

# URBAN STREAM RESTORATION AND COMMUNITY ENGAGEMENT: EXAMPLES FROM NEW ZEALAND

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## ABSTRACT

Several examples of urban stream restoration and community engagement are summarised and compared from across New Zealand. Urban streams are usually highly modified from their natural, pre-urbanised state, with significant differences in stream and riparian habitat, stream flow and water quality. Typically, streams in urban areas serve a variety of functions: habitat, urban drainage and flood management, and public and community amenity (including linkages to open space), and can include special cultural and community significance. The examples presented are streams in the Birkenhead and Browns Bay areas of North Shore City, Meola Creek in Auckland City and Project Twin Streams in Waitakere City in the Auckland region; Waitangi Park wetland in Wellington City; and the urban rivers of Christchurch. These examples demonstrate the variety of manners in which urban stream restoration and protection is occurring in New Zealand. The examples, furthermore, demonstrate the range of methods and levels in which the community and private landowners are engaged by local governments, and how government and community work together for improved stream restoration and protection in urban areas. Successes reflect a combination of using techniques with proven track record, while tailoring the programmes to reflect the local community and land owners, and the particular local government where the work is undertaken. Observations about the examples and made.

## KEYWORDS

Urban streams, restoration, community engagement, stormwater quality, flood control

## INTRODUCTION

Urban streams and drainage waterways form an integral component of the stormwater drainage network and traditionally have been modified to suit urban land development and activity, and to provide flood mitigation. The piping and realignment of streams has reduced the overall extent of urban streams and drainage waterways, and many of the remaining stream reaches have been modified to the point where they provide very little, if any, ecological function. In addition, development has occurred in a way such that many urban streams and waterways are separated from neighbourhoods and communities. Urban streams are usually highly modified from their natural pre-urbanised state, with significant difference in stream and riparian habitat, stream flow and water quality.

Typically, streams in urban areas serve a variety of functions: stream habitat, urban drainage and flood management, public and community amenity (including linkages to open space), and can include special cultural and community significance. More recently, communities and government are recognising that urban streams are degraded and neglected, and that restoring them can provide multiple benefits from reconnecting communities with urban streams to improved stormwater performance. Examples of urban stream restoration and community engagement are summarised and compared from across New Zealand.

## URBAN STREAM RESTORATION

Restoration can take a range of forms and involve small, incremental efforts to significant capital works and intensive efforts. Small, incremental efforts can be performed by private landowners whose properties back up to urban streams. Significant capital works can involve extensive restoration of stream reaches in highly urbanised areas. Perhaps the most extreme case of restoration is daylighting streams that have become piped during urbanization. Lewis (2008) provides a conceptual design of stream daylighting three historic streams in Auckland City. Restoration and protection of streams and rivers can revitalise neglected city areas (Lewis 2008; Palmer 1994). Some of the potential benefits of restoration can include (depending on the nature and location of the restoration efforts):

### Economic

- Improved stormwater quality through use of natural systems and riparian filtering (i.e., decreasing need for stormwater quality capital works).
- Improved drainage and flood control.
- Revitalisation, improved capital land and property value, and economic activity.
- Improved demand management and reduced pollution change due to increased recognition of values of the urban water cycle leading to behavioural change.

### Social

- Enhanced community character and sense of place.
- Improved public amenity, potentially serving as focus point for parks or neighbourhood revitalization.
- Provision of recreational open space, corridors for cycling, walking and traffic-free routes.
- Serves as 'outdoor classroom' for local schools.
- Buffer of green space against urban noise, dust and pollution.
- Improved safety.

### Environmental

- Improved stormwater quality through use of natural systems and riparian filtering.
- Improved aquatic and terrestrial habitat, and fish passage and wildlife movement.
- Reduced stormwater run-off velocity, preventing downstream erosion.
- Improved temperature control through shading of streams.
- Improved maintenance of base flows, flood attenuation and flow reduction.

Within urbanised areas, urban streams form part of the urban drainage system that supplies important stormwater drainage and flood control functions, provided by local councils. These systems are typically comprised of a mix of pipe network, drainage channels and urban streams. Importantly, many urban streams and drainage channels are on private property. Consequently, management of the urban drainage network and stream restoration efforts often require working with private landowners and communities.

## COMMUNITY ENGAGEMENT

Various methods exist to engage with communities. Creighton (2004) provides a summary of public participation planning from decision / action analysis through implementation planning (Table 1). Creighton (2004) also provides a summary of techniques to engage the public dependent upon the level of involvement (Table 2). Within New Zealand, legislation exists that requires the opportunity for public participation in council decision-making. The level of public participation varies, however, on a range of factors and particular circumstances. For example, the public is consulted broadly on the range of priorities and activities that councils undertake in their Long Term Council Community Plans. Specific projects or initiatives may entail public participation that ranges from co-decision makers in some instances through to methods in which the council is actively reaching out to particular sectors who may be uninformed or initially uninterested so that they can participate or that behaviour and attitudes change. The stream restoration examples documented in this paper demonstrate the range of stakeholder techniques utilised.

**Table 1: Stages of Public Participation Planning**

<b>Decision / Action Analysis</b>
Clarify the decision /actions being made.
Specify the planning/decision-making steps and schedule.
Decide whether to include public and for what purpose.
<b>Process Design</b>
Specify what is needed to be accomplished with the public at each step of the planning/decision-making process.
Identify the stakeholders – internal and external.
Identify techniques to be used at each step in the process, taking account of the needs of various diverse populations.
Link techniques in an integrated plan.
<b>Implementation Planning</b>
Plan implementation of individual public participation activities.

Source: Creighton 2004.

**Table 2: Techniques for public participation based on stakeholder**

Type of Stakeholder	Possible Technique
Co-decision maker	Negotiation session
Active participant	Workshop or advisory committee
Technical reviewer	Peer review panel
Commenter	Public meeting
Observer	Newsletter or information bulletins
General public	News releases
Uniformed/informal/ historically marginalised	Outreach and engagement

Source: Expanded from Creighton 2004.

In practical terms, stream restoration occurs through a variety of methods.

- Capital works projects undertaken via councils.
- Operational maintenance works undertaken via councils.
- Volunteer programmes managed via councils on public land.
- Council, community or private programmes managed by councils focusing on private land.
- Community or individuals undertaking restoration with and independent of council on private land.

Communities or individuals undertaking restoration can self fund and also seek additional contestable funding available from councils (e.g., the Auckland Regional Council's Environmental Initiative Fund or Rodney District Council's heritage fund) or other private or semi-public funds.

## OVERVIEW OF URBAN STREAM RESTORATION IN NEW ZEALAND

The examples presented are: streams in the Birkenhead and Browns Bay areas of North Shore City, Meola Creek in Auckland City and Project Twin Streams in Waitakere City in the Auckland region; Waitangi Park wetland in Wellington City; and the urban rivers of Christchurch (Table 1). These examples demonstrate the variety of manners in which urban stream restoration and protection is occurring in New Zealand. The examples, moreover, reflect the range of methods and levels in which the community and private landowners are engaged by local governments, and how government and community work together to restore and protect streams in urban areas. Successes reflect a combination of using techniques that have a proven track record, while tailoring the programmes to reflect the local community and land owners, and the particular local government where the work is undertaken.

The urban stream restoration examples are described below in more detail. Observations are made about the examples to conclude the paper.

## CASE STUDIES OF URBAN STREAM RESTORATION IN NEW ZEALAND

### *Pine Ridge Apartments, Birkenhead, North Shore City*

#### **Situation**

This pilot project was undertaken to address the fact that existing North Shore City Council (NSCC) programmes only dealt with already engaged and motivated residents with a typical, urban, residential section size. Community development and community based social marketing tools were used with a discrete apartment block community (72 apartments) whose properties were not all immediately connected to the stream and bush environment. The apartments shared a large bush block, bisected by a highly ecologically valuable stream. This

**Table 3: Urban stream restoration examples**

Location / river	Issue(s)	Community engagement
Pine Ridge, Birkenhead, North Shore City – Eskdale Stream	Stormwater quality, riparian degradation, habitat enhancement, community access	Council - community partnership, private property
Bayside, Browns Bay, North Shore City – Taiaotea Creek	Upgrade of stormwater pond and naturalisation of stormwater channel in public reserve plus flooding, stormwater quality, riparian degradation, habitat restoration, community access on private properties adjacent to reserve.	Council - community partnership, public and private property
Meola Creek, Auckland City	Flooding, combined sewer overflows, community access, public health, riparian degradation, interaction with groundwater aquifer.	Council, network operator led; Community consultation
Project Twin Streams, Waitakere City	Flooding, stormwater quality, riparian degradation, habitat restoration.	Council – community partnership, public and private property
Urban rivers of Christchurch	Poor stream health in particular water quality; Public divided on the current health of the waterways; A significant proportion of the population not knowing correctly what stormwater is and where it goes; A large majority of public feel positive about taking actions that will make rivers and streams healthier.	Regional council led; Joint regional and city council branded project; External Advisory Group
Waitangi Park, Wellington	Piped stream with inflow and infiltration issues, demonstration project, community asset / aesthetics	Consultation on park design as part of public consultation on the waterfront development.

shared area is at the bottom of the site – completely separate from eight of the ten blocks of units (Photograph 1).



*Photograph 1: The Pine Ridge apartment complex, Birkenhead, North Shore City*

The area of bush contained a good range of native species but was heavily weed infested. Litter and rubbish also were often a problem. Pooling water under blocks I and J created favourable conditions for mosquitoes to breed and a fish barrier, created when the stream was diverted during the construction of the complex, meant native fish could not reach the headwater section of stream behind the apartments. Bank erosion and slumping were evident along the stream length and access to the stream and bush area was difficult and hazardous, meaning it was not utilised by the residents.

A key member of the complex's Owners Committee was highly motivated to take action to improve this area, and successfully convinced a small number of other committee members of the benefits of doing so. However, the majority of the residents (many of whom were tenants) were not engaged, motivated, interested or even aware of the stream before the project started.

This pilot involved the NSCC and the community working in partnership and aimed to get the residents engaged in working towards the same goals as the Owners Committee. The NSCC's Stream Restoration Project Leader worked with the community and acted as the conduit between the community and the NSCC on all issues involving the community in the pilot area.

The community of the apartment complex was subject to regular change. Of the 72 apartments at the start of the project (January 2008), only 14 apartments were owner occupied, while the remaining 58 were tenanted. The residents of the apartment complex formed a diverse community from a range of family situations (students, single parents, couples, parents with young children, etc) and a range of ethnic backgrounds. Rental accommodation agents indicated that there was a significant turn-over of tenants annually, and interactions with the community supported this. The transient nature of the community was a key challenge for the community engagement side of the pilot project. Only one of the members of the Owners Committee (not all of whom had motivation for this project) lived on site; the rest were absentee owners. This member was also the resident caretaker (the 'Maintenance Manager'), who looked after the gardens, and throughout the project she indicated an interest in improving the shared natural areas of the site.

## **Tasks**

The key tasks for this pilot were to:

- Use a range of community engagement strategies and social marketing tools to involve the Pine Ridge community in the restoration activities
- Through education, communication and the use of other tools, increase the environmental knowledge, awareness and action of the target community
- Increase the target community's use of the shared bush and stream area for recreational purposes
- Increase the proportion of beneficial vegetation in the riparian zone of the stream on the shared site
- Reduce the proportion of pest plant vegetation in the riparian zone of the stream on the shared site
- Improve the ecological performance of the section of the Eskdale stream running through the shared site

## **Actions**

Examples of key actions undertaken on private property in partnership with the Pine Ridge community are outlined below:

- Physical actions including:
  - Weed removal and control
  - Weed mat installation
  - Litter and rubbish removal
  - Planting
  - Construction of fish passage

- # The stream at Pine Ridge is going places
- "You think you are a million miles from the city - not living in suburbia," - Pine Ridge resident, 2008
- ## Streams never stay still
- "Freshwater bodies, whether rapid streams or quiet wetlands, are all in some sense temporary. They are incidents in the ongoing cycle of erosion by water - the never-ending work of cutting and deposition."
- A Natural History of Auckland, Prof John Morton and Maureen Lewis, 1993
- This little stream is one of many small tributaries flowing into the main channel of the Eskdale Stream.
- At this early stage in its journey to the sea it is shallow and small enough to jump over. There are little hiding places under the banks for fish and insects to shelter in.
- The soft ground on either side is made up of small grains of silt from further upstream. The silt forms a flood plain which is big enough to contain most of the floodwater in heavy rain.
- ### Where does the rain go?
- Pine Ridge residents live next to the headwaters of the Eskdale Stream, close to where it begins its journey.
- The Eskdale Stream flows for more than 13 kilometres, from the ridges in Birkenhead, through the valleys of Birkenhead and to the sea.
- It has a catchment area of nearly 4 square kilometres, (see map left).
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- You are here**
- It is one of the longest streams on the North Shore.
- ### Rain drops trickles, flows.
- Cut and carry little stream, running to the sea.
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2010 Stormwater Conference 6

## Results

The Pine Ridge pilot project has achieved a great deal in a short space of time, including:

- Ecological achievements arising from physical actions including:
  - 2000 ecosourced native plants planted over a total area of approximately 1000m<sup>2</sup> in the 2008 and 2009 planting seasons
  - Weeds cleared from an area of approx 1000m<sup>2</sup>
  - Koura, banded kokopu and eels found upstream of the new fish passage
- Social achievements including:
  - Residents talking and getting to know each other for the first time
  - An increase in residents' level of environmental knowledge, awareness and action (social data report currently being compiled)
  - Resident attendance at, and participation in, working bees and other community activities
- Infrastructural achievements
  - A reduction in the volume of household rubbish and green waste from the Pine Ridge complex going to landfill, with a saving of \$600/month in disposal costs
  - A small number of residents worm farming kitchen waste
  - Uptake of a permanent green waste collection service by the Owners Committee
  - Reports of regular use of the access gate and steps to the bush and stream area and the walking track by residents and their visitors
- Educational / awareness raising achievements
  - Residents and their visitors using the walking track, botanical signage and interpretation panels for recreational purposes
  - Resident participation in stream walk and talk sessions
  - Regular positive feedback as a result of the newsletters
  - Steady hit rate on Pine Ridge pages on council's website
- Monitoring achievements
  - Stream Ecological Valuation score improvement of 0.54 (February 2008) to 0.68 (February 2010) in just a 2 year period (Golder 2008, 2010)
  - Reduction in pest plants present
  - Reduction in animal pests present

## Ongoing activities

Following the first year of intensive community engagement during 2008, the focus for 2009 was on infill planting, maintenance of the area and the continuation of a significant level of community engagement with residents and owners. During 2010, the level of intervention will be significantly reduced and efforts have been made to enable the Pine Ridge community to take responsibility and become 'self-sufficient'. The Maintenance Manager has taken over the regular maintenance of the enhanced area and is being supported on a regular basis by a council expert. The Owners Committee and Body Corporate has been encouraged to take over the bimonthly community newsletter and has been provided with the Pine Ridge 'identity' materials developed by Council. From 2011 community assistance will be provided as required and as resources permit.

Further details of the Pine Ridge project can be found in Campbell (2009) and Kirkland-Smith and Heijs (2009).

## ***Bayside, Browns Bay, North Shore City***

### **Situation**

This pilot project was undertaken to target the approximately 60% of a population who are ‘action ready’ and just require the correct tools to move them into the environmentally ‘active’ category. A community based social marketing approach has been adopted, trialling a range of tools (such as prompts, incentives, creating social norms, etc.) and evaluating their effectiveness in fostering positive behaviour change. Desired behaviours have included: the removal and sustained control of invasive pest species; planting of natives and approved exotic species and ongoing site maintenance. The Council’s Stream Restoration Project Leader continues to work with the community and acts as the conduit between the community and the NSCC on all issues involving the community in the pilot area.

Bayside Reserve – at the heart of the target community – was the focus for extensive public works throughout 2009 (Photograph 2). These involved a complete upgrade of the existing stormwater pond, along with the naturalisation of the existing concrete lined stream (a section of the Taiaotea Creek) flowing through the reserve. The works included extensive planting; the use of innovative technology in the form of floating wetlands to improve water quality in the pond; fish passage in the pond outfall, allowing the movement of native fish up and downstream and the creation of a loop track around the pond, joined up with existing paths in the reserve to allow public access to the whole reserve all year round. The large scale works were be highly visible and resulted in huge improvements in both the ecological and amenity values of the reserve.

Just over two hundred metres downstream of Bayside Reserve, and separated from the larger reserve by private properties with a stream on Beach Road, is the smaller, less used Taiaotea Reserve. This reserve is bisected by the stream and was heavily weed infested, although some good native species are present. Downstream of Taiaotea Reserve, there are further private properties with a stream before the waterway enters a culvert and continues under a commercial area.



**Photograph 2 – Bayside, Browns Bay, North Shore City**

During research of communities with streams conducted in 2007, the residents of North Shore City said that they would be willing to maintain the streams on their private properties if they saw Council leading by example and walking the talk with stream restoration on public land first. Bayside reserve provided the opportunity to

demonstrate this. Alongside the public works in the reserve, NSCC partnered with 20 private property owners downstream of the reserve to undertake stream enhancement activities on their land also.

The Bayside community demonstrated a greater degree of stability than that at Pine Ridge; all residences are single house lots with no high density multi-unit dwellings and a high proportion of owner occupation – only approximately 25% were tenanted when the partnership commenced with this community in January 2009. Within the target area there were two existing community groups (Scouts and Baha'i) which were both keen and open to becoming involved in the project.

The community consultation regarding the public works in the reserve, which would usually, in such a situation, have been carried out by Infrastructure Services – Water (and been small scale and low profile), was managed by the Sustainable Environmental Team for the Bayside Reserve upgrade. Because of the links between the public land works and the private property pilot project, a different, innovative and wider scope approach was taken to this 'consultation'.

It is important to note that the information contained in this section predominantly focuses on the Council's partnership with the community for stream enhancement activities predominantly on private properties and to a lesser extent in Taiāotea and Bayside Reserves.

Further information on the outcomes of the capital works project to upgrade of the stormwater pond and channel in Bayside Reserve can be found in Hewison et al. (2010).

### **Tasks**

The key tasks for this project were to:

- Use a range of community engagement strategies and social marketing tools to involve the Bayside residents in the restoration activities
- Through education, communication and the use of other tools, increase the environmental knowledge, awareness and action of the target community
- Increase the target community's use of the reserve and stream area for recreational purposes
- Increase the proportion of beneficial vegetation in the riparian zone
- Reduce the proportion of pest plant vegetation in the riparian zone
- Improve the ecological performance of the section of the Taiāotea stream running through the project area

### **Actions**

Examples of key actions undertaken on private property (and on public land, not including the contractual components of the Bayside Reserve upgrade), in partnership with the Bayside community, are outlined below:

- Physical actions including:
  - Weed removal and control (on private properties and in Taiāotea Reserve)
  - Planting (on private properties, in Bayside Reserve and in Taiāotea Reserve)
  - Rubbish and debris removal (from private properties)
  - Conservation Volunteers New Zealand (CVNZ) active in riparian weed removal in Taiāotea Reserve
  - Personal on-site consultations for private property owners with streams to identify and plan for weeding and planting activities to enhance the riparian environment
- Social actions including:
  - Innovative community engagement approach involving face to face contact with 130 households in the project area plus numerous opportunities for the community to feedback on the concept plans for the Bayside Reserve upgrade
  - Community input integrated into some design (planting, path and artistic elements) for the reserve upgrade
  - Collection of social data from the community (including their barriers and benefits to engaging in positive riparian behaviours and their levels of knowledge, awareness and action), undertaken at start of project
  - Collaboration between neighbours during planting activities

- Numerous community ‘working bees’ for planting and weeding activities in Bayside and Taiāotea Reserves
- Community ‘events’ based on milestones for reserve upgrade, e.g. reopening, interpretation panel unveiling.
- Educational / awareness raising actions including:
  - Regular education and activity sessions for the local Scout group focusing on the ecology of the stream area, weeds and native plants, stormwater and pollution
  - Installation of interpretation panels in Bayside Reserve with information about the stream, stream life, history and geography of the area (in response to community requests)
  - Regular bi-monthly community newsletters
  - Development of Bayside specific pages on the Council’s website
- Monitoring actions including:
  - Stream Ecological Valuation surveys prior to commencing the project
  - Monitoring of pest plants present

## **Results**

The Bayside pilot project has achieved a great deal in a short space of time, including:

- Ecological achievements arising from physical actions including:
  - 6000 ecosourced native plants planted by 200 community members in the riparian zone on 20 private properties plus Bayside and Taiāotea Reserves in the 2009 planting season (Figure 2)
  - Weeds removed from 20 private properties plus Bayside and Taiāotea Reserves
  - Concrete rubbish and other large debris removal from in and around the stream on private properties
- Social achievements including:
  - Increased social cohesion with some residents meeting their neighbours for the first time and neighbours helping neighbours to enhance the riparian environment
  - Resident attendance at, and participation in, working bees and other community events and activities
- Educational / awareness raising achievements
  - Reports of a significant increase in reserve usage and positive feedback about the interpretation panes and their content
  - Regular positive feedback as a result of the newsletters
  - Steady hit rate on Bayside pages on council’s website
- Monitoring achievements
  - Stream Ecological Valuation report and score (0.49) with indications of clear actions that could be undertaken to enhance the score in future (Golder 2009)
  - Reduction in pest plants present

## **Ongoing activities**

Following the first year of intensive community engagement during 2009, the focus for 2010 is on the control of re-emerging pest plants and further planting on private properties. Due to the extent of weed cover on private properties, a staged approach to weed control was implemented to avoid large scale clearance and the associated risk for instability and erosion. The 2010 season will see new areas planted along with infill of areas planted last season. The NSCC will once again partner with the private property owners, involving them in the weed control and planting on their private properties. In addition, attention is being paid to enhancing the environment in Taiāotea Reserve to minimise the risk of this acting as a weed source for downstream private properties where stream enhancement has taken place.



**Figure 2 - A Bayside private property owner helps out at a planting event.**

With the capital works project complete in Bayside Reserve, the intensity of communications with the wider target audience will be reduced but the regular community newsletter will continue. Existing partnerships with the Scout and Baha'i groups will be maintained and community events organised as required.

The following couple of years will see a further reduced level of intervention as the native plants become more established, the weed seed source on site reduces and the community takes more responsibility for the maintenance of their stream.

Further details of the Bayside project can be found in Campbell (2009) and Kirkland-Smith and Heijs (2009).

### ***Meola Creek, Auckland City***

Meola Creek is the first of the five publically managed watercourses in Auckland City to have a Watercourse Management Plan (WMP) prepared and implemented by Metrowater on behalf of Auckland City Council. Two more WMPs for Oakley and Motions Creeks are in the final stages of completion.

The purpose of the WMP is to provide a management framework with supporting ecological and engineering information for use by Auckland City Council, Watercare and Metrowater along with stakeholder groups to manage streams in an integrated sustainable manner (Coup et. al. 2009). The WMP prioritises values in terms of conveyance, amenity and habitat for the watercourse. Management zones and restoration opportunities are identified and documented to aid in prioritisation of sites and provide clear direction for community groups and agencies. The WMP is developed collaboratively with input from the watercourse maintenance contractor and the WaiCare community program to bring together diverse values and objectives for the urban stream. The initial restoration opportunity in the Meola WMP was progressed at the Roy Clements Treeway (Clarke 2008).

### **Situation**

In its upper reaches Meola Creek is highly modified and has been piped and channelled in many locations to improve stormwater conveyance and minimise erosion. The Roy Clements Treeway (RCT) is a privately owned park accessway alongside Meola Creek and next to schools that is subject to flooding on around a monthly basis. The contaminated stream floodwaters (from urban runoff and combined sewer overflows) created significant risks to public health and safety as well as inhibiting access along the streamside. It was necessary to investigate options to mitigate public health risk.

Despite the modification and contamination issues, the high base flows from basalt aquifers in the catchment has increased the creeks resilience to degradation. Community expectations were high given the values within the area including a wetland and the groundwater spring inputs.

## **Task**

Several options were identified to manage the public risk. This included solutions at a local and regional scale, with varying timeframes, longevity and costs. Mitigation of the public health risk was paramount and it was important to ensure community involvement for the success of the project.

The immediate solution involved coordinated actions from the primary stakeholders. A key part of the solution was to build a raised timber-boardwalk through the park to limit contact with stream floodwaters. This was undertaken as a joint project between Auckland City Council and Watercare Services Ltd as the regional wastewater network operator. The project integrated well with community objectives incorporated with the Meola WMP and provided an enhanced public access and urban greenbelt environment. This also addressed the short term impacts of combined sewer overflows and flooding by changing the land use and public expectations ahead of planned longer term large infrastructure solutions. A number of other improvements were made which included, on-line monitoring, increased stream bank maintenance and installation of coarse screens on key stormwater outlets to minimise debris (Figure 3).

## **Action**

The boardwalk was built with viewing platforms and passing bays, and low floodplain plantings along its 600 m length. The installation of the boardwalk improved visual access to the stream and wetland while restricting physical contact with the watercourse (Figure 3).

Community involvement and collaboration was a core principle of this project. Designs were reviewed to maximise opportunities for improvement of the community - stream relationship. This included providing a weir to enhance a spring fed wetland, discussing the route and access points for the boardwalk and development of weed removal and planting proposals. Community planting and weeding days, organised through WaiCare and the St Lukes Ecological Protection Society (STEPS), has brought stream values and the environment to public attention.

## **Result**

Benefits of the boardwalk include reduced public health risk, improved and increased amenity and a sense of community engagement and ownership. The presence of a large residential population in the immediate area increases the scale of the community benefit. The boardwalk is utilised more as a result of the upgrade which has also placed value on the public area including the Meola Creek. Members of the public are often seen picking up rubbish or frequently raise maintenance issues.

## **Ongoing activities**

Community engagement was achieved through communication and collaboration through design, and involvement in the implementation of planting of the initial restoration project. Subsequently the local community have managed additional plantings in the area and are involved in proactive maintenance. Educational signage is being developed through a request from the community for Small Local Improvement Project (SLIPs) funding from the local Community Board.

The ongoing watercourse maintenance is conducted in a manner that continues the community engagement, with the contractor and contract managers maintaining direct contact with stakeholder groups. Waicare programs continue to operate taking into account the overarching WMP objectives and planned outcomes.

The WMP and the associated restoration has improved recognition of the values of the Meola Creek. The values for amenity and habitat can now be integrated with conveyance requirements for planning of proposed major drainage infrastructure in the catchment.



**Figure 3. (a) and (b) planting days, (c) Boardwalk in high flows, (d) Havestock storm water discharge screen**

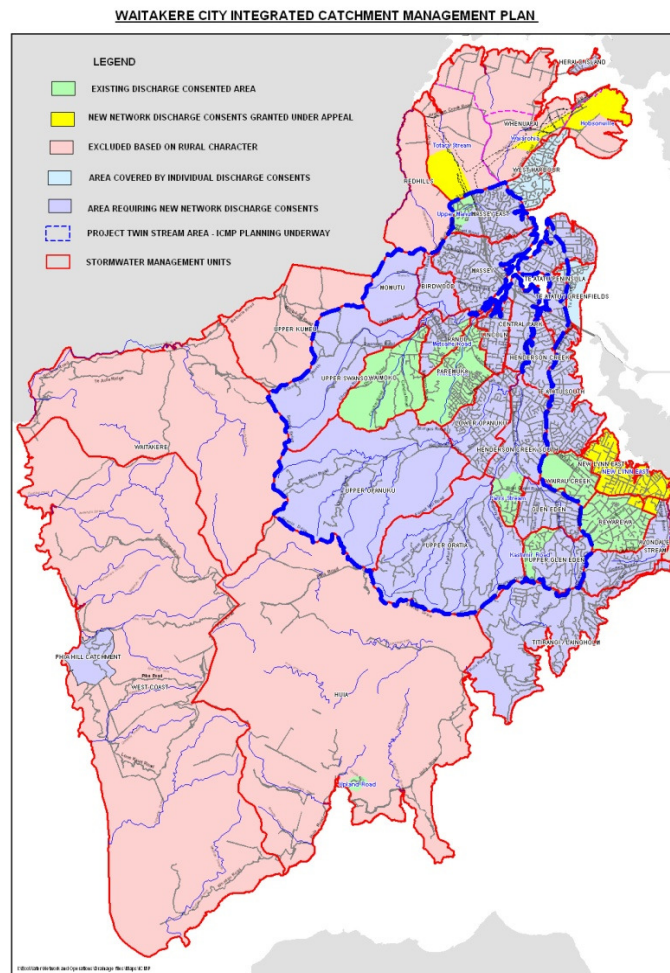
### ***Project Twin Streams, Waitakere City***

#### **Situation**

The Project Twin Stream (PTS) catchment comprises 10,000 hectares, around one quarter of the land area of Waitakere City (Figure 4). The catchment is home to around 100,000 people, just over 50% of the city's population. Stormwater management issues were identified in the Twin Streams catchment (comprising the Huruheru and Henderson Creeks and their tributaries) including flooding of residential properties, streambank erosion, and pollution discharged into the Waitemata Harbour. The problems with stormwater and flooding were threatening future development in the Oratia and Opanuku catchments. Population pressure and climate change exacerbate the issues identified.

#### **Task**

PTS was granted funding in 2002 by Infrastructure Auckland (now Auckland Regional Holdings – a wholly owned division of ARC) for stormwater management initiatives to reduce flooding and improve water quality in the Henderson and Huruheru Creek catchments. This included the purchase of properties affected by flooding and a programme of riparian restoration to improve water quality and bank stability.



**Figure 4. Project Twin Streams catchments**

The original Infrastructure Auckland grant amount for the period 2002-2012 was \$38.2 million. The WCC was successful in a further application for ARH funding of \$4 million to design and build walk and cycleways along the Oratia, Opanuku and Waikumete streams (Figure 5). These facilities provide a major network of off-road connections between suburban neighbourhoods, public transport (particularly to stations on the western train line) and town centres, thus reducing vehicle use and the concomitant heavy metal pollutants which adversely affect the streams.

From 2004 to June 2007, additional funding was received from Sustainable Communities, a three year Central Government project - part of the Sustainable Cities programme. Organisations such as Landcare and Wai Care also provide support.

## Action

Project Twin Streams' sustainable community development approach to stream restoration was designed to achieve environmental, social, cultural, and economic outcomes. In the first stage of the project, locality-based community organisations were contracted by Waitakere City Council (WCC) to engage their local communities in caring for their streams, and – in stage two - to explore the project's wider aims of fostering behaviour change towards more sustainable living patterns.

As part of stage two – and in response to community recognition that stream bank restoration was not by itself going to solve the catchment's problems, the PTS Sustainable Living-Sustainable Households demonstration project was developed. The scheme was piloted in 2008-2009 to test whether the community development model that has been so successful in engaging communities in stream restoration could also be used to engage households to live more sustainably.

In the third stage of the project, WCC is developing complementary integrated water resource management practices, to mitigate the effects of present and future development in the PTS catchment and to improve the effectiveness of stormwater management.

The underlying assumption implicit in the design of the project is that when local communities own the issues and solutions for environmental stewardship and wise resource management, sustained behaviour change is much more likely. Achieving long-term sustainable management of the catchment relies on sustainable communities, neighbourhoods who are strong, resilient and connected with each other, with the landscape, with water and with the living systems they are part of.

Another assumption is that riparian restoration assists with the long-term strategy of replacing built infrastructure by reinstating natural stormwater systems. Over 70 houses have been removed from the floodplain, allowing the landscape to permit stormwater flow more freely. Riparian planting increases the capacity of the stream banks to withstand erosion and to filter contaminants before they enter the streams.

## Results

PTS has been hugely successful in terms of public response, with over 17,000 volunteer engagements in stream restoration since the project began. Through 2009, PTS has planted 523,323 trees (344,361 by the community at community planting days and 180,962 by contractors in hard-to-reach areas) (Figure 5). Over their lifetime these plants will absorb the carbon emissions from approximately 21,360 cars.



**Figure 5. (a) Streambank restoration, (b) cycle way, (c) and (d) planting days.**

In 2008-9 550 households took part in the Sustainable Households programme, with each one receiving a free home water and energy check and (where necessary) low-flow showerheads, gizmos in toilets and other water-saving devices, as well as referrals for insulation retrofits. Transport and waste are other key aspects of human behaviour targeted through the programme, which aims to foster neighbourhood conversations and actions towards sustainability.

Through 2009 the quarterly 'Streamtalk' publication was distributed to 46,000 households, stakeholders and organizations within the catchment. In 2010, the publication has been revised to a monthly email newsletter.

The project has gained international and national recognition:

- July 2007: Finalist in the International River Theiss Awards.
- September 2007: PTS is a finalist (and commended) in the Sustainable Urban Communities Category of the ARC Environment Awards.
- May 2008: PTS is a finalist in the Public Sector Communications category of the Public Relations Institute Awards.
- May 2008: Te Piataata win Youth category for their work on PTS at the MfE Green Ribbon Awards.
- July 2009: PTS walk/cycleway wins Golden Foot award for Best Practice Walking Facility at the Best Practice Walking Awards.
- November 2009: PTS walk/cycleway wins Avanti award for Best Cycle project at CAN Cycle-Friendly Awards.
- February 2010: PTS Song Quest is a finalist (and commended) in the Youth category of the ARC Environment Awards.

### **Ongoing Activities**

PTS continues to complete riparian planting and restoration in the areas that remain areas through 2012 (when the Infrastructure Auckland funding completes) alongside other PTS activities. The current focus of PTS is within the urban areas of the catchment. It is known that significant sediment and contaminants are generated within the catchment that discharge to the Waitemata Harbour and end up deposited in many estuaries within the region, including, for example, in Shoal Bay on the North Shore. Consequently, the catchment has regional significance. WCC is investigating methods and funding alternatives to continue PTS beyond 2012 and to commence engagement in the upstream portion of the catchment.

### **Wellington Region**

#### ***Waitangi Park, Wellington***

##### **Situation**

The Waitangi Park is named after the Waitangi Lagoon that existed nearby until the mid-19<sup>th</sup> century. Fed by the Waitangi Stream, it was an important food source for local Maori – but largely disappeared after the 1855 earthquake. Land now known as Waitangi Park was reclaimed from the sea during development of the city. Waitangi Stream was piped during construction of one of the city's oldest stormwater system from 1859 onwards. In addition, the build-up of heavy metals and hydrocarbons in the marine sediments in the vicinity of the Waitangi Park stormwater outfall was recorded (Stephenson et al. 2008).

Redevelopment of a contaminated urban brownfield site presented the opportunity to develop an innovatively multifaceted cultural, aesthetic, and ecologically functional public space that incorporated a designed wetland to treat stormwater and serve as a community amenity.

##### **Task**

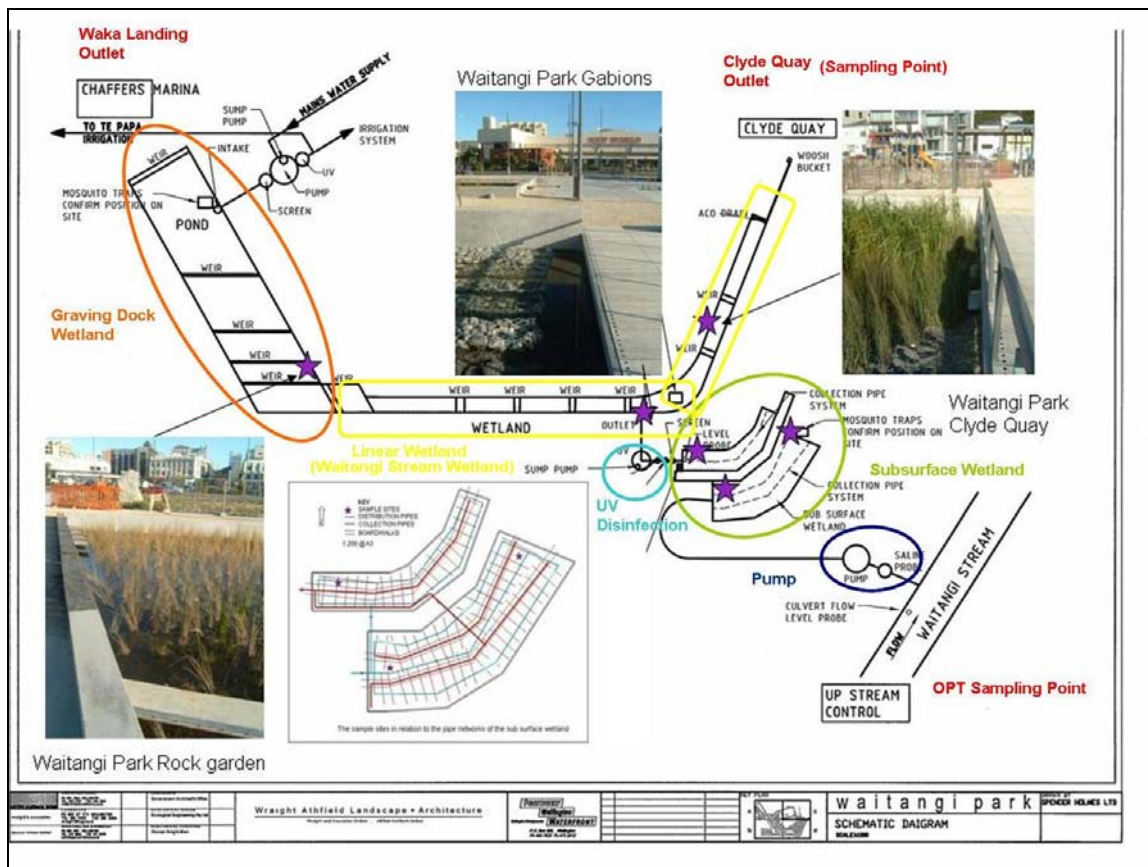
The Waitangi Park Wetland treatment train was designed as part of the redevelopment of the waterfront for public use. It was a capital works project undertaken by the Wellington City Council (WCC); there was minimal community engagement or consultation carried out as part of the design, its selection or its development. Waitangi Park is not a 'natural' stream restoration project. Rather the treatment train is an engineered creation – using pumps, screens, concrete and an expensive UV system, in addition to the natural filtration properties of the wetland and the vegetation.

## Action

The Waitangi Par Wetland treatment train was constructed that treats approximately 10% of the base flows from the stormwater pipe that runs beneath the park. Water is pumped into the wetland two hours either side of low tide.

The wetland treatment train consists of a sub-surface wetland, UV disinfection process, and a linear wetland (Waitangi Stream wetland) that flows into the 'Graving Dock' wetland. The entire system is built to mimic the water quality cleansing processes of a natural wetland system. It removes contaminants from stormwater through sedimentation, fine filtration and plant nutrient uptake.

Figure 6 shows the various parts of the Waitangi Park Wetland Treatment Train.



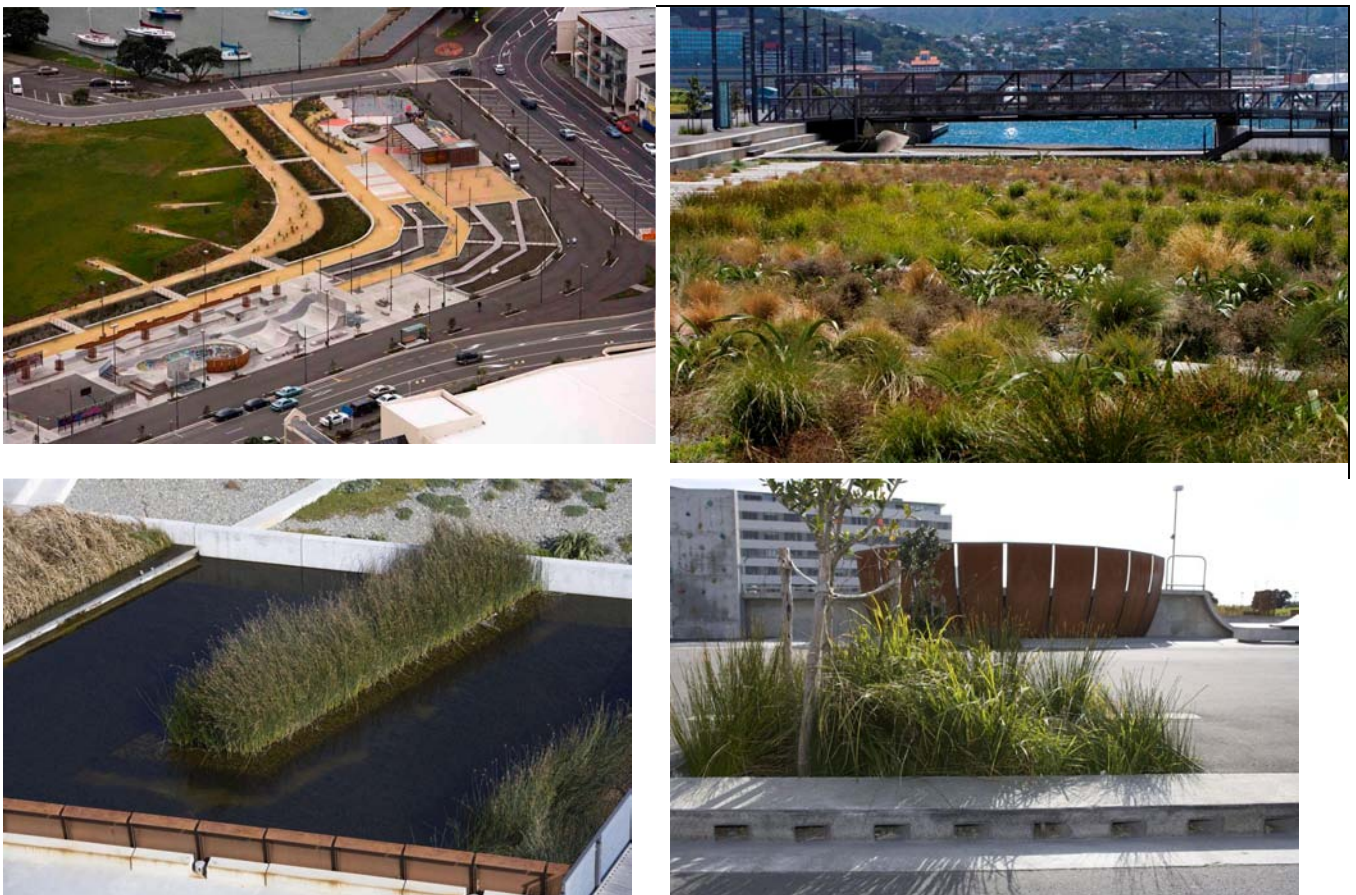
**Figure 6. Waitangi Park Wetland Treatment Design**

The following describes the treatment components of the Waitangi Park Wetland, which are also shown in Figure 7.

- **Gross Pollutant Trap:** helps to exclude litter, debris and some sediment prior to the water being pumped into the wetland system.
- **Diversion Pump:** Stormwater from the culvert is 'daylighted' via a pumping system about 100m upstream of the park. The pump is linked to culvert water level and salinity sensors to exclude seawater at high tide. Water is pumped at 10 l/s, which is approximately 10% of the dry weather flow of Waitangi Stream.
- **Sub-surface Wetland:** Water enters a sub-surface wetland designed to reduce turbidity in the stormwater to levels suitable for UV disinfection (<10-15mg/l). Water flows through a gravel bed in which plants are rooted. A biofilm growing on the gravel assists in the sediment and pollutant removal through microbial activity. Any grease, solids and silts are removed here.
- **Windmill:** On site a small windmill converts wind energy to power some of the UV system. This is backed up by mains power.

- **UV Disinfection:** Disinfection of flows prior to entering the wetland results in 90 to 99% reduction in bacterial levels (faecal coliforms) helping to ensure risk to public health is reduced.
- **Waitangi Stream Wetland:** Flows within the Waitangi Stream wetland are treated through filtration, absorption and biological/chemical transformation. Vegetation in the wetland helps to trapped sediments of all sizes including fine particles. Epiphytic biofilms on vegetation surfaces assists in the uptake of pollutants that are found in sedimentation. Stormwater run-off is slowed through the wetland system, assisting in pollutant removal and biodegradation of organic material. The plants filter sediments and pollutants from the water and also absorb nutrients for growth.
- **Graving Dock Wetland:** A continuation of the Waitangi Stream wetland that is heavily vegetated providing additional pollutant and sediment removal.
- **Storage Pond - Irrigation Reuse:** Treated stormwater from the wetland is used to irrigate the park and the neighbouring grounds of Te Papa. This water undergoes further UV disinfection.
- **Outlet:** The water discharges from the wetland system and into the Wellington Harbour at Clyde Quay and Chaffers marina.

**Bio-retention Tree pits:** Along the streetside promenade stormwater runoff is directed into sunken planted tree pits where it slowly filters through the soil. Contaminants are removed by micro-organisms around the root zone.



**Figure 7. Various views of the Waitangi Park Wetland**

## Result

Waitangi Park wetlands are part of an artificial stormwater treatment train located within an urban park. They are designed to improve stormwater run-off quality by using natural and artificial filtration systems whilst raising

public awareness in a high profile location. The park has won international and national landscape design and architecture awards that recognise its sustainable, ecological and social attributes and its sophisticated design.

Stormwater sampling test results to date show a significant improvement between the pipe sample that flows underground and the wetland sample. These monitoring results show that the wetland treatment train is effectively removing contaminants from the pumped stormwater, including removing bacteria, trace metals and sediment from the stormwater.

Establishment of a low impact design approach to stormwater management in a high profile location like Waitangi Park provides an excellent opportunity for raising public awareness. Signs are to be installed that will outline the wetland processes and tours are also held on request. In addition, the urban green spaces and wetlands offer other ancillary benefits, such as aesthetic benefits as well as forming an important element in sustainable urban drainage and in encouraging biodiversity.

Several lessons were noted, however. Wellington Waterfront Ltd was responsible for the design and construction of the wetland treatment train. Wellington City Council is now responsible for the ongoing monitoring, maintenance and operation. Greater communication and involvement between Wellington Waterfront and WCC's business units throughout the design and construction of Waitangi Park would have been beneficial in achieving an asset that could easily be transferred from one organisation to another.

The construction, operation and maintenance of the park can by no means be considered sustainable (financially or environmentally). Pumping stormwater from the underground pipe to the treatment train and the UV treatment is not energy efficient despite wind power being harnessed. In addition, consideration should also have been given to drought tolerant plants in the wetlands, as in the summer months potable water must be supplied to the wetland to keep the plants alive.

### **Ongoing activities**

The WCC is currently working with the Department of Conservation and Forest and Bird to assess whether eels and/or other native freshwater species can be established in the re-created wetlands/stream in Waitangi Park.

The reasons for doing this would be to re-establish some native wildlife in the city centre and give some much needed advocacy for freshwater species. Many people are unaware that the Waitangi Stream existed and that it supported a diverse population of native species. Following the planting of aquatic indigenous plant species, restoring an eel population would complete the re-creation of the stream habitat.

Eels are under pressure throughout New Zealand. Introducing them to the wetlands is a prime opportunity to increase people's appreciation of them and increase awareness of their plight.

It has been established that there is likely to be suitable habitat for native species in the stream. The Department of Conservation will carry out an electric fish survey and the Greater Wellington Regional Council is scheduled to undertake a macroinvertebrate survey to determine what aquatic life has established itself in the wetland stream. Eels in the adjacent stormwater system would not be able to naturally migrate into the wetland/stream, so reintroduction would be needed.

There are various other things that would complement the introduction of eels. Investigations are underway to assess the possibility of establishing a fish passage at the dry dock end of the stream to allow passage to and from the sea.

### **Canterbury Region**

#### ***Urban Rivers of Christchurch***

##### **Situation**

Diesel made its way into the Heathcote River in Christchurch in February 2005 from an industrial site. The community rallied round and were part of the wildlife clean up. Public meetings followed the incident to discuss how the response to a spill could be better handled in the future. Also at that time the community voiced that they wanted a proactive role in the management and care of their rivers. The regional councillors agreed to fund a long term project to achieve this but wanted to ensure that activities would have a demonstrable positive impact on the health of the waterways. Subsequently Environment Canterbury commissioned the analysis of 14

years of city council quarterly water quality data and it showed poor water quality and some locations of concern, 'hot spot areas, along the rivers (PDP 2007). Investigations are currently underway to establish what is affecting the health of these waterways and what might be done to improve the quality of them.

A pollution prevention team was established post the diesel spill to work with industry to clean up their activities and encourage best management practices. The monitoring of compliance with resource consents is being targeted in catchments where the water quality 'hot spots' were identified and further physical investigations are happening.

In the meantime market research of the community carried out for Environment Canterbury showed that the vast majority of people feel that having healthy rivers and streams is very important to them (Opinions 2007). Sixty-nine per cent feel they could do more to help with keeping waterways healthy and 66% would be willing to participate in some activity. Eighty-six per cent also feel positive about taking actions that will make rivers and streams healthier. On the flipside 42% felt the rivers are healthy or very healthy and 56% felt the opposite, the rivers are unhealthy. Furthermore between 34 and 37% either did not know or got it wrong when asked where water ends up that comes from their property, streets and roads, demonstrating a lack of understanding of what stormwater is and where it goes. Therefore despite the majority of Christchurch residents saying they are willing to take action they may not. A large proportion do not view the rivers as unhealthy and if they did choose to take action many do not understand the connection of stormwater and waterways nor their influence on the quantity and especially the quality of stormwater before it enters the waterways.

## **Task**

To develop an awareness campaign aimed at the general residential population of Christchurch until there is a better understanding of specific causes of stream health in Christchurch and what specifically the community can do about those causes to make a difference. In the meantime it was agreed by Environment Canterbury that there is an immediate need to let the community know that the councils want to work with them towards healthier waterways and there are things they can learn about and do that will make for healthier waterways.

### Objectives of the Campaign

- To position Environment Canterbury as a partner with the community in achieving desired environmental outcomes.
- To inform the community and key stakeholders that a process for improving urban waterway health is underway.
- To raise awareness among Christchurch people that they have a role to play in improving urban waterway health.
- To demonstrate a partnership between Environment Canterbury and Christchurch City Council.

### Key messages

- You care about your urban rivers and you want them to be healthy  
(healthy = good water quality, abundant fish life and invertebrates, appropriate riparian planting)
- What you do at your place, in parks, at work etc affects stream health  
(actions = pick up dog faeces and litter, wash cars away from drains/roads/driveways, don't tip paint/oil/etc down outside house/street drains, call Pollution Hotline)
- Environment Canterbury is working with you to clean up the streams.

Conceptual ideas and then artwork for an advertising campaign, and an appropriate media schedule were developed. Input throughout the process was obtained from an external advisory group made up of representatives from Avon-Heathcote Estuary Ihutai Trust and Styx Living Laboratory, Fish and Game, University of Canterbury, Ngai Tahuiriri Runanga, Christchurch Combined Residents Association and Canterbury Employers Chamber of Commerce and Christchurch City Council. After reviewing the first version of adverts they tasked the project team *"to develop an advert that has a unifying coordinated, collaborative message that is bold and humorous yet, still within the reality of the political framework that both organisations"*

(councils) operate. The various advert designs and placement of these were tested through a focus group process undertaken by Opinions Market Research with Environment Canterbury staff present. The feedback from this focus group guided the final design of the adverts and largely supported the views of the external advisory group in terms of being bold and collaborative. The final design did not lend itself to bus backs as recommended by both groups; however it met the rest of their recommendations and bus backs will hopefully be utilised in future campaigns.

## **Action**

The three adverts appeared in print media (The Press, the Christchurch newspaper and local community newspapers) (Figure 8). Simplified versions were installed in bus interiors, on billboards around the city concentrating on locations near major waterways and intersections in attempt to reach the four corners of Christchurch. A lack of billboards in the north meant more emphasis was placed on advertising in the local community paper in that area. Radio advertising in the 'community' diary section was also carried out for two weeks. The adverts were also printed as posters for schools at their request and samples were put in E box, a resource material box sent to every school in Canterbury. The adverts were modified to include more information on the reverse and were used as an insert into the newsletter of a local community waterway group, the Avon-Heathcote Estuary Ihutai Trust. A website was developed [www.cleanwaterways.org.nz](http://www.cleanwaterways.org.nz). This uses the adverts on its home page and contains comprehensive information and actions for residents and businesses to improve the health of urban waterways as well as all supporting research. In total the campaign ran from late June through to early September 2009 as budget allowed.

## **Result**

Opinions Market Research was contracted by Environment Canterbury to pre test the campaign in June 2009 and post test the campaign in September 2009. The results showed 65% recalled at least one of the campaigns communications, with 24% recalling the radio advertising and a recall rate between 21% and 27% for the three adverts and 12% were aware of the website.

The post campaign results showed there was an increase of 7% for those that perceived the health of Christchurch rivers, streams and waterways as unhealthy and an increase of 8% in those perceiving the water quality as being adequate to extremely poor. The researchers saying both shifts in perception are potentially a result of the campaign messages.

There was little change over the campaign as to the role of the councils, as the majority (86%) still saying the councils should be telling the public more about how they can better improve the health of Christchurch waterways.



There was an increase (38%) in the view that they personally could do more to improve the health of Christchurch waterways. Just over half (53%) agreed that they actually try to do things to keep the waterways of Christchurch healthy, which is a decrease of 25% compared to pre the campaign. So perhaps people are beginning to realise what behaviours and activities they could undertake to improve the health of waterways in Christchurch, but for unknown reasons are yet to do them. This comment may be supported by the 22% drop in people feeling positive about taking actions to make Christchurch waterways healthier. On a positive note 76% of people now understand that water from gutters ends up in Christchurch waterways, an increase of 7%, so perhaps a better understanding of stormwater is growing.

## **Ongoing activities**

There is ongoing development of the general awareness campaign and the latest version begun in April 2010. It has been modified to fit on buses as requested by external people involved in the campaign, more radio advertising because of good results in the evaluation survey and continuing with newspaper advertising in particular in local community papers. More effort is being put into generating local media waterway stories and integrating with the networks and projects being done by members of the external advisory group.

Everything you drop here

affects every drop here

When it rains, our stormwater system takes the rainwater from roofs, driveways, parks, streets and swales. The rainwater washes dropped litter down stormwater drains. That litter is carried through a network of pipes, straight into the Avon, Heathcote and Styx rivers and into the sea. Disposing of litter properly takes no effort, but it makes a big difference to our waterways.

Christchurch Waterways. Let's change our ways, to change our waterways.

Christchurch City Council



Environment Canterbury  
Your regional council

Toi tū te marae o Tangaroa. Toi tū te marae o Tāne. Toi tū te Iwi. If we look after the waters and land around us, we will be looked after in turn.

cleanwaterways.org.nz

Be careful where you wash the car

you may be cleaning out the rivers

When dirty water is poured down stormwater drains, the dirt and chemicals contribute to the pollution of our waterways. Water washing from roads and down drains is carried through a network of pipes, straight into the Avon, Heathcote and Styx rivers and then into the sea. So when you wash your car, wash it on grass or take it to your local car wash. It makes a real difference to our waterways.

Christchurch Waterways. Let's change our ways, to change our waterways.

Christchurch City Council



Environment Canterbury  
Your regional council

Toi tū te marae o Tangaroa. Toi tū te marae o Tāne. Toi tū te Iwi. If we look after the waters and land around us, we will be looked after in turn.

cleanwaterways.org.nz

If you wash your brushes near a drain

that's not all you wash up

Washing paint brushes into stormwater drains contributes to the pollution of our waterways. The paint chemicals are carried through a network of pipes, straight into the Avon, Heathcote and Styx rivers and then into the sea. Play your part – make sure your paint doesn't pollute our waterways. Visit our website to get tips on how to dispose of paint properly. It's one way you can help keep our waterways clean.

Christchurch Waterways. Let's change our ways, to change our waterways.

Christchurch City Council

Environment Canterbury  
Your regional council

Toi tū te marae o Tangaroa. Toi tū te marae o Tāne. Toi tū te Iwi. If we look after the waters and land around us, we will be looked after in turn.

cleanwaterways.org.nz

**Figure 8. Christchurch Waterways Adverts**

Environment Canterbury and University of Canterbury staff are working at a subcatchment level on Okeover Stream (which flows into the Avon River) to engage with the community of this stream's catchment to develop

and pilot education and engagement tools around connectedness and behaviour change. The purpose of the tools is that when implemented they will foster a greater sense of personal connection with and interest in the stream and/or actions that help improve the ecological health of the stream.

Environment Canterbury has internally set up a programme called Improving Urban Waterway Health which brings together all the sections of regional council whose work relates to urban waterways.

Pollution Prevention and compliance monitoring work continues on a catchment by catchment basis as do the physical investigations into the health of sub catchments of the larger rivers of urban Christchurch.

An interagency group has been set by Environment Canterbury that involves representation from many local waterway related non governmental organisations, the local universities and the local city council. Purpose of this group is to get a better understanding of the work being done by all the parties and identify synergies and develop joint projects and provide for a coordinated voice on urban waterways for Christchurch.

New information is being added to the website [www.cleanwaterways.org.nz](http://www.cleanwaterways.org.nz).

## **DISCUSSION AND OBSERVATIONS**

The examples presented in this paper demonstrate the variety of methods and ways that councils, communities and private landowners can collaborate and coordinate intervention to make improvements to urban streams. In the example, these methods ranged from local special interest groups that have formed to undertake effort on their own and engage council to improve stream health and amenity to council led and implemented initiatives. The stream restoration projects reflect capital works with relatively little public input (e.g., Waitangi Park in Wellington) to more collaborative efforts (e.g., Meola Creek).

In terms of the techniques for public participation based on stakeholder (Table 2, Creighton 2004), the examples depict the range of stakeholders and possible techniques, from co-decision maker on aspects of projects on Project Twin Streams in Waitakere City where negotiation sessions take place, for example, to uniformed residents in North Shore City and Christchurch where outreach and engagement techniques were used.

In most cases, the projects involved the community taking some form of ownership of the stream restoration, either through participation in how the stream management plan or project was formulated, or through taking over stream maintenance of riparian plantings and weeding, for example, upon completion of the initial restoration effort. Collaboration can lead to improved project design and allow related project and community aspirations to be documented and incorporated into the projects.

Furthermore, the examples demonstrate the range of interest and understanding of the communities about stream health. In some areas, the public is often unaware of streams that used to exist in urban areas, which now are piped beneath streets, or about the true health of streams that exist nearby. There also is strong interest by some communities that recognise that streams are community features and assets, forming local special interest groups to look after the streams. In other areas, some councils are assuming a proactive role in educating the communities about the streams and range of values that they provide. Demographics, income levels, land use, tenant rates and environmental awareness, for instance, can influence whether communities have created local stream organisations or rather there is largely apathy regarding stream issues.

Within councils, stream restoration often requires cross departmental teams, which can pose internal cultural and logistic challenges within councils that strictly work departmental mandates. In particular the stream restoration projects can bring departments that deal with infrastructure, operations and maintenance, environment, community development, parks and in some cases include the arts. It also brings together different disciplines from scientists and engineers to community development and engagement specialists.

Stream restoration costs can vary tremendously depending upon the scale of restoration and whether capital works are required as part of stormwater infrastructure upgrades, the latter which may be required in some form regardless of whether stream restoration is undertaken. The largest stream restoration discussed in this paper is Project Twin Streams in Waitakere City. This project was facilitated by a \$42 million grant from Infrastructure Auckland, with a significant portion of the money going towards purchasing properties to re-establish the floodplains. In other cases, a small amount of council seed money can help initiate a stream restoration effort which is then largely undertaken through volunteer effort.

Last, stream restoration is one measure that can be advanced within the broader context of catchment management. Stream restoration and catchment management can and do take various forms. Coordination, however, is a key aspect of the institutional framework and its implementation, including horizontal and vertical synchronisation across: (a) national departments, (b) national, regional, and local government levels, (c) public and private entities and (e) disciplines. Coordination can be motivated through local, private (and public-private) interest to manage a common pool resource – that is a stream (Blomquist 1992; Blomquist et al. 2004; Ostrom 1990). Furthermore, coordination and wise water and land use can be encouraged through economic incentives (Lant 2004). Coordination and sustainable practices, nonetheless, often require top down legislation and a facilitating environment to motivate many water users and interests to participate. At the same time, councils and government must be responsive to private and community interest and initiatives to make improvements. This paper chronicled several efforts between councils and communities to come together to restore and protect urban streams.

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