

Stream Education and Action in Waitakere City

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ABSTRACT

Increasingly in the Waitakere area, individuals, education and action groups are involved in monitoring and looking after local streams, supported, resourced and encouraged by Waitakere City Council. With environmental sustainability as the overarching concept, there are social, cultural and individual partnerships that are a key part of the environmental outcome. Working with tribal partners as provided for by legislation and at the strategic level, supports and enables the implementation of a variety of programmes within the city. Education and engagement, integral parts of Council's Stormwater Strategy, provide a link between resource management and behaviour change. Teacher professional development enables teachers to begin their own programmes to help the community choose behaviours that reduce stormwater pollution and to advocate for stream life while Wai Care, a regional initiative supported by individual councils, enables schools and community groups to monitor their local streams and plan flexible programmes to achieve specific goals. Waitakere City Council also enters into partnerships on a project-by-project basis. Recent support for a Department of Conservation-led project called 'Alien Aquatic Invasion' successfully promoted the message about threats posed to our streams by pest fish and highlighted the value of partnerships in support of stream action.

INTRODUCTION

This presentation will outline some of the unique features of Waitakere City and its streams and then demonstrate some of the strategies and programmes that we have established to help manage human impacts on our freshwater ecosystems. With environmental sustainability as the overarching concept, there are social, cultural and individual partnerships that are a key part of the environmental outcome. Council's Integrated Catchment Management Plans which were developed within the framework of the Comprehensive Urban Stormwater Management Strategy and Action Plan (the Stormwater Strategy) [7] provide a very real link between resource management and community behaviour-change. These community programmes involve a variety of partners and have diverse goals, but underlying them all is the recognition of the critically important role Waitakere has in preserving and enhancing its waterways and protecting the Waitakere Ranges.

THE PHYSICAL ENVIRONMENT OF WAITAKERE

Waitakere, the fifth largest city in New Zealand, is located between the Manukau and Waitemata harbours. The dominant feature of Waitakere is the Waitakere Ranges to the west. The ranges were formed by an ancient massive uplift of hard volcanic basalt. Over time, soft rock has worn away from the hills and silt has collected in the valleys and lowlands. The kauri forest was logged in the 19th century by European settlers and the foothills and lower valleys were used as horticultural and viticultural land. Extensive urbanisation has occurred below the

Waitakere Ranges. The streams in Waitakere have a history of use for recreation, industry and trade.



Figure 1: Waitakere Ranges in the foreground and Waitakere City in the background.

Rainfall in Waitakere varies across the region. On the western side of the Ranges, we received 2003 mm in the year to June 2007, while on the Eastern slopes, the rainfall was 1450mm. In that period, there were several significant events, all but one sited in the Ranges.

Duration	Depth(mm)	Date	Return Period	Site
10 min	18.3	30/3/07	Nom. 1 in 11 years	Candia Rd
20 min	21.4	1/10/06	Nom. 1 in 4 years	Waitakere Filter Stn
30 min	30.6	1/10/06	Nom. 1 in 8 years	Waitakere Filter Stn
1 hour	52.6	1/10/06	Nom. 1 in 30 years	Waitakere Filter Stn
2 hour	70.9	1/10/06	Nom. 1 in 29 years	Waitakere Filter Stn
6 hour	80.5	1/10/06	Nom. 1 in 6 years	Waitakere Filter Stn
12 hour	111.1	1/10/06	Nom. 1 in 4 years	Waitakere Filter Stn
1 day	131.8	1/10/06	Nom. 1 in 3 years	Waitakere Filter Stn
2 day	145.1	30/9/06	Nom. 1 in 4 years	Waitakere Filter Stn
3 day	151.4	30/9/06	Nom. 1 in 3 years	Waitakere Filter Stn

Table1 - Maximum Rainfall Depths and Return Periods for 1 July 2006 to 30 June 2007

THE SOCIAL, ECONOMIC AND CULTURAL ENVIRONMENT OF WAITAKERE

- **Total land area:** 36,700 hectares
- **Metropolitan Urban Limit (MUL) area:** (23% of the total land area).
- **'Open Space Environment'** a mix of parks and the Waitakere Ranges is 18,308 hectares (Just under 50% of the total land area)

Table 2 - Geographical size of Waitakere City

Population	186,444	38% of the population is under the age of 24 (inclusive).
Households	61,836	Average household size is 3.0 people.
Businesses	13,697	Employee Count 45,040

Table 3 - Waitakere City Population (2006 Census)

Being An Eco City

International concern about the global environment and social inequality reached a major milestone with the United Nations Conference on Environment and Development (UNCED) or "Earth Summit" held in Rio de Janeiro, Brazil in 1992. The major outcome of this conference was a document known as Agenda 21 which is an "Agenda for the 21st Century". In 1993 as part of Waitakere's eco-city concept, Waitakere City Council agreed to implement the goals and programmes proposed under Agenda 21 at the local level.

Being an eco city means working together for better social, economic and environmental outcomes for our children, our grandchildren and ourselves. This involves working with people and communities to:

- Build a strong local economy
- Create attractive town centres with good road and passenger transport access
- Protect and expand the 'Green Network' which links our streams and parks from the ranges to the sea
- Use resources better and produce less waste
- Improve the wellbeing of residents

The 'Green Network', which has recently become part of a wider rehabilitation network to support the movement of birds between the Waitakere Ranges and the predator-free islands of the Hauraki Gulf, has extensive planting to encourage biodiversity movements into and out of the Waitakere Ranges.

PARTNERSHIPS IN SUPPORT OF FRESHWATER BIODIVERSITY

Programmes that provide knowledge, increase motivation and also provide opportunities for residents to engage are important to improve outcomes for Waitakere streams. These include

providing information about changing daily behaviours such as using cars less to reduce point-source pollution as well as opportunities to engage in stream-side restoration on public and private land. These programmes are directly supported by Council or through Council-supported groups such as Project Twin Steams and Wai Care. These stream-focused programmes have been extended to the provision of incentives to install rain tanks for stormwater detention and as non-potable water supplies.

Waitakere City Council also provides training programmes for developers and is currently working with the territorial authority, the Auckland Regional Council, to develop programmes for drain layers.

Biodiversity risks from introduced species including accidental introduction of aquatic and terrestrial weeds and pest fish rely on education programmes such 'Aquatic Alien Invasion'- a play provided to Waitakere schools in partnership with the Department of Conservation and outlined later in this paper.

There are also a variety of regulatory and infrastructural initiatives on new development sites that help to reduce the impact of urbanisation on streams, as well as restoration initiatives such as providing fish passage in culverts and the development of wetlands, swales and sand filters in existing urban areas.

The process by which the city manages its own discharges is coordinated via the Stormwater Strategy [7] which is concerned with identifying the issues, values and opportunities associated with stormwater quality and quantity. It sets out Waitakere City Council's vision for holistic management of stormwater in conjunction with iwi (tribal groupings) and the wider community and provides an assessment of the relative sensitivity and value of receiving environments. Because Waitakere is a rapidly-growing city, a major focus of the strategy is on preventing future problems through careful design of new development and through its stormwater management systems, which need to be consistent with and actively contribute to, environmental and community outcomes. (See Appendix A "Goals of the Stormwater Strategy [7].)

Programmes designed to have cultural and social benefits as well as individual benefits are often delivered with partners. This section of the paper will outline five partnerships of particular importance to stream biodiversity.

Partnership Between Waitakere City Council And Te Kawerau A Maki

Te Kawerau a Maki is an *iwi* (tribal grouping) that has *Mana Whenua* within Waitakere City. This essentially means that the iwi are the traditional owners of the area now called Waitakere and that they have an ancient ancestral connection with the area that perseveres to this day. Tangata Whenua (Maori local to a particular area) have an intimate knowledge of the areas within their tribal domain, which is reflected in the ethic of *Kaitiakitanga*. *Kaitiakitanga* can be translated as meaning guardianship or stewardship of natural resources, though this does not really convey the holistic nature of the concept. In essence, the role of Kaitiaki (guardian) is to protect the *taonga* (treasured possessions, both physical and non-physical) of the tribe. Natural resources are also considered *taonga*, and in this regard *Kaitiakitanga* means preservation of these resources for the wellbeing of the iwi and of future generations. Fundamental to this approach is having an awareness of the impact of human activity on the *Mauri* of a particular resource or ecosystem. *Mauri* is a profound concept and is difficult to translate, however it can be described as the life essence or life-sustaining capacity of an object or system.

In a modern context, the role of Tangata Whenua as Kaitiaki is provided for in legislation, through the Resource Management Act 1991. This act has contributed to the impetus for Local Authorities to have relationships with Tangata Whenua. Waitakere City is a young city and its leadership has always recognised the value of working collaboratively with local communities. Beyond the Resource Management Act, the Council has embraced the Treaty of Waitangi as a fundamental document guiding the way it relates to Maori. A key principle embedded in the Treaty is the spirit of partnership between the Crown and Tangata Whenua. The Council acknowledge that partnership with Tangata Whenua is essential, but also that this partnership should not be taken for granted, that it is a challenging ideal that we must continue to strive for. (Personal communication Wayne Knox, Pae Arahi – Maori Relationships Manager, Waitakere City Council)

The partnership component of our programmes involves Council working with iwi as provided for by legislation at the strategic level, as well as as partners in the implementation of a variety of programmes within the city. Programmes about streams form an important part of this partnership, as water in its many forms is very important to iwi.

Central Government As Partners

The Department of Conservation is the central government organisation charged with conserving the natural and historic heritage of New Zealand on behalf of and for the benefit of present and future New Zealanders. Its mission is "to conserve New Zealand's natural and historic heritage for all to enjoy now and in the future". [10]

There is a variety of legislation that governs freshwater fish in New Zealand, designed to protect our freshwater environments from alien pests. These include the Conservation Act 1987 which means that to introduce any aquatic life (native or introduced fish, plants or invertebrates) into an area where they don't already occur you need a permit from the Minister of Conservation, or could be liable for a fine of \$5,000.

The Unwanted Organisms (Biosecurity Act 1993) relates to the fact that it is illegal to release, spread, sell or breed unwanted organisms. There is a \$100,000 fine or five years imprisonment for people caught doing so. There are also Noxious Fish (Freshwater Fish Regulations 1983) which mean that people who possess, control, rear, raise, hatch or consign noxious fish without authority are liable for a fine of \$5000.00

This legislation and regulatory framework is supported by policies designed to improve understanding of the issues and encourage people to protect waterways. These include parts of the Conservation General Policy particularly "7.Conservation Beyond Public Conservation Lands and Waters" which state:

"7 (d) The Department should undertake statutory advocacy to protect natural resources and historical and cultural heritage outside public conservation lands and waters and for the benefit and enjoyment of the public, including public access, in particular where:

- i. the resource or heritage is of international, national or regional significance; or
- ii. indigenous terrestrial or aquatic species or recreational freshwater fisheries are threatened with loss or decline; or

and 7 (e) which states that the Department may support the protection efforts and conservation advocacy of other people and organisations. [11]

Trout have been introduced as game fish to streams in many parts of New Zealand and more recently *Didymo* alga has invaded waterways, so Waitakere streams are significant for the

preservation of native freshwater fish. Pest fish such as koi carp and *Gambusia* threaten our freshwater ecosystems, so Waitakere City Council and the Department of Conservation developed and provided a theatre-in-education project to schools, to up-skill students about ways to prevent their spread and to enhance students' knowledge about and love of freshwater native fish.

Wai Care As Community Partners

Wai Care is a community-based water quality monitoring and action programme in the Auckland region. Community groups and schools are supported by local councils to monitor a local stream on a regular basis. Groups can learn about all the interactions that occur within the environment and can build up a picture of the health of their stream. Using this information, they can then plan appropriate actions to rehabilitate or enhance their local stream environment. In addition, data produced by the Wai Care groups is entered into an online database and website that can be accessed by the wider public.

Councils currently supporting Wai Care are Auckland City Council, Auckland Regional Council, Manukau City Council, North Shore City Council, Papakura District Council, Rodney District Council and Waitakere City Council. Each council employs a "Wai Care Co-ordinator", who works alongside the Wai Care groups. In Waitakere City over 20 school and community-based groups have been regularly active in the Wai Care programme and many other groups are involved in casual monitoring and in education.

Waitakere Schools As Partners

In addition to the various community-engagement programmes, Waitakere City Council offers a variety of environmental education programmes at all school levels and to the adult community.

In general, "water-related education delivered by Waitakere City Council is varied depending on the audience, venue and partners. The original impetus for the development of the education advisor role and community programmes was financial, as it was Council's experience that Council could go on for ever removing rubbish from streams, while people would continue to add more. Now the education programme in schools and in the community is an integral part of the Stormwater Strategy." [9]

WAITAKERE ECOSYSTEMS

Waterways are important because they are an integral part of the hydrological cycle and provide essential ecosystem services such as drinking water.

Freshwater Invertebrates In Waitakere

Ecologically, Waitakere City is clearly two distinct areas – the urban and pastoral areas that drain into the Waitemata harbour, and the forested areas of the Waitakere Ranges, which have catchments draining into the Waitemata and the Manukau harbours as well as the Tasman Sea'. [9]. The forested areas support a diverse range of stream invertebrates, including mayflies, stoneflies and caddisflies. The urban and pastoral areas, which are mostly made up of lowland muddy-bottomed streams, generally have a less diverse range of invertebrates. Here the commonly found invertebrates are more tolerant to a range of water conditions, and do not rely on the cool stony streams of the upper catchments. Table 4 shows the invertebrate groups found in the lowland urban streams of Waitakere. The most abundant group is Diptera (true

flies), which are generally tolerant to a range of conditions, including quite polluted or degraded streams.

Freshwater Invertebrates	Number of taxa
Ephemeroptera (mayflies)	3
Plecoptera (stoneflies)	1
Trichoptera (caddisflies)	9
Odonata (damselflies & dragonflies)	5
Coleoptera (beetles)	6
Hemiptera (bugs)	3
Diptera (true flies)	19
Crustacea (shrimps, crayfish, crabs, amphipods, isopods)	9
Mollusca (snails, limpets & bivalves)	9
Other (Oligochaete worms, Hirudinea leeches, Platyhelminthes flatworms, Nematode worms, Collembola springtails, Acarina mites)	6
Total	70

Table 4: Major invertebrate groups found in urban Waitakere Streams (Jones 2001-2004) [3]

Native Freshwater Fish In Waitakere

Waitakere's streams are critically important habitat for many of the Auckland region's freshwater native fish "Scientists believe Waitakere City to be really significant for the preservation of native freshwater fish species for national commercial reasons as well as for the preservation of a New Zealand-wide stock of whitebait (the young of five freshwater native fish species). A few native freshwater fish species appear to occur more commonly in Waitakere City urban streams than in other cities; for example longfin eels, shortfin eels, common bullies, redfin bullies and inanga". [9]

However the Allibone, et al. [2] survey is of urban streams only, and the survey will have under-represented rural and bush streams where species like banded kokopu are most common. In addition, smelt, giant bullies and giant kokopu are often in the lower reaches of streams where it is often difficult to conduct surveys, so they tend to be under-represented in the database. (S Moore, Landcare Research - personal communication)

Waitakere City Council undertakes annual Freshwater Fish surveys. From a regional perspective, a recent report [5] found that "The high biodiversity of these fish communities relative to streams in the greater Auckland Region indicates that habitat quality is higher than in many other parts of the region." The 2007 report provides the following more detailed information for the 29 sites sampled each year:

Native freshwater fish		% sites
Shortfin eel	<i>Anguilla australis</i>	63
Longfin eel	<i>Anguilla dieffenbachii</i>	44
Eel (not identified as long or shortfin)	<i>Anguilla spp</i>	16
Banded kōkopu	<i>Galaxias fasciatus</i>	38
Inanga	<i>Galaxias maculatus</i>	13
Giant kokopu	<i>Galaxias argenteus</i>	0
Crans bully	<i>Gobiomorphus basalis</i>	19
Common bully	<i>Gobiomorphus cotidianus</i>	16

Redfin bully	<i>Gobiomorphus huttoni</i>	9
Giant bully	<i>Gobiomorphus gobioides</i>	0
Common smelt	<i>Retropinna retropinna</i>	0
Torrentfish	<i>Cheimarrichthys fosteri</i>	3

Table 5 – Waitakere native freshwater fish surveys 2007

Note: Crans bullies are of particular importance, as they are not diadromous, so each river system needs to preserve its own stock. They were found at 11 sites in Waitakere. It is also of note that longfin eels are listed nationally as threatened (5 - Gradual decline) by the Department of Conservation.

Our emphasis is on education about the native fish in our streams. If we educate individuals about the importance of the in-stream habitat and macroinvertebrate populations that support these habitats as well as emphasizing the social and cultural benefits of protecting them, the populations of native freshwater fish have a better chance of survival.

Threats to Freshwater Ecosystems In Waitakere

Urbanisation has a huge impact on freshwater ecological processes. The area of impermeable surfaces such as roads, buildings and carparks, is high in urban areas meaning water cannot naturally soak into the ground. This has the effect of increasing magnitude and frequency of flooding during rain and reduces the filtering of rain and runoff through the soil. Instead, pollutants that have accumulated on these impermeable surfaces flow directly into the streams via the stormwater drains. In addition, misuse of the stormwater drainage system is common, with many people still washing their vehicles on the road side and emptying paint and concrete down drains. This is often due to a lack of knowledge about the stormwater system as many people still believe that the stormwater drains lead to the waste water treatment plant. Education and awareness has an important role in decreasing this stormwater pollution particularly now that the disposal of trade wastes is better managed in the region.

In many urban areas streams are piped underground causing a loss of habitat to stream life. Waitakere City has the benefit that many of its streams have remained unpiPED and have potential to be ecologically rehabilitated. There is also the benefit that many of the streams begin in the native forest of the ranges, providing an important support for biodiversity. However there is a constant pressure to keep developing land and piping of many small tributaries continues. These small streams are very important to the ecosystem in that they provide habitat for fish and invertebrates. Many people are surprised that the “ditch” in their property is even regarded as a stream, or that it was ecologically important (R. Jones pers. obs.). When shown the variety of life found in these streams, people often develop an increased sense of value, which highlights the importance of education.

Waitakere Streams have the advantage over other streams in New Zealand in that there are no introduced trout populations. There are however several pest species including koi carp and *Gambusia* (mosquito fish). The koi, which degrades habitat and will feed on invertebrates and small fish, was introduced as an ornamental and the *Gambusia* as a biological control for mosquitos. *Gambusia* are small but aggressive fish, which have been known to attack native fish. It is illegal to keep these fish or distribute them through waterways.

CASE STUDIES

Te Kawerau a Maki As Iwi Partners

Te Kawerau a Maki value the opportunity to work with Councils' environmental education staff to begin to create an understanding of iwi values and of the statutory role described above. Te Kawerau a Maki have been a valued collaborator and are now an integral part of the stream protection story in Waitakere.

About six years ago, we began working together to deliver stream workshops about Tangata Whenua waterway values, stories and traditional knowledge, as part of our ongoing programmes. The workshops were a huge success and soon demand outstripped the staff time available. This coincided with Waitakere City Council's decision to make an underwater movie, using the results of our fish and macroinvertebrate stream surveys for the river. The life history of the diadromous freshwater native fish provided a basic narrative and a way to show the condition of the water in different parts of the catchment. To make a story, we needed to find characters with which young adults could identify and that were able to provide an emotive engagement for viewers. Te Kawerau a Maki developed the story and has gifted the intellectual property to Waitakere City Council for the benefit of future generations.

We believe that 'The Guardians of the Mauri' as a pivotal part of our array of programmes about streams, has supported school programmes as well as groups and agencies working for sustainable development in our communities. Its messages highlight benefits for individual action in support of social and cultural benefits. The fact that there is also a Māori version of the movie highlights the importance of the cultural strength of our city. 'Nga Kaitiaki o te Mauri' has also been recognised nationally in the movie world when it won the Te Reo Award at the Māori Film Festival in 2006.

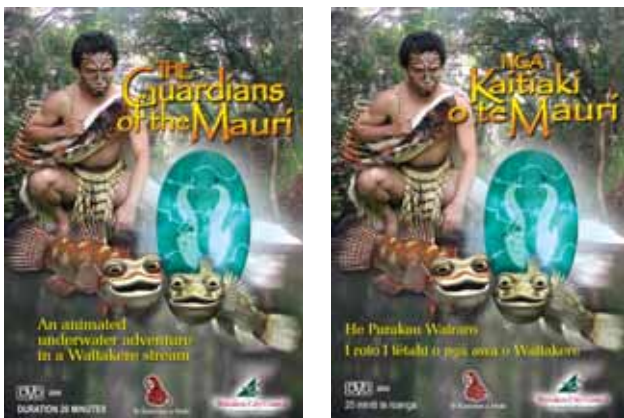


Figure 2 – Front covers of 'The Guardians of the Mauri' and 'Nga Kaitiaki o te Mauri'

Central Government As Partners

The theatre-in-education programme called 'Aquatic Alien Invasion' was a partnership developed to stop the spread of pest fish to Waitakere streams, in support of the Department of Conservation's responsibilities as outlined previously and in recognition of the significant biodiversity value of Waitakere streams. It toured 26 schools and one shopping mall in 2006, thanks to a funding and project management partnership between Waitakere City Council and the Department of Conservation.

"The purpose of the programme was to:

- raise awareness in children and their families of the impacts of exotic fish and weeds on Waitakere waterways. The upper Waitakere catchments were identified as having the highest conservation value thus schools were chosen for play performances based on their proximity to these catchments
- foster a sense of responsibility for the healthy future of local waterways in these communities
- foster behaviours that prevent movement and release of pest fish and aquatic weeds within Waitakere freshwater environments.” [8]

In the executive summary, the authors noted: “Play performances and teacher follow-up work resulted in direct and interactive delivery of the following key messages:

1. Stop the spread (of exotic fish & weeds)
2. Don't dump your pets – unwanted pet fish should be returned to pet shops or disposed of to dry land
3. Waitakere waterways are worth protecting and you are the lifeline for these waterways.
4. Koi carp and *Gambusia* are unwanted fish and it is illegal to release, hold and/or breed these species.
5. Boaties and fishermen have a part to play to stop the spread of weeds – check, clean and dry equipment between waterways.
6. Aquatic weeds aren't wanted, they reduce water and habitat quality in watercourses

Whilst no baseline data of aquatic pest awareness levels in Auckland is known to exist, staff observation and feedback from teachers, parents and children indicate that this programme has successfully achieved it's objectives as evidenced by the following:

- The play which contained key aquatic pest messages was performed to over 12 000 school children at 26 Waitakere schools (who live an average of 1242m from a Waitakere stream, pond or estuary)
- Approximately 400 posters and 12 000 fact sheets and stickers containing aquatic pest messages have been distributed to 400 classroom teachers in the Waitakere region and been used by at least 64% of teachers.
- The play prompted further discussion amongst students about pest fish and water weeds in 91% of classes from which we received teacher evaluation forms.
- After seeing the play 79% of children talked about water weeds or pest fish at home with their parents. ” [8]

As previously noted, schools selected for the first programme were those considered to be schools with students who came from communities that posed a high risk. The first target schools were communities living in the critically important upper catchments of streams while the second target schools were those with a high percentage of new immigrants and Asian students, because pest fish such as koi carp have a significant cultural value in this community. 'Aquatic Alien Invasion', which was designed to create a new culture in relation to pest fish, was so popular that it toured again in 2007, highlighting the success of the partnership model

Wai Care As A Community Partner

According to the Wai Care Strategy, [6] Wai Care will have achieved its goal when people have an affinity for the environment, know they are responsible for creating a sustainable future, take action and know they have made a difference for the environment and act as kaitiaki and guardians for the environment. To achieve this, many different organisations and people have a role to play and need to work together. The role of the Wai Care programme in achieving this vision is to enable communities to be active in the protection and management of waterways.

To do this, Wai Care works to develop community awareness and understanding of freshwater issues and their relationship to catchment health and enables communities to collect, store and report meaningful information about the health of their local waterways. Wai Care also helps to establish and maintain effective partnerships and communication with all sectors of the community working towards healthy waterways, to be an advocate for the ecological value of waterways and to contribute to local, regional and national policy.

Waitakere Schools As Partners

One of the first initiatives was 'Learning Waters', a newsletter about stream education resources and opportunities for support, which is sent to Waitakere teachers several times a year.

Currently our programmes provide a variety of media as delivery mechanisms supported by class visits, field trips and allowing the possibility of expert support for individual research. We run annual teacher professional development days to give the school staff an opportunity to gain new skills and knowledge so that they can confidently run programmes with minimal on-the-ground support. Schools plan their waterways topics and we are able to provide experts, field trips and differing amounts of curriculum support to each of the programmes. In each school the emphasis is a little different, but what we are hoping for in each case is support for the published 'Guidelines for Environmental Education', [1] which includes the provision of education 'about the environment, in the environment and for the environment'.

All our resource kits provide information about individual actions that help reduce stream pollution so that students can easily take daily actions in support of stream health and they engender a culture change and emphasize the social benefits of freshwater biodiversity. 'Focus on Bugs' our first video to be released nationally, pioneered magnified filming techniques and drew heavily on the expertise of freshwater and urban ecology staff at Landcare Research. It showed the macroinvertebrates as fascinating forms of stream life, as well as explaining the way that we can use them to measure stream health. An additional benefit in Waitakere was that the students were also able to meet and work with one of the scientists from the video, increasing their motivation by involving them in a socially significant interaction. They knew that they were important because the video had been made for them. 'Focus on Bugs' and the web site 'Underwater Life' (which was written especially for kids)

<http://www.waitakere.govt.nz/AbtCit/ei/EcoWtr/macroinv/bugmainpage.asp> (Fig.3) made stream studies instantly accessible in schools.

Macroinvertebrates

Welcome to this part of Council's site. We hope that you will enjoy exploring it and that you will take the time to view the video files that show the live 'bugs' under microscopes. If you get to know the macroinvertebrates that live in different parts of streams, you will be able to check water quality very easily.

[Click here](#) to find out what macroinvertebrates are.

This map shows the sites that we sampled in the autumn of 2002. We have chosen this way of getting into the site because the 'bugs' that are found in any stream are affected by things like shade, pollution, and the amount of oxygen and sediment in the water.

To view a stream, click on a red star on the map or follow the links below

[Lincoln stream](#)

[Opanuku stream \(lower\)](#)

[Opanuku stream \(upper\)](#)

[Oratia stream](#)

[Glen Esk stream](#)



Figure 3: The Macroinvertebrate website

More recently, underwater images have become a big part of what Wai Care and Waitakere City have been working on together.



Figure 4: Underwater photography is a powerful tool (Photos: Ruby Jones and Stephen Moore)

Increasingly in Waitakere, we have tried to allow the “streams to speak for themselves” as a powerful, motivating tool. This approach helps people who are visual learners and those who are not native speakers of English. With the availability of digital cameras, we have been teaching simple underwater photography techniques to enable teachers to take their students on ‘virtual field trips’ to the local river, rather than having to rely on generic resources, as in the past.” [9]

CULTURAL AND SOCIAL BENEFITS WORKING FOR THE ENVIRONMENT

There are a variety of programmes that have cultural, economic and social benefits as well as environmental outcomes. Project Twin Streams is the largest of these in the city. The vision for Project Twin Streams is "Working together for healthy streams and strong communities: creating a sustainable future." Launched in 2002, Project Twin Streams is the largest water management scheme undertaken by a local government in New Zealand. While the focus of the project is on stream bank restoration, the vision is much wider. It involves looking at how land is used, how households can become more sustainable and how cycle and walkways along streams can influence public health. The Project Twin Streams catchment area covers 10,000 hectares and has a population of 100,000 people. Recently, Project Twin Streams was the runner-up on the International Thies Riverprize announced during the 10th International Riversymposium and Environmental Flows Conference in Brisbane in September 2007.

CONCLUSIONS

In this presentation we have outlined some of the programmes we have been running or supporting with partners. These programmes, which are integral to the Stormwater Strategy and the Integrated Catchment Management Plans, the mechanism used to manage the impacts of our lifestyles on stream biodiversity, have great potential to contribute to the health of Waitakere streams. In addition they contribute to social, cultural and economic benefits. It is our hope that the workshop will also have provided you with an understanding of the freshwater values and issues in our subtropical island environment.

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APPENDIX A

EXCERPT FROM WAITAKERE CITY COUNCIL, DRAFT COMPREHENSIVE URBAN STORMWATER MANAGEMENT STRATEGY AND ACTION PLAN, 2000

The ten key objectives set are listed below.

Objective 1: To achieve a multidisciplinary, coordinated approach to address all aspects of stormwater management in Waitakere City.

Objective 2: To protect and enhance the quality and quantity of freshwater and marine habitats.

Objective 3: To reduce the adverse effects of point-source contamination.

Objective 4: To reduce the adverse effects of non-point source contamination.

Objective 5: To reduce the adverse effects of flooding on people and property.

Objective 6: To prevent any acceleration of the natural rate of erosion both on land and in stream channels.

Objective 7: To plan and provide stormwater infrastructure ahead of development.

Objective 8: To achieve hydrologically neutral development which maintains the natural water balance as much as possible.

Objective 9: To optimise the effectiveness of the existing stormwater infrastructure network in a way that meets the needs of the community and, where possible, to implement alternative instead of traditional stormwater management solutions while ensuring that Council's management of stormwater pays due regard to the safety of staff and the public.

Objective 10: To protect and enhance community access to and enjoyment of freshwater and marine environments.

INTEGRATED CATCHMENT MANAGEMENT PLANS (ICMPS)

To ensure the objectives of the Stormwater Strategy are met, the ICMPS detail a number of management options for the various catchments. ICMPS, which have been prepared with regard to the ARC funding guidelines for ICMP preparation (ARC, 2005) and to be consistent with the Resource Management Act 1991, the Local Government Act 2002, the Proposed Air, Land and Water Plan (Auckland Regional Council, 2001) and higher order planning documents such as the Auckland Regional Policy Statement 1999 and other regional plans, are driven by the Auckland Regional Council as their main methodology of managing stormwater. These ICMPS, which support Council's application for network discharge consents, include community engagement amongst their strategies for stormwater management.