The following pages are an excerpt from the 2007 annual report prepared by the Wairewa Rünanga , the Kaitiaki [guardians] of the lake.

TE ROTO O WAIREWA

“By harnessing the oceans natural energy and tidal patterns we will allow the lake to breathe.”

TUNA FISHERIES IN CRISIS

In 2005 we received the results of the research we undertook, in collaboration with NIWA and funded by the Ministry of Fisheries. We hoped this research would give us a general idea of the health of the tuna population including age spread and growth rates.

Instead we received a major wake up call; the research showed that due to a lack of recruitment the eel fishery, as we know it, would be extinct in less than ten years. The reasons for this are simple; tuna mate and spawn out in the South Pacific and although migrating eels may leave from Wairewa to mate and spawn, their young aren't programmed to return like inaka (whitebait). Inaka spawn in New Zealand, their young then go to sea and herein lies the difference; they are born here and have genetic information that programmes them to return home to where they were born.

Approximately 110 years ago our lake was actually a tidal hapua (estuary or lagoon).

In those days the tidal fush of nutrients, mixed with fresh water flowing into the ocean, attracted numerous young tuna (elver) into our waterways. These nutrients acted like a beacon; their smell and taste signaling kai and safety. The ebb and fow of the tides is how Wairewa (waters rising) got its name. This nutrient rich water attracted other fsh and there was a thriving fishery. It attracted krill, the little shrimp-like marine animals that whales feed on; Right Whales were particularly plentiful here and the cows would nurse their calves in the shelter of the bays and feed on krill. Unfortunately Right Whales were sought after by the whalers. At one stage there were six whaling stations operating along our southern bays. The whale numbers soon dwindled but have been increasing again in the last few years.

Meanwhile, gravel pushed out of the major rivers systems in the south like the Waitaki, Rangitata and Rakaia was driven north, rolled up the coast and deposited at the Mata Hapuka end of Kaitörete. As this gravel built up it gradually closed the estuary mouth. This did not happen over night but over many years. There are records of barges and boats still entering what they called Mowhery (Mäori) Harbour through the "shallows" in the late 1800's. Most of the timber from our takiwä was taken out this way.

Once the opening closed our people would have been forced to reconsider how they continued to fsh what was now Te Roto o Wairewa a lake. We can make some assumptions that they drew on their experiences of fshing Te Waihora, where traditionally channels were cut into Kaitörete Spit during the migration and eels seeking the fastest route to the ocean would swim up them and be caught. This was a tried and true method and probably seemed the best solution to their dilemma. Our eel drains were born as an adaptation and response to a changing environment.

The channel mouth closure would have had catastrophic affects on other mahinga kai.

The founder, inaka, kanakana, kahawai and other fisheries that had existed in the estuary would never be the same. Out in the ocean the fshery that once fourished at our front door would have slowly moved to more promising waters as the nutrients stopped fowing.

The moment the estuary closed the eel fishery was under threat. Unable to scent a strong beacon and having to climb over an ever increasing gravel barrier, fewer and fewer elver found their way back into the lake.

It takes approximately 35 years for the tuna in our lake to grow to heke size and run the gauntlet of the drains out to the ocean.

The research has shown us that there are no longer the stocks available in the lake to keep the fishery alive.

It is a fact that in less than ten years the last heke tuna will be hooked from the drains and our most valuable mahinga kai will be lost. When the tuna have gone the reason our tüpuna settled here will no longer exist.

We must act now if we are to fnd a solution, maintain our mana and protect the birth right of our mokopuna.

Over the last 3 years we have been focusing our energy on fnding and implementing a solution.

We have:

- held a numerous wänanga with our tuna fishers, Rünanga members, the wider iwi, various agencies and our community
- successfully raised the public profle of the lakes' state through, newspapers, radio and more recently television "Extraordinary Kiwis"
- built up a committed team of experts
- identifed a potential solution
- lodged a Resource Consent Application to build an experimental rock groyne to test the feasibility of creating a permanent mouth opening, as a solution.

CURRENT SITUATION

On the 27th of March 2001, the Banks Peninsula District Council (BPDC) lodged a resource consent application with Environment Canterbury for works associated with the opening of Te Roto o Wairewa / Lake Forsyth. Initially the council wanted a 35 year concession to continue the current mechanical opening of the lake.

After negotiating with the council they agreed to reduce the application to 15 years with 5 yearly rights of review. This was stipulated so that new information that came to light through our research could be considered. We also negotiated the ability to test other options including possible permanent openings.

CREATING A PERMANENT OPENING IS NOT A NEW IDEA

The idea was frst discussed in the 1930's. In December 1937 an agreement was signed between the Minster of Works and Wairewa County Council which "provided for the government to carry out the construction of a permanent outlet for Lake Forsyth" This was dependent on the council raising £5,000 against a budget of £16,000. The £5,000 raised was held by Council but the war intervened. When the council approached Government once more, it was told that the proposal costs had escalated and it was now too expensive. We have copies of these plans and they involved tunneling through the cliffs to Oashore.

These original initiatives were not motivated by a desire to save our fsheries but were in fact driven by local desires to drain the lake completely and turn it into pasture.

In the end the Council opted for a cheaper option that meant the lake would be opened mechanically at certain times, based on an arbitrary level, to reduce the threat of fooding. In 1946/7 the frst cut was made though the barrier beach and has been maintained to the present day at an approx average cost of around $12K-$14K pa.

Originally this was achieved using horses, then bulldozers and currently, by digger.

This was always a stop gap measure that has outlived its time and has not helped our fsheries or improved Te Roto o Wairewa water quality. In fact over the last 60 years the current regime has contributed to the lake's condition.

When the lake is opened all the good surface water leaves and the wai kino remains on the bottom.

The closure means the living myriads of Tangaroa are unable to carry life between the lake and the sea and has triggered a variety of changes in what has now become a lake.

The chemical composition of the lake altered as the Wairewa catchment was stripped of its proud forests; erosion and sediment made its way into the lake and settled on the bottom. There is over one metre of sedimentation in the lake, equating to approx' 5,000,000 cubic meters of topsoil which has eroded from the catchment. If left, this sediment will eventually fll the lake and more importantly will give natural and introduced phosphates a place to attach. Phosphates aid and support cyno bacterial blooms.

CYANOBACTERIAL BLOOMS (ALGAE BLOOMS)

These conditions provide an ideal environment for cyno bacteria particularly if the lake is opened at the beginning of summer and the low lake level means the water heats up and becomes turbid. This cyno bacteria is extremely toxic. The latest research undertaken by Dr Barbra Dolamore reinforces the dangers to people stock and the fsheries. This cyno bacteria is so toxic that a piece the size of a pea is toxic enough to kill two grown men.

Evidence would suggest that the algae blooms started appearing when the lake closed during the 1880's. Cyno bacteria do not like salty water so when the lake was open and a hapua the salinity of the water would have prohibited the bacteria's growth.

The closure of the lake amongst other things would have suddenly provided an ideal breeding ground.

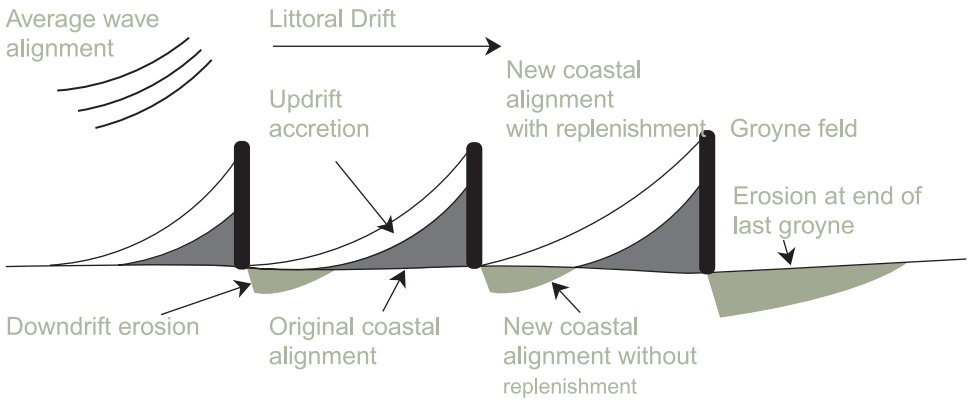
The old people referred to the blooms as "tutae o te taniwha"

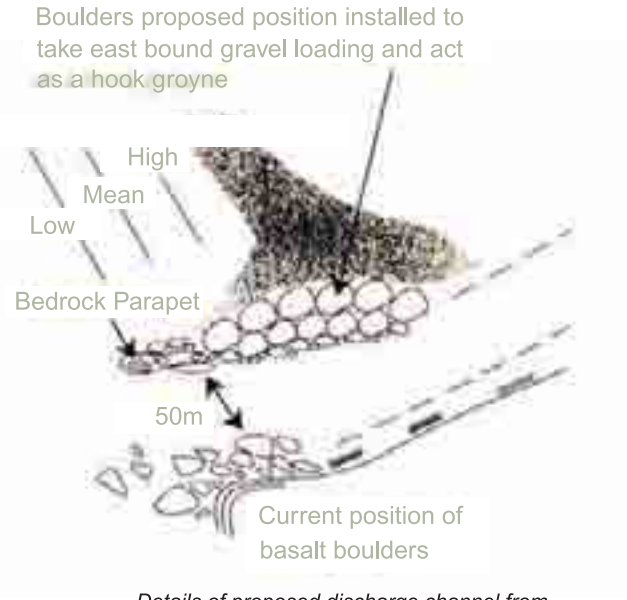
In October 2005 we called an urgent public meeting in collaboration with the Wairewa Community Board. The purpose of this meeting was two–fold. Firstly to ensure the community fully understood the health hazards associated with the cyno bacteria and secondly to discuss a possible bio engineering solution to the lakes condition and our intention to test the feasibility of this proposal.

Mechanical lake opening in the early days

WE ARE PROPOSING A PRACTICAL SOLUTION TO AN OLD PROBLEM

We are calling what we are proposing a bio-engineering solution which involves the construction of a groyne beneath the cliffs at the north end of Kaitörete Spit, using the existing basalt boulders in that area. The key to this is the existing parapet of bedrock.





Details of proposed discharge channel from Lake Forshyth (Wairewa)

The parapet stands at extreme low water spring, approximately 50m beachside of the cliff. The lay of the land suggests the original channel entrance ran between the bar and the cliff faces over a distance of 400 m from Bossu Rd to the sea.

The groyne will be built with existing high density basalt that is available at the foot of the cliff, and which was more than likely formed on the northern side of the original channel going out to sea. The boulders are at about mean tide and range from .5 to 10 ton.

Effectively we want to recreate what the cliff is doing but 50 meters down the beach.

Groynes are used extensively around the globe to help manage and protect coastlines. Research has shown us that, where there are groynes on a coast the last groyne on the upside of the prevailing upward drift (in our case to the north) begins to create an erosion pocket on the upward side. Although this poses problems globally it is precisely what we want to occur to in our situation. This along with the wave action bouncing off the cliff face will help scouring and keep the mouth open. Ultimately this will tell us if we can maintain an opening clear of gravel build up, and if the experiment is successful we will begin to see erosion on the upward side of the groyne (see diagram above).

The groyne will be shaped like a roman bridge on its side with the prevailing energy pushing against the outer southern edge .

This process is about reconnecting the traditional food chain by harnessing the oceans natural energy and tidal patterns to allow the lake to breathe.

To do this we need to frstly test if we can keep an opening in place at least 80% of the time. If this is possible then we may be able to save the eel fshery by creating ongoing access and providing a strong freshwater signature to attract them, along with other species such as inaka.

The tides in our area average around 1.4 meters. This is not very high and the existing tidal energy could be easily lost in the lake's expanse. This means it will either not have enough push or enough ebb to keep the channel open effectively. To counteract this situation and create a rush of water out, we will probably need to build a weir structure or barrier further up the lake that stops the tidal energy before it is lost in the lake. This will create an estuary in front of the structure, open to the sea with the weir further up the lake giving us suffcient head to generate a powerful tidal fush.

Through the use of a simple spill way, or over fow, the weir structure can be used to control the level to suit everyone.

The reality is that even if we are successful it will take many years for the lake and the tuna population to recover.

Above: The Groyne will be shaped like a roman bridge.

CREATING A PERMANENT OPENING

In 2005 we lodged a Resource Consent with Banks Peninsula District Council and Environment Canterbury outlining a proposal to test the feasibility of a permanent outlet for the lake. This was a publicly notifed consent process which received 19 submissions in favour and 18 against. Most of those expressed the opinion that what we are attempting is bound to fail. This argument misses the point entirely; what we are doing is taking action in the absence of any better solution.

It is an experiment and even if it fails we will have learnt a lot and will then move on to the next solution. What we won't be doing is giving up. There was a brief furry of letters about the proposal to the editor of The Press but in the end this did not gain any traction from the wider reading audience. It's safe to assume that the wider Canterbury community either supports what we are trying to achieve or really doesn't care.

We were surprised to receive a detailed submission against our proposal from our Treaty Partners the Department of Conservation (DOC). Surprisingly DOC did not express opposition to the consent for a continuance of the mechanical opening regime, lodged by Banks Peninsula District Council in 2001, considering that the mechanical opening process has done more to perpetuate the lake's problems and exacerbated detrimental environmental effects.

From our perspective, it is one thing to oppose what we are trying to achieve but quite another to provide a workable solution.

Although we merely want to test the feasibility of a groyne we have had to provide a number of reports from experts. Consequently the process has taken far longer than we expected. Ultimately we have met all the DOC concerns and we are hoping that their position will now be more supportive.

What we won't be doing is giving up.

Ultimately we have met all the DOC concerns and we are hoping that their position will now be more supportive.

ENVIRONMENTAL COMMISSIONER (ECAN)

Currently we are awaiting a date to appear before the Environmental Commissioner(s). This is a relatively informal process which will give us the opportunity to; answer any questions, provide new information and, state our case in relation to our Resource Consent. It will also be an opportunity for those that oppose our experiment to do the same.

The Environmental Commissioner(s) will then decide if what we are proposing is acceptable in terms of the Resource Management Act and any other relevant legislation. We expect this date to be set some time in October 2007. If we are successful we will be in a position to start work over summer.

(UPDATE: This submission was successful)

Wayne Alexander searches for the wave platform that will help us stabilise the Groyne

Parapet Rock that will help anchor the Groyne

HOW THIS WILL HELP THE LAKE

A major component of the project is to utilise low-cost tidal power, the hydraulic head developed by freshwater infows and the chemical and physical properties of seawater, to develop a regime to precipitate and fush phosphates, nitrogen and other nutrients stored in the lake hypolimnion (the lower and colder layer of water in the lake) over an annual cycle.

Over the long term, it is intended to shift the lake phytoplankton from blue-green algal dominance toward diatom dominance by this process.

This will in turn trigger a range of changes to the lake ecology, culminating in restored and enhanced fsheries and a safer environment for those who would like to use the lake. Ongoing fushing of the lake hypolimnion, by restoring tidal effects in the lake, will also have the beneft of vastly improving fsh passage opportunities. Populations of whitebait, kanakana, founder and mullet would be able to return to the lake.

Improvement of catchment runoff quality is also highly important if changes in the lake are to be fully effective. Currently we are working with and supporting the ECan Living Streams Project. Their team is working with land owners and farmers to promote water quality in the catchment above the lake, through excluding stock from water ways and through riparian planting.

To our knowledge what we are attempting has not been undertaken on this scale in New Zealand, but if successful may help others in a similar predicament.

This will in turn trigger a range of changes to the lake ecology, culminating in restored and enhanced fsheries and a safer environment for those who would like to use the lake.

DESIGNING THE SOLUTION

Throughout there have been a number of people involved in the mix, each bringing their own particular expertise. We are especially grateful for the ongoing support received from Charles Mitchell (fisheries scientist) and Wayne Alexander (engineer).

Charles Mitchell

After 30 years research on native freshwater fsh, Charles Mitchell developed a whitebait ranch at Raglan on the west coast of the North Island of New Zealand.

The farm is the frst of its kind and is producing some promising results. Charles also grows eels and mullet and is the frst New Zealander to breed whitebait in captivity; his research may also help solve the problem of what to do with waste effuent from farms.

Charles brings a level of expertise and experience in the practical application of science and is "hands on"; this was well illustrated by the Country Calendar programme, screened by Television New Zealand, which visited his fresh water aquaculture farm in Raglan.

Charles brings a wealth of knowledge and proven experience to the lake project and in particular the possibilities related to the sustainable production of mahinga kai and fshery science.

Wayne Alexander

Wayne is an innovator; from Everest to the Brittan Motorcycle, Wayne has a proven record of success.

Incidentally (Te Toki o te ara Mauka) the Toki Pounamu Wairewa gave him before the climb, made it to the summit of Everest; possibly this the frst pounamu to summit!

Wayne takes engineering solutions to an artistic level with his ability to think outside the square and problem solve; skills that will be an essential part of our project's success.

He isn't bad at publicity either and recently, when given an opportunity to focus attention on our lake during the Extraordinary New Zealander's programme screened by Television New Zealand, he did a fantastic job. This was priceless publicity for our cause.

OTHER POTENTIAL SOLUTIONS

We have considered a number of options from pipes to culverts to boxes and, although they may have potential to aid the recruitment of tuna, they do not address the fundamental problem of water quality and would not be able to drain the lake fast enough in a major food event.

We have also considered transferring elver and various aged tuna from other locations such as Te Waihora. However this is only part of the solution and could probably be looked at in conjunction with the opening.

THROUGH A PERMANENT OUTLET TO LAKE WAIREWA

A permanent outfow from the lake, in this area, can be expected to be highly attractive to a variety of fshes and invertebrates.

It is anticipated that at least 16 species will be attracted into the vicinity if this work is successful. The table lists the species that can be expected to arrive over an annual cycle.

The presence of these fsh species in the area, together with a range of marine vagrants that may be expected to be attracted to the feeding opportunities that would be presented, is anticipated to have a fow on effect for marine birds and mammals.

A recent study in the Waikato has shown that the consumption of eel by Mäori contributes to their well-being through a reduction in type 2 diabetes.

Eels have been found to contain high levels of the omega-3 fatty acid that acts as a protectant against type 2 diabetes.

Fish/Invertebrates	Life-cycle stage, Seasonal timing	Daily Tidal timing
Long fnned eel	Juveniles in – spring Adults out – autumn	Night – rising tide Night – food discharge
Short fnned eel	Juveniles in – spring Adults out – autumn	Night – rising tide Night – food discharge
Common Whitebait	Juveniles in – spring Larvae out – autumn	Day – rising tide Night – falling tide
Common Smelt	Juveniles in – spring Larvae out – autumn	Day – rising tide Night – falling tide
Stokells Smelt	Adults in – spring/summer Larvae out – spring/summer	Day – rising tide Night – falling tide
Common bully	Larvae out – spring Juveniles in – summer	Night – falling tide Day – rising tide
Lamprey	Adults in – winter/spring Juveniles out – autumn	Night – rising tide Night – food discharge
Black Flounder	Juveniles in – summer Adults out – summer	Night – rising tide Night – falling tide
Yellow bellied Flounder	Juveniles in – summer Adults out – summer	Night – rising tide Night – falling tide
Yellow –eyed mullet	Juveniles in – summer Adults out – summer	Day – rising tide Day – falling tide
Stargazer	Juveniles in – summer Adults out – summer	Night – rising tide Night – falling tide
Brown trout	Adults in – autumn Juveniles out – spring	Night – rising tide Night – falling tide
Chinnook Salmon	Adults in – summer Smolt out – spring	Night – rising tide Night – food discharge
Kahawai	Adults in/out – summer	Day – rising tide
Barracouta	Adults in/out – autumn	Day – rising tide
Freshwater Shrimp	Larvae out – summer Juveniles in – summer	Night – falling tide Night – rising tide

Oruaka Pa, Ngai Tahu tribal property

RAISING THE LAKES PROFILE

It has been our ongoing learning that environmental rehabilitation and in particular fixing paru lakes is a competitive and political process.

Competing for resources is a prime example e.g. Wairewa v's Lake Taupö. Taupö is considered a national icon whereas Te Roto o Wairewa does not figure highly on the national radar. Gathering political and community support and focusing attention on the lake's condition is essential; we need Canterbury people and others to get behind our challenge.

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More recently, in collaboration with Dr Tim Davie of Manaaki Whenua (Land Care Research), we launched a website www.wairewa.org.nz. This site is stage one in pulling all the relevant information regarding the lake into one space. Tim has been working with us on a number of initiatives around the lake's condition and, his support has been invaluable.

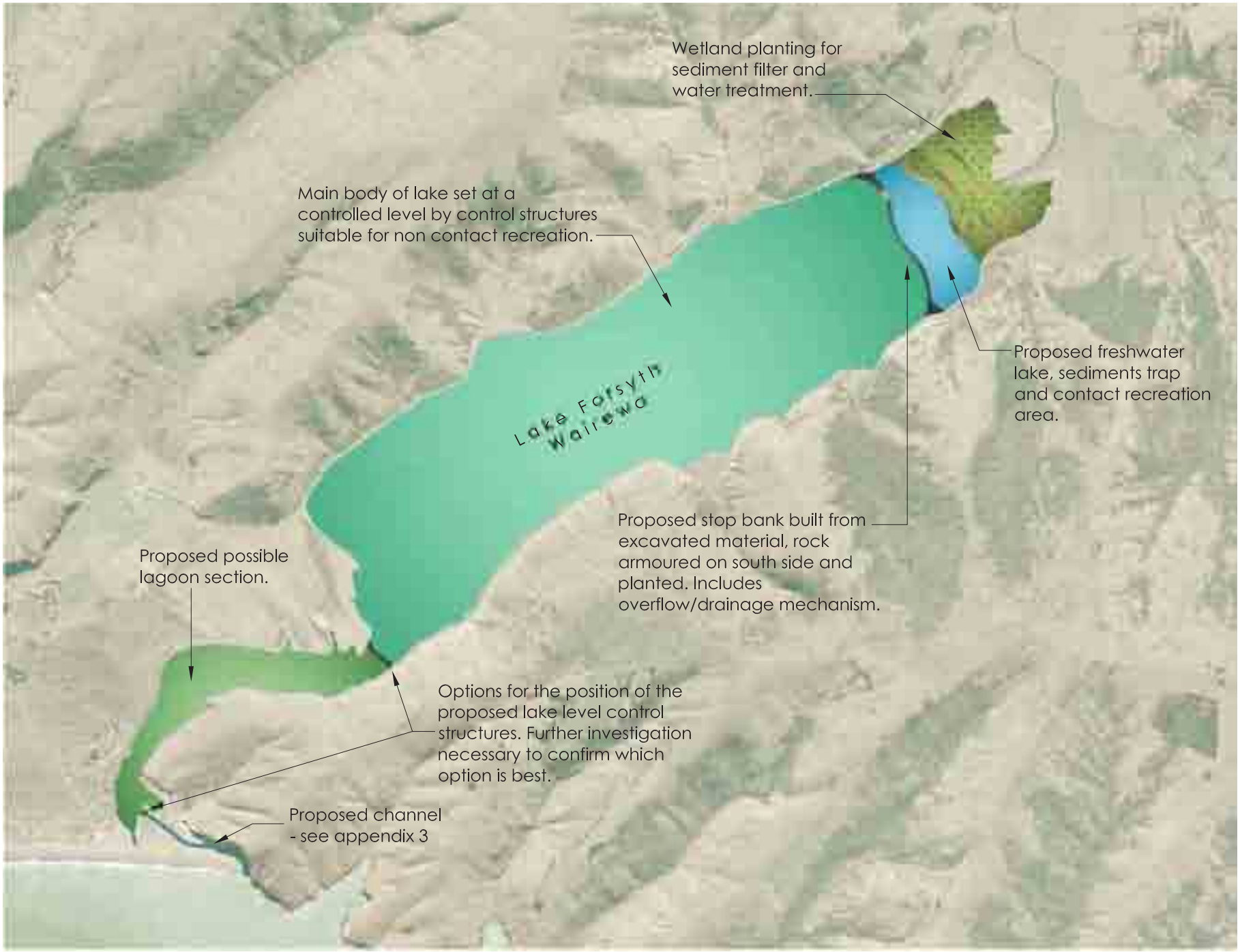
We have also been promoting the thinking that communities need to provide their own solutions despite the odds. This includes the idea that community business can provide resources to fix community problems. This gives us all more control and means we take responsibility without relying on handouts or the vagaries of government policy. This is how Te Kete o Wairewa discharges its charitable objectives. It is also how one member of our own communities has responded to the call.

This gives us all more control and means we take responsibility without relying on handouts or the vagaries of government policy.

Hamish Rae is a Birdlings Flat resident and jeweller who has produced a line of jewelry using stones from Mata Hapuku. Hamish worked with us to develop design concepts and has dedicated a percentage of his proft to the rehabilitation of the lake. Hamish has set a perfect example of what can be achieved; it works for him and it works for the lake.

Purchase of this item helps fund the protection of Te Roto O Wairewa (Lake Forsyth) in partnership with the Wairewa Rünanga the guardians of the lake.

Appendix 2



Notes

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EARTHWORK landscape architects

1091 Ferry Road, Christchurch
Ph (03) 384 4363
6 Durham Street, Rangiora
Ph (03) 313 4363
PO Box 41047, Christchurch
Fax (03) 384 2480
info@earthwork.co.nz
www.earthwork.co.nz

Overall Site Plan

site address: Lake Forsyth

scale: NTS
date: 8.11.07
drawn: BQ
file: E06048

designing with respect for land and people

Wairewa Restoration Proposal - Lake Restoration Diagram

Appendix 3

Wairewa Restoration Proposal - Proposed Sea Channel

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Perspective View

site address: Lake Forsyth

scale: NTS
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drawn: BQ
file: E06048

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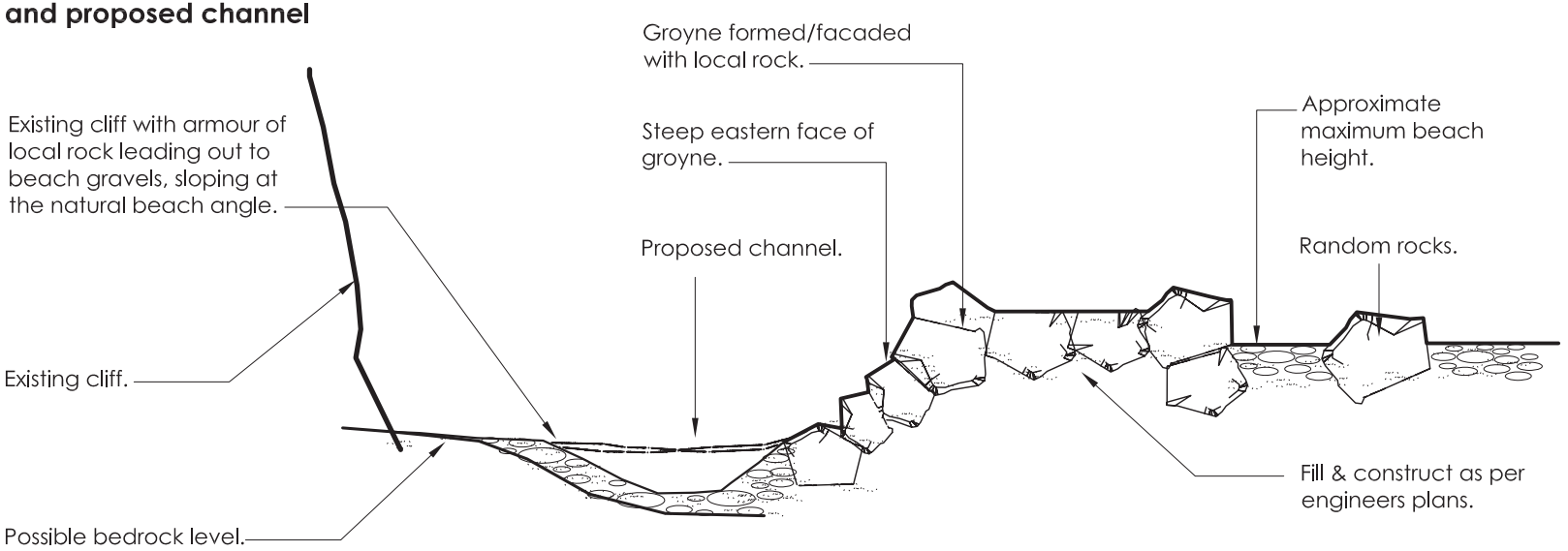
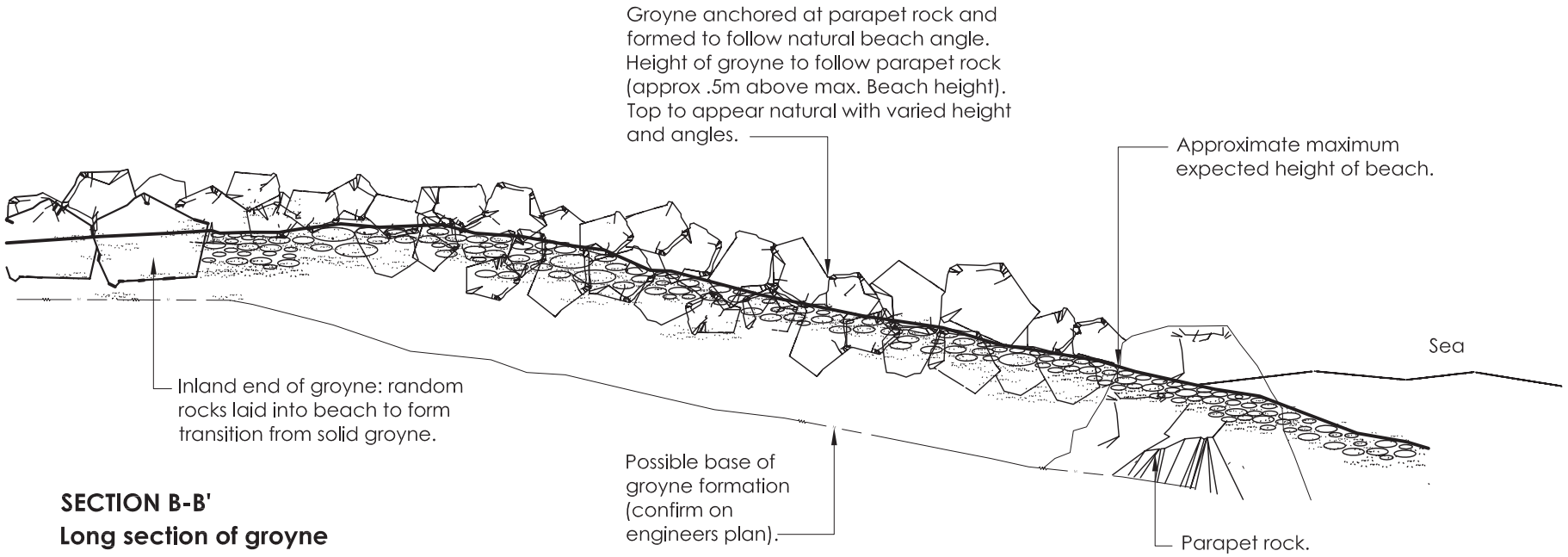
Appendix
4 & 5

SECTION A-A'
Cross section through groyne and proposed channel





SECTION B-B'
Long section of groyne

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Fax (03) 384 2480
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Sections

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