

Appendix 27: Engagement

1. Introduction

During the Waikato River Independent Scoping Study issues were raised about the current policy setting and decision-making processes related to the Waikato River, its lakes, tributaries and wetlands. A lack of effective and/or meaningful engagement, poor community relationships, ineffective communication and unsuccessful conflict resolution procedures were all identified as impacting on the community's ability to be involved decision-making processes and implementation of actions to restore and protect the health and wellbeing of the Waikato River.

This sense of disengagement of communities from the Waikato River is the result of a number of different factors. For Waikato-Tainui, land confiscation in the 1860's severely reduced their association with the land and the awa, and breaches of the Treaty of Waitangi by the Crown denied their rights and interests in, and Mana Whakahaere over the Waikato River, compromising their ability to ensure the river's wellbeing (NZ Government 2010, Waikato-Tainui Deed of Settlement). The movement of people from rural to urban areas has also reduced regular contact with natural waterways and rural life. The history of pollution due to poorly managed sewage and other point sources (from at least 1903 until the 1970-80's (More, 1976)) also contributed to urban dwellers and others "turning their backs on the river" (Gibbons, 1977). The perception that the river is unsafe to swim appears to have persisted with many people long after severe microbial pollution problems were resolved. The development of hydro-lakes flooded many sites of cultural significance for Maori and affected their ability to carry out traditional cultural activities associated with the river (O'Sullivan and Te Hiko, 2010).

Restoring the health and wellbeing of the Waikato River requires increased engagement as well as changes in many people's understanding, perceptions and the social norms that drive improved behaviours (e.g., Rhodes et al., 2002; Parminter et al., 2006; Ison and Watson, 2007). Achieving this will require an integrated approach to engage different audiences (e.g., youth, urban dwellers, farmers, industries, managers and different ethnicities).

New initiatives should be linked to and build on, existing programmes being run in primary schools (e.g., there are over 100 Waikato schools involved in the enviroschools¹) and resources provided by local government (e.g., Environment Waikato's 2002 Clean Streams Guide), Hamilton City Council's Gully Restoration Guide (Wall and Clarkson, 2002)), industries (e.g., DairyNZ Farm Enviro Walk), Non-

¹ <http://www.ew.govt.nz/for-schools/Waikato-Enviroschools-newsletters>

Governmental Organisation's (e.g., NZ Landcare Trust's guide for silt traps on peat lake tributaries (Berry and Dresser, 2010))² and Crown Research Institutes (e.g., NIWA's guide on Wetland treatment of tile drainage (Tanner et al., 2010)).

Linking to the Vision and Strategy

The Vision and Strategy for the Waikato River includes the implementation of strategies 8 and 10, which are to:

- Actively promote and foster public knowledge and understanding of the health and wellbeing of the Waikato River among all sectors of the Waikato regional community.
- Establish new, and enhance existing, relationships between Waikato-Tainui, other river iwi (where they so decide), and stakeholders with an interest in advancing, restoring and protecting the health and wellbeing of the Waikato River.

The methods listed in the Vision and Strategy to implement Strategy 8 and 10, within a 3 year timeframe include (but are not limited to):

- The development of curricula for schools in the Waikato region focusing on the restoration and protection of the health and wellbeing of the Waikato River.
- The development and delivery of postgraduate scholarship programmes focused on the restoration and protection of the health and wellbeing of the Waikato River.
- The development of a public education programme focused on the restoration and protection of the health and wellbeing of the Waikato River.
- Promote greater public knowledge and understanding of river iwi relationships with the Waikato River.
- Promote greater public understanding of the relationship of the wider community with the Waikato River.
- Facilitate and encourage participation to enable sharing between national and international river enhancement experiences that will foster and assist in the restoration and protection of the health and wellbeing of the Waikato River.

² <http://www.landcare.org.nz/user-content/2300-silt-trap-fact-sheet.pdf>

Many community members made a number of positive suggestions about how these issues might be addressed and also indicated a willingness to be involved in the implementation of actions to restore and protect the health and wellbeing of the Waikato River. Feedback gathered in the Study indicates that 'hands on' involvement in the restoration and protection of the Waikato River will help improve community wellbeing through re-engagement.

Feedback also suggested that in order to effectively participate in the restoration of the river, a number of capacity building, education and training programmes need to be implemented and that these programmes needed to target a variety of age groups, audiences and a range of learning preferences. In addition, inadequate access to information and funding, were also highlighted as barriers to contributing to decisions and policy development on the current management of the river.

These suggestions are supported by research showing that environmental education plays a major role in encouraging responsible behaviour needed for sustainable resource management and environmental protection, while also enabling people to participate effectively (Bay of Plenty Regional Council, 1999; Environment Waikato, 1996; Hamilton City Council, 1998; Matamata-Piako District Council, 1999; MfE, 1995; MfE, 1998; MfE, 1999; Northland Regional Council, 1998; Parminter et al., 2006; Tasman District Council, 2000; Wellington Regional Council, 1998).

Targeting school curricula to enhance student knowledge and developing positive attitudes towards the health and wellbeing of the Waikato River is promoted in association with the existing EnviroSchools/Kura Taiao programme and the EMAP waterways programme (www.emap.rsnz.org). These aim to influence student's awareness, knowledge, attitudes and skills and to build a network of schools/kura committed to environmental learning, action and creating sustainable communities. Furthermore, research shows that educating children also educates their parents (Connor et al., 2006).

2. A description of the prioritised action(s)

A wide variety of actions were proposed and incorporated into this Study to increase the awareness, knowledge, capacity, and involvement of all stakeholders within of the catchment in the restoration of the health and wellbeing of the Waikato River. The actions listed below target a variety of age groups, audiences, and a range of learning preferences and can be broadly grouped under the following:

- Education, training and research.
- Communication and publicity.

- Partnerships and coordination.

Environmental education in schools

The development of a cross-curriculum resource (both primary and secondary levels), in collaboration with the Ministry of Education, will engage school children, parents and teachers throughout the catchment, to promote greater public knowledge and understanding of the restoration and protection of the health and wellbeing of the Waikato River.

In addition to the involvement of the Ministry of Education, collaboration with existing environmental education initiatives, including EnviroSchools³, the Royal Society Environmental Monitoring and Action Project (EMAP)⁴, the Royal Society Teachers Fellowship Scheme⁵, Learning Media⁶ and Environment Waikato's Environmental Education for schools⁷ will greatly benefit the development of this cross-curriculum resource. The Environmental Education Directory of New Zealand⁸ provides further links to environmental education resources that have been developed around New Zealand.

Actions designed to provide Waikato River focused cross-curriculum materials as well as professional development and support for primary and secondary teachers include:

Action A. Provide Waikato River focused cross-curriculum materials and professional development and support for primary and secondary teachers:

- Prepare Waikato River focused cross-curriculum resources for primary and secondary schools (Te Reo Maaori, preparation, publishing and distribution).
- Develop supplementary activities (primary and secondary) to add to Waikato River cross-curriculum resource pack every year.
- Develop associated professional development workshops for school teachers.

³ <http://www.enviroschools.org.nz>

⁴ <http://www.emap.rsnz.org.nz>

⁵ <http://www.royalsociety.org.nz>

⁶ <http://www.learningmedia.co.nz>

⁷ <http://www.ew.govt.nz/For-schools>

⁸ <http://www.eednz.org.nz>

Marae-based training courses

The hui with the five river iwi confirmed that successive generations have utilised the Waikato River, extensively drawing upon its resources to sustain themselves. In doing so they have acquired in-depth knowledge of species, their relationships, ecosystem functions and learnt how to modify their practices to accommodate changing ecological conditions. Whaanau and hapuu at all the hui stated their commitment to restoring the health and wellbeing of the River and their landscapes. The participation of tangata whenua in 'on-the-ground' restoration and monitoring projects is an ideal opportunity for helping to re-connect whaanau and hapuu (especially tamariki and rangatahi) with the river, which will aid the restoration of wellbeing in these communities.

Implementation of the following actions would see environmental restoration activities combined with cultural affirmation, knowledge transmission and Te Reo revitalisation. The aspirations of the five river iwi include:

- Re-vegetation, protection or reintroduction of culturally-important species.
- Conservation of valued landscapes including re-establishing connections.
- Where supported by whaanau, hapuu and iwi promoting greater understanding of historical associations with the Waikato River.

The development and delivery of a series of marae-based training courses are proposed as a means of providing access to the knowledge, skills and opportunities for tangata whenua to actively participate in the restoration and protection of the health and wellbeing of the Waikato River. Ideally these waananga, coordinated by the Waikato Regional Authority and the five river iwi, would occur alongside new and existing restoration initiatives (e.g., Te Kanae Kakariki Trust) so that the 'hands on' component of the training workshops can be undertaken as part of the overall restoration programme. The types of training courses to be delivered include, but are not limited to: traditional fishing methods, riparian planting, fencing and management (including culturally purposeful planting), project management and coordination, monitoring and evaluation, the Resource Management Act, tuna and whitebait biology and pest species management (e.g., willow and koi carp eradication).

The development of enterprises associated with the restoration of the Waikato River, (e.g., native plant nurseries that are managed by iwi and supply riparian planting programmes throughout the catchment) will also provide capacity building and employment opportunities for the five river iwi. Ideally, these will be organised in partnership with education providers, such as the New Zealand Qualifications

Authority (NZQA), so that participants receive a formal qualification upon completion of these training initiatives.

Action B. Provide access to the knowledge, skills and development opportunities for five river iwi to actively participate in the restoration and protection of the health and wellbeing of the Waikato River:

- Provide marae-based waananga/training courses.
- Establish iwi-based restoration training and employment development enterprises, e.g., native plant nurseries, koi carp removal programme.

Research capacity and coordination

The Vision and Strategy outlines objectives to increase research capacity and the coordination of the delivery of appropriate research initiatives to increase current knowledge and understanding of the health and wellbeing Waikato River. Such research may include the application of maatauranga Maaori in the development of tools to restore the health and wellbeing of the Waikato River and the restoration of taonga species, particularly those where key information gaps have been identified (e.g., kaaeo/kaakahi, kooura, piiharau).

The new *“Waters of the Waikato”* book (Collier et al., 2010) is to be launched at Turangawaewae Marae in 2010 as part of the Koroneihana celebrations (Friday 20 August 2010). This book provides a rich resource of information regarding the biophysical and management issues facing the Waikato River. Therefore, this resource could provide a valuable contribution to the content of a series of ‘fact-sheets’ for distribution to the general public.

The coordination of research (including undergraduate and postgraduate studies) can be assisted by establishing an academic chair focused on the restoration of the Waikato River (similar to role of Professor David Hamilton and the Te Arawa Lakes). This role would help facilitate and coordinate research targeted on the restoration and protection of the health and wellbeing of the Waikato River amongst tertiary institutions such as the Waikato-Tainui College for Research and Development and the University of Waikato. This role would also assist in the development and maintenance of local, national and international research networks (including indigenous expertise) that can be applied to the restoration and protection of the health and wellbeing of the Waikato River.

Action C. Increase Waikato River-related research capacity, and coordinate the delivery of appropriate research initiatives to increase current knowledge and understanding of the health and wellbeing Waikato River:

- Support tertiary student scholarships (masters, PhD, and/or postgraduate) undertaking targeted Waikato River-related research.
- Establish an academic Chair to facilitate and coordinate research relevant to the restoration and protection of the health and wellbeing of the Waikato River and to foster local, national and international research networks.

Communication and publicity

Based on the information collected during the Study, it was identified that the Waikato River Authority (WRA) will need to coordinate opportunities to communicate and engage with stakeholders in order to change behaviours where necessary. This process will involve identifying and addressing barriers to change, whilst simultaneously promoting the benefits of new behaviours to stakeholders in the Waikato River catchment. The overarching aim of these communication and publicity initiatives is to keep the community informed so they can make sound judgements and implement new improved behaviours from their own learned perspective. Topics for discussion could include:

- **Iwi relationships with the Waikato River** – including the economic, social, cultural and spiritual relationships of river iwi in accordance to their tikanga and kawa.
- **Community relationships with the Waikato River** – including the economic, social, cultural and spiritual relationships of the many communities along the Waikato River.
- **Increasing awareness of rubbish reduction and pollution management initiatives** – (a) to assist point source management by informing stakeholders of the issues and how they can contribute to solutions and (b) finding ways to consult, engage, include and motivate communities in order to ensure their help in reducing pollution and rubbish.
- **Protection and conservation** – helping to improve the community's knowledge of healthy waterways, native fisheries, flora and fauna and enlisting the community's support and participation to protect these taonga.
- **Significant sites** – including waahi tapu (where the fiver river iwi so decide) as well as significant and historic sites of the wider Waikato community –

expanding awareness of the presence of these significant sites by developing and improving understanding, appreciation and recognition.

In order to provide more permanent opportunities to promote greater public knowledge and understanding of Waikato River amongst all stakeholders in the community it is proposed that Waikato River-focused public education centres (one in Scenario 2, five in Scenario 3) are implemented. These centres will provide both schools and the general public with Waikato River and five river iwi relevant services which include, but are not limited to:

- Information and education facilities.
- Exhibitions (e.g., that have been developed to portray the significance of the Waikato River to the five river iwi).
- Guided fieldtrips.

At present communication with stakeholders throughout the Waikato River catchment is maintained through a variety of newsletters, press releases and web sites. However, the next level of information available tends to be too detailed and/or too hard to get hold of (e.g., technical and legal documents). To bridge this gap the Study team recommends that 'issues and options' articles be written by an experienced journalist to be published in a wide variety of media, including newspapers and magazines.

Appropriately written 'how to' handbooks on activities that enhance the Vision and Strategy, such as riparian management, wetland restoration, contaminant source management on farms, monitoring and assessment methods would also be beneficial if they were made freely available to the public. These will build on existing resources, such as those mentioned earlier. More extensive communication and publicity measures include the production of a Waikato River restoration and protection-focused magazine that is widely distributed throughout the catchment and/or the production of a Waikato River restoration and protection-focused series of 30 minute long documentaries appropriate for distribution via DVD and/or television.

It is proposed that a Waikato River Festival is held biannually (alternately hosted by each region within the catchment, i.e., Waipa, Lower Waikato, Middle Waikato and Upper Waikato). The programme for this 2-3 day event would include an international river symposium (involving local, regional, national and international restoration initiatives) and includes cultural activities (where the five river iwi so decide) such as Kapa Haka, as well as water sports, entertainment and other activities.

Action D. Improve and increase communication and publicity focused on the health and wellbeing of the Waikato River:

- Provide Waikato River public education centre(s) (one in Scenario 2 and five in Scenario 3).
- Commission a professional journalist to develop 'issues and options' articles on key aspects of the restoration of the Waikato River and publish in a variety of media (including newspapers and magazines).
- Collaborate with existing agencies to adapt and extend existing 'how to' handbooks on activities that enhance the Vision and Strategy (e.g., riparian management, wetland restoration, contaminant source management on farms and monitoring and assessment methods).
- Develop a Waikato River focused magazine, distributed throughout the catchment.
- Commission the delivery of Waikato River-focused documentaries suitable for television and/or DVD release.
- Develop a Biannual Waikato River Festival – with a programme that includes an international river symposium, cultural activities, watersports and other activities.

Partnerships and coordination

Some local authorities have non-statutory processes on restoration that include grants or funding to help meet the costs of remedial actions. For example, the Environment Waikato Clean Streams initiative has made funding available to farmers to exclude cattle from streams and reforest riparian areas. The Waikato Catchment Ecological Enhancement Trust (WCEET) assists organisations, agencies and individuals with projects that foster and enhance the sustainable management of ecological resources in the Lake Taupo and Waikato River catchments. In addition, a number of national and regional government, iwi authority, industry and voluntary strategies, action plans, projects and awards (e.g., National Wetland Trust, Maungatautari Ecological Island Trust, Waikato Biodiversity Forum, Hakarimata Restoration Trust, and Ecosourced Waikato) currently exist within the Waikato River catchment. The Waikato River Authority will need to coordinate and administer grants to community groups, iwi and industry for restoration and monitoring and link its activities with existing funding agencies.

The actions proposed here aim to complement existing initiatives, by:

- Developing and strengthening partnerships between stakeholders.

- Improving the coordination of restoration activities undertaken throughout the catchment.
- Improving access to funding for restoration activities.
- Providing more awards for stakeholders undertaking river, lake, riparian and wetlands activities that improve health and wellbeing of the Waikato River.

Actions designed to strengthen and increase partnerships and coordination of activities that improve the health and wellbeing of the Waikato River include:

Action E. Increase partnerships and coordination of activities that improve the health and wellbeing of the Waikato River:

- Improve coordination of community groups focused on Waikato River restoration and protection by supporting a coordinator.
- Support annual community meetings/mini fora in support of joint restoration initiatives.
- Build partnerships with industry located within the Waikato River catchment (e.g., DairyNZ, MeatNZ, Fonterra, Federated farmers, AFFCO, Kinleith) to coordinate activities that enhance the vision and strategy through the development of an industry-lead joint accord.
- Provide seed funding to support collaborative industry-led and community-led projects.
- Sponsor new awards for river, lake, riparian and wetland restoration projects that improve health and wellbeing of the Waikato River to complement existing awards.

3. How will the action(s) be accomplished?

The diversity of actions outlined here require input from the five river iwi, local authorities, education providers, research organisations, industry, community groups and government, coordinated by the Waikato River Authority.

4. Where in the Waikato River catchment should the actions occur?

Engagement was an issue expressed throughout the entire Waikato River catchment and the actions presented here require a whole of catchment approach. However, it is acknowledged that each region within the catchment, (i.e., Waipa, Lower Waikato,

Middle Waikato and Upper Waikato) may request specific services or activities to be tailored to meet their priority needs.

5. What is the cost of the action(s)?

Table 1: The estimated costs of the proposed engagement actions include:

Action	Description	Costs (\$Mill, NPV)
A	Waikato River focused cross-curriculum materials for primary and secondary schools, updates and professional development to support long term implementation	\$2,3
B	Marae-based training workshops	\$6.5
	Iwi-based restoration training and employment development initiatives, e.g., native plant nurseries, koi carp eradication programmes	
C	Provide scholarships (postgraduate and undergraduate) for students undertaking Waikato River-related research restoration	\$6
	Academic chair to coordinate research undertaken on the Waikato River and foster national and international networks	
D	Five Waikato River public education centres	\$7.6
	"Issues and options" articles on key aspects of the restoration of the Waikato River and publish in a variety of media (including newspapers, magazines)	\$4.5
	'How to' handbooks on activities that enhance the vision and strategy (e.g., riparian management, wetland restoration, contaminant source management on farms, monitoring and assessment methods)	
	Waikato River focused magazine, distributed throughout the catchment	
	Waikato River focused documentaries suitable for television and/or DVD release	
	Biannual Waikato River Festival	\$1.8
E	Improve coordination of community groups focused on Waikato River restoration and protection by supporting coordinator to achieve better integration of efforts across catchment	\$2
	Support annual community meetings/mini fora in support of joint restoration initiatives	
	Build partnerships with industry to coordinate activities that enhance the vision and strategy through the development of an industry-lead joint accord	\$0.32
	Facilitate collaborative industry-led and community-led restoration projects	
	Biannual vision and strategy restoration awards for industry-led and community-led projects	\$0.61

6. Who could do it and how long will it take?

The Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 and the Ngati Tuwharetoa, Raukawa, and Te Arawa River Iwi Waikato River Bill establishes and grants functions and powers to the Waikato River Authority. The purpose of this authority is to:

- Through the Vision and Strategy set the primary direction to achieve the restoration and protection of the health and wellbeing of the Waikato River for future generations.
- Promote an integrated, holistic and co-ordinated approach to the implementation of the Vision and Strategy and the management of the Waikato River.
- Fund rehabilitation initiatives for the Waikato River in its role as trustee for the Waikato River Clean-up Trust.

The targets listed in the Vision and Strategy in regards to the timeframe for the completion of these initiatives includes:

- Within 3 years: The curricula for schools in the Waikato Region include a focus on the restoration and protection of the health and wellbeing of the Waikato River.
- Within 3 years: Public education programmes focused on the restoration and protection of the health and wellbeing of the Waikato River are implemented. The programme will include updates on the state of the health of the Waikato River, and actions that residents can take to positively influence the health and wellbeing of the Waikato River.
- Within 3 years: Postgraduate scholarships are developed.
- Within 3 years of the postgraduate scholarship being established: At least two postgraduate degrees have been successfully completed. Appropriate undergraduate programmes will include within their courses a focus on the restoration and protection of the health and wellbeing of the Waikato River.
- Within 5 years: One international river symposium has been held in the Waikato Region with a focus on the restoration and protection of the Waikato River.
- Within 6 months, and thereafter at least every 6 months: Mini fora are held locally.

7. What are the interactions with other activities (co-benefits and drawbacks)?

The actions proposed here will increase the involvement and participation of five river iwi and the wider Waikato community in restoring the health and wellbeing of the Waikato River. In particular these outcomes will contribute to the restoration of Aspiration 1 - *“That the management of the Waikato River and its lakes, wetlands and tributaries to protect their health and wellbeing is conducted in a holistic, integrated way”* and Aspiration 2 - *“That people feel engaged with the Waikato River and its lakes, wetlands and tributaries, and processes, initiatives or actions to restore and protect their health and wellbeing.”*

8. An analysis of uncertainties and information gaps

It is crucial that the Waikato River Authority facilitate opportunities to communicate and educate stakeholders in order to change behaviours where necessary. This process will involve identifying and addressing barriers to change, whilst simultaneously promoting the benefits of new behaviours to stakeholders in the Waikato River catchment. The role of the Waikato River Authority will be pivotal to creating and maintaining long-term collective stakeholder ‘buy in’ (i.e., acceptance, recognition of importance, understanding and participation) regarding the final actions selected.

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Appendix 28: Impediments

1. Purpose

The purpose of this report is to summarise some of the statutory and non-statutory impediments to the range of priority actions being proposed to contribute to the enhancement of Waikato River as part of the Waikato River Independent Scoping Study. The priority actions are outlined in further detail in Table 7.3 (see Section 7). This appendix provides a description of the statutory framework and discusses how these influence or impact on some of the impediments identified in Table 7.3 (see Section 7).

A brief outline of the statutory framework is included below. The statutory impediments outlined below were identified during workshops with council staff from within the Waikato region in December 2009 and at an internal workshop about 'Statutory Impediments to the Waikato River Independent Scoping Study Actions' in May 2010. The impediments are grouped into statutory or non-statutory categories. The statutory impediments all relate to actions that are regulated or influenced by legislation. Non-statutory impediments relate to all other impediments.

2. Statutory framework

Many of the recommended priority actions in the Study (and which inform the review of the Vision and Strategy for the Waikato River) are influenced by the Resource Management Act 1991 (RMA), Local Government Act 2002 (LGA) or Land Transport Management Act (LTMA) processes. The diagram below outlines some of the relevant legislation, associated documents and some of the relationships between these.

Statutory Framework and Implementation Toolkit Hierarchy (Sourced and Adapted from the Future Proof Strategy)

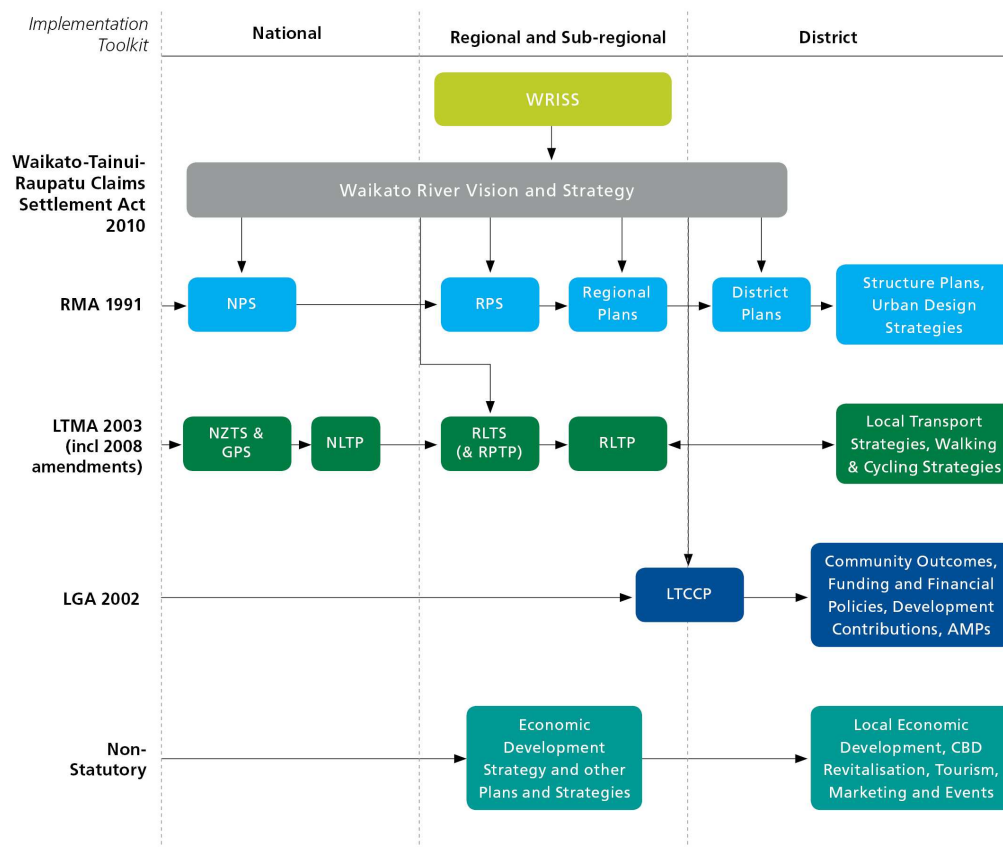


Figure 1: The relationship between the Vision and Strategy for the Waikato River and the Resource Management Act 1991

Under the RMA the key planning documents are national policy statements (NPS), regional policy statements (RPS) and regional and district plans. Where an NPS exists it sets national policy direction. An RPS sets the region-wide policy direction and cannot be inconsistent with an NPS. Regional Plans and District Plans must give effect to the RPS.

The Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 (which came into effect in May 2010) and the Ngati Tuwharetoa, Raukawa, and Te Arawa River Iwi Waikato River Bill direct Environment Waikato to incorporate the Vision and Strategy for the Waikato River into the Waikato Regional Policy Statement without a formal Schedule 1 RMA process of submissions and hearings. The Vision and Strategy content also prevails over any inconsistent provision of a National Policy Statement. The Waikato Regional Council is also required to update the RPS (if necessary) so that it is not inconsistent with the Vision and Strategy without going through the Schedule 1 RMA process.

2.2 Vision and Strategy reviews

The first review of the Vision and Strategy is required to commence not more than 3 months after the settlement date. Subsequent reviews are necessary no earlier than 5 years later, then 10 years thereafter. The reviews are required to consider whether the Vision and Strategy includes specific targets and measures for achieving the overarching purpose of the settlement agreement. These reviews are required to follow a consultation and submission process outlined in the Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010.

Once the review has been completed all Councils within the region are required to review their own RMA documents to consider whether changes to the Vision and Strategy result in the need for a change their respective RMA documents (RPS, Regional and District Plans).

Such reviews are required to go through formal Schedule 1 RMA processes and therefore will be also subject to submission, hearing and potentially appeals to the Environment Court – meaning it could be months/years until such time as all documents are aligned with the Vision and Strategy. Having said that, where a plan change is supported by the Vision and Strategy, there will be less room to contest the content of the policy statement or plan change process.

2.3 Impact on resource consent process and existing consents and designations

Regional and District Plans outline which activities require resource consent. A resource consent application requires an assessment against the RMA, objectives, policies and rules of relevant RMA documents and an Assessment of Effects on the Environment – this will now include a need to provide commentary of the proposed activity in terms of its consistency with the Vision and Strategy.

Depending on the activity status for which resource consent is required, the resource consent may be notified and go through a submission and hearing process. Should a hearing committee need to be established for applications of interest to the Waikato River Authority, the Panel is required to be made up of an equal number of Waikato River Authority appointed decision makers as those appointed by Council. An independent chairperson also needs to be jointly appointed.

3. Study recommendations – RMA impediments

RMA process impediments are identified below. It is noted typically RMA issues tend to be related to concerns about ‘additional cost’, ‘additional time’ and ‘increased uncertainty’ impacts on business and communities as a result of the consent processes. Many of the Study’s recommendations for priority actions have such implications.

3.1 Need for resource consents

Many of the priority actions recommended by the Study involve physical works or activities that will require resource consents to be obtained from either District or Regional Councils (or both).

Resource consent requirements are often seen as an impediment because they add uncertainty, time and cost to a project or activity. In the case of the Study's recommendations, resource consents will typically be required by a Regional Plan for activities that involve dredging, water takes or diversion, geothermal water takes and reinjection, discharges to land, water or air and significant earthworks in proximity to water bodies. At the district level, resource consents will typically be required for 'out of zone' buildings and structures, vegetation removal and earthworks.

Consents/designations will therefore likely be required for restoration actions such as those that will improve access to and around the river (e.g., to construct and operate the river walkway, visitor centers, reserves, boat ramps, alter drainage systems, improve flood protection, alter hydro power schemes to facilitate/improve fish passage or alter geothermal power schemes to re-inject geothermal water).

Many existing activities, such as point source discharges from industrial activities and municipal wastewater, are operating to consented regimes. If a higher level of treatment or alternative disposal methods are required this will involve reviewing and amending the existing consent conditions, reconsidering the consent at the time the existing consent period expires and capital costs to alter site activities. Costs associated with both the resource consent process and the technological improvements required to improve the quality of the point source discharge. For example, obtaining new or renewing existing wastewater treatment plant consents can often be a lengthy process, with many taking more than 10 years to work through from the initial concept and strategy development stage, community consultation, consenting and then implementation. This means there are often significant 'lag' periods between any improvement processes commencing to the time where quality improvements actually occur.

3.2 Permitted activities

District and Regional Plans can identify activities that are permitted provided they meet the standards set out in the plan. Currently farming activities such as pastoral dairy farming and clear felling forestry in high catchment areas are a permitted activity in most plans within the region. Many of the Study's recommended actions look to change and/or improve rural land management practices by way of education and voluntary actions. (e.g., industry approaches and potentially self regulation).

Permitted activity standards don't reinforce the requirement for change. Conversely radical changes of approach to regulating historical (and economically important) land use practices are likely to be unacceptable – and will be costly to look to

propose via the RMA process as evidenced by Variation 5 to the Waikato Regional Plan. It was proposed in 2005 and is still under appeal to the Environment Court now.

3.3 Monitoring

The effectiveness of standards and rules in District Plans and resource consent conditions are required to be monitored to ensure that they achieve the intended environmental result. Resource consent conditions also require monitoring to ensure they are being complied with.

However monitoring tends to be poorly resourced, which results in poor data being gathered to inform strategy and policy review and refinement. Collection of data aligned with the Study's objectives, strategies and actions will be imperative if the effectiveness of the Study's recommended priority actions is to be able to be critically reviewed. This will likely require increased time (and cost) to be invested in this activity.

3.4 Lack of national guidance

As noted in the recent SKM study for the Ministry for the Environment titled 'Regional Council Practice for Setting and Meeting RMA-Based Limits for Freshwater Flows and Quality', a key impediment around water allocation and water quality is the lack of national guidelines around setting such standards.

This causes significant delays and disagreements when developing them on a region by region basis. The Study noted that Councils feel there is a need for direction on national water quality/quantity issues including a clear outline of what is important at the national level. It also noted that the majority of councils think national guidelines on water quality limits are needed to reduce arguments around methods and limits and avoid duplication of effort.

4. Study recommendations - LGA 2002 implications and impediments

Councils in New Zealand are required to prepare a Long Term Council Community Plan (LTCCP) every three years. The LTCCP is guided by 'Community Outcomes' which are an expression of a community's desired outcomes in terms of the present and future social, economic, environmental and cultural well-being of the community. Councils consult with their community when developing the LTCCP and, once adopted, the LTCCP can be changed only after appropriate consultation with the community. The LTCCP outlines details of all of the Council's activities and how these activities contribute to the desired Community Outcomes. It also outlines the Council's budget, explaining what the Council plans to spend over the next ten years.

The recommended actions outlined in the Study propose a number of new activities for Environment Waikato and District Councils to act on – many of which will not have been identified in their current LTCCPs. Activities like walkways, boat ramps, visitor centers and wastewater treatment process changes will ultimately cost the

local communities more (e.g., through increased rates, development contributions etc.). Many Councils are reporting difficulties with servicing existing community activities identified in their LTCCPs, with many activities being deferred. The likely ability of these Councils to introduce additional work activities into their 10 year plans will be a challenge.

5. Study recommendations – LTMA implications

The Study's recommended actions propose a number of new activities for road controlling authorities to act on – many of which will not have been identified in their current activity plans or budgets.

Improved treatment for point source road runoff discharges and culvert upgrades to provide fish passages are such examples. They will require budgeting for – both in Long Term Council Community Plans (LTCCPs) where Councils are **RCA's**, but also by the New Zealand Transport Agency in the case of State Highways and potentially the Department of Conservation (where conservation land is affected).

6. Non statutory impediments

6.1 Political and community resistance

Political and community aspirations are based on a community's values. These values can differ within, and between, regional and local contexts. Implementing region-wide changes can therefore be met with political and/or community resistance at the regional and/or local level. An example of this is in relation to non-point source discharges. As noted in the recent SKM study referred to above, regulation of non-point source discharges is controversial and requires attitudinal change and buy-in by politicians and stakeholders.

6.2 Cost of implementation

Many of the Study's recommended actions will incur costs to implement. The costs can be broken into several categories and may be incurred by a number of parties.

In broad terms there may be a capital and operating cost to purchase land, build, operate or maintain the action and a cost to gain resource and/or building consent for the activity. There may also be opportunity costs associated with an action with communities and businesses having a limited pool of resources to make decisions, and act if necessary, if they think a recommended action will affect viability of their service provision or commercial operations.

For example, if all treated wastewater was disposed to land this will raise the question about who pays and who benefits, the quality improvement resulting from the action and cost versus the significant improvement to cultural values.

When considering new consents or the renewal of any existing sewage discharge consents the Territorial Local Authorities (TLAs) or other applicants are generally required to investigate and report on the technical and economic feasibility of implementing a land disposal scheme. Many Council's in the Waikato are understood to have assessed the technical and economic feasibility of land based disposal to be too costly for their communities to develop and then maintain. These findings are presented in their Assessment of Effects on the Environment (AEE) which are taken into consideration by regional councils at hearings and the Environment Court during appeals. This will be a key consideration for any actions the Waikato River Authority chooses to fund in its role as trustee for the Waikato River Clean-Up Trust.

There has been a recent example of this in Gisborne where a technical solution which met community and cultural objectives was developed as a concept and granted consent but the cost to then implement the scheme was shown to be prohibitive and would have significant adverse social and economic effects on the community the improvement was intended to serve. The projected increase in rates was unacceptable to the community and an alternative, less costly solution had to be developed, in consultation with the wider community and iwi, and then reconsented.

6.3 Coordinated planning

Another potential impediment to some of the recommended actions is lack of coordinated planning. For example there currently no regional Access Plan that outlines the priorities for access throughout the region, the purposes access might be required e.g., for cultural, aesthetic, or sporting purposes and prioritising resources (time, money, people etc.) to implement effective solutions. A coordinated plan would enable all agencies to work towards common priorities and objectives.

Another impediment noted by the Study team is the lack of integration between RMA processes and the LTCCP, whereby some non-regulatory methods identified in RMA documents never make it into the LTCCP, and conversely many effective non-regulatory methods funded by the LTCCP are not directly referenced in an RMA plan.

It is noted that an Integrated River Management Plan is a key activity arising from s35 of the Waikato–Tainui Raupatu Claims (Waikato River) Settlement Act 2010. The purpose of this plan is primarily centred on management of aquatic life, habitats and natural resources and hazard management. However, this Plan could be extended to become a document that is used to better coordinate the priority actions the Waikato River Authority decides to fund – e.g., by informing funding criteria and decision making of the Trust, RMA decision making and, potentially, other agency activity planning as well (e.g., LTAs, EW, NZTA etc.).

6.4 Training

The lack of trained RMA commissioners with specific knowledge of the Vision and Strategy for the Waikato River and the statutory powers of the Waikato River Authority is also identified as an impediment to the successful implementation of the recommended priority actions. Training of Waikato River Authority (or river iwi) accredited commissioners will be a necessary ongoing commitment (and is also a legal requirement to comply with s25 of the Waikato–Tainui Raupatu Claims (Waikato River) Settlement Act 2010).

6.5 Knowledge and education

A lack of knowledge or information about how to mitigate adverse farming effects or undertake improvements can also be an impediment. Environment Waikato, farm advisors and industry groups currently play a role in education.

Readily available information showing good practice examples and technologies that are endorsed by the Regional Council and/or an independent industry organisation, similar to Energy Efficiency and Conservation Authority (EECA), would help. The voluntary uptake of such advice may be greater if it is seen to come from an independent advisor as opposed to the agency enforcing compliance.

6.6 Attitude change and industry collaboration

An unwillingness by the Waikato community to change behaviours or attitudes could be a key impediment to the successful implementation of many of the recommended priority actions but illustrating the benefits of change is one way to instigate gradual attitudinal change e.g., illustrating the benefits of an action to the quadruple bottom line, international market drivers for sustainability and the national 'clean, green' image.

Working with industry, rather than against it, is a positive method to work towards industry-wide changes. There are existing successful examples of collaboration with industry such as the Dairy Industry Clean Streams Accord between Fonterra, Regional Councils, Ministry for the Environment and Ministry of Agriculture and Forestry which sets a national-level framework for reducing the impacts of dairying on the quality of New Zealand's water bodies. One of the targets often quoted in relation to this Accord is the target to exclude stock from streams by 90 percent by 2012.

7. References

Sinclair; Knight; Merz (2010). Regional Council Practice for Setting and Meeting RMA-Based Limits for Freshwater flows and Quality. Ministry for the Environment. National Summary Report.

Appendix 29: Monitoring and Evaluation

1. Introduction

Monitoring and evaluation of restorative actions to restore and protect the health and wellbeing of the Waikato River are essential to:

- **Measuring success:** Assessing progress towards the implementation of restorative actions and achieving a healthy and well Waikato River.
- **Supporting adaptive management:** Ongoing reviews of progress allow strategies to be adapted to meet targets if the expected progress does not occur.
- **Providing accountability:** The Waikato River Authority will need to provide transparency and accountability for actions it chooses to fund (in its role as trustee for the Waikato River Clean-up Trust).
- **Engaging communities:** Community-based environmental monitoring programmes assist individuals, community groups and organisations to actively participate in caring for their surrounding environmental resources and assets.

1.1 Monitoring and evaluation as stated in the Vision and Strategy

The development and implementation of a Cultural Health Index (CHI) for the Waikato River is clearly outlined in the Vision and Strategy. The Vision and Strategy includes the implementation of strategies 2–4, which are to:

- Establish what the current health status of the Waikato River is by utilising maatauranga Maaori and latest available scientific methods.
- Develop targets for improving the health and wellbeing of the Waikato River by utilising maatauranga Maaori and latest available scientific methods.
- Develop and implement a programme of action to achieve the targets for improving the health and wellbeing of the Waikato River.

The methods listed in the Vision and Strategy to implement strategies 2–4 within an 8 year timeframe include (but are not limited to):

- Develop and implement a Cultural Health Index (CHI) for the Waikato River to understand environmental matters and the mauri of the Waikato River. The CHI will incorporate maatauranga Maaori and latest available scientific methods to direct and prioritise resources for restoring and protecting the health and wellbeing of the Waikato River.
- Monitoring undertaken by statutory agencies and other stakeholders to determine if there are deficiencies in their information, including an analysis

of adverse cumulative effects, required to understand threats to the health and wellbeing of the Waikato River.

1.2 Community based environmental monitoring

The United Nations Environment Programme stresses public participation as an essential component of sustainability (Au et al., 2000). Community based environmental monitoring programmes assist individuals, community groups and organisations to actively participate in caring for their surrounding environmental resources and assets (e.g., India¹ and Canada²). Such initiatives provide the coordination, networks, knowledge, training and support required by communities to monitor, track and respond to issues of common concern (Conrad and Daoust, 2008; McKenzie et al., 2000; Whitelaw et al., 2003).

Community involvement regarding the identification of relevant indicators to monitor progress towards environmental management goals is increasingly recognised, within literature by academics and environmental managers alike as an important component of sustainable and effective management (Fraser et al., 2006; Jollands and Harmsworth, 2006; Leach et al., 1999; Reed et al., 2008; Whitelaw et al., 2003). A shift towards participatory 'bottom-up' approaches combined with conventional 'top-down' systems is evident internationally. This is largely due to the failure of 'top-down' systems to realise sustainable environment management (Fraser et al., 2006; Sharpe and Conrad, 2006).

In an assessment of participatory processes (i.e., 'bottom-up approaches') on indicator identification and environmental management, Fraser et al., (2006) drew three key conclusions that are relevant to the Waikato River Independent Scoping Study. They are:

- That the process of engaging people to identify locally relevant indicators not only provided valuable databases for making management decisions, but also an opportunity for community empowerment and education that current conventional approaches fail to provide.
- Multi-stakeholder processes must formally feed into decision-making forums or they run the risk being viewed as irrelevant by policy makers and stakeholders.
- Since ecological boundaries rarely meet with political jurisdictions, it is necessary to be flexible when choosing the scale at which monitoring and decision-making occurs.

1.3 Cultural Health Index for Maaori

Part 2 of the Resource Management Act (particularly sections 5, 6(e), 7(a) and 8) refers to the relationship Maaori have with the environment. Resource management

¹ <http://www.sipcotcuddalore.com>

² <http://www.envnetwork.smu.ca>

agencies are required to recognise and provide for the culture and traditions of Maaori relating to ancestral lands, water, sites, waahi tapu and other taonga. They must also have particular regard to kaitiakitanga and take into account the principles of the Treaty of Waitangi. Thus, as a Treaty partner Maaori interests are recognised as being distinct from those of other stakeholders. Given these statutory provisions, Maaori expect resource managers to recognise and provide for their cultural beliefs and practices and that they are included and actively involved in environmental management processes (Tipa and Teirney, 2006).

Although many resource management agencies attempt to recognise cultural practices, many struggle with the intangible or metaphysical aspects of Maaori values, thus, finding it difficult to understand what these represent and how to adequately or appropriately recognise and provided for them (Tipa and Teirney, 2003). Tipa and Teirney (2003 and 2006) have developed the Cultural Health Index (CHI) to facilitate the participation of iwi in land and water management processes and decision making. Utilising tools such as the CHI recognises that only Maaori are able to provide the clarity needed by resource managers when dealing with Maaori spiritual and cultural issues and, significantly, supports application of the Treaty of Waitangi principle 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”* (Ministry for Environment, 1987) (Tipa and Teirney, 2003). The CHI responds to these beliefs by enabling Maaori to identify waters of special significance and use an assessment tool which is grounded in Maaori beliefs and values to ensure cultural data informs management of that Taonga (Tipa and Teirney, 2006).

The Cultural Health Index articulates cultural values, assesses the state of the environment from a cultural perspective, and assists with establishing a role for Maaori in environmental monitoring. However, Maaori also need to know that contemporary resource managers support the use of tools such as the CHI, recognise the validity of the data collected and will respond to the information provided (Tipa and Teirney, 2003). The CHI provides information that can be used as the basis for discussions between tangata whenua and territorial authorities or industry. To appreciate the detail within the CHI scores and, therefore, the issues in greater detail, resource managers and tangata whenua need to work together. By analysing the scores (e.g., A-0/2.1/4.2) of the index, tangata whenua are able to diagnose issues, decide on priorities and determine the remedial actions they see as necessary to restore or enhance the cultural values of the site. The CHI also provides the ability to monitor changes and improvements after restoration has been carried out at a stream site (Tipa and Teirney, 2006).

2. A description of the prioritised action(s)

The scope of this Study includes providing guidance on how to develop a monitoring programme to support the restoration of the health and wellbeing of the Waikato River. Monitoring is discussed in some detail in Section 8. Specific monitoring actions include:

- a. The development of Cultural Health Indices and monitoring programmes.
- b. Creating and maintain a repository of environmental monitoring equipment that can be used by volunteer monitors.
- c. Developing regional or centralised database(s) for storing environmental monitoring and background data for use by each iwi, including a dedicated person managing and supporting it.
- d. Establishing a system of regular Report Cards, to monitor and communicate the progress of restoration activities.

2.1 A Cultural Health Index for the five river iwi

Tipa and Teirney (2006) provide guidelines outlining how to identify areas for evaluation, setting up a CHI programme and the collection and analysis of data. It is important to note that thus far this index has only been utilised in streams and rivers (TDC, 2007; Tipa and Teirney, 2003 and 2006; Young et al., 2008) and further research will be required to extend to other areas (as part of Action A). Each river iwi will need to develop their own CHI to assess the cultural and biological health of a stream or catchment of their choosing. This includes:

- Development of appropriate indicators to be included in the CHI framework.
- Design and implementation of monitoring programmes (e.g., monitoring specific values and at specific sites of importance).
- Databases (web-based for increased accessibility) for each iwi to securely store the CHI monitoring information over the long-term.

Action A. The development and implementation of a Cultural Health Index (CHI) for the Waikato River includes the following components:

- The development of cultural indicators by each river iwi.
- Development and implementation of cultural health monitoring programmes by each river iwi.

Māori have already been developing indicator and monitoring tools, mainly in response to the RMA and as part of the Ministry for the Environment environmental indicator programme (TDC, 2007; Tipa and Teirney, 2002, 2003 and 2006; Townsend et al., 2004; Young et al., 2008). A large number of potential indicators that could be used by individual iwi when they develop their own CHI's for the Waikato River were captured during discussions at the hui (for more information see Appendix A at the end of this paper). These lists of indicators provide a valuable resource to facilitate the development of Cultural Health Indices by the five river iwi.

The majority of these indicators were unable to be scored by the Study team at this time because the relevant information does not yet exist but they are identified in the sample Report Cards provided in Appendix 30: Report Cards to highlight key knowledge gaps. This is not unique to this Study and a similar approach was undertaken in an assessment of wellbeing that was used to engage communities in forestry planning in Western Canada (Fraser et al., 2006).

As mentioned previously, it is for the five river iwi to identify the range of Cultural Indices that they want to see developed that are consistent with their values and aspirations. It is unrealistic to expect one CHI (and in effect a one size fits all approach) to be developed that is applicable in its entirety to all five iwi. But it is essential that cultural indices are integrated and reported alongside scientific and economic data in the Report Cards developed, otherwise holistic assessments of the health and wellbeing of the Waikato River will not be achieved. It is, therefore, recommended that combinations of the indicators presented in Appendix A (at the end of this paper) be packaged together to provide a subset of cultural indices that are assessed by all five river iwi. It is suggested that this agreed subset of cultural indices (approved by all five river iwi) are then monitored and the information collated is provided to the Waikato River Authority for collation into the Aspiration Report Cards (see Section 8). The five river iwi may also choose to monitor more cultural indices than is supplied to the Waikato River Authority as they see fit.

Three potential Cultural Indices are presented below. These are merely examples for illustrative purposes, to show how this tool could be developed and used by the five river iwi and incorporated into the Aspiration Report Cards.

For example, utilising Tipa and Teirney's (2006) CHI framework and the list of potential indicators provided by the five river iwi (see Appendix A at the end of this paper) a 'Cultural Recreational Index' could be constructed by iwi to monitor the progress of the restoration actions in realising Aspiration 6 - Swimming and Boating, (i.e., improving the use of the Waikato River and its lakes, wetlands and tributaries for recreational purposes).

A 'Cultural Recreational Index' could comprise the following indicators, or selection of:

Cultural Recreation Index
Examples of indicators that could be incorporated
Iwi satisfaction regarding access to boat ramps, their location and condition.
Number of negotiated access agreements over private land.
Number of safe swimming sites.
Satisfaction of iwi users in relation to waka ama/waka taua with: (a) flow levels, (b) ability to enter and exit water safely, (c) level of weed and algae present and (d) water quality.
Satisfaction of iwi users with experience given presence of invasive species.
Whaanau and hapuu confirm (Yes/No) that the valued features of key sites/river reaches are protected.
Satisfaction of iwi with ability to use preferred skills, practices and methods when interacting with the river.
Use of the Waikato River for waka ama

The ability of the river to sustain taonga species is vitally important if the health and wellbeing of the Waikato River is to be restored (Aspiration 11 – Taonga species). A possible index to assess the health of taonga species from the perspective of tangata whenua could comprise the following measures, or selection of, as part of a 'Cultural Species Index':

Cultural Species Index
Examples of indicators that could be incorporated
Presence/absence of valued species (e.g., kai, cultural materials and other taonga species).
Number of taonga species to be in gradual decline, threatened or endangered.
Cultural materials (fit for purpose) available at appropriate sites.
Yes/No having to purchase customary kai species (renowned species) for marae.
Level of contaminants and food safety.
Number of waterbodies without pest fish, numbers/kg of pest fish removed.
Number (and area) of new reserves established.
Number of koohanga (nursery) for valued species that are protected/restored/created e.g., proportion of whitebait spawning sites in the Waikato River that are protected compared to agreed historical baseline.
Percentage of the customary rights exercised (e.g., permits granted).

Some participants at the consultation hui held during the Study prioritised increasing the participation and engagement of their members in the restoration of the Waikato River (Aspiration 2) and may therefore benefit from development of a 'Cultural Participation Index' which could comprise the following indicators, or selection of:

Cultural Participation Index
Examples of indicators that could be incorporated
Number of iwi commissioners: (a) trained, and (b) practicing.
Number of whaanau engaging in cultural activities at specific sites (e.g., waananga, programmes, generational).
Number of new monitoring sites introduced that reflect cultural indices or Report Card indices.
Increase in hapuu and iwi environmental officers.
Whaanau and hapuu monitoring of restoration activities.
Increase in iwi participation in restoration activities on public and private land.
Number of whaanau and hapuu members engaged as volunteers in restoration activities.
Number of whaanau and hapuu members engaged as employees in restoration activities.
Number of section 33 transfers (ratio of approved vs total applications).
Whaanau, hapuu and iwi are satisfied with their ability to participate and influence decisions and achieve outcomes benefitting the river.
Total number of restoration projects initiated compared to number of programmes iwi initiated.
Increase in Maaori/cultural specific degrees for freshwater and aquatic sciences.
Increase in funding for marae based restoration activities.

2.2 Environmental monitoring equipment for communities

In Nova Scotia the Community Based Environmental Monitoring Network has developed partnerships with other organisations to create the Environmental Stewardship Equipment Bank. The goal of this initiative is to provide equipment for environmental monitoring to any person who requires it but would otherwise not be able to access it. The Community Based Environmental Monitoring Network provides this service to help augment monitoring costs and enable more community groups and individuals to be involved in environmental monitoring.

To assist individuals, community groups and organisations to actively participate in the monitoring and evaluation of the health and wellbeing of the Waikato River, a proposed action is the formation of repositories of monitoring equipment which would be available to iwi and the wider community. These repositories would be maintained by the Waikato River Authority and borrowed by volunteer monitors to:

- Enable the collection of monitoring information for use in Report Card assessments.
- Increase engagement of in the restoration of the health and wellbeing of the Waikato River.

Action B. Develop and maintain a repository of environmental monitoring equipment that can be borrowed by volunteer monitors to meet report card assessments required for funded projects and general state monitoring at a variety of scales.

2.3 Environmental monitoring database network

The development of databases (web-based for increased accessibility) for each river iwi to securely store the CHI data and other environmental monitoring information collected over time will be crucial to supporting the implementation of monitoring programmes such as the CHI (see Action D). Training workshops will also need to be held for iwi members who are responsible for the management and maintenance of these databases.

A further action includes the implementation of a centralised database that is able to securely hold the information submitted by the five river iwi, volunteer groups and local authorities. It is recommended that this is managed by a dedicated person within the Waikato River Authority.

Action C. Database for storing environmental monitoring and background data:

- Database for storing environmental monitoring and background data for use by each iwi.
- Create centralised database, coordinated by a dedicated person managing and supporting it.

3. Action Report Card – Monitoring and evaluation

Action Report Cards summarise monitoring information that measures the success of a single action or a number of closely related actions (see Section 8). To enable stakeholders to track the development and implementation of monitoring and evaluation actions the following targets, indicators and scores for the current state of the proposed actions are recommended:

Monitoring and evaluation				
Action	Measure or indicator	Target	Current state	Score
A	Implementation of cultural health monitoring programmes by each river iwi	5	0	E
B	Repository of equipment are available and being used by iwi and community groups for monitoring	10	2.5	D
C	Iwi databases established and contributions held by a centralised database for Waikato River monitoring data	6	0.5	C-

3.1 Current state

In the table above the 'current state' of these actions has been preliminarily scored based on the information gathered as part of this Study:

- Action A:** The current state of this action is scored as an E (i.e., very poor). While it is recognised by the Study team that some river iwi are engaged in developing cultural health indicators and associated monitoring programmes, this progress is not common to all five river iwi and therefore this action has not yet been implemented in a coordinated manner as set by the targets outlined in the Vision and Strategy.
- Action B:** The state of this action is currently scored as a D (i.e., poor). This score is to reflect that although some monitoring equipment does exist and is being used by community monitoring and restoration groups (e.g., the Stream Health Monitoring and Assessment Kit (SHMAK)), its use and knowledge of its availability is disparate and uncoordinated. The target for the number of monitoring equipment repositories has been set at total of 10 (one for each iwi and five that are available throughout the catchment for community groups involved in restoration activities).
- Action C:** The state of this action is currently scored as a C- (i.e., fair). This score is to reflect the existence of environmental information that is currently collected and managed by the local authorities within the Waikato River catchment (e.g., Environment Waikato). However, the ultimate target is for each river iwi to have a database to securely store data that is collected as part of their cultural health monitoring programmes, a selection of which is provided to a centralised database for the purpose of reporting restoration progress.

4. How will the action(s) be accomplished?

The Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 and Ngati Tuwharetoa, Raukawa, and Te Arawa River Iwi Waikato River Bill outlines co-management arrangements that are to be implemented including: (1) Integrated river management plans, (2) Environmental plans, and (3) Joint management agreements. The joint management agreements provide for the local authority and iwi to work together in carrying out a number of duties and functions. In relation to monitoring, these joint management agreements include meeting no less than twice per year to:

- Discuss and agree on priorities for monitoring, methods for and extent of the monitoring and discuss the potential for the river iwi to participate in the monitoring.
- Discuss appropriate responses to address the outcomes of the monitoring, including the potential for review of RMA planning documents and enforcement under the RMA including criteria for commencement of prosecutions, applications for enforcement orders, the service of abatement notices and the service of infringement notices.
- Agree appropriate procedures for reporting back to iwi on the enforcement actions taken.
- Discuss and agree on role of the river iwi Trusts in a 5 yearly review in section 35(2A) of the RMA.
- Discuss potential for persons to be nominated by the river iwi Trusts to participate in enforcement action under the RMA.

In terms of monitoring the Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 and the Ngati Tuwharetoa, Raukawa, and Te Arawa River Iwi Waikato River Bill also establishes and grants functions and powers to the Waikato River Authority to:

- Monitor the carrying out, effectiveness and achievement of the Waikato River Authority.
- Monitor the implementation, effectiveness, and achievement of the Vision and Strategy, including any targets and methods.
- Monitor the implementation, effectiveness, and achievement of clean-up initiatives funded by the Waikato River Clean-up Trust.
- Report every 5 years on the results of the monitoring.

5. Where in the Waikato River catchment should the actions occur?

The development and implementation of a Cultural Health Index for the Waikato River is clearly outlined in the Vision and Strategy. The targets listed in the Vision and Strategy in regards to the timeframe and extent of the Waikato River catchment to be covered by this initiative are:

- Within 2 years: 25 percent of the Waikato River has been incorporated within a CHI monitoring programme.
- Within 4 years: The CHI has been incorporated within the monitoring regime for the Waikato River.
- Within 8 years: 100 percent of the Waikato River is subject to the Waikato River CHI monitoring programme.

6. What is the cost of the action(s)?

The estimated costs of the proposed monitoring and evaluation actions include:

Action	Description	Set up costs	On-going costs (i.e., after set up)
A	Development of Waikato River iwi-specific cultural indicators	\$250k/iwi	
	Implementation of cultural indicator monitoring programmes by each Waikato River iwi		\$100k/iwi/year
B	Develop and maintain a repository of quality equipment for environmental monitoring		\$80k/year
C	Develop a database appropriate for storing environmental monitoring data collected by each Waikato River iwi	\$250k	--
	Database training (workshop) for Waikato River iwi representatives	\$30k	--
	Develop a centralised database, that is managed and supported by a dedicated person	\$200k	\$80k/year

7. Who could do it and how long would it take?

The timeframes for the implementation of the CHI by the five river iwi are clearly outlined in the Vision and Strategy (see Sub-Section 6 above). The actions proposed here require the involvement and input from all iwi and the Waikato River Authority.

8. What are the interactions with other activities (co-benefits, drawbacks)?

The actions proposed here will increase the involvement and participation of iwi and the wider Waikato community in monitoring and evaluating the health and

wellbeing of the Waikato River. These outcomes will contribute to the restoration of Aspiration 1 – Holism “*That the management of the Waikato River and its lakes, wetlands and tributaries to protect their health and wellbeing is conducted in a holistic, integrated way*” and Aspiration 2 – Engagement “*That people feel engaged with the Waikato River and its lakes, wetlands and tributaries, and processes, initiatives or actions to restore and protect their health and wellbeing.*”

9. An analysis of uncertainties and information gaps

The five river iwi need to know that resource managers support the use of tools such as the CHI, recognise the validity of the data collected and will respond to the information provided (Tipa and Teirney, 2003). Some of this uncertainty will be addressed through the implementation of the Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 and the Ngati Tuwharetoa, Raukawa, and Te Arawa River Iwi Waikato River Bill. Intellectual property agreements between the river iwi and local authorities may be required to ensure that the information supplied by iwi is used only for the purposes that are jointly agreed upon.

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11. Appendix A

Types of indicators that could be included by the river iwi in their Cultural Health Indices:

This list of potential indicators was identified during the Study, the majority of which reflect the issues and aspirations that the river iwi identified during the consultation hui held in July/August 2009 and February 2010. They are presented in no particular order of priority.

Examples of indicators that could be incorporated
Iwi satisfaction regarding access to boat ramps, their location and condition
Number of negotiated access agreements over private land
Appropriate controls on access are initiated in areas of high risk and sites of significance
Number of culturally specific sites restored
Ability to implement and enforce local-based management measures such as raahui
Presence/absence of valued species (kai, cultural materials and taonga species)
Percentage of the customary rights exercised (e.g., permits granted)
Cultural materials (fit for purpose) available at appropriate sites
Distribution and abundance of valued species compared to historical baseline
Number of whaanau engaging in cultural activities at specific sites (e.g., waananga, programmes, generational)

Examples of indicators that could be incorporated
Iwi are satisfied that protocols for harvesting customarily important kai species are (a) appropriate and (b) observed
Yes/No having to purchase customary kai species (renown species) for marae
Level of contaminants and food safety
Number of safe swimming sites
Water quality standard is the food gathering standard
Satisfaction of iwi users in relation to waka ama/waka taua with (a) flow levels, (b) ability to enter and exit water safely, (c) level of weed and algae present and (d) water quality
Identified springs/groundwater meet drinking water standards
Number of marae that have access to healthy drinking water
Number of taonga species to be in gradual decline, threatened or endangered
Satisfaction of iwi users with experience given presence of invasive species
Number of waterbodies without pest fish, numbers/kg of pest fish removed
Number of reintroductions of taonga species
Number of new monitoring sites introduced that reflect CHI or report card indices
Increase in hapuu and iwi environmental officers
Increase in whaanau and hapuu monitoring activities
Increase in iwi participation in restoration activities on public and private land
Number of iwi hearings commissioners (a) trained and (b) practicing
Number of section 33 transfers (ratio of approved vs total applications)
Number of economic development opportunities initiated by whaanau, hapuu and iwi directly related to the river and/or resources
Percentage of Maaori lands being used as whaanau, hapuu and iwi desire
Whaanau, hapuu and iwi are satisfied with their ability to participate and influence decisions and achieve outcomes benefitting the river
Total number of restoration projects initiated compared to number of programmes iwi initiated
Whaanau and hapuu confirm (Yes/No) that the valued features of key sites/river reaches are protected
Percentage of cultural materials available and used today compared to historically
Number of whaanau households that still gather kai and cultural materials

Examples of indicators that could be incorporated
Number of traditional practices that can be reinstated as a result of restoration activities
Number or percentage of rangatahi perceiving species and cultural practices as still relevant and meaningful today
Whaanau and hapuu are satisfied at the level of protection in place for sites of significance
Whaanau and hapuu confirm (Yes/No) that linkages between key sites/river reaches and other sites in significant cultural landscapes are protected
Number of damaging activities at or in the vicinity of identified sites of significance
Number of placenames changed at request of iwi
Number of corrections to incorrect/dislocated placenames
Number of whaanau and hapuu members engaged as volunteers in restoration activities
Number of whaanau and hapuu members engaged as employees in restoration activities
Whaanau and hapuu are satisfied at how the river is being treated
Whaanau and hapuu have a sense of pride in how the river looks
Whaanau and hapuu believe the river is a health environment with which they and communities can interact
Whaanau and hapuu are satisfied with the nature and extent of publicly available information advising of their association with the river
Number of programmes in place for transmission of knowledge (e.g., waananga)
Number of iwi participants in each programme
Number of whaanau who still engage in cultural practices. Percentage of rangatahi engaged in cultural practices
Traditional sites recorded are restored or have a action plan
Satisfaction of tangata whenua that range of healthy habitats used in river and along riverbank (e.g., shelter, tuna burrows covered etc.)
Number of koohanga for valued species that are protected/restored/created
Proportion of whitebait spawning sites in the Waikato River that are protected
Islands identified by iwi are maintained and protected as islands
Number (and area) of new reserves established
Number of regulatory barriers removed (e.g., policies, bylaws, methods, rules removed)
Satisfaction of iwi with ability to use preferred skills, practices, methods when interacting with the river

Examples of indicators that could be incorporated
Iwi specific flow preferences identified
Whaanau, hapuu and iwi satisfied at river flow regimes
Iwi satisfaction with balance of floods/freshes/low flows
Iwi satisfied that flow variability and changing currents do not pose safety risks
Area of land (ha) exposed to frequent flooding (historical compared to today)
Increase in Maaori/cultural specific degrees for freshwater and aquatic sciences
Increase in funding for marae-based restoration activities

Appendix 30: Report Cards

1. Introduction

This paper provides a full set of sample Report Cards for the aspirations outlined in Section 6. These Report Cards can be used to ‘audit’ priority actions. They use both ‘action’ indicators and ‘state’ indicators. As explained in Section 8.2.1, ‘state’ indicators describe the health and wellbeing of the Waikato River, and can be scored from monitoring data or predicted from models. ‘Action’ indicators describe how far a particular restoration action has been carried out.

When carrying out restoration, it is important that monitoring is put in place as soon as possible to assess and manage the restoration actions, including describing the baseline state for health and wellbeing. At this point of time, there is very little data available to score indicators on the current state, so ‘action’ indicators are used as surrogates (as described in Section 8.2.2). In the following Report Cards, state indicators have been used where possible, along with action indicators. The action indicators could be scored at this time, but many of the state indicators will need development and could not be scored at this time. Exceptions were most water quality indicators and some ecological indicators where there is monitoring data. If a proposed indicator could not be scored, it was still listed in the example Report Cards as a ‘placeholder’.

As Report Cards evolve, with experience and ongoing restoration, a subset of the most useful indicators will emerge and can be used. Guidance for developing and scoring indicators is given in Appendix 29: Monitoring and Evaluation.

The Report Cards can be prepared for any part of the Waikato River. In the following examples, we have used monitoring data and predicted water quality for the Waikato River at Horotiu in the Lower Waikato, except where this was inappropriate, and this is indicated (e.g., shallow lakes).

These sample Report Cards illustrate a way forward for the Waikato River Authority. A similar type of Report Card, the Cultural Health Index (CHI) (also see Appendix 29: Monitoring and Evaluation), also contains measures for both the health and wellbeing of the Waikato River, and reporting the overall benefits of restorative actions. As recommended in Section 8, the five river iwi may wish to identify the range of Cultural Health Indexes that they want to see developed, and the type of indicators to be included, that are consistent with their aspirations. These types of Report Cards are described in the Section 8 and Appendix 29: Monitoring and Evaluation.

Environment Waikato have also prepared Report Cards for many indicators, and the Study team has drawn on their methodology where relevant.

Note that Regional and National Prosperity aspiration indicators (Aspirations 14 and 15) were not scored. Actual data is used.

2. Report Cards

The sample Report Cards provided below are listed in the following order:

Table	Report Card
1A	Fisheries and Kai - Whitebait
1B	Fisheries and Kai - Tuna
2	Taonga Species
3A	Ecological Integrity - Lakes
3B	Ecological Integrity – Riverine Habitat
4	Aesthetics
5	Swimming and boating
6	Human Health
7	Water Quality
8	Water Allocation
9	Significant and Historic Sites
10	Access
11	Spiritual Values
12	Holism
13	Engagement

Table 1A: Fisheries and Kai - Whitebait Report Card					
	Measure or indicator	Target		Current	Score
Action Indicators (see Appendix 6: Whitebait)					
1	Adult iinanga prime stream habitat (km).	800		350	C-
2	Iinanga spawning habitat (bank length km).	20		10.5	C
3	Weeds managed appropriately in low-land drains to enhance adult iinanga habitat (km).	3,460		1,800	C
4	Number of impassable tidegates made fish-friendly in prime potential habitat area at Aka Aka (number).	23 ^a		0	E
5	Number of road culverts passable to migrant iinanga (number).	180		70	D
6	Number of farm culverts passable to migrant iinanga (number).	5,000		2,000	D
7	Total stream length of potentially prime habitat for banded kookopu with restored riparian vegetation (km).	310		250	B
8	Number of farm culverts passable to migrant banded kookopu (number).	4,000		2,560	C
9	Restore shallow lake habitat (see Ecological Integrity – Lakes).	2 large riverine lakes		Very poor habitat	E
10	Whitebait habitat score (weighted summary of above).	See above		See above	D-
11	The impact of pest fish on juvenile whitebait is reduced.	Research completed		Research underway	D
12	All aspects of the whitebait fishery come under the control of a single regulatory agency.	Legislation enacted		Several agencies	E
13	For individual fishers, average catch per unit effort.	20g/hr	2g/hr	D	B
14	Total catch.	TBD	TBD	TBD	TBD
15	Water clarity suitability (measured by ariari board, m).	1	0.6 ^b	C	A

Table 1A: (cont.) Fisheries and Kai - Whitebait Report Card					
	Measure or indicator	Target		Current	Score
State Indicators				Current	Future
16	Abundance restored to allow marae to provide locally caught whitebait (number of events).	20 ^c	0	E ^c	B ^c
17	Access to traditional fishing sites.	Iwi ^d	D ^c	D ^c	B ^c
18	A measure of activities associated with knowledge transfer.	Iwi ^d	Iwi ^d	Iwi ^d	Iwi ^d

For action indicators, the current score only is given because all actions should score 'A' if completed successfully.

Grey text indicates best professional judgement.

TBD = To Be Developed.

^aTotal number, some may already be partially passable..

^bMeasured at Tuakau.

^c Strictly speaking these can only be scored by river iwi, but tentative scores were given by the Study team based on feedback from the consultation hui.

^dIwi – these can only be scored by river iwi. However, actions recommended for Engagement (see Section 5) include that every year 2 workshops be conducted for each river iwi on restoration methods including traditional fisheries.

Table 1B: Fisheries and Kai - Tuna Report Card					
	Measure or indicator	Target	Current	Score	
Action Indicators (see Appendix 5: Tuna)					
1	Creation of tuna pond habitat (ha).	200	0	E	
2	Creation of tuna wetlands habitat (ha).	500	0	E	
3	Weeds managed appropriately in low-land drains to enhance tuna habitat (km).	3,460	1,800	C	
4	Continue existing elver transfer (number).	2.00E+06	0	A	
5	On-growing transferred elvers (number).	8E+05	0	E	
6	Fish-friendly pump stations (number).	65	0	E	
7	Fisheries legislation on minimum and maximum sizes.	Amended		E	
8	Create reserves in restored Lake Whangape and <3 rd order streams.	Regulations amended	None	E	
9	The tuna habitat in the Waikato River catchment is doubled (ha).	5,000	2,500	C	
State Indicators				Current	Future
10	Total catch	200	100	C	A
11	Abundance restored to allow marae to provide tuna (tonnes).	40	10	D ^a	A ^a
12	Access to traditional fishing sites and/or ability to implement and enforce local-based management measures such as raahui.	Iwi ^b	Iwi ^b	Iwi ^b	Iwi ^b
13	Iwi satisfaction with quality and quantity.	Iwi ^b	D ^a	D ^a	B ^a
14	A measure of activities associated with knowledge transfer.	Iwi ^b	Iwi ^b	Iwi ^b	Iwi ^b

For action indicators, the current score only is given because all actions should score 'A' if completed successfully.

Grey text indicates best professional judgement.

TBD = To Be Developed.

^aStrictly these can only be scored by river iwi, but tentative scores were given by the Study team based on feedback from the consultation hui.

^bIwi – these can only be scored by river iwi. However, actions recommended for Engagement (see Section 5) include that every year 2 workshops be conducted for each river iwi on restoration methods including traditional fisheries.

Table 2: Taonga Species Report Card					
	Measure or indicator	Target	Current	Score	
Action Indicators					
1	Tuna habitat (see Tuna).	See Tuna	Fair	D-	
2	Whitebait habitat (see Whitebait).	See Whitebait	Fair	D-	
3	Proportion stream length with RMC score ≥ 4 weighted for stream size (%). ^a	85	45	C	
4	Knowledge of causes of the decline in kooura, kaaeo and piiharau and restoration actions.	Research projects including marae-based monitoring	Some existing programs	D	
5	Knowledge of successfully rearing and reintroducing kooaro and giant kookopu.	Research being done	Some existing programs	C	
State Indicators				Current	Future
6	Whitebait catch.	TBD	TBD		
7	Tuna catch.	200	100	C	A
8	Kooura numbers, biomass and distribution (tau kooura).	TBD	TBD	TBD	TBD
9	Kaaeo density in shallow lakes and Waikato mainstem (aerial density).	TBD	TBD	TBD	TBD
10	Piiharau occurrence and size distribution (occurrence/size).	TBD	TBD	TBD	TBD
11	Kooaro occurrence and size distribution in Upper Waikato streams (occurrence/size).	TBD	TBD	TBD	TBD
12	Giant kookopu occurrence and size distribution in urban streams (occurrence/size).	TBD	TBD	TBD	TBD
13	Native bird surveys (aerial density).	TBD	TBD	TBD	TBD
14	Plant species of traditional significant to iwi (cultural plant index in riparian/wetlands). ^a	Correct mix of plants (to be developed by iwi)	TBD	D	
15	Plant species as habitat and food resources for taonga species (habitat plant index in riparian/wetlands). ^a	Correct mix of plants (to be developed by iwi)	TBD	D	

Grey text indicates best professional judgement.

TBD = To Be Developed.

For action indicators, the current score only is given because all actions should score 'A' if completed successfully.

^aAlso a state indicator.

Table 3A: Ecological Integrity - Lakes Report Card				
	Measure or indicator^a	Target	Current	Score
Action and State Indicators (see Appendix 12: Shallow Lakes)				
2 of the 4 dune lakes (data used from Lake Otamatearoa)				
1	Proportion lake perimeter with RMC score ≥ 4 (%).	90	50	C
2	Submerged plant Index (LakeSPI).	75	18	D
3	Emergent plant index.	TBD	No data	
4	Lake Trophic Status (TLI).	Mesotrophic	Mesotrophic	B
5	Water clarity (m).	1.6	~3	A
6	Dissolved oxygen (% saturation).	80	Unknown	B
7	Pest fish (CPUE ^b).	Goldfish only	Goldfish only	A
8	Community satisfaction with access and use (social survey).	TBD	TBD	TBD
4 of 35 peat lakes (data used from degraded peat lakes)				
1	Proportion lake perimeter with RMC score ≥ 4 (%).	90	30	D
2	Submerged plant Index (LakeSPI).	75	0	E
3	Emergent plant index.	TBD	No data	E
4	Lake Trophic Status (TLI).	Mesotrophic	Super- and hypertrophic	E
5	Water clarity (m).	1.6	<0.4	E
6	Dissolved oxygen (% saturation).	80	Unknown	B
7	Pest fish (CPUE ^b).	Eliminate	Variable	D
8	Community satisfaction with access and use.	TBD	TBD	D
9	Catchment nutrient inputs (loads).	TBD	TBD	E
10	Internal lake nutrients inputs (loads).	TBD	TBD	E
11	Water depth (m).	TBD	TBD	D ^c

Table 3A: (cont.) Ecological Integrity - Lakes Report Card				
	Measure or indicator^a	Target	Current	Score
2 of 3 large riverine lakes (data used from Lake Whangapee)				
1	Proportion lake perimeter with RMC score ≥ 4 (%).	85	10	E
2	Native submerged vegetation cover.	75	0	E
3	Emergent plant index.	TBD	0	E
4	Lake Trophic Status (TLI).	Mesotrophic	Super- and hypertrophic	E
5	Water clarity (m).	1.6	Highly turbid	E
6	Dissolved oxygen (% saturation).	80	Unknown	B
7	Pest fish (CPUE ^b).	Sustainable numbers (TBD)	Prolific	E
8	Community satisfaction with access and use (social survey).	TBD	TBD	E
9	Catchment nutrient inputs (loads).	TBD	TBD	E
10	Internal lake nutrients inputs (loads).	TBD	TBD	E
Lake Ohakurii				
1	Proportion lake perimeter with RMC score ≥ 4 weighted for stream size (proportion).	0.85	0.25	D
2	Invasive Impact Index (part of Lake SPI).	60	96	E
4	Lake Trophic Status (TLI).	Oligotrophic	Mesotrophic	C
9	Nutrient inputs (loads).	TBD	TBD	D
11	Internal lake nutrients inputs (loads).	TBD	TBD	E

Grey text indicates best professional judgement

TBD = To Be Developed

^aFor additional maatauranga Maaori indicators see Taonga Species Report Card.

^bCPUE = catch per unit effort

Table 3B: Ecological Integrity - Riverine Report Card					
	Measure or indicator	Target	Current	Score	
Action Indicators					
1	Tuna habitat (see Tuna habitat score ^a).	See Tuna	-	D-	
2	Whitebait habitat (see Whitebait habitat score ^a).	See Whitebait	-	D-	
3	Proportion stream length with RMC score ≥ 4 weighted for stream size (%).	85	45	C	
State Indicators				Current	Future
5	Turbidity (NTU).	5	2.7	A	A
6	Dissolved oxygen (% saturation).	80%	98%	A	A
7	Temperature ($^{\circ}$ C).	20	21.8 ^c	A	A
8	Periphyton cover in tributaries (%).	TBD	TBD	TBD	TBD
9	Shade in tributaries.	TBD	TBD	TBD	TBD
10	Macrophyte cover and type.	TBD	TBD	TBD	TBD
11	Sediment composition.	TBD	TBD	TBD	TBD
12	Algal blooms (chlorophyll μ g/L).	10	16	B	A
13	Satisfaction of tangata whenua of the range of suitable habitat in river and along riverbank (e.g., shelter, tuna burrows covered).	TBD	TBD	TBD	TBD
14	Ecosystem Health (macroinvertebrate indices).	Satisfactory	See notes	D	A
15	Fish biodiversity.	2.8	2.2	C	B

Grey text indicates best professional judgement.

TBD = To Be Developed.

For action indicators, the current score only is given because all actions should score 'A' if completed successfully.

^aTuna and whitebait habitat restoration are used as indicators of restoration of riverine and associated wetland habitat (but not shallow lakes) in general.

^cMaximum temperature at Horotiu in 2008.

Table 4: Aesthetics Report Card					
	Measure or indicator^a	Target	Current	Score	
State Indicators^a				Current	Finish
1	Riparian vegetation - proportion stream length with RMC score \geq 4 weighted for stream size (%). ^b	85	45	C	A-
2	Colour of water (change in Munsell colour units).	<10	16.3	C-	B-
3	Clarity of water (m).	1.6	1.28	B	A
4	Sediment composition.	TBD	TBD	TBD	TBD
5	Community satisfaction with appearance of river.	TBD	TBD	TBD	TBD
6	Rubbish.	TBD	TBD	TBD	TBD

TBD = To Be Developed.

^aThe indicators for aesthetics are all state indicators except for one which is both an action and state indicator. Here the efficacy of the priority actions: fencing, restricting stock access, planting and bank protection, are assessed by their effects on riparian aesthetics, water colour and clarity, sediment muddiness, community satisfaction and rubbish, but the actions themselves are described and assessed in the Water Quality Report Card.

^b See Appendix 11: Riparian Aesthetics.

Table 5: Swimming and Boating Report Card					
	Measure or indicator	Target	Current	Score	
Action Indicators					
1	Strategic Access, Boating and Swimming Plan (completion).	Completed	Some policies and rules	C	
2	Strategic Access, Boating and Swimming Plan (implemented).	Implemented	No plan	E	
3	Snags removed at strategic locations.	10	Some removal	D	
4	Aquatic weeds (sites controlled).	40	2	D	
5	Satisfactory flows for regattas (agreements in place).	Agreements	Some agreements	C	
State Indicators				Current	Future
7	<i>E. coli</i> (numbers per ml).	<126	82	A	A
8	Clarity (m).	1.6	1.28	B	A
9	Toxic algal blooms (chlorophyll concentration µg/L).	10	16	C-	A
10	Duck itch (survey of parasites at weed control sites).	TBD	TBD	TBD	TBD
11	Satisfaction in relation to waka ama/waka taua with (a) flow levels (b) enter and exit water safely (c) level of weed/algae present (d) water quality.	TBD	TBD	TBD	TBD
12	Satisfaction with Waikato River Iwi with ability to use preferred skills, practices and methods when interacting with the river.	TBD	TBD	TBD	TBD
13	Surveys of recreational activity and satisfaction.	TBD	TBD	TBD	TBD

TBD = To Be Developed.

For action indicators, the current score only is given because all actions should score 'A' if completed successfully.

Table 6: Human Health Report Card					
	Measure or indicator	Target	Current	Score	
Action Indicators					
1	No sewage discharges to water (number).	0	30	E	
2	Duck itch (sites weeds controlled).	40	2	D	
3	Streams fenced on dairy to exclude all livestock and native buffers established (%).	100	Unknown	TBD	
4	Streams \geq 3 rd order fenced on sheep and beef to exclude all livestock and native buffers established (%).	100	Unknown	TBD	
5	Septic tanks (cleaning frequency).	2–3 years	2–6 years	C	
6	Marae with treated water (number).	67	0	E	
7	Proportion geothermal fluids discharged (%).	0	~50	C	
8	Food basket health risk.	Food advisory	TBD	TBD	
9	Arsenic release risk.	No significant release	TBD	TBD	
State Indicators				Current	Future
10	<i>E. coli</i> (numbers per ml).	126	82	A	A
11	Toxic algal blooms (chlorophyll $\mu\text{g/L}$).	10	16	B	A
12	Food basket health risk (mercury concentrations in food).	Survey data	TBD	TBD	TBD
13	Hg in hair samples in the river iwi.	TBD	TBD	TBD	TBD
14	Food basket health risk (arsenic concentrations in food).	Survey data	TBD	TBD	TBD
15	Arsenic release risk (arsenic in hyperlimnion $\mu\text{g/L}$).	TBD	TBD	TBD	TBD
16	Arsenic release risk (DO in hyperlimnion).	5	TBD	TBD	TBD
17	Arsenic risk (arsenic in water $\mu\text{g/L}$).	11	35	D	A
18	Duck itch (survey of parasites at weed control sites).	No parasites	TBD	TBD	TBD
19	Iwi satisfaction with food basket health risk (social survey).	TBD	TBD	TBD	TBD

Grey text indicates best professional judgement.
TBD = To Be Developed.

Table 7: Water Quality Report Card					
	Measure or indicator	Target	Current	Score	
Action Indicators					
1	Streams fenced to exclude cattle and banks stabilised (proportion %).	100	22 ^a	D+	
2	Streams fenced on dairy to exclude all livestock and native buffers established (%).	100	Unknown	TBD	
3	Streams >= 3 rd order fenced on sheep and beef to exclude all livestock and native buffers established (%).	100	Unknown	TBD	
4	Proportion of farm area where P fertiliser optimised to soil tests (%).	100	Unknown	TBD	
5	Proportion of dairy farm area where nitrification inhibitors (%).	100	Unknown	TBD	
6	Proportion of dairy farm area where nitrogen fertiliser is not applied during winter (%).	100	Unknown	TBD	
7	Proportion of dairy farm laneways which drain to streams diverted (%).	100	Unknown	TBD	
8	Proportion of runoff from dairy farms routed through 1% wetlands.	100	Unknown	TBD	
9	Proportion of treated sewage discharges that have advanced nutrient (P) and pathogen removal (%).	100	TBD	TBD	
State Indicators				Current	Future^b
10	TP (µg/L N).	500	400	A	A
11	TN (µg/L P).	35	50	B	A
12	Chlorophyll (µg/L).	10	16	B	A
13	Colour (Munsell colour change, Munsell units).	10	16	C	A
14	Turbidity (NTU).	5	2.7	A	A
15	Community satisfaction with water quality (social survey).	TBD	TBD	TBD	TBD

TBD = To Be Developed.

^aStorey (2010).

^bPredicted by the Waikato Catchment Model (see Appendix 13: Water Quality).

Table 8: Water Allocation Report Card				
	Measure or indicator	Target	Current	Score
Action Indicators				
1	Holism, ecological effects, tangata whenua values, cumulative effects, assimilative capacity, efficiency.	Variations in RPV6 ratified	Not ratified	E
2	Water quality targets are met under reduced flows (concentrations).	Targets are met for TP, TN, <i>E. coli</i> , clarity and colour	Not ratified	E
3	Effects of land use change and riparian management impacts on allocable flows.	Land use change effects on water yield have been considered when setting environmental flows	Not taken into account	E
State Indicators (preliminary suggestions only)^a			Current	Finish
4	Water take plans all optimised to efficient water use.	TBD	TBD	TBD
5	Nutrient plans developed for all irrigation of crops and farmland.	TBD	TBD	TBD
6	Tangata whenua values have been considered in all consents (e.g., proportion of time flow within prescribed ecological and iwi-specific range).	TBD	TBD	TBD

TBD = To Be Developed.

^aChoice of indicators should wait until the Regional Plan Variation 6 is finalised.

Table 9: Significant and Historic Sites Report Card					
	Measure or indicator	Target	Current	Score	
Action Indicators					
1	Waahi Tapu and Significant Sites Management Plan (completion).	Plan	TLA plans	C	
2	Joint Management Agreements between iwi and TLAs (completion).	Significant and historic sites included in JMAs	None signed	C	
3	Appropriate signage (percent completion).	Where it is appropriate and in Plan	0%	D	
4	Restoration at high priority sites identified in the Management Plan (percentage completion).	Percentage completion	0%	D	
State Indicators				Current	Finish
5	The community understands the historical and cultural associations of sites with the Waikato River (social surveys).	TBD	TBD	TBD	TBD
6	Iwi/community are satisfied that significant sites are protected (and where appropriate) recognised.	TBD	TBD	TBD	TBD
7	Iwi satisfied that valued features of key sites/river reaches are protected.	TBD	TBD	TBD	TBD

Grey text indicates best professional judgement.

TBD = To Be Developed.

Table 10: Access Report Card					
	Measure or indicator	Target	Current	Score	
Action Indicators					
1	Strategic Access Plan is completed for the Waikato Region covering access to the Waikato River, legal impediments, including riparian reserves, access and use for boating, footpaths and cycleways, and riparian vegetation.	Plan completed	Local district plans	C	
2	Access along, the banks of the Waikato River and its tributaries is improved and thereby uses for recreational purposes such as walking and cycling increased.	Various	Access excellent in places, poor in others	C	
3	Access is improved to historic sites, collection sites for kai and cultural materials, and to other sites of cultural significance where river iwi so decide.	Footpaths- some private, some public.	Access excellent in places, poor in others	D	
4	Access to and from the Waikato River is improved by adding to the existing number of reserves and boat ramps, or improving existing facilities, thereby improving and increasing use for boat launching, swimming and leisure activities.	Works completed	Access excellent in places, poor in others	C	
State Indicators				Current	Finish
5	Proportion of mainstem Waikato and Waipa with walkways and cycleways.	TBD	TBD	TBD	TBD
6	Community satisfied with access (social survey).	TBD	TBD	TBD	TBD

Grey text indicates best professional judgement.
TBD = To Be Developed.

Table 11: Spiritual Values Report Card					
	Measure or indicator	Target	Current	Score	
State Indicators^a				Current	Future
1	The relationships of iwi, their culture and traditions with the Waikato River which are taonga to them, and integral to their tribal identities (social survey).	Recognised and provided for	TBD	TBD	TBD
2	The relationships of the wider Waikato community, their culture and traditions with the Waikato River (social survey).	Recognised and provided for	TBD	TBD	TBD
3	All statutory plans recognise and provide for iwi and wider Waikato community economic, social, cultural and spiritual relationships with the Waikato River.	All plans	TBD	TBD	TBD

TBD = To Be Developed.

^aSpiritual Values are mostly addressed through meeting other aspirations.

Table 12: Holism Report Card			
	Measure or indicator	Target	Score
Action Indicators^a			
1	Precautionary principle in all plans, policies and decision making.	Plans, policies and rules have been audited and changed if necessary so that decision making is guided by the precautionary principle.	C
2	Plans, policies and rules take into account cumulative effects including multiple stressors.	Technical methods have been developed and adopted. Plans, policies and rules have been audited and changed if necessary to guide decision making	D
3	Plans and policies take into account cultural, spiritual, social and economic relationships of iwi and wider community with the Waikato River.	Plans have been audited and changed if necessary	B
4	Decision making is guided by effective national policy and guidelines.	Effective national policy and guidelines are in place	D
5	An integrated statutory management plan for the Waikato River has been implemented that encompasses physical, chemical, biological, social, economic, cultural and historic matters, at regional, sub-catchment and farm scale.	Plans have been audited and changed if necessary	E
6	Co-management agreements have been established between iwi and local authorities.	Co-management agreements established	B
7	The methods used by local authorities are standardised.	The same procedures, guidelines and standards are used by local authorities where possible	B
8	Actions to restore the Waikato River are being coordinated through the development and implementation of non-statutory management plans.	Plans have been developed (see Boating and Swimming etc.)	D
9	Joint industry-community accords have been established.	Accords established	D

Grey text indicates best professional judgement.

TBD = To Be Developed.

^aIn the Holism Report Card, all the indicators are both 'action' and 'state' indicators.

Table 13: Engagement Report Card			
	Measure or indicator	Target	Score
Action Indicators			
1	Representatives from each iwi have completed training course for Commissioners (number trained).	2 per iwi per year	D-
2	Commissioner-run workshops and group training sessions for each iwi (number).	1 per iwi per 2 years	E
3	Waikato River focussed public education centres.	Wanaanga established	E
4	Training workshops on restoration methods including riparian fencing and planting, monitoring, traditional fisheries (number).	2 per Iwi per year	C
5	Financial support and resources to co-ordinators working with iwi and community groups to facilitate better integration of community-based restoration and monitoring initiatives.	Co-ordinators supported	C-
6	Repository of equipment that can be used by iwi and community groups for monitoring the progress of restoration.	Equipment available	D
7	A centralised database and auditing system for monitoring data.	Iwi and centralised databases established, audited and available	D
8	Culturally appropriate monitoring tools.	Available for use by iwi	E
9	Partnerships between WRA, industry and community groups to help restore and protect the Waikato River.	Partnerships established	D
10	Partnerships with international organisations working on river restoration.	Partnerships established	C-
11	Scholarship on the Waikato River and research to fill important information gaps preventing restoration.	Agreement with University of Waikato and Waikato-Tainui College for research and development, number of scholarships, Waikato River academic chair appointed	C+
12	School cross-curriculum resources on restoration.	Prepared and delivered	D

Table 13: (cont.) Engagement Report Card				
	Measure or indicator	Target	Score	
13	Professional development workshops for school teachers.	1 per year	E	
14	Marae-based enterprises that include vocational training centred on restoration.	Enterprises established and supported	D	
15	Articles and videos promoting the restoration and protection of the Waikato River.	Number of articles and videos	D+	
16	A Waikato River festival held every 2 years to publicise restoration efforts and the value of the Waikato River to the community.	Organised and run	C	
17	Awards are made that celebrate the success of restoration projects.	Organised and awards made	D	
State Indicators			Current	Future
18	Communities (iwi, hapuu, whaanau and individuals) have the knowledge, skills, attitudes and values that result in sound environmental behaviour (social surveys).	TBD	C	TBD
19	Knowledge (maatauranga Maaori and science) gained from research, good practice and existing relationships with the Waikato River is being effectively transferred and used (social surveys).	TBD	TBD	TBD
20	The unique relationship that the five river iwi have with the Waikato River is understood and recognised within the wider community and regional organisations (social surveys).	TBD	TBD	TBD
21	Communication and publicity initiatives effectively promote greater public knowledge and understanding of the health and wellbeing of the Waikato River (social surveys).	TBD	TBD	TBD

Grey text indicates best professional judgement.
TBD = To Be Developed.

3. Overall Report Card

The following report card is a weighted average of indicator scores derived for the ladder diagrams (see Section 6), and is the Study team's assessment of the current state of the Waikato River. The average score is D+, assuming aspirations have equal weightings.

Aspiration	Score
Fisheries and Kai	D-
Taonga Species	D-
Ecological Integrity	D
Aesthetics	C+
Swimming and Boating	C-
Human Health	C
Water Quality	D+
Water Allocation	C
Significant and Historic Sites	C-
Access	C
Spiritual Values	D+
Local Prosperity	Not scored
National Prosperity	Not scored
Holism	C-
Engagement	D
Average	D+

4. Scoring restoration indicators

4.1 Whitebait

Indicator	Methods Outline
1. Adult iinanga prime stream habitat (km)	This indicator measures the amount of potential high quality iinanga habitat in rivers and streams, which is simply recorded at the start of restoration action and updated as restoration proceeds. The scores A, B, C, D, E were linearly distributed between ≥ 800 km (= 'A') and $< 25\%$ of target (< 200 km = 'E').
2. Spawning habitat	This indicator measures the amount of potential spawning habitat. Historical length unknown, but if all banks in the river with appropriate tidal range and salinity had been utilised, spawning could have occurred within 30 km, but it is likely that only about 20km was used at any one time. The scores A, B, C, D, E were linearly distributed between ≥ 20 km (= 'A') and $< 20\%$ of target (< 2 km = 'E').
3. Lowland stream habitat	<p>Amount of potential stream habitat below Karaapiro Dam is 6,400 km (riverine with slope $< 3\%$). The current state of this potential habitat is largely unknown, but expert opinion suggest 25% is in good condition, 25% needs planting on northern side (plus fencing if that hasn't occurred already), the rest to managed by physical and herbicide removal of macrophytes. In the example Report Cards the scores A, B, C, D, E were linearly distributed between the target ≥ 6400 km (= 'A') and $< 25\%$ of target (< 1600 km = 'E').</p> <p>The indicator for this action needs more robust scoring, using data collected actual surveys of these streams and drains to map the course of the restoration actions and the type of actions chosen.</p>
4. iinanga tide gate migration barriers	<p>This indicator assesses the barriers to migration posed by tide gates. There are presently 23 gates potentially restricting access to prime iinanga spawning and adult habitat. Issues are physical access, barriers at key migration times and barriers posed by the water quality behind gates (especially low DO concentrations). Scoring this indicator in the example Report Cards is based on proportion of gates that pose significant barriers. The scores A, B, C, D, E were linearly distributed between '0' gates (= 'A') and > 20 gates (= 'E').</p> <p>In the future, this indicator may need to be developed using a combined index from a survey that measures physical access, barriers at key migration times and the quality of the water behind gates, using the following scheme or its equivalent.</p> <p>Physical access: total barrier=2, partial barrier = 1, no barrier = 0.</p> <p>Barrier at migration times total barrier = 2, partial barrier = 1, no barrier = 0.</p> <p>Poor water quality: DO < 2 mg/L = 2, DO 2 – 6 mg/L = 1, DO > 6 mg/L = 0.</p> <p>The overall score = mean area weighted gate scores and individual gate grades (from combined score) so that:</p> <p>A Score = 0; B Score = 1; C Score = 2 ; D Score = 3 ; E Score 3–6.</p> <p>A mean area weighted gate scores might also be developed that takes into account the area of habitat behind each gate.</p>

Indicator	Methods Outline
Whitebait (cont.)	
5, 6, 8. Iinanga and banded kookopu culvert barriers (number)	<p>Scoring indicators for culverts barriers was based on number of culverts that pose barriers. The scores A, B, C, D, E were linearly distributed between <10% of total number of culverts as barriers (= 'A') and 80% of total culverts (= 'E').</p> <p>Once restoration actions get underway, surveys (to identify barriers) could record the information in a GIS layer, which then could be used to estimate the total area inaccessible to iinanga and banded kookopu. The indicator would then be scored based on these areas.</p>
7. Adult banded kookopu habitat (km)	<p>The historical habitat in the Lower Waikato was unknown but may have been extensive if many streams and wetlands had forest cover. The present total length of first order streams providing prime habitat for banded kookopu = 308 km. The scores A, B, C, D, E were linearly distributed between ≥300 km (= 'A') and <25% of target (<50 km = 'E').</p>
9. Shallow lake habitat	See Ecological Integrity – Lakes.
10. Whitebait habitat score	<p>The total whitebait productivity restored by removing barriers and restoring stream habitat was calculated by summing the area accessible, accounting for increased productivity from restoration actions, and also accounting for increased spawning and return of adults.</p> <p>This indicator combines and integrates the above 9 other action indicators.</p>
11. Research on pest fish impacts	The indicator for this action used in the example Report Cards was scored 'A' if the research was funded and being carried out.
12. Whitebait fishery under one regulatory agency	The indicator for this action used in the example Report Cards was scored 'A' when this was completed.
13, 14. Whitebait catch and catch effort	<p>Measuring populations of whitebait is challenging because fish move around and numbers are highly dependant on factors affecting the population in the ocean phase of their life cycles.</p> <p>This indicator method would be developed by collecting information from surveys of whitebaiters to estimate total catch and condition of the whitebait fishery. This requires that a management authority can be established with the legislative right to do this and has the resources to achieve it. There are considerable challenges to address to develop these indicators, in terms of accurate information, natural variability and off-site factors. It would take many years (10–20) to obtain sufficient information to address these challenges.</p> <p>The CPUE scores in the example Report Cards were based on expert opinion and surveys of fishers through Bay of Plenty rivers (Saxton et al., 2010).</p>

Indicator	Methods Outline
Whitebait (cont.)	
15. Water clarity (ariari board)	Water clarity can be measured using ariari boards, which is of direct relevance to fishers and the five river iwi. The method would need development and the relationship determined between it and the usual scientific measure (e.g., black disk, turbidity) measures.
16. Satisfaction for hospitality	Number of times that traditional hospitality is met by providing locally-caught whitebait to guests. This is an issue involving quality and quantity and would need to be developed by the Lower Waikato iwi. The number of times in the example Report Cards were based on 8–10 marae in Lower Waikato for own poukai and supply to Koroneihana.
Access to traditional fishing sites	Satisfaction with restoration of traditional fishing sites. This requires changes in legislation. The indicator would be developed from social surveys with local iwi (see http://www.niwa.co.nz/our-science/freshwater/research-projects/all/restoration-of-aquatic-ecosystems/social-research).
17. Knowledge transfer	This is an internal matter for iwi and needs development by individual iwi.

4.2 Tuna

Indicator	Methods Outline
1, 2. Pond and wetland habitat	This indicator simply measures the area of pond and wetland habitat created on farms and in marginal low-lying pasture. The scores A, B, C, D, E were linearly distributed between the target of 700 ha (=‘A’) and present day (0ha =‘E’).
3. Lowland stream habitat	See Whitebait.
4. Upstream transfer of elvers	In the example Report Cards, the scores A, B, C, D, E were linearly distributed between the target for on-growth of 2E+06 elvers (=‘A’) and no transfer (=‘E’).
5. Upstream passage and on-growing of juvenile tuna	<p>In the example Report Cards, the scores A, B, C, D, E were linearly distributed between the target for on-growth of 800,000 elvers (=‘A’) and no on-growth (=‘E’).</p> <p>In the future, the indicator for this action could be numbers or weight of tuna returns. For example, optimistic but realistic returns could be 60 tonnes (presently they are recorded as 2 tonnes).</p>
6. Pump stations as spawning migration barriers	This indicator assesses the barriers to adult (spawners) tuna migration posed by 65 pumping stations. In the example Report Cards, the scores A, B, C, D, E were linearly distributed between the target of zero barriers (=‘A’) and present day (>50 pump barriers =‘E’). Future scores should be based on area or length of channel behind the pumps that have safe downstream passage in place.
7. Fisheries legislation on size	The indicator for this action used in the example Report Cards was scored ‘A’ when this was completed.
8. Reserves (ha)	<p>This indicator would directly measure the area of reserves created (as part of measures seeking to ensure 40% of the original spawning stock can reach the sea).</p> <p>In the future, this indicator could be alternatively based on surveys of tuna numbers and sizes in the reserves.</p>
9. Tuna habitat doubled	<p>The total tuna productivity restored by removing barriers and restoring stream habitat was calculated by summing the area accessible, accounting for new areas and increased productivity from restoration actions, and increased return of elvers from the sea.</p> <p>This indicator combines and integrates the above 8 other action indicators.</p>

Indicator	Methods Outline
Tuna (cont.)	
10. Commercial catch	This indicator assesses the total number and size distribution of fish caught and also released (i.e., adult spawners). The overall aim of the restoration strategy is to sustainably double the weight of fish caught, but this will depend on the actions chosen. This indicator and its grading would be developed once it is clear what strategies have been put in place, the time line for these strategies and the further development of the habitat restored/fish biomass model from these strategies. The monitoring method would collect information from surveys of tuna fishers to estimate total catch and condition of the fishery. This requires that a management authority can be established with the legislative right to do this and has the resources to achieve it.
11. Cultural catch	This indicator is similar to the one above and would be monitored in the same way, but relates to river iwi being able to supply tuna as part of manaakitanga.
12. Access to traditional fishing sites	This index would need to be developed by river iwi.
13. Ability to implement and enforce raahui	This index would need to be developed by river iwi, and is related to establishment of reserves and new fisheries regulations.
14. Satisfaction with quality and quantity	The index would be developed from social surveys with river iwi (see http://www.niwa.co.nz/our-science/freshwater/research-projects/all/restoration-of-aquatic-ecosystems/social-research).
15. Knowledge transfer	This is an internal matter for iwi and needs development by individual iwi.

4.3 Taonga Species

Indicator	Methods Outline
1, 2, 6, 7. Whitebait and tuna habitat and catch	See Whitebait and Tuna.
3. Riparian vegetation	See Aesthetics.
4, 5. Research on kooura, kaaeo, piiharau, kooaro and giant kookopu	The indicator for this action used in the example Report Cards was scored 'A' if the research was being carried out.
8. Tau kooura	Kooura (freshwater crayfish) are often common in pastoral and forested headwater streams, in edge-habitats along mid to high order streams and rivers, and in deeper areas of lakes. However, there is a lack of information on abundance along the Waikato mainstem and in Waikato lakes. Abundance is best assessed by tau kooura in lakes, spotlighting (rama-kooura) in wadeable areas of lakes and streams, or electric fishing in wadeable streams. This monitoring method would be based on population/size distribution, using traditional methods. It will need development with river iwi.
9. Tau Kaaeo/Kaakahi	Shallow lakes were once extensively colonised by freshwater mussels, but these have been almost completely lost through lake deterioration. It would be straightforward to develop an indicator based on kaaeo coverage (density) of the lake bed with river iwi. The present grade for most shallow lakes is 'E'.
10. Piiharau	A suitable indicator and scoring method would need to be developed from the proposed research programme.
11. Kooaro	A suitable indicator and scoring method would need to be developed from the proposed research programme.
12. Giant kookopu	A suitable indicator and scoring method would need to be developed from the proposed research programme.
13. Native bird densities	There are well established methods for bird surveys, and there are national and local surveys of birds (especially with interest around the release of bellbirds in the Hamilton area and because of initiatives to re-establish tui). This indicator would need development, however, because it is not possible to determine what would constitute a 'restored' ecosystem, given the fact that riparian restoration only is contemplated here, there are many other restoration efforts occurring nationally and because of the many factors that determine bird populations (e.g., predators and predator controls). It is therefore not a fundamental indicator for state but something that should be monitored, documented and developed as restoration proceeds.
14. Cultural materials fit for purpose	Plant species that have traditional significant to river iwi. This cultural plant index in riparian zones and wetlands will need to be developed by river iwi.
15. Plant species suitable for habitat	Plant species that have particular value as habitat and food resources for taonga species. This habitat plant index in riparian zones and wetlands will need to be developed by Iwi in conjunction with DOC

4.4 Ecological Integrity – Lakes

The action indicators for lakes can all be addressed by stage indicators.

Indicator	Methods Outline
1. Riparian aesthetics	See Aesthetics
2. LakeSPI	<p>‘LakeSPI Index’ is a measure of the condition of native plants, the impact of invasive plants and grazing fish and the light climate of a lake determined by nutrients and suspended sediment and thus provides an overall indication of lake condition. The shallow lakes of the Waikato region have been graded using the LakeSPI Index.</p> <p>‘LakeSPI Index’ is a measure of both the condition of native plants, the impact of invasive plants and grazing fish, and to some extent, the light climate of a lake (as determined by nutrients and suspended sediment) and thus provides an overall indication of lake condition. The higher the score the better the condition. The two indices that make up the LakeSPI Index are:</p> <p>‘Native Condition Index’ – This captures the native character of vegetation in a lake based on diversity and quality of indigenous plant communities. A higher score means healthier, deeper, diverse beds.</p> <p>‘Invasive Impact Index’ – This captures the invasive character of vegetation in a lake based on the degree of impact by invasive weed species. A higher score means more impact from exotic species.</p> <p>A lake scoring full points for all LakeSPI indicator criteria would result in a LakeSPI Index of 100%, a Native Condition Index of 100% and an Invasive Impact Index of 0%. For the purposes of placing them within the Report Cards, lakes have been categorised into five main groups indicating overall lake condition based on the LakeSPI Index. Lakes are grouped as being in an A ‘excellent’, B ‘high’, C ‘moderate’, D ‘poor’ or E ‘non-vegetated’ condition. Absence of submerged vegetation usually indicated severely degraded conditions of water clarity, sediment disturbance and or pest fish disturbance (see Edwards et al., (2009) and http://www.ew.govt.nz/Environmental-information/Environmental-indicators/Inland-water/Lakes/lake10-keypoints/).</p>
3. Emergent vegetation	<p>Shallow lakes often have a band of emergent vegetation at the lake shore – an important component of the lake ecosystems. Grazing by pest fish and cattle, and/or competition from exotic weeds can destroy this vegetation.</p> <p>Emergent vegetation distribution is lake specific and depends on the depth distribution and exposure. The indicator would be limited to lake edge only, and would need to consider a wider range of lakes to calibrate the scoring method, in particular locating the upper (A) and lower grades (D, E).</p> <p>The indicator and its scoring could be considered as a proportion of potential/historical extent, where A = >80% of potential, B = 50-80% of potential, C = 20-50% of potential, D = >5%, <20% of potential, E = <5% or dominated by aliens (e.g., <i>Iris pseudacorus</i>).</p>

Indicator	Methods Outline																					
Ecological Integrity – Lakes (cont.)																						
4. Lake Trophic Index (TLI)	<p>Nutrients, water clarity and algal levels determine a lake’s trophic state which in turn reflects how well a shallow lake can support native freshwater plants and animals. The Lake Trophic Index of a lake is calculated for each of the four trophic indicators: chlorophyll a (Chla); secchi depth (SD); total nitrogen (TN); total phosphorus (TP). The method has been adopted as a Ministry for the Environment protocol (Burns et al., 2000). It is currently available for only 13 lakes in the Waikato region. The measure compares and integrates measures of nutrients, phytoplankton and clarity.</p> <table border="1" data-bbox="644 622 1161 945"> <thead> <tr> <th>Grade</th> <th>Lake Type</th> <th>Trophic Level Index</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>Microtrophic</td> <td>2.0</td> </tr> <tr> <td>A</td> <td>Oligotrophic</td> <td>2.0–3.0</td> </tr> <tr> <td>B</td> <td>Mesotrophic</td> <td>3.0–4.0</td> </tr> <tr> <td>C</td> <td>Eutrophic</td> <td>4.0–5.0</td> </tr> <tr> <td>D</td> <td>Supertrophic</td> <td>5.0–6.0</td> </tr> <tr> <td>E</td> <td>Hypertrophic</td> <td>6.0–7.0</td> </tr> </tbody> </table> <p>(See http://www.ew.govt.nz/Environmental-information/Environmental-indicators/Inland-water/Lakes/lake4-keypoints/).</p>	Grade	Lake Type	Trophic Level Index	A	Microtrophic	2.0	A	Oligotrophic	2.0–3.0	B	Mesotrophic	3.0–4.0	C	Eutrophic	4.0–5.0	D	Supertrophic	5.0–6.0	E	Hypertrophic	6.0–7.0
Grade	Lake Type	Trophic Level Index																				
A	Microtrophic	2.0																				
A	Oligotrophic	2.0–3.0																				
B	Mesotrophic	3.0–4.0																				
C	Eutrophic	4.0–5.0																				
D	Supertrophic	5.0–6.0																				
E	Hypertrophic	6.0–7.0																				
5. Water clarity	See Swimming and Boating.																					
6. Dissolved oxygen	See Ecological Integrity – Riverine Habitats.																					
7. Pest fish	<p>Pest fish are major pressures on wetlands, lakes and riverine ecosystems, through predation of, or competition with, native fish, overgrazing of native plants and aquatic weeds, bottom disturbance and increasing turbidity. The presence/absence of each of the destructive fish is a measure of state and pressure on lakes.</p> <p>At present lakes are graded A (no pest fish presence) or E (pest fish presence), because if present, they are assumed to be able to increase to full pest populations. A more refined indicator will need development when fish populations are controlled effectively by intensive netting. This likely to be based in catch per unit effort (CPUE), and will need calibration as to what is a sustainable level. This refined indicator may also need to take into account several pest species.</p>																					
8. Lake usage	Social surveys of lake usage and satisfaction will need to be developed using social surveys.																					

Indicator	Methods Outline
Ecological Integrity – Lakes (cont.)	
9. Catchment nutrient loads	Catchment loads can be measured, although this requires an extensive monitoring effort. Instead nutrient loads could be predicted using appropriate models such as OVERSEER see (Appendix 9: Farms) which also incorporate the effects of restoration actions.
10. Internal lake load	To be developed. The TLI can be used as an indicator for total load which includes the internal lake load.
11. Water level indicator	<p>The Waikato peat lakes habitats are particularly vulnerable to water level lowering. Environment Waikato monitors the type of water level control structures in peat lakes in the Waikato region. Control structures are one effective way of protecting water levels within the peat lakes. Most lakes without control structures are considered at high risk to the lowering of water levels. Their indicator shows that:</p> <p>Of the 31 peat lakes in the Waikato region, 55 percent (17 out of 31) are not protected 45 percent (14 out of 31) are protected by engineered water level control structures (see http://www.ew.govt.nz/Environmental-information/Environmental-indicators/Inland-water/Lakes/lake5-keypoints/).</p> <p>Additional measures to protect these lakes could be creating wide riparian buffer zones (e.g., 50 m) to allow vegetation to accumulate and to control drainage to the lake. These factors need further consideration and an indicator that integrates restoration measures may need to be developed.</p>

4.5 Ecological Integrity – Riverine Habitats

Indicator	Method
1. Tuna habitat	See Tuna habitat score. ^a
2. Whitebait habitat	See Whitebait habitat score. ^a
3. Riparian vegetation	See Aesthetics.
4. Turbidity (NTU)	See Water Quality.
5. Dissolved oxygen	<p>Dissolved oxygen is necessary for aquatic animals to breathe. Oxygen levels can be compromised by organic enrichment, lake stratification and excessive plant growth. This, in turn, reflects nutrient enrichment, which is a consequence of land use and its management.</p> <p>Scoring this indicator is based on Environment Waikato’s classification of dissolved oxygen (% of saturation) as unsatisfactory <80% saturation (see http://www.ew.govt.nz/Environmental-information/Environmental-indicators/Inland-water/River-and-streams/riv1-report-card/).</p> <p>Scores for the Report Cards were based on measured values relative to these targets. The scores A, B, C, D, E were linearly distributed between >80% (=‘A’) and =<20% (=‘E’).</p>
6. Temperature	<p>High water temperatures, occurring in plumes of hot wastewater, or during the afternoon of hot days in mid-summer in streams lacking riparian shade, can be stressful to aquatic animals including native fish and invertebrates (Parkyn et al., 2009). Restoration will restore riparian shade to streams which will reduce high temperature excursions. Environment Waikato categorise optimum temperatures for spawning (May to September) as excellent <10°C; satisfactory 10–12 °C; unsatisfactory >12 °C; and optimum temperatures for fish and macroinvertebrate health (October to April) as excellent <16°C; satisfactory 16–20 °C; unsatisfactory >20°C.</p> <p>An indicator could be developed based on these categories and monitoring data although it is probably the summer temperatures that are more important for assessing ecological integrity.</p>
7. Periphyton cover in tributaries (%)	<p>Periphyton is a complex assemblage of benthic algae, bacteria and fungi that grows on surfaces in streams. Periphyton is an important food source for stream biota. However, nuisance growths of periphyton can occur where there is ample light and nutrients. These growths can make the streambed habitat unsuitable for sensitive invertebrate species and make the stream unattractive for swimming and angling (Parkyn et al., 2010).</p> <p>Methods for monitoring periphyton are well established (Collier et al., 2007 Harding et al., 2009). An appropriate scoring system could be developed for Waikato tributaries.</p>

Indicator	Method
Ecological Integrity – Riverine Habitats (cont.)	
8. Shade	<p>Shade plays an important role in the regulation of stream light and temperature, with profound effects on in-stream plant growth, ecosystem metabolism and the relative suitability of the habitat for differing biota (Parkyn et al., 2009). Shade should increase with riparian planting. Shade can be measured with specialised equipment or light meters.</p> <p>A suitable indicator could be developed based on the amount of optimum shade for different restoration objectives (e.g., tuna, iinanga, banded kookopu, piiharau, cultural materials and temperature limitations) using paired light meters (Parkyn et al., 2010).</p>
9. Macrophyte cover and type	<p>Macrophytes are important components of stream ecosystems. They provide habitat and cover for invertebrates and fish and a surface for colonisation by algae and bacteria. They also reduce water velocity and encourage the deposition of fine particles and their roots help to stabilise the streambed. However, they can also have negative impacts. Dense growths of macrophytes in streams, particularly of invasive introduced species, can smother benthic habitats, reduce stream biodiversity, impede water flow, and their photosynthesis-respiration cycle can cause wide fluctuations in dissolved oxygen and pH (Parkyn et al., 2010). In-stream macrophyte growth in streams is strongly controlled by light availability and should respond to riparian planting.</p> <p>A macrophyte indicator could be developed similar to LakeSPI which measures cover and relative occurrence of native and exotic species. Alternatively, it could incorporate three other simple indices: Macrophyte Total Cover (MTC), Macrophyte Channel Clogginess (MCC) and Macrophyte Native Cover (MNC) developed for the macrophyte cover rapid assessment method of Collier et al., (2007) for wadeable streams.</p>
10. Sediment composition	<p>Stream-bed particle size is a strong driver of the biological community in streams. Fine sediments (sand and silt) are generally considered unsuitable for the majority of invertebrates (except for certain taxa such as worms, molluscs, some midges) and may affect native fish also. Most native fish use the stream bed for shelter, foraging and nesting, thus benefit from large particles (cobbles and boulders) (Parkyn et al., 2010). Excessive amounts of very fine sediments (silt) affects aesthetics because they feel unpleasant to walk in and can turn the water turbid. Restoration action to afforest unstable lands, keep stock out of streams, reduce bank erosion and filter overland runoff should reduce fine sediment inputs.</p> <p>While there are a number of methods for determining sediment composition, a new method is currently being developed for fine sediments (Parkyn et al., 2010). An indicator could be developed from this new method, along with consultation with river iwi (over aesthetics) and an understanding of what should be the natural sediment composition at any particular site or reach.</p>

Indicator	Method
Ecological Integrity – Riverine Habitats (cont.)	
11. Algal blooms (chlorophyll µg/L)	See Water Quality.
13. Ecological health	<p>This indicator measures the presence and numbers of freshwater invertebrates (such as insects, crustaceans and worms) in rivers across the region (see http://www.ew.govt.nz/Environmental-information/Environmental-indicators/Inland-water/River-and-streams/riv3-techinfo/). Different types of invertebrates have different tolerances to pollution and are also affected by quality of their habitat. This can be used to tell how good the water and habitat quality is by the types and numbers of invertebrates living in the river. The indicator integrates information from three metrics that reflect the sensitivity and diversity of the invertebrate community at a site, including:</p> <ul style="list-style-type: none"> • number of sensitive taxa ('species'): mayflies+stoneflies+caddisflies (EPT). • percentage of sensitive taxa: %EPT. • tolerance of taxa to pollution: Macroinvertebrate Community Index (MCI). <p>The indicator is expressed as excellent, satisfactory and unsatisfactory. The example Report Cards have used Environment Waikato's satisfactory/unsatisfactory classification to produce the following grades:</p> <p>A = 80–100% of sites satisfactory or better. B = 60–80% of sites satisfactory or better. C = 40–60% of sites satisfactory or better. D = 20–40% of sites satisfactory or better. E = <20% of sites satisfactory or better.</p> <p>This is highly provisional as it is based on relatively few samples for this metric (about 50).</p>
14. Fish Index Biodiversity Integrity (IBI)	<p>The Fish IBI developed by Joy (2007) could be used to develop this indicator.</p> <p>On a catchment scale, an indicator can be developed based on the Diversity Index for Fish in Rivers (DIFR), which places the Waikato River (from below Lake Taupo) at 2.7 (Rowe et al., 2010). This is comparable with the nationwide average of 2.6, but it is lower than the value of 3.0 or more which applies to relatively unmodified rivers. In the Waikato River, fish species diversity is biased (upwards) by the high number of exotic species. If these are removed, the measure decreases to 2.2. A value of 2.8 or more (excluding pest fish species) would indicate significant restoration.</p>

4.6 Riparian Aesthetics

Indicator	Method
1. Riparian vegetation	<p>The method is based on the RMC aesthetic ratings (see Appendix 11: Riparian Aesthetics) developed from Environment Waikato's 2007 surveys of streams throughout the Waikato region (Storey, 2010). Riparian management can enhance landscape aesthetics substantially by providing vegetation diversity with ribbons of green within developed pastoral and urban landscapes. Shrubs and trees have generally greater aesthetic appeal than pasture grass, and native vegetation has more appeal than exotic vegetation. However, aesthetics vary highly amongst individuals.</p> <p>RMC rating guide for enhancing stream aesthetics:</p> <p>0 = bare ground or covered in blackberry and other invasive weeds.</p> <p>1 = pasture with unconstrained livestock access to the stream, no trees.</p> <p>2 = fenced pasture grasses without livestock access to the stream; or pasture with livestock access and a 1-2 types of exotic trees (e.g., willows and/or poplars).</p> <p>3 = varied exotic dominated vegetation, limited livestock access.</p> <p>4 = native shrubs or wetland is dominant vegetation type.</p> <p>5 = native forest is dominant vegetation.</p> <p>The score is calculated from the proportion of the stream bank under RMC score ≥ 4. The scores A, B, C, D, are distributed linearly between the maximum of 100% of category 4, 5 (= 'A') and the minimum is 0% of category 4, 5 (= 'E').</p>
2. Water clarity	See Water Quality.
3. Colour	See Water Quality.
4. Sediment composition	See Ecological Integrity – Riverine Habitats.
5. Community satisfaction	Community satisfaction with appearance of river would be measured by a social survey.
5. Rubbish	<p>Human derived rubbish, either organic or inorganic, can be a major concern for the public and its lack would be a measure of success in engagement in restoration, as well as aesthetics.</p> <p>A monitoring method proposed by Parkyn et al., (2010) monitors rubbish by noting and categorising rubbish that is large enough to be seen by the naked eye. An indicator could be developed by conducting some baseline assessments on reaches, especially in urban areas.</p>

4.7 Swimming and Boating

Indicator	Method
1. Strategic Swimming and Plan	The indicator for this action used in the example Report Cards was scored 'A' when the Plan was completed. The present score, 'C', was based on present day progress by all river iwi.
2. Strategic Boating and Swimming Plan	The indicator for this action used in the example Report Cards was scored 'A' when the Plan was implemented.
3. Snags removed at strategic locations	The indicator for this action used in the example Report Cards was scored 'A' when snags were removed at locations identified in the Plan. Presently scored 'C' because some snag removal is occurring.
4. Aquatic weeds (sites controlled)	The indicator for this action used in the example Report Cards was scored 'A' when the Plan was implemented. Presently scored 'D' because weeds are controlled at some locations.
5. Satisfactory flows for regattas (agreements in place)	This action indicator was scored 'A' when all agreements have been established. Presently scored 'D' because of some existing successful agreements.
6a. <i>E. coli</i> (number per 100 ml)	<p><i>Escherichia coli</i> (<i>E. coli</i>) bacteria are used as an indicator of the human health risk from harmful micro-organisms present in water, for example from human or animal faeces.</p> <p>The scoring for <i>E. coli</i> in the example Report Cards was based on the Regional Plan which specifies median concentrations not exceeding 126 count/100 ml. It was also based on more recent MoH Guidelines (MoH, 2003). These guidelines specify three concentration zones similar to a 'traffic light' system. Concentrations <260 counts /100 ml are in the green zone and are acceptable Concentrations ≥ 260 counts /100 ml are in the orange zone and trigger further sampling to investigate these concentration of concern. Concentrations > 550 counts/ 100ml are in the red zone and unacceptable for contact recreation and are equivalent to 'must close beach'.</p> <p>Scores for the Report Cards were based on measured or predicted values relative to the MoH (1999) Recreational Guidelines of 126 count/100 ml and the MoH (2003) red zone. The scores A, B, C, D, E were linearly distributed between ≤126 (= 'A') and ≥ 550 (= 'E').</p>
6b. <i>E. coli</i> (alternative method)	An alternative method may need to be developed with the more recent MoH Guidelines (MoH, 2003). Note that Environment Waikato have used these guidelines and the following classification for <i>E. coli</i> : excellent <55 /100 ml; satisfactory 55 - 550 /100 ml; unsatisfactory >550 /100 ml (see http://www.ew.govt.nz/Environmental-information/Environmental-indicators/Inland-water/River-and-streams/riv2-keypoints/).

Indicator	Method
Swimming and Boating (cont.)	
7. Clarity	<p>Water clarity and underwater visibility is important for recreation such as swimming and boating. It is also important from an aesthetic point of view – most people prefer clear water in rivers and streams. To allow good visibility for swimming, MfE guidelines specify that people should be able to see at least 1.6 m underwater. Clarity is determined by suspended sediment, phytoplankton and dissolved colour concentrations in the water. These, in turn, reflect land use and its management, erosion and artificial drainage of peat lands.</p> <p>The targets are described in Appendix 13: Water Quality and are 4 m in the Upper River, 1.6 m everywhere else, except for 1 m in the lower Waikato (below the Waipa confluence).</p> <p>Scores for the Report Cards were based on measured or predicted values relative to these targets. The scores A, B, C, D, E were linearly distributed between \geqtarget (=‘A’) and 0 m (=‘E’).</p> <p>Note that Environment Waikato have a classification for clarity of: excellent > 4 m; satisfactory 1.6 – 4 m; unsatisfactory <1.6 m. Their scoring for their report cards is based on number of samples which fall in these categories (see http://www.ew.govt.nz/Environmental-information/Environmental-indicators/Inland-water/River-and-streams/riv2-report/).</p>
9. Toxic algal blooms	<p>Blue green algae are potentially toxic, and high concentrations can be associated with acute or chronic toxicity to aquatic animals, watering stock, dogs, and humans through drinking water supplies.</p> <p>Blue-green algae (BGA) have been monitored in the mainstem of the Waikato River and in some of the shallow lakes in the lower river. Monitoring has been based on older MfE Guidelines for BGA cell counts for drinking water supplies of <2,000 counts/100 ml and 15,000 counts/100ml for contact recreation. New guidelines use a traffic light system based on the volume of BGA. However, monitoring information is only now being collected and older data is being converted to this form.</p> <p>This indicator will need development in the future based on the new guidelines, conversion of the historical monitoring data where possible, and new monitoring data. In the Report Cards, the risk of <u>large</u> (and hence problematic) BGA blooms was assessed using chlorophyll data. The Study team determined that the relationships between chlorophyll concentrations and the occurrence, size and extent of BGA blooms suggested that there is a low risk of a large BGA bloom if total chlorophyll was less than 10 µg/L. The scores A, B, C, D, E were linearly distributed between \leqtarget (=‘A’) and $\geq 2 \times$ target (=‘E’).</p>

Indicator	Method
Swimming and Boating (cont.)	
10. Duck itch (survey of parasites at weed control sites)	This indicator would need research and development. The indicator may be the host snail, the parasite or some proven correlatory parameter, such as weed density.
12. Satisfaction with interaction with the river	This indicator for satisfaction with ability to use preferred skills, practices and methods when interacting with the river will need development by five river iwi.
13. Surveys of recreational activity and satisfaction	The index would be developed from social surveys with river iwi and with the wider community (see http://www.niwa.co.nz/our-science/freshwater/research-projects/all/restoration-of-aquatic-ecosystems/social-research).

4.8 Human health

Indicator	Method
1. Treated sewage discharges to water (volume)	This action indicator is scored through the proportion of treated sewage discharges that are discharged to land, wetlands or through rapid infiltration devices. Currently score 'D' because some WWTP use land disposal or will do so in the future.
2. Duck itch (sites weeds controlled)	The indicator for this action used in the example Report Cards was scored 'A' when the Swimming and Boating Plan was implemented. Presently scored 'D' because weeds are controlled at only 2 locations.
3. Streams fenced on dairy (%)	See Water Quality.
4. Streams $\geq 3^{\text{rd}}$ order fenced on sheep and beef	See Water Quality.
5. Septic tanks	The action indicator is based on cleaning frequency, and in the Report Cards this was the proportion of septic tanks on 2–3 year cleaning cycle. In the Report Card this was scored 'C' because 60% are already on that cleaning cycle. In the future, it should be based on the proportion of septic tanks that meet satisfactory guidelines in terms of distance to waterways, condition and operation. Such an indicator needs development, through actual surveys of septic tanks near waterways.
6. Marae with treated water	Proportion of marae with water treatment plants. In the Report Card this was scored 'E' because assumed none have water treatment (however this does not imply poor drinking water quality).
7. Geothermal fluids discharged (%)	Existing consent condition should result in no untreated discharges to the river. This indicator records the proportion of geothermal fluids discharged (currently about 50% from Wairakaiki).
8. Food basket health risk	The indicator for this action used in the example Report Cards was scored 'A' if the research was being carried out.
9. Arsenic release risk	The indicator for this action used in the example Report Cards was scored 'A' if the research was being carried out.
10. <i>E. coli</i> (no. per 100 ml)	See Swimming and Boating.

Indicator	Method
Human health (cont.)	
11. Turbidity (high flows)	<p>Turbidity is routinely monitored and used as an ecological indicator. It may also be used in another way for ecological health. This is based on the fact that there is a relationship between <i>E. coli</i> and turbidity (particulate matter) at high flows. <i>E. coli</i> levels are much higher during high turbidity (suspended sediment), which probably reflect common processes of washoff and association of bacteria with suspended sediment.</p> <p>Most weather and flows during stormflows are not conducive to contact recreation. However, there are some conditions which are suitable for contact recreation that involve elevated turbidity, e.g., high turbidity from localised rain storms upstream, long recession flows during warm, fine weather.</p> <p>This indicator needs development to determine a turbidity (NTU) or clarity (m) where the <i>E. coli</i>/turbidity relationship indicates <i>E. coli</i> levels of concern.</p> <p>Why do we need this indicator? Turbidity is much easier to measure than <i>E. coli</i>, and can be measured continuously and remotely and does not require rapid return of samples to the laboratory. It may also be developed as an indicator for land management action where these actions reduce sediment inputs to receiving waters.</p>
12. Food basket health risk (mercury concentrations in food)	<p>At present there is limited historical data available which suggests some risk (see Appendix 21: Toxic Contaminants). This indicator needs development (together with appropriate government agencies, e.g., NZ Food Safety Authority) from further monitoring and up-to-date information over a greater geographical area, for Hg levels in kai and kai consumption patterns.</p>
13. Hg in hair samples of river iwi	<p>This potential indicator is currently being utilised in a NIWA research project on traditional food sources (Phillips, 2008) to help understand exposure.</p>
14. Food basket health risk (arsenic concentrations in food)	<p>Arsenic is not strongly accumulated in kai except for watercress, where it can be taken up from both the water and the sediments (Robinson et al., 2003). A health assessment of watercress from Lake Ohakurii has indicated that regular consumption of 16g of fresh watercress a week from Lake Ohakurii would be sufficient to exceed the tolerable daily intake (Robinson et al., 2006).</p> <p>The low availability of watercress in the Waikato River mainstem is considered to be a significant limitation to regular dietary consumption. (The hyperaccumulation of As by some aquatic plants, including watercress, also makes these suitable for monitoring ambient As conditions).</p> <p>Indicator grades are yet to be developed after collecting sufficient data. However, the small quantity needed to exceed tolerable daily intake suggest this grade is probably 'E' at present in Lake Ohakurii.</p>
15. Arsenic release risk (arsenic in hyperlimnion µg/L)	<p>This indicator will need to be developed from laboratory mobilization experiments and monitoring of As concentrations in the hyperlimnion (bottom waters).</p>

Indicator	Method
Human health (cont.)	
16. Arsenic risk in water (downstream of Ohakurii)	<p>The risk of arsenic release can also be assessed by monitoring arsenic levels in the river downstream from Ohakurii. This also addresses the desire by Maaori to drink untreated surface water. While this desire is constrained by risk of infection by pathogen organisms, it can also be constrained by arsenic levels. Arsenic concentrations are routinely monitored by Environment Waikato (mean 20 µg/L range 15–40 µg/L; background is ~11 µg/L from Lake Taupoo).</p> <p>The following was summarized from Piper and Kim (2006).</p> <p>Health risk at 50 µg/L - intellectual impairment in children and a significant cancer risk. Rarely (if ever) occurs in river.</p> <p>Cancer risk at 20 µg/L - excess bladder/lung 1:140, excess skin 1:1700.</p> <p>Cancer risk at 10 µg/L - excess bladder/lung 1:300 (MoH, 2005; drinking water guideline).</p> <p>Cancer risk at 5 µg/L - excess bladder/lung 1:500.</p> <p>Cancer risk at 3 µg/L - excess bladder/lung 1:900.</p> <p>Any indicator would need development with MoH, but a suggested approach could be based on comparing mean concentrations in water with cancer or health risk, e.g.,</p> <p>A <3 µg/L - very low cancer risk, achievable by conventional water treatment.</p> <p>B 3–10 µg/L - low cancer risk, background (Lake Taupoo gates).</p> <p>C 11–20 µg/L - low – moderate cancer risk, these concentrations occur frequently in river.</p> <p>D 21–50 µg/L - moderate cancer risk, these concentrations occur frequently in river at the present day.</p> <p>E >50 µg/L - significant cancer risk and intellectual impairment in children.</p>
17. Arsenic release risk (DO in hyperlimnion)	Dissolved oxygen in the hyperlimnion with concentrations <2 mg/L is strong indicator of developing anoxic conditions. This indicator will need development through surveys of depth profiles of dissolved oxygen in Lake Ohakurii, and other lakes downstream. See Ecological Integrity – Riverine Habitats.
18. Duck itch parasite	See Swimming and Boating.
19. Iwi satisfaction with food basket health risk	The index would be developed from social surveys with local iwi (see http://www.niwa.co.nz/our-science/freshwater/research-projects/all/restoration-of-aquatic-ecosystems/social-research).
Viruses (potential future method)	Based on direct measures of human adenoviruses and retroviruses. These viruses are indicators for human viral pollution, septic tanks and poor WWTP treatment. They are very difficult and costly to monitor. A major issue at present is the methodology which keeps changing (and improving). Different methods are not directly comparable. This indicator could be developed in the future.

Indicator	Method
Human health (cont.)	
Cryptosporidium (potential future method)	<p>Cryptosporidium is a human pathogen, largely derived from dairy cows. It is therefore an indicator of human pathogen pollution, a specific zoonose, protozoan pollution and contamination of waterways by dairy cows.</p> <p>It is, however, difficult to measure. It could be developed as an indicator in the future when stable, routine methodology becomes available.</p>

4.9 Water Quality

Indicator	Method
1 – 9. Farm actions	All the farming actions (e.g., fencing, planting and fertiliser controls) are scored by the proportion of farm area or waterways length which have successfully employed those actions.
10. Total nitrogen	<p>Nitrogen is a nutrient for plants. Excessive amounts can encourage the growth of aquatic plants to nuisance levels, especially algae. Total nitrogen is a direct measure of the extent of nutrient enrichment and the risk of algal blooms. These reflect land use and its management, and WWTP discharges.</p> <p>The targets for TN are described in Appendix 13: Water Quality and are 300 µg/L for the Upper River (above Karaapiro Dam) and 500 µg/L elsewhere.</p> <p>Scores for the Report Cards were based on measured or predicted values relative to these targets. The scores A, B, C, D, E were linearly distributed between \leqtarget (=‘A’) and $\geq 2 \times$ target (=‘E’).</p> <p>Note that Environment Waikato have a classification for total nitrogen as: excellent <100 µg/L; satisfactory 100–500 µg/L; unsatisfactory >500 µg/L. Their report card scoring is based on number of samples which fall into these categories (://www.ew.govt.nz/Environmental-information/Environmental-indicators/Inland-water/River-and-streams/riv1-report-card/).</p>
11. Total phosphorus	<p>Phosphorus is a nutrient for plants. Excessive amounts can encourage the growth of aquatic plants to nuisance levels; especially algae. Total phosphorus is a direct measure of the extent of nutrient enrichment, and the risk of algal blooms. These reflect land use and its management, and WWTP discharges.</p> <p>The targets for TP are described in Appendix 13: Water Quality and are 20 µg/L for the Upper River (above Karaapiro Dam) and 35 µg/L elsewhere.</p> <p>Scores for the example Report Cards were based on measured or predicted values relative to these targets. The scores A, B, C, D, E were linearly distributed between \leqtarget (=‘A’) and $\geq 2 \times$ target (=‘E’).</p> <p>Note that Environment Waikato have a classification for total phosphorus as: Excellent <10 µg/L; Satisfactory 10–40 µg/L; unsatisfactory >40 µg/L. Their report card scoring is based on number of samples which fall into these categories (://www.ew.govt.nz/Environmental-information/Environmental-indicators/Inland-water/River-and-streams/riv1-report-card/).</p>
12. Clarity	See Swimming and Boating.
13. Colour	<p>The colour of the water is important for aesthetic reasons. The river changes from blue, clear water at the Taupoo Gates, to greeny-blue in the lower hydrolakes and Middle Waikato River, to yellow green then yellow-brown in the lower river.</p> <p>The targets for colour are <10 Munsell units below the values that are predicted to have existed in the river in the 1920s prior to the dams being built or peat land being drained (see Appendix 13: Water Quality). Scoring in the Report Cards was based on a linear scale: where it is measured or otherwise a predicted change in Munsell units scores. The scores A, B, C, D, E were linearly distributed between \leqtarget (=‘A’) and $\geq 2 \times$ target (=‘E’).</p>

Indicator	Method
Water Quality (cont.)	
14. Turbidity (NTU)	<p>Turbidity is a measure of the murkiness of water, reflecting the amount of sediment and algae in the water. High turbidity reduces the amount of light available for plants to photosynthesise. It also makes it difficult for fish and other animals to see their prey (but may protect prey). It inhibits native fish migrations, especially banded kookopu. Turbidity is determined by suspended sediment and phytoplankton concentrations in the water. These, in turn, reflect land use and its management, and erosion.</p> <p>Turbidity should be less than 5 NTU (turbidity measurement scale) for water to support plant growth. This indicator was not scored in the Report Cards, but could be based on Environment Waikatos Classification for turbidity at low flow of unsatisfactory >5 NTU.</p> <p>Note that Environment Waikato have a classification of excellent <2 NTU; satisfactory 2–5 NTU; unsatisfactory >5 NTU. Their report card scoring is based on number of samples which fall into these categories (://www.ew.govt.nz/Environmental-information/Environmental-indicators/Inland-water/River-and-streams/riv1-report-card/).</p>
15. Chlorophyll	<p>Chlorophyll is used as a measure of total algal biomass. High levels can affect aesthetics, clarity and colour and also be indicative of high risks of cyanobacteria (blue-green algae) blooms. Targets for the Waikato are outlined in Appendix 13: Water Quality, and were based on trigger level of 5 µg/L, warning level of 10 µg/L and water filter-clogging levels of 20 µg/L. A target of 5 µg/L was set for the Upper Waikato, and 10 µg/L elsewhere.</p> <p>Scores for the Report Cards were based on measured or predicted values relative to these targets. The scores A, B, C, D, E were linearly distributed between <=target (=‘A’) and ≥ 2 x target (=‘E’).</p>
16. Cyanobacteria (Blue-green algae)	See Swimming and Boating

4.10 Water Allocation

The need for, and the type of indicators used for assessing water allocation will need to be determined once the Regional Plan Variation 6 (RPV6) is in place. Possible indicators may relate to water take being optimised to efficient water use and the impact of irrigation on nutrient exports from farmland. These would require expert development (e.g., in the latter case, irrigation may affect other indicators (e.g., nutrients, clarity, chlorophyll, blue green algal blooms) and restoration outcomes. River iwi may wish to develop an indicator that assesses whether tangata whenua values have been considered in consents for water takes. The Study team considers it prudent to await the outcome of RPV6 before considering indicator development.

4.11 Significant and Historical Sites

Indicator	Method Outline
1. Waahi Tapu and Significant Sites Management Plan	The indicator for this action used in the example Report Cards was scored 'A' when this was completed. The present score, 'C', was based on present day progress by all river iwi.
2. Joint Management Agreements (JMA) between iwi and TLAs	A short-term indicator could be based on the proportion of JMAs signed (% completion). In the long term, a performance indicator could be developed which is a measure of ongoing satisfaction with relationships. In the example Report Cards, it was assumed that while none have been signed, there has been significant progress in relationships between river iwi and TLAs (hence 'C').
3. Signage meets Management Plan (% completion)	An indicator could be based on the proportion of sites that have adequate signage and correct place names consistent with the Management Plan. In the example Report Cards it was assumed that existing signage contributes to this indicator, but much needs to be done (hence 'D').
4. Restoration of sites meets Management Plan (% completion)	An indicator could be based on the progress of restoration consistent with the Management Plan % completion. In the example Report Cards it is assumed that existing restoration had moved the score to 'D'.
5. The community understands the historical and cultural associations of sites with the River (social surveys)	This indicator will need development through social surveys.
6. Iwi/community are satisfied that significant sites are protected (and where appropriate) recognised	This indicator will need development through social surveys.
7. Iwi satisfied that valued features of key sites/river reaches are protected	This indicator will need development through social surveys.

4.12 Access

Indicator	Method Outline
1. Access Management Plan	The indicator for this action used in the example Report Cards was scored 'A' when this was completed. The present score, 'C', was based on present day access initiatives by TLAs.
2. Proportion of mainstem Waikato and Waipa with walkways and cycleways meets management plan (% completion)	The proportion of riverbanks that have pathways and cycleways consistent with the Management Plan. Presently scored 'C' because access is excellent in some areas and patchy in others.
3. Access to historic sites, collection sites for kai and cultural materials meets management plan (% completion)	The proportion of riverbanks that has access consistent with the Management Plan. Presently scored 'C' because access is excellent in some areas and patchy in others.
4. Number and distribution of reserves meet management plan (% completion)	The proportion of riverbanks that has reserves consistent with the Management Plan. Presently scored 'C' because of existing reserves.
5. Number and distribution boat ramps meet management plan (% completion)	The proportion of riverbanks that has boat ramps consistent with the Management Plan. Presently scored 'C' because of existing boat access.
6. Iwi satisfaction with access	This is probably best assessed through a cultural recreation index (see Appendix 29: Monitoring and Evaluation).
7. Community satisfied with access (social survey)	This indicator will need development through social surveys.

4.13 Spiritual Values

Indicators	Method Outline
1. The relationships of river iwi, their culture and traditions with the Waikato River which are taonga to them, and integral to their tribal identities (social survey)	These two state indicators would need to be developed from social surveys with river iwi and the wider communities (see http://www.niwa.co.nz/our-science/freshwater/research-projects/all/restoration-of-aquatic-ecosystems/social-research).
2. The relationships of the wider Waikato community, their culture and traditions with the Waikato River (social survey)	
3. All statutory plans recognise and provide for river iwi and wider Waikato community economic, social, cultural and spiritual relationships with the Waikato River	See Holism.

4.14 Regional and National Economic Wellbeing

This is a specialist area and would be assessed using economic models to estimate net regional and national value and employment added. We recommend that this is updated every 5 years.

4.15 Holism

Indicator	Method Outline
1. Precautionary principle in all plans, policies and decision making	Plans that have been audited and changed if necessary (% complete).
2. Plans, policies and rules take into account cumulative effects including multiple stressors	Plans have been audited and changed if necessary (% complete).
3. Plans and policies take into account cultural, spiritual, social and economic relationships of river iwi and wider community with the Waikato River	Plans have been audited and changed if necessary (% complete).
4. Decision making is guided by effective national policy and guidelines	WRA determines where national policy and guidelines are needed, makes recommendations with other regional authorities and monitors outcomes (% complete).
5. An integrated statutory management plan for the Waikato River has been implemented that encompasses physical, chemical, biological, social, economic, cultural and historic matters, at a regional, sub-catchment and farm scale	Plans have been audited and changed if necessary (% complete).
6. Co-management agreements have been established between river iwi and local authorities	Co-management agreements established (% complete).
7. The methods used by local authorities are standardised	Procedures, guidelines and standards are used by local authorities where possible.
8. Actions to restore the Waikato River are being co-ordinated through the development and implementation of non-statutory management plans	See Swimming and Boating, Significant and Historic Sites, and Access.
9. Joint industry-community accords have been established	Accords identified and established. In the short term, the indicator could be the number successfully established. In the long term, a performance indicator could be developed which is a measure of ongoing satisfaction with relationships.

4.16 Engagement

Indicator	Method outline
1. Iwi Commissioners trained	Ongoing action based on numbers trained per year or total numbers of active commissioners. It should be refined after optimum numbers is determined.
2. Commissioner-run river iwi workshops	Ongoing action based on number of training courses.
3. Waikato River focussed public education centres	Number of visitor centres, but could change in the future to number of visitors.
4. Training workshops on restoration methods	Number of workshops and workshop attendees.
5. Financial support and resources to co-ordinators working with iwi and community groups	No grading, financial support stated. Performance indicator will need to be developed.
6. Repository of equipment that can be used by iwi and community groups	No grading, but a performance indicator (e.g., equipment register).
7. Centralised databases and auditing system for monitoring data	% completion.
8. Culturally appropriate monitoring tools	Not graded but register of CHI developed and reported to WRA.
9. Partnerships between WRA, industry and community groups	After partnerships have been identified and established, a performance indicator could be developed which is a measure of ongoing satisfaction with relationships.
10. Partnerships with international organisations working on river restoration	Partnerships identified and established. Goals for a performance indicator would need to be developed, such as visits, joint projects, and scientific papers. Annual report presented to WRA.
11. Scholarship on the Waikato River and research	Not graded, but number of projects, papers, reports, honours and assessment of output usefulness for restoration recorded.
12. School cross-curriculum resources on restoration	Curriculum needs identified and developed (% completion).
13. Professional development workshops for school teachers	Not graded. Number of participating teachers recorded.
14. Marae-based enterprises that include vocational training centred on restoration	After enterprises established and supported, performance indicators could be developed based on the nature of the activities.
15. Articles and videos promoting the restoration and protection of the Waikato River	Not graded, but an assessment on the number/quality of articles and videos is presented to WRA and public.

Indicator	Method Outline
Engagement (cont.)	
16. A Waikato River festival held every 2 years to publicise restoration efforts and the value of the Waikato River to the community.	Not graded, but a detailed assessment is presented to the WRA and public after each festival.
17. Awards are made that celebrate the success of restoration projects	Not graded, but a report would be presented to the WRA annually.
18. Communities (iwi, hapuu, whaanau and individuals) have the knowledge, skills, attitudes and values that result in sound environmental behaviour (social surveys)	The next four state indicators are the primary methods for assessing engagement. These indicators would need to be developed from social surveys with river iwi, and the wider communities (see http://www.niwa.co.nz/our-science/freshwater/research-projects/all/restoration-of-aquatic-ecosystems/social-research).
19. Knowledge (maatauranga Maaori and science) gained from research, good practice and existing relationships with the Waikato River is being effectively transferred and used (social surveys)	
20. The unique relationship that the river iwi have with the Waikato River is understood and recognised within the wider community and regional organisations (social surveys)	
21. Communication and publicity initiatives effectively promote greater public knowledge and understanding of the health and wellbeing of the Waikato River (social surveys)	

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