Environment Waikato Technical Report 2004/23

Mangatutu River and Catchment Management Plan

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Table of Contents

List of Tables

1 Introduction

Environment Waikato has established a comprehensive Waikato River catchment based funding policy to address soil conservation, river management and flood protection issues across the entire Waikato catchment area.

Consultation with landowners has identified issues in specific catchments, which require attention. The Mangatutu River Management Group was formed as a result of this consultation and its main aim is to address river management issues in the Mangatutu River.

Riverbank erosion and gravel management are the main issues in the catchment that have been raised by the River Management Group. Environment Waikato will focus on the river works and address those soil conservation works on individual properties on a case by case basis.

The Mangatutu River has historically been excavated by individual landowners. Through this process the river has degraded in places, while in other places along the river it is shallow and has severe bank erosion.

An integrated river and catchment management plan is considered the appropriate way to provide consistent information and advice to deal with stabilising the river through erosion control works, gravel placement and riparian plantings.

2 River & catchment description

2.1 Location

The Mangatutu River is a tributary of the Puniu River and its catchment (approximately 12200 ha) is located south-east of Te Awamutu (see map 1). The length of the main river stem, from confluence with the Puniu River to the headwaters is approximately 40km. Approximately 50% of the river flows through pasture and the remainder through indigenous forest.

2.2 Vegetation

The lower half of the catchment has been developed for pastoral farming while the upper catchment is mainly in indigenous vegetation

2.3 Rainfall

Rainfall is spread relatively evenly throughout the year with a winter maximum and summer minimum. Mean annual rainfall varies from 1,300 millimetres over the lowlands and increases to 2,360 millimetres over the steeper hill areas.

2.4 Geology and soils

The geology of the catchment is dominated by material derived from the Taupo eruptions with Taupo Ash and Rhyolite in the upper catchment and Mairoa Ash and some Maihihi Ash in the lower catchment. The underlying base rock is mainly Greywacke and Rhyolite. Deep volcanic clay soils have formed on the thick ash cover, with more skeletal hill soils on the steeper terrain with thin ash cover, or where this has eroded and the base rock has been exposed. In the lower reaches of the Mangatutu and tributaries, alluvial river flats have formed from washed off Mairoa and Taupo Ash on which silt loam and loam soils have developed.

2.5 Erosion

The majority of the catchment is stable. The New Zealand Land Resource Inventory Worksheets identify approximately 1600 ha (13.2%) as having potential for slight hill slope erosion (slip and sheet erosion) while approximately 158 ha (1.3%) of high value pastoral land could be affected by stream bank erosion.

Specific erosion concerns are focused primarily in the lower catchment along the Mangatutu River (stream bank erosion) and in the upper catchment gorge area (hill slope erosion).

A number of Soil Conservation works have been carried out in the catchment involving the planting of poplars, willows and other trees for soil conservation purposes. These works attracted grant assistance from Central Government under a scheme, which was administered by Environment Waikato.

3 Issues identified by landowners/care group

3.1 Erosion

3.1.1 Hill slope erosion

Hill slope erosion occurs mainly in the upper Mangatutu catchment and consists of soil slip, earth slip and sheet erosion. Soil and earth slips are the more visible forms of erosion while sheet erosion is the often “unseen”, but significant form of erosion when exposed soil is transported along the slope during rainstorms. Overgrazing of pasture in particular can increase this type of erosion. Approximately 1600 hectares or 13.2% of the catchment is subject to slight to moderate hill slope erosion.

3.1.2 Streambank erosion

Occurs on river and stream banks consisting of unconsolidated soil material (sometimes overlain with volcanic ash) with little or no vegetative cover during high water flows. The majority of stream banks in the upper catchment are relatively stable, however 158 hectares of land (1.3% of the catchment area) has been identified as being affected by stream bank erosion. Where stock has access to waterways, stream bank erosion may be further accelerated.

3.2 River management

3.2.1 Gravel issues

The Mangatutu River transports shingle and sand which has entered the river as a result of erosion processes in the upper catchment. Although shingle provides protection for the streambed against the erosive forces of the water, channel in-fill can occur, particularly in low gradient sections where the river is allowed to spread out and allow flow velocities to decrease. This can then result in increased erosion as the river meanders within its own channel/plain forming shingle beaches and sharp bends thus exerting more pressure on river banks.

Otorohanga District Council has historically removed gravel from the Mangatutu Stream for road construction purposes. As a result of this activity the river dynamics have been changed and the channel is still recovering from the activity.

Degradation in turn often occurs where there is a relatively high gradient and soft bed material. This can be as a result of natural or artificial diversions where the river

channel is shortened. These are natural dynamic processes, which are exacerbated by accelerated erosion and poor river bank maintenance. The degree to which these processes can be managed in the catchment as a whole needs to be fully understood before carrying out any river management works.

3.2.2 Obstructions

These are mainly occurring in the lower reaches of the river where willows in particular are congesting the channel. Isolated obstructions are caused by trees and logs falling into the river, becoming lodged in the banks or bed and diverting the flow and causing localised erosion. If substantial blockages occur this may also cause localised flooding. Poorly maintained stream bank plantings may also obstruct the flow and in smaller tributaries Crack Willow and Grey Willow infestation may effect drainage.`

3.2.3 In-stream works/structures

In-stream structures such as fords, culverts and bridges are important to farms, and to roading networks. However, it is particularly important that the river channel is maintained in a stable condition in the vicinity of these structures.

Some erosion control structures such as groynes and rock rip-rap also need to be monitored and maintained.

3.2.4 Bank erosion

Stream bank erosion occurs at various places along the Mangatutu River. Where it has a flat gradient the meandering nature of the river, can result in lateral erosion, while poorly vegetated sections with a steep gradient may suffer from slumping banks. Erosion processes along stream banks can be initiated or exacerbated by stock trampling.

3.2.5 Natural diversions

The natural meandering tendency of rivers may lead to meanders being cut off and the river effectively short cutting itself. The resulting increase in gradient can in turn cause other changes to the river upstream (potential bed scouring and possible slumping of banks) and downstream (sedimentation and bank erosion).

3.3 Flooding

3.3.1 Localised flooding

Apart from some localised flooding, this is not a significant issue in the catchment.

4 Related issues

4.1 Water quality

Water quality is important in relation to recreation, human and stock health, fisheries, ecology and river aesthetics. There are strong indications that elevated levels of faecal bacteria and nutrients (N and P) are associated with increasing farming intensity. Dung, urine and fertiliser enter waterways either directly from animals and fertiliser application or through run off or subsurface drainage

Suspended sediment and fine bed sediment arising from hillslope and river bank erosion is in large part responsible for the depauperate nature of the indigenous fishery in the Waipa River catchment. Most of the migratory species of indigenous fish are relatively sensitive to high levels of suspended sediment and are known to avoid the Waipa River and some of its tributaries during the annual upstream migration in early spring and summer.

4.2 Recreational fisheries

The Mangatutu is a highly valued trout fishery that attracts anglers from throughout the Auckland and Waikato Regions. Angler usage is high with about 1600 angler visits annually (1994/96 National Angler Survey).

Each summer the Fish & Game Council carries out a drift dive survey to estimate the number of adult trout in the Mangatutu River. Recent surveys have shown that compared to most other North Island rivers the Mangatutu holds high numbers of adult rainbow and brown trout. Fish & Game also monitors trout spawning, growth rates, and water temperature in the Mangatutu, and they are presently developing an energetics based computer model for predicting how trout growth rates in the Mangatutu are affected by changes in water clarity and food availability.

The majority of rainbow trout in the Mangatutu spend their entire lives in the river and its tributaries. Rainbow fry (juveniles) hatch from eggs that are laid in the streambed by adults during autumn/winter. The fry spend their first few months in shallow backwaters along the stream margins. Over the next two years they grow rapidly reaching a length of about 35 cm by the end of their second summer. In the Mangatutu the maximum length for rainbow trout is about 45 cm with a maximum age of 5-6 years.

In contrast to the rainbows, the brown trout in the Mangatutu River are not resident but undertake a seasonal migration to the Waikato River. Brown trout spend their juvenile years in the Mangatutu but once they reach a length of about 35 cm they spawn in the Mangatutu tributaries and move down into the lower Waikato after in spring. However by about mid-November, the water temperature in the lower Waikato is generally too warm for trout and they move back upstream to the Waipa headwaters for the summer months.

Given the value of the Mangatutu as a recreational fishery, access and fishing opportunity are also significant issues for the Auckland Waikato Fish and Game Council and its members. Erosion protection works, and general river management need to give due consideration to maintaining the “fishability” of the river.

4.3 Biodiversity

Just over 40 % of the Mangatutu catchment consists of indigenous vegetation which is mainly situated in the upper catchment on the Rangitoto Range. Small indigenous forest pockets are present on steep contours in the lower part of the catchment, while Kahikatea fragments are found on the valley floor, some of which have been protected from stock grazing.

4.4 Biosecurity

Animal Pests such as possums and goats can pose a threat to the ecological health of indigenous forest but can also damage commercial timber species. Possums and goat populations are also potential TB vectors. The National Pest Management Strategy for Bovine TB Control is an Animal Health Board responsibility. Environment Waikato provides a management agency service to the Animal Health Board for possum and ferret (vector) control and wild animal surveys. There are substantial mutually beneficial spin–offs from both the TB programme and the animal pest programme partnerships.

The Department of Conservation (DoC) is also bound to the outcomes of the RPMS (Waikato Regional Pest Management Strategy) under the Biosecurity Crown Obligation Order 1998. The Order requires the Department to control plant and animal pests to standards specified in the RPMS and contribute financially to the implementation of the strategy.

5 Management strategy

5.1 Introduction

The strategy seeks to promote comprehensive management and integrated solutions involving the range of resource management issues within the Waipa Management Zone and those individual catchments that have being identified as priority catchments through Project Watershed that require a significant level of river management and soil conservation works. This includes catchment management, soil conservation, river management, plant and animal pest issues, and Biodiversity issues, wherever practicable.

The available funding for soil conservation, river management, river improvement and clean streams activities that is included in the LTCCP is to be allocated to the catchments within the Waipa Management Zone and phased over the next ten years. As described in Appendix 2 of this report, part of the overall Waipa Management Zone funding under the LTCCP for the next ten years is allocated to the Mangatutu River and Catchment Strategy.

The primary focus in completing the works described in this management strategy is to stabilise the river through the implementation of the various work programs.

The following approach is used:

- Catchment land management works
- Management and maintenance of rivers & streams
- Maintenance of existing flood protection
- Continue the ability for drainage
- Advice and information for landowners
- Asset Management Best Practice Guidelines
- Monitoring the environment to report on health and show changes
- Co-ordinated community approach

The above results in integrated management of the catchment and allows works to focus in areas of greatest need.

5.2 Interested parties

5.2.1 Landowners

There are approximately 90 landowners in the catchment of which 24 own land along the main stem of the Mangatutu River.

In the past, river management in the Mangatutu Catchment (in particular bank erosion on the Mangatutu River) has been dealt with on an ad-hoc basis and with limited success. Lack of good information and understanding of related issues; inconsistent advice, RMA requirements and associated costs have been identified by the community as barriers to achieving a stable and well-maintained river channel.

Landowners and managers adjacent to the river, together with other interest groups (DoC, Fish & Game), have formed a river management group. The groups aim is to develop a common management strategy/plan for the river environment to provide for a more consistent, cost-effective way to deal with river and land management issues.

5.2.2 Fish & Game, New Zealand

Fish & Game has statutory responsibility for the management of freshwater sports fishing and game bird hunting. Freshwater sports fishing is most often trout and salmon based while game bird hunting is predominantly based around ducks, geese, quail, swans, pheasants and partridges.

Key functions of the Fish & Game Council are:

- advocating the interests of anglers and hunters and the protection of the habitat for sports fish and game birds;
- monitoring trout, salmon, and game bird numbers and setting regulations to ensure that harvest of them is on a sustainable basis;
- managing and protecting sports fish and game birds and their habitat;
- in the areas where there are insufficient places for sport fish to breed, releasing fish raised in hatcheries;
- providing information on access to people who wish to fish and hunt.

In the Mangatutu River, Fish & Game's primary focus is the protection of habitat for trout.

5.2.3 Department of Conservation (DoC)

DoC administers most of the Crown land in New Zealand protected for scenic, scientific, historic or cultural reasons, or set aside for recreation. This is almost a third of New Zealand's land area, including national forest and maritime parks, marine reserves, nearly 4,000 land reserves, river margins, some coastline and many offshore islands. DoC's mission is to conserve New Zealand's natural and historic heritage for all to enjoy now and in the future.

Key functions:

- working with local communities, other organisations and iwi for the benefit of conservation;
- saving threatened native species;
- managing threats like possums and weeds;
- ecosystem restoration;
- caring for marine life;
- protecting natural heritage with help from landowners;
- looking after historic heritage on public conservation land;
- providing for recreation.

Crown land in the Mangatutu Catchment consists of Scenic Reserve land in the upper catchment as well as considerable lengths of marginal strip along the Mangatutu River

5.2.4 Iwi

The local Iwi who are to be consulted with regards to the management of issues within the Mangatutu Catchment are as follows:

- Nehenehenui Regional Management Committee (RMC) for Maniapoto Maori Trust Board and Raukawa Trust Board

- Raukawa Maori Trust Board

Iwi consultation is to be undertaken to establish the following:

- Identify relevant issues in catchment and environment;
- Develop a working partnership;
- Identify Waahi Tapu and other culturally significant sites;
- Develop an Iwi management plan.

5.2.5 Otorohanga District Council

The catchment is situated in the Otorohanga District. The District owns and manages a number of infrastructure assets such as roads and bridges. Significant areas of road reserve (paper road) exist along the Mangatutu River.

In the past the Otorohanga District Council has operated a quarry on a site just upstream of the Wharepunga Road.

5.3 Environmental monitoring

5.3.1 Introduction

Under the Waikato River Catchment Services funding system, river management and soil conservation initiatives are being implemented in the Mangatutu Catchment to reduce the adverse effects of streambank erosion and river channel instability. These initiatives will also provide increased protection of productive land and soil resources.

It is proposed to establish a monitoring program to provide a representative (and where possible quantitative) indication of the long term changes in stream bank erosion, sedimentation and aquatic habitat in selected streams within the Mangatutu catchment. Where possible, comparisons will be made with untreated "control" streams and with the wider EW regional monitoring programs (REMS and RERIMP[1]).

The monitoring program will rely on additional cost effective sub-catchment scale monitoring. However, this monitoring will contribute to monitoring information for the Waipa zone.

The purpose of this section is to outline the nature of the monitoring proposed for the Mangatutu subcatchment.

5.3.2 Monitoring objectives

Where river and riparian management initiatives are planned:

1 Provide a representative (and where possible quantitative) indication of the long term changes stream bank stability.
2 Provide a representative (and where possible quantitative) indication of the long term changes in river bed sedimentation and suspended solids.
3 Provide a representative (and where possible quantitative) indication of the long term changes stream bank character.
4 Provide a representative (and where possible quantitative) indication of the long term changes aquatic habitat condition.
5 Where possible, compare changes with untreated and unimpacted streams in the Mangatutu sub-catchment.

5.3.3 Recommendations for monitoring

Monitoring methods consistent with those used for other sub-catchments are recommended. However, monitoring will focus on the riparian area in accordance with the priority erosion issues and river channel work.

The following methods are proposed to provide a balanced assessment of long term riparian land and in-stream changes. Short-term works monitoring will not be conducted as the environmental impacts of these works are likely to far less than the long-term environmental gains.

[1] REMS focuses on monitoring the ecological health of 130 streams throughout the region with a focus on algea, periphyton, invertebrates and fish
RERIMP focuses on monitoring the water quality of 100 streams throughout the region.

Table 1 Proposed monitoring methods for the Mangatutu subcatchment

Monitoring method	What is monitored and why	Frequency and term of change
Riparian characteristics	Change in length of fencing, vegetation and erosion – Fencing decreases stock access, decreasing bank and streambed disturbance; planting increases bank stability	Repeated every ~3 years Medium to long term changes (3-10+)
Photo points	Visual changes in riparian characteristics – quality of planting, aesthetics and bank stability are shown	Annual Short to long term changes (1-10+)
Suspended sediment site	Suspended sediment yields for a subcatchment – Fencing decreases stock access, decreasing bank and streambed disturbance; planting increases bank stability. Collectively, soil conservation initiatives should reduce the land use contribution to sediment yield for the subcatchment.	Event sampling Long term changes (10+)
Snapshots of suspended sediment during events	Identify relative contributions of Suspended sediment within the subcatchment – Provides an indication of major sediment sources and priority areas for treatment within the subcatchment.	Event sampling - Indicative spatial picture of sources within the subcatchment.
Stream temperature	Shading of surface water – shading increases as plantings grow, water temperature peaks during summer should decrease, providing good habitat for fish (~<20 C).	Annual Medium to long term changes (3-10+)
Stream ecological health	Indicator of water quality – less sediment, nutrients and bugs in the water provides a good habitat for freshwater invertebrates	Annual Medium to long term changes (3-10+)

Monitoring will focus on assessing changes in the main Mangatutu river channel where the majority of the proposed work is scheduled. The following section of the report presents a summary of this monitoring to date and monitoring scheduled for 2004/05.

5.3.4 Riparian characteristic survey

A riparian characteristics survey will be conducted in 2004/05. Up to 10 km of stream length will be assessed, concentrating on the Mangatutu River where it crosses Walker road (lower catchment) and Wharepuhunga Road (upper catchment). Comparative sites outside this area will also be included. The survey will collect baseline information about the amount of stream bank erosion relative to changes in riparian fencing and planting. It is expected that this method will show long term changes (>5 years) but some stream bank stability may be evident initially from exclusion of animals near the stream edge.

5.3.5 Photo points

A photo point assessment will be carried out during the final stages of the riparian characteristics survey (20004/05) or prior if time permits. The photo reference points established and photos collected will be a valuable resource for showing early (<5 years) changes in riparian character. These will be repeated on a 2 yearly basis.

5.3.6 Permanent suspended sediment site

A permanent sampling site will be established in 2004/05. This site will be used to collect suspended sediment samples during high flow events. Equipment will be purchased during 2003/04. The proposed location of the site is on the Mangatutu River at Walker Road Bridge. The potential of this location will be investigated during 2003/04.

5.3.7 Suspended sediment snapshots

Low flow and high flow suspended sediment "snapshots" within the monitoring sub-catchment can be conducted to assess relative sediment contributions within the Mangatutu sub-catchment.

5.3.8 Water temperature & stream ecological health

Stream temperature monitoring sites have being installed in the Mangatutu Stream to assess the affect of soil conservation (riparian planting) on stream shading and water temperature. The temperature monitoring sites are located in close vicinity to the stream ecological health monitoring sites and proposed riparian characteristics survey sites. Those sites are located at the following road bridge crossings within the Mangatutu Catchment:

- Walker Road
- Lethbridge Road
- Wharepuhunga Road

The initial data set will provide baseline data, which will be compared to subsequent annual data to indicate any change in stream temperature. Three sites will be installed, one upstream of the soil conservation works, one downstream and one at a nearby reference site. Water temperature will be recorded for the warmer summer months as this is the time when high (>20° Celsius) water temperatures affect fish habitat. A stream ecological health assessment will be conducted annually at the lower and upper sites to assess stream aquatic habitat and biological condition. This ecological assessment will follow the REMS protocols currently employed by the council at 130 sites throughout the region and will enable comparisons to be made with other sites in terms of relative improvement over time.

5.3.9 Scheduled monitoring

The following monitoring activities are scheduled for 2003/04 (Table 2). A number of these planned activities form part of the annual monitoring programme for the Waipa Zone. The photo point, water temperature and stream ecological health monitoring are ongoing on an annual basis.

Table 2 Monitoring scheduled in the Mangatutu subcatchment for 2003/04

Monitoring	Planned activity	Progress
Riparian characteristic assessment	Re-scheduled 2004/05	Postponed
Photo points	Scheduled 2003/04	In Progress
Permanent water quality sampling sites	Site visit to confirm equipment requirements Purchase *Isco* sampler, water level sensor, data logger and other misc. equipment Installation	March 2004 April 2004 June 2004
Suspended sediment snapshots	Scheduled 2004/05 (next financial year)	Low flow -completed April 2004 High flow
Water temperature	Install and record stream temperatures at three sites on the Mangatutu River - annual	Completed March 2004
Stream ecological health	Assess aquatic habitat health at two sites on the Mangatutu River -annual	Completed March 2004

5.3.10 Estimated costs

Estimated costs for Mangatutu catchment monitoring for 2003/04 and 2004/05 are presented in Table 3. The costs include all internal labour charges, analysis and basic reporting.

Table 3 Estimated costs for Mangatutu subcatchment monitoring for 2003/04

Monitoring		2003/04	2004/05
Riparian characteristic assessment	Not scheduled		$8000
Photo points		$1500	$1500
Permanent water quality sampling sites and ongoing servicing/analysis	Isco sampler	$7000	$3000
	Sensor	$1500	$3000*
	Data logger	$1835	
	Misc/labour	$7500*	
	Total	$9335	
Suspended sediment snapshots	Not scheduled but low flow completed	$2700	High flow $5000
Water temperature		$1500	$2500
Stream ecological health		$1500	$2500
Total		**$16,535**	**$20,000**

*funded by Resource Information Group

6 Funding mechanism

A river and catchment management strategy has been completed which outlines the level of annual funding required over the next ten years (refer to Appendix 2 of this report) to complete the necessary works. Those works will include the following;

- erosion protection works,
- channel realignment,
- stream bank stabilisation,
- fencing and planting of the main channel and tributaries,
- hillslope stabilisation.

The management strategy outlines a level of funding required which is derived from soil conservation, river management and river improvement budgets, funded through Waikato Catchment Rating System. The LTCCP includes expenditure for the Mangatutu Catchment in the Waipa zone budgets. Minor allowance has been made for some fencing and planting to be sourced from clean streams. Pest management is included in the soil conservation new works costs.

6.1 Cost of works

The total cost of the proposed river management (refer to Appendix 2 of this report) and soil conservation works for the next ten years is approximately $245,000. Funding commences in the 2004/05 financial year.

The 2004/05 financial year has an initial expenditure of $31,000, as it includes the cost to set up a permanent sediment sampling site at Walker Road, as well as implementing other environmental monitoring programs within the catchment (refer to section 5.2.3 of this report for detailed monitoring program). The remaining 9 years of expenditure ranges between $20,000 - $50,000 per year With the majority of costs incurred in the first 4 years.

7 Implementation

7.1 Soil conservation

7.1.1 Soil conservation measures

Stream bank erosion control measures mainly involve the planting of willows, poplars and natives, or a combination thereof. The maintenance of these trees is also important for the maintenance of a well vegetated stable bank and may involve layering, lopping clearing etc. To protect the stream bank vegetation from grazing stock, fencing is usually also carried out.

7.1.2 Farm planning and funding

On farm soil conservation measures normally have high on-site benefits. Under the Waikato catchment funding system however, there is funding available to recognise the off-site benefits of the soil conservation measures such as reduced run off and sedimentation of streams and rivers.

To be eligible for grant assistance under the funding system, landowners need to provide a soil conservation property plan with an estimate of costs. Land Management staff at Environment Waikato can help landowners with the preparation of these plans.

7.2 River management

In addition to stream bank erosion control measures as outlined in section 3.2, river management involves the removal of obstructions such as logs and overhanging trees as well as the management of gravel in the channel.

7.3 Flooding

No significant flooding issues within the catchment.

8 Local management plan

8.1 Types of activities

8.1.1 Issues

- Willow congestion,
- Water quality/stock access,
- Bank erosion,
- Gravel build up,
- Blockages e.g. Debris dams,

8.1.2 River control treatment methods

8.1.3 Gravel removal

Gravel removal can be part of the strategy where there is a supply in excess of the rivers ability to shift it. There are a few consents for gravel extraction on this river that are current.

Gravel removal will continue to be a management tool and specific sites can be identified and managed where removal is appropriate.

8.1.4 Vegetation control

This will include tree and willow removal from inside bends in order to prevent further erosion of the associated outer bend. Willows force water moving around the bend to push outwards and increase pressure upon the outer bend, hence resulting in further erosion. Tree willows are to be removed by poisoning and physical removal.

Pussy and grey willows may be subjected to aerial spray in conjunction with ground control.

8.1.5 Willow replacement and bank stabilisation

In areas of instability and bank erosion it will be necessary to introduce new willow poles (Matsudana willows – male) along the top of the bank, to provide some stabilisation of soils on eroding banks.

In areas where severe erosion is occurring, it will be necessary to construct live willow groynes to provide rapid stabilisation of banks. This will occur when and where materials are available.

8.1.6 Rock groynes

Rock groynes are to be placed upstream of serious problem areas. Islands and rocks causing adverse impact, e.g. accelerated bank erosion, are to be removed and/or relocated between the stream banks.

8.1.7 Willow maintenance

Willows are to be removed or maintained where they are overcrowded or are reaching the end of their useful life. There are also a number of pussy willows on the riverbanks, which require removal. A number of the existing willows used in the plantings are female. These could potentially spread their seed to downstream areas and require removal.

Berm flow is to be encouraged adjacent to the river channel, in order to better contend with flood flows.

8.1.8 Stock access and water quality

Refer to sect. 8.1.10 of this report under Clean Streams

8.1.9 Environmental monitoring

Environmental information e.g. Water Quality Monitoring for bacteria, sediment etc. Will liaise with RIG to set up a comprehensive monitoring program in the Mangatutu catchment to monitor sedimentation rates and water quality.

8.1.10 Clean Streams Project

The Clean streams Project recently initiated by Environment Waikato, is a concept that promotes riparian planting and the retirement of streambanks to prevent stock access. Unfenced streams allow stock direct access to waterways where they damage natural habitats, exacerbate erosion of the banks and affect water quality.

Water monitoring has shown that some streams in the Waikato are unsafe for drinking and for contact recreation, as the levels of bacteria in the water are elevated. Much of this bacteria is sourced from farm runoff and stock depositing waste into waterways. Stock access to streams also causes increases in nitrogen, phosphorous, sediment and faecal matter.

Waterway management can benefit farmers as follows:

- Reduce stock losses,
- Reduce bank erosion,
- Conserves soil,
- Improving stock health.

Riparian margins provide a crucial buffer between land use activities and the natural waterway. Well managed waterway margins are free from stock damage and can perform a number of vital roles.

Well managed waterway margins protect water quality by:

- Filtering surface runoff,
- Uptake of nutrients through plant roots,
- Removing nitrogen (bacteria in wet riparian soils can remove substantial quantities of nitrogen from water, releasing it into the atmosphere as nitrogen gas),
- Preventing stock access when streams are fenced (reducing bank trampling and direct inputs to waterways of sediment, nutrients and harmful faecal bacteria), Waterway margins can provide food and habitat for freshwater life e.g.
  - fish habitat – inanga spawn in grassy areas in the lower floodplain
  - leaf litter – important food for aquatic animals
- Shade – important for reducing water temperature for sensitive freshwater life. Shade also reduces the growth of nuisance plants in waterways.

Well managed waterways also improve biodiversity by:

- Providing for more diverse plant and animal communities,
- Providing important native wildlife corridors and habitat,

Managing waterway margins can also provide farm benefits by:

- Stabilising banks,
- Reducing stock losses (fencing them out from wet or dangerous areas),
- Enhancing the farm landscape,
- Reducing the need to clear drains and streams,
- Excluding stock form natural water (which can sometimes contain disease organisms),
- Making stock and grazing management easier.

Objectives of Clean streams should be incorporated into works undertaken in the Mangatutu Catchment.

9 Resource consent requirements

A comprehensive river and catchment based consent is required for the Mangatutu, which will allow for the proposed river control works in and along the Mangatutu Stream to be completed. The proposed works are located from NZMS 260 Sheet S15: 204 - 422- (Walker Road Bridge) to NZMS 260 Sheet S15:222 - 365 (Wharepuhunga Road Bridge) which is 12 kilometres in length. These works include:

- stabilising the river bed and banks;
- construction of erosion control and channel training structures;
- gravel management; and
- ongoing maintenance of the above works.

As a result it has been determined that the following resource consents are required from Environment Waikato:

Discretionary activity landuse consent to construct erosion control structures in the bed and banks of the Mangatutu Stream between Walker Road Bridge and Wharepuhunga Road Bridge.

Discretionary activity landuse consent to disturb the bed of the Mangatutu Stream between Walker Road Bridge and Wharepuhunga Road Bridge.

The consents have been granted.

Appendix 1 Property by property issues in Mangatutu catchment

Property	Issue	Method
Corrland	Willow congestion Bank erosion	Poison and physical removal Willow groynes
Farnley Tyas	Willow congestion Bank erosion Water quality (stock access to stream)	Poison and physical removal Willow replacement Bridge or culvert
Leonard Kay	Severe bank erosion	Willow planting
Cameron Kay	Severe bank erosion	Willow planting
Leveson Gower	Willow problems Bank erosion Shifting river course Rocks in river	Poison and physical removal Willow replacement Gravel/sand repositioning Rock groynes
Graham Smith	Willow removal and/or maintenance	Poison and physical removal Willow replacement
Stuart Henderson	Willow removal Bank erosion	Poison and physical removal Willow groynes
Waipa District Council	-	-
Adrian Van Der Hulst	Willow congestion Severe bank erosion	Poison and physical removal Willow groynes and willow planting

Appendix 2 Mangatutu River and Catchment Funding Strategy - 10 years

Works Activity	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Total 03/04 - 13/14
Information & Advice	1,000	1,000	1,000								
Soil Con Maintenance											35,000
Soil Con New Works		5,000	10,000	10,000	10,000						150,000
River Management	20,000	20,000	20,000	20,000	20,000	20,000	20,000				60,000
River Improvement	10,000	20,000	20,000	10,000							
Total	31,000	46,000	51,000	40,000	30,000	20,000	20,000	20,000	20,000	10,000	245,000