpose of the Ministry for the Environment's EPI Programme was to develop a core set of environmental performance indicators that would allow progress towards the key goals of *Environment 2010* to be tracked over time. Specifically, the Ministry contended that the EPI Programme would enable resource managers to assess:

- the state of the environment at national, regional and local levels
- the impact of human activities on the environment
- emerging trends
- the effectiveness of key legislation and policy, such as the Resource Management Act 1991, Environment 2010, New Zealand Coastal Policy Statement and the statutory plans and policies of regional and district councils.

The Ministry for the Environment led the Environmental Performance Indicators Programme which, although now ended, resulted in indicators being developed for air, the marine environment, freshwater, terrestrial and freshwater biodiversity, energy and transport resources.

Environmental performance indicators have the potential to be crucial to resource management, but the framework initially adopted by the Ministry threatened to reduce ecosystems to simplistic sets of natural resource components (eg air, freshwater, land, plants). Considerations fundamental to Māori, such as interactions within ecosystems, were not well accommodated (Crengle, 1997). This represented a weakness in the overall indicators framework. Direction from Māori was needed to show how they might be directly involved in the development of EPIs. Four Māori case studies were supported, to test the efficacy of Māori participation in the formulation of EPIs, one being the Taieri Indicator Project and the development of the Cultural Health Index.[4]

[4] The Taieri River project commenced in 1997/98 with the identification of indicators to assess stream health.

## 2. Background to the identification of freshwater indicators and the development of the Cultural Health Index

The project was initially developed in response to a number of concerns about freshwater management voiced by members of Ngāi Tahu whanui. Numerous catchments within the rohe of Ngāi Tahu experience both deteriorating water quality and mounting pressures on the quantity of water available to meet the needs of both in-stream and extractive uses. Ngāi Tahu contend that these issues need to be addressed by resource managers because they are adversely impacting on the cultural association of Ngāi Tahu with the affected freshwater resources.[5]

Water quality remains a concern throughout the rohe as there are still examples of point source water pollution caused by the discharge of effluent from sewage plants. Despite treatment and few apparent biological adverse effects, these discharges have significant adverse cultural effects that are not fully acknowledged. Of yet greater concern, however, particularly given the increase in dairying in the South Island, is the poor water quality resulting from non-point sources of pollution.

With respect to water quantity, Ngāi Tahu have argued strongly in resource management fora that cultural values have been accorded lower priority in decisions relating to the allocation of water than have extractive uses. Observable adverse impacts on cultural and spiritual values include low flows, loss of in-stream habitats, changes to estuarine areas and the related issues of salt water intrusion, unnatural dewatering of significant sites, reduced flushing and flood flows and changes to sediment movement and deposition patterns.[6] The issue of inadequate minimum flows and excessive extractions are concerns that are shared by *papatipu rūnanga*[7] within the Canterbury, Otago and Southland regions, and are in evidence in the plans and policies of the three regional councils covering these parts of the South Island.[8] The Taieri River project and the identification of indicators had its origins in the minimum flow debates – when it became apparent that Ngāi Tahu would continue to struggle to have their perspective recognised by the Otago Regional Council through the existing management approach.

The Ministry for the Environment's report, *Environmental Performance Indicators, Proposals for Air, Fresh Water and Land* (1997), reinforced these concerns by confirming that the focus of many of the water quantity monitoring regimes within New Zealand was the extent of extractions and how the level of extraction relates to the maximum sustainable yield. A concern, expressed on page 64 of the Ministry's report, is the statement that spiritual issues, such as mauri, were not being addressed in the monitoring activities of regional councils. This served to reinforce the concerns of Māori who, in struggling to be heard in resource management fora, were faced with individuals within resource management agencies who did not fully appreciate Māori cultural and spiritual values in respect of freshwater.

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5 Te Rūnanga o Ngāi Tahu, 1999, *Freshwater Policy Statement*, Kai Tahu Ki Otago, 1996, Natural Resource Management Plan.

6 Evidence submitted in support of the Ngāi Tahu claim before the Waitangi Tribunal documented many examples of modifications to waterways and the resultant adverse impacts on Ngāi Tahu whanui.

7 Papatipu rūnanga within the rohe of Ngāi Tahu are listed in Schedule of the Te Rūnanga o Ngāi Tahu Act 1996.

8 The three regional councils being Environment Canterbury, Otago Regional Council and Environment Southland.

Despite observing and voicing concerns about the poor health of freshwater resources within their rohe, the ability of Ngāi Tahu to influence freshwater management has thus far been limited as their role has been largely confined to one of advocacy. Māori have been consulted by resource management agencies as statutory plans and policies are formulated, but they have not been accorded the status of equal participants in decision-making fora. One of the outcomes sought by the project was a change in the nature of participation by Ngāi Tahu in freshwater management within the Otago region.

The project was thus narrowly defined. Its initial focus was freshwater issues in the Taieri Catchment, specifically the previous lack of attention to the incorporation of Māori values in their management. It therefore sought to address what was perceived to be a shortcoming in the Ministry's EPI programme and the regional council's proposed approach to the monitoring of freshwater resources by determining how Māori would go about assessing the health and wellbeing of these resources – should they become involved in data collection and monitoring.

## 3. Going forward: regional council monitoring

Although the Ministry for the Environment's Environmental Performance Indicator Programme has ended, a rising consciousness and concern with the health of the environment has prompted the preparation of state of the environment reports that document the condition of resources and the wider environment. Within the New Zealand context, section 35 of the Resource Management Act 1991 requires environmental monitoring by local authorities in order for them to carry out their functions under the Act. At least every five years local authorities must report to the public on their monitoring of the effectiveness of their policies and plans. This is most commonly done by producing a state of the environment report or an annual environmental monitoring summary.

In 1997, the Ministry for the Environment provided a national overview of the environment through a State of the Environment Report. At a regional and district government level, a range of reports present more detailed local perspectives on the state of the environment. As well as informing the public of the environmental problems that are being experienced, these reports also establish baselines for long-term monitoring programmes. Linked closely to the establishment of long-term monitoring programmes was the formulation of environment performance indicators that, if adopted by resource management agencies, could ensure a consistent approach to monitoring and assessment. What can be at issue, however, is the means by which the state of the environment is assessed and monitored. We believe the opportunity afforded by the Ministry for the Environment's EPI Programme enabled the development of a tool, the Cultural Health Index (CHI) for rivers and streams, which will facilitate the participation of iwi in resource management processes, specifically the management of streams and rivers.